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Via Electronic Mail

February 28, 2025

Mr. Christopher Smith
EPA Project Manager
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New England Region
Five Post Office Square, Suite 100
Boston, MA 02109

Re: GE-Pittsfield/Housatonic River Site
Rest of River (GECD850)
Baseline Restoration Assessment Report for Housatonic River Reaches 5B and 5C

Dear Mr. Smith:

In accordance with GE's *Revised Baseline Restoration Assessment Work Plan for Rest of River Reaches 5B Through 8*, submitted in February 2023, as modified by a letter from GE dated November 22, 2024, approved by EPA on December 2, 2024, enclosed for EPA's review and approval is GE's *Baseline Restoration Assessment Report for Housatonic River Reaches 5B and 5C*, prepared for GE by AECOM.

Please let me know if you have any questions about this report,

Very truly yours,



Kevin G. Mooney
Senior Project Manager

Enclosures

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AECOM



Baseline Restoration Assessment Report for Housatonic River Reaches 5B and 5C

Prepared for General Electric Company

February 28, 2025

Delivering a better world

Baseline Restoration Assessment Report for Housatonic River Reaches 5B and 5C

Prepared for:

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Abbreviations

BEHI	Bank Erosion Hazard Index
BRA	Baseline Restoration Assessment
CD	Consent Decree
cfs	cubic feet per second
CMS	Corrective Measures Study
Confluence	Confluence of the East and West Branches
dbh	diameter at breast height (of trees)
EA	Exposure Area
EFDC	Environmental Fluid Dynamics Code
EPA	U.S. Environmental Protection Agency
EPT	Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)
EPRI	Electric Power Research Institute
ESA	Endangered Species Act (Federal)
FEMA	Federal Emergency Management Agency
Final Revised OSS	*Final Revised Overall Strategy and Schedule for Implementation of Corrective Measures*
Final Revised SOW	*Final Revised Rest of River Statement of Work*
GE	General Electric Company
GIS	Geographic Information System
GPS	global positioning system
HEC-RAS	Hydrologic Engineering Center River Analysis System (USACE)
HHA	Hydrologic/Hydraulic Analysis
IPaC	Information for Planning and Consultation (USFWS)
IPANE	Invasive Plant Atlas of New England
LGS	Low Gradient Stream
LiDAR	Light Detection and Ranging
LWD	large woody debris
MassDFW	Massachusetts Division of Fisheries and Wildlife
MESA	Massachusetts Endangered Species Act
mg/kg	milligram per kilogram
MGS	medium-gradient Stream
MIPAG	Massachusetts Invasive Plant Advisory Group
MNHESP	Massachusetts Natural Heritage and Endangered Species Program
NBS	Near-Bank Stress
PCBs	polychlorinated biphenyls
PDI	pre-design investigation
PSA	Primary Study Area
RBP	EPA Rapid Bioassessment Protocol
RCRA	Resource Conservation and Recovery Act
RCMS	Revised Corrective Measures Study for Housatonic Rest of River
RD/RA	Remedial Design/Remedial Action
Revised Permit	Revised Final RCRA Permit Modification
RFI	RCRA Facility Investigation
ROR	Rest of River

RU	Remediation Unit
SAV	submerged aquatic vegetation
SSS	side-scan sonar
SOW	Statement of Work
USACE	U.S. Army Corps of Engineers
USDA NRCS	U.S. Department of Agriculture Natural Resource Conservation Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Woodlot	Woodlot Alternatives, Inc (now Stantec)
WSE	water surface elevation
WWTP	Pittsfield Wastewater Treatment Plant
YOY	young-of-the-year
YSI	Yellow Springs Instrument

1. Introduction and Objectives

1.1 Background

On December 16, 2020, pursuant to the 2000 Consent Decree (CD) for the GE Pittsfield/Housatonic River Site (EPA and GE 2000), the U.S. Environmental Protection Agency (EPA) issued to the General Electric Company (GE) a final revised modification of GE's Resource Conservation and Recovery Act (RCRA) Corrective Action Permit (Revised Permit) for the Housatonic Rest of River (ROR) (EPA 2020). The ROR is defined as that portion of the Housatonic River and its backwaters and floodplain (excluding Actual/Potential Lawns as defined in the CD) downstream of the confluence of the East and West Branches of the Housatonic River (the Confluence) in Pittsfield, Massachusetts. The Revised Final Permit set forth a Remedial Action selected by EPA to address polychlorinated biphenyls (PCBs) in the ROR. The ROR is shown on **Figure 1-1**.

The Revised Final Permit required GE to develop and submit a Statement of Work (SOW) specifying the deliverables and activities that GE will conduct to design and implement the ROR Remedial Action. In accordance with that requirement, GE submitted a Final Revised Rest of River Statement of Work on September 14, 2021 (Final Revised SOW; Anchor QEA et al. 2021), and EPA approved it on September 16, 2021. Subsequently, as also required by the Revised Permit GE submitted a *Final Revised Overall Strategy and Schedule for Implementation of the Corrective Measures* on July 5, 2022 (Final Revised OSS; Anchor QEA 2022), and EPA approved it on July 6, 2022. As described in that document, the ROR has been segmented into six separate Remediation Units (RUs), corresponding to various reaches of the river, to manage workflow and schedule for the ROR Remedial Action.

Section II.B.1.c.(2)(a) of the Revised Permit requires GE to conduct and submit a work plan for a Baseline Restoration Assessment (BRA) of areas that will be affected by the ROR Remedial Action. Sections 4.2.1.4 and 4.2.1.5 of the Final Revised SOW describe the work plan and report on the BRA in more detail.

On December 22, 2021, GE submitted a Baseline Restoration Assessment Work Plan (initial BRA Work Plan) to meet the above requirements. On March 31, 2022, EPA issued a conditional approval letter for that initial BRA Work Plan. Among other conditions, that letter required GE to submit a focused BRA Work Plan for Reach 5A of the ROR (the first RU to be addressed under the Revised Permit) and then to submit a separate general revised BRA Work Plan that would cover Reaches 5B through 8. GE submitted a Revised Reach 5A BRA Work Plan on July 14, 2022 (AECOM 2022), and EPA approved that Work Plan on July 18, 2022. GE conducted data collection for the Reach 5A BRA from July 2022 through June 14, 2023. On February 19, 2024, GE submitted a Revised Reach 5A BRA Report (AECOM 2024a), which EPA approved on March 5, 2024.

In accordance with EPA's March 31, 2022 conditional approval letter of the initial BRA Work Plan, GE submitted a Revised BRA Work Plan for Reaches 5B through 8 on August 2, 2022, covering the RUs in those reaches. On December 22, 2022, EPA issued a conditional approval letter for that work plan, requiring modifications to be addressed in a further Revised Work Plan for Reaches 5B through 8. That Revised BRA Work Plan for Reaches 5B through 8 was submitted by GE on February 20, 2023 (Revised Reaches 5B-8 BRA Work Plan; AECOM 2023), and EPA issued its approval for that Work Plan on March 8, 2023. That Revised BRA Work Plan noted that, upon completion of the BRA survey activities described therein, GE would submit a BRA Report for Reaches 5B-8.

The Final Revised OSS provided that the sediment and floodplain soil removal in Reach 6 will be conducted in parallel with sediment/soil removal in Reach 5A such that sediment/soil removal in both reaches will be completed at approximately the same time (although capping in Reach 6 will be delayed until after all remedial activities have been completed in all upstream RUs). As a result, GE advanced the performance of the pre-design investigation (PDI) of Reach 6 before the PDIs for Reaches 5B and 5C, for which work plan are not yet due to be submitted. The results of that Reach 6 PDI were provided in a PDI Summary Report for Reach 6, and a Conceptual Remedial Design/Remedial Action (RD/RA) Work Plan

was developed for Reach 6, both of which were submitted concurrently on October 31, 2024. Similarly, as requested by GE and approved by EPA, the BRA for Reach 6 was advanced prior to the other work provided for in the Revised Reaches 5B-8 BRA Work Plan; and GE submitted a separate BRA Report for Reach 6 on October 31, 2024 (AECOM 2024b); that report is currently under EPA review.

In the meantime, from April 2023 to November 2024, GE conducted the BRA for Reaches 5B and 5C in accordance with the Revised Reaches 5B-8 BRA Work Plan. On November 22, 2024, GE submitted a request to EPA to submit a separate BRA report for Reaches 5B and 5C (by February 28. 2025), rather than combine these reaches with Reaches 7 and 8 as previously proposed. EPA approved that request via email on December 2, 2024. Accordingly, GE is submitting this separate BRA Report for Reaches 5B and 5C.

The upstream end of Reach 5B is situated at the Pittsfield-Lenox municipal boundary just south of the Pittsfield Wastewater Treatment Plant (WWTP), nearly 25,000 linear feet downstream of the Confluence. Reach 5B flows south roughly 6,200 feet to the New Lenox Road crossing and then continues another 7,500 feet to the Reach 5C boundary.[1] Reach 5C extends downstream roughly 17,900 feet to the Woods Pond transition zone The lower portion of Reach 5C extends into the Town of Lee in addition to Lenox **(Figure 1-2)**.[2] The habitats in Reaches 5B and 5C are interrelated and can be discussed together.

1.2 Restoration Performance Standards

The Performance Standards for restoration of disturbed areas in the ROR, as provided in Section II.B.1.c.(1) of the Revised Permit and summarized in Section 2.1.3 of the Final Revised SOW, are to: (1) implement a comprehensive program of restoration measures to address the impacts of the remediation and support activities on affected ecological resources, species, and habitats; and (2) return areas disturbed by remediation activities to pre-remediation conditions (e.g., the functions, values, characteristics, vegetation, habitat, species use, and other attributes) to the extent feasible and consistent with the remediation requirements. Under Section II.B.1.c.(2) of the Revised Permit, these Performance Standards will be achieved through a program designed to address the potential impacts of remediation, which will be specified in the following series of documents: (1) a BRA Work Plan; (2) a Restoration Performance Objectives and Evaluation Criteria Report; (3) Restoration Corrective Measures Coordination Plans; and (4) Restoration Plans. Each of those documents was described further in the Final Revised SOW. As noted above, this document constitutes a BRA Report for Reaches 5B and 5C.[3]

1.3 BRA Objectives for Reaches 5B and 5C

This BRA Report for Reaches 5B and 5C BRA is intended to provide a detailed baseline ecological inventory and assessment of pre-remediation conditions and functions of the affected habitats within Reaches 5B and 5C and thus to serve as the foundation for meeting the restoration Performance Standards set forth in Section II.B.1.c.(1) of the Revised Permit as applicable to those reaches. Reaches 5B and 5C are on separate tracks and schedules for investigation and remediation, as described in the Final Revised OSS document. However, they have been evaluated together in this BRA Report given the inter-relationship of their habitats and to avoid duplication. Where there are differences in habitat conditions between those reaches, the specific conditions in each reach are described.

For each of these reaches, the conditions and features identified in this BRA Report will be used in concert with engineering considerations in an effort to site access roads and staging areas in the subject reach, giving preference to areas with lower habitat values where practicable. That information will be

[1] For the purposes of this BRA, the boundary between Reaches 5B and 5C has remained the same as that in the Revised Reaches 5B-8 Work Plan (AECOM 2023). This boundary line is at the downstream end of where flow from Roaring Brook could discharge into the Housatonic River, such that all flow from this tributary will discharge into Reach 5B.

[2] Two Exposure Areas (EAs 56 and 57) located partially within Reach 5C and Reach 6 were covered in the Reach 6 BRA Report. For continuity, these EAs are shown on the figures for this Reach 5B/5C BRA Report without differentiating their limits.

[3] In addition, GE has prepared the required Restoration Performance Objectives and Evaluation Criteria Report on a site-wide basis. The Revised Restoration Performance Objectives and Evaluation Criteria Report was submitted to EPA on April 15, 2024 (Arcadis and AECOM 2024) and was conditionally approved by EPA on July 15, 2024.

taken into account in the later preparation of the Conceptual RD/RA Work Plan for each of Reaches 5B and 5C on the schedule specified in the Final Revised OSS document.

1.4 BRA Requirements

Section II.B.1.c.(2)(a) of the Revised Permit and Section 4.2.1.4 of the Final Revised SOW set forth the requirements for the BRA Work Plan for each RU. Those requirements and the requirements in Section 4.2.1.5 of the Final Revised SOW indicate that the BRA for each RU, including Reaches 5B and 5C, is to include the following elements:

- Identification of the presence and location of specific habitat types, including delineation of existing wetlands;
- Identification of the presence, location, abundance, and condition of federal or state-listed threatened or endangered species or other state-listed species (often collectively referred to as rare species herein) and their habitats, as well as other representative species;
- Identification of the presence, location, abundance, and condition of invasive species;
- Evaluation of vernal pool locations, hydrology, and species use; and
- Characterization of physical/biological attributes of affected habitats (e.g., substrate characteristics, water depth, velocity, temperature, elevation/bathymetry, species composition, density, percent cover, and structural components).

In addition, EPA's prior conditional approval letters dated March 31, 2022 and December 22, 2022 included requirements that were addressed in the Revised Reaches 5B-8 BRA Work Plan and were thus required to be part of the BRA for Reaches 5B and 5C.

1.5 Organization of BRA Report for Reaches 5B and 5C

Consistent with the Revised Reaches 5B-8 BRA Work Plan, this BRA Report is organized according to the major habitat types which occur in Reaches 5B and 5C. Section 2 provides an overview of the approach taken for this report. Sections 3 through 7 provide baseline ecological descriptions of the riverine, riverbank, backwater, floodplain, and vernal pool habitats in Reaches 5B and 5C. Following those habitat assessments, Section 8 presents information on federally listed and state-listed species in Reaches 5B and 5C, and Section 9 addresses invasive species identified in the different habitats of these reaches. Section 10 presents information obtained during the BRA on: (a) floodplain areas with disturbed or degraded habitats that will be considered for support areas for the remediation activities of these reaches; and (b) potential restoration opportunities identified in Reaches 5B and 5C. Finally, Section 11 describes supplemental BRA activities and a schedule for conducting these activities, and Section 12 lists the references cited herein.

2. Overview of Approach for Reaches 5B and 5C BRA

The general approach for conducting the BRA for each major habitat type in Reaches 5B and 5C has been consistent among the habitats. For each habitat type, the initial step was to consolidate and summarize prior reports and investigations that included characterization of that habitat and ecological conditions of or applicable to these reaches. The relevant prior investigations through 2022 were described in Section 2 of the Revised Reaches 5B-8 BRA Work Plan.

This information from prior investigations was supplemented with the results of the specific habitat investigations conducted in 2023 and 2024 in Reaches 5B and 5C in accordance with the Revised Reaches 5B-8 BRA Work Plan.

The habitat-specific sections of this BRA Report describe the pertinent information from prior investigations described in Section 2 of the Revised Reaches 5B-8 BRA Work Plan, the results of the specific BRA investigations conducted for the subject habitat in Reaches 5B and 5C, and a comprehensive assessment of the habitat and the functions provided by that habitat, based on the referenced information. As mentioned above, although Reaches 5B and 5C are on different investigation and remediation timetables, they have been combined and evaluated together in this BRA Report, with any specific conditions relevant to each reach noted.

3. BRA of Riverine Habitats in Reaches 5B and 5C

The first step in the BRA for the riverine habitats in Reaches 5B and 5C was to consolidate pre-existing information on those riverine habitats. This was followed by additional field survey work in the river channel of these reaches. These activities have collectively provided a comprehensive description of the riverine characteristics in Reaches 5B and 5C. This approach recognizes that parameters encompassing the physical, hydrologic, and structural characteristics of the riverine system are linked to ecological functions and values. Physical processes form habitat in a stream channel. Combined with chemical constituents and biological interactions, physical habitat determines biological productivity and diversity and drives the aquatic ecosystem.

Table 3-1 provides a summary of the parameters that were incorporated into the assessment of baseline riverine habitat conditions in Reaches 5B and 5C. These include a broad range of riverine characteristics related to riverine geomorphology, hydrology, floodplain connectivity, riverbank conditions, in-stream habitat, aquatic biota, and bordering vegetative conditions.

As noted above, the riverine habitat inventory/characterization process for Reaches 5B and 5C included consolidating and incorporating existing information on riverine habitats that is applicable to these reaches. It also included site-specific inventories and data collection, including a physical riverine habitat survey, a benthic macroinvertebrate survey, and a fish community survey, as described below. During these riverine surveys, information was also collected on the presence of aquatic plants and use of the riverine habitat by wildlife observed incidental to the data collection.

3.1 Background Ecological Information

As noted in **Table 3-1**, some of the riverine assessment parameters were based on information consolidated from the sources cited previously in Section 2 of the Revised Reaches 5B through 8 BRA Work Plan. Other information, such as hydrologic/hydraulic data, was obtained from other available sources, as also noted in **Table 3-1**.

3.1.1 Woodlot Ecological Characterization (2002)

On behalf of EPA, Woodlot Alternatives, Inc (Woodlot, now Stantec) conducted an ecological characterization of the Housatonic River and presented its findings in two documents (Woodlot 2002a, 2002b). Woodlot defined the Primary Study Area (PSA) as the 12-mile stretch encompassing Reaches 5 and 6. The first document (Woodlot 2002a) includes information covering Reaches 5B and 5C and is summarized below.

The ecological characterization study carried out by Woodlot included a variety of biological investigations which addressed natural communities, rare plants, macroinvertebrates, fish, reptiles, amphibians, birds, and mammals. The study included a discussion of natural communities and rare plants in Reaches 5B and 5C. It noted that, in Reach 5B, agricultural development cleared large, forested areas, resulting in open pools available for amphibians to breed and birds to wade. Additionally, the study stated: “The Housatonic River channel is highly sinuous in this area and a number of oxbow pools were found. Channel banks are still vertically cut and a number of mucky sand beaches and accretion bars were located that often harbored the rare mudflat spikesedge (*Eleocharis intermedia*)” (Woodlot 2002a, page III-1-11). In Reach 5C, the vertically cut banks are not present, silt and fine organic particles dominate the bottom substrate, and backwaters and sloughs are present throughout. Woodlot noted that the hydrology in that area was affected by industrial and municipal discharges that contributed significant flow quantities to the Housatonic River.

Macroinvertebrate surveys by Woodlot included surveys of mussels, dragonflies, vernal pool invertebrates, earthworms, and terrestrial litter invertebrates. In Reaches 5B and 5C, mussel surveys were limited to viewing buckets from canoes due to deeper water and soft sediments. While eastern elliptio (*Elliptio complanata*), eastern floater (*Pyganodon cataracta*), and triangle floater (*Alasmidonta*

undulata) were located throughout the entire PSA, eastern floater was the most abundant found in Reach 5C.

Fish populations were qualitatively and quantitatively sampled by Woodlot within the PSA during 1998-2000, with some specific results in Reaches 5B and 5C. Woodlot characterized the results of the fish species collected by feeding guilds (predator species, bottom feeders, forage fish). When categorizing sections of the PSA for the fish surveys, Woodlot listed Reach 5B as relatively free-flowing and Reach 5C as subject to influences from the Woods Pond Dam. Fifteen and 16 species were collected during biomass sampling events for Reaches 5B and 5C, respectively. In Reach 5B, white sucker (*Catostomus commersonii*), yellow perch (*Perca flavescens*) and largemouth bass (*Micropterus salmoides*) accounted for greater than 75% of the biomass. In Reach 5C, white sucker, largemouth bass, yellow perch, common carp (*Cyprinus carpio*) and bluegill (*Lepomis macrochirus*) accounted for greater than 75% of the biomass and represented more structurally balanced biodiversity than 5B. No threatened or endangered fish species were confirmed to exist in the PSA.

3.1.2 RCRA Facility Investigation Report (2003)

GE's 2003 RCRA Facility Investigation Report (RFI Report; BBL and QEA 2003) provided substantial information characterizing ecological resources in the ROR area, including the riverine habitats in Reaches 5B and 5C. The focus of the RFI Report was on documenting the extent of PCBs in the river, which will not be summarized herein. However, in depicting PCB distribution, some relevant riverine habitat information was provided. For example, the RFI Report characterized the Reaches 5B and 5C conditions as follows: "Downstream of the WWTP, the River slope decreases, producing a deeper and wider channel. This section is characterized by a broad floodplain and large areas of shallow backwater regions associated with Woods Pond Dam. These characteristics affect chemical fate and transport differently than does the steeper channel upstream, as the lower energy environment promotes deposition and accumulation of fine sediments as well as biological growth" (RFI Report, page 8-4). It noted further that the decreasing river gradient in these reaches has a significant impact on hydrodynamics and transport processes, as spatial changes in current velocity and bed properties are related to the spatial variation in river gradient, and the extent of meandering increases as gradient decreases.

The RFI Report documented previous biota sampling activities that involved fish, plants, invertebrates, reptiles, amphibians, birds, and small mammals, providing ancillary information on faunal and floral species composition. The RFI Report noted that, with respect to fish, the Cyprinids, such as dace (*Leuciscus leuciscus*) and other minnows, are common in the upstream portion of Reach 5B above New Lenox Road, whereas the Centrarchids (sunfish and largemouth bass), yellow perch, white sucker and brown bullhead (*Ameiurus nebulosus*) are more abundant in the slower, deeper sections of Reach 5C. In summarizing water quality data, the RFI Report indicated that phytoplankton biomass in Reaches 5B and 5C is relatively low due to the relatively short residence time in the flowing system. It explained that benthic invertebrate abundance increased in the downstream direction, which was consistent with riverbed characteristics in Reaches 5B and 5C. In Reach 5C, finer sediments accumulate as the river deepens and slows, and the higher organic carbon content of these sediments serves as a source of food for invertebrates. The RFI Report also indicated that, according to 1999-2000 EPA data, total abundance of benthic invertebrates in Reaches 5B and 5C was relatively moderate, slightly higher than in Reach 5A and lower than in Woods Pond.

3.1.3 EPA Modeling (2006)

EPA's documentation of its modeling efforts for the ROR (EPA 2006), notably its hydrodynamic, sediment transport, and contaminant fate modeling using the Environmental Fluid Dynamics Code (EFDC), provides information on specific functions, such as riverine hydrodynamics, that can be used in characterizing riverine ecological functions, at least partially applicable to Reaches 5B and 5C.

During this study, the movement of largemouth bass was assessed in Reaches 5B and 5C. Fish movement was found to be limited but still sufficient to support spawning resident fish. Additionally, the study concluded that the amount of over-wintering largemouth bass habitat in the main channel reaches increases with distance downstream.

The EFDC modeling report noted that Reach 5B contains free-flowing riverine habitat that is generally made up of coarse substrates and affected by higher flow velocity, and that Reach 5C contains quiescent aquatic habitat, including impounded areas, backwaters, or slow-moving low-gradient river reaches generally characterized by finer-grained substrate and the increased presence of macrophytes and periphyton. It noted that macrophyte beds in Reach 5B increase in size, relative to the few beds observed in Reach 5A, and continue to increase downstream. Macrophyte beds in Reaches 5B and 5C were often observed in near-shore areas. The report indicated that, in free-flowing habitats like Reach 5B, white suckers dominate the fish community and feed on epifauna, while benthic communities mainly consist of the larvae of true flies (order *Diptera*). In quiescent habitats like Reach 5C, brown bullheads dominate the bottom fish community and feed on infauna and detritus, while benthic communities mainly consist of gastropods and bivalves.

3.1.4 Revised Corrective Measures Study Report (2010)

In 2008, GE issued a Corrective Measures Study (CMS) Report, which provided detailed evaluations of remedial alternatives for the ROR (Arcadis and QEA 2008). In October 2010, GE issued a Revised Corrective Measures Study (RCMS) Report, which included additional remedial alternatives and provided an updated evaluation of the remedial alternatives (Arcadis et al. 2010). The RCMS Report included an expanded description of the affected habitats in the ROR, including Reaches 5B and 5C riverine habitats, and the ecological impacts and potential for restoration associated with the remedial alternatives.

The RCMS Report described the riverine habitat from approximately the Holmes Road Bridge to Woods Pond, which includes all of Reaches 5B and 5C, as a low-grade river. Additionally, riverine point bars were noted to exist throughout Reach 5B. Mud flats were noted as seasonally available habitat in Reach 5C during the lower water late summer/early autumn months. The RCMS Report described the low-gradient areas as having substrate dominated by silts, organic muck, and fine sand, with the possibility of small amounts of gravel, cobble, or boulder present, especially along the margins. It also noted that this area has considerable meanders throughout, as well as submerged woody debris that adds structure and affects depositional patterns. Typical depth in these areas was listed at six to seven feet in the main channel, with a maximum depth of 10 feet.

Biological communities within Reaches 5B and 5C were also described in the RCMS Report, including aquatic vegetation, aquatic invertebrates, fish, and rare species habitats. It noted that most of the riverine habitat in Reach 5B hosts only sparse patches of aquatic vegetation in sandy areas. In Reach 5C, there are dense patches of aquatic vegetation, especially along the periphery, and submergent aquatic vegetation coverage may be substantially greater than is obvious from the surface of the river. As noted in the RCMS Report, the aquatic macroinvertebrate community associated with the riverine habitats of the Housatonic River, including Reaches 5B and 5C, is extensive and includes state-listed clubtail dragonflies (family Gomphidae) as well as numerous other invertebrates. Many of these insect species live in the river while in their larval form and then morph into a flying adult stage during the spring and summer.

Fisheries information on Reaches 5B and 5C reported in the RCMS Report was primarily taken from Woodlot (2002a), which indicated that most fish that utilized the Housatonic River were warm water species. The report noted that, in 2000, the most abundant fish species in Reaches 5B and 5C was the white sucker, followed by largemouth bass, yellow perch, rock bass (*Ambloplites rupestris*), and common carp.

The RCMS Report noted that the riverine point bars found throughout Reach 5B provide a connection between the river and the floodplain for access by wading birds and small and large mammals, and act as emergence habitat for amphibian and invertebrate larvae. Potential nesting habitat for wood turtles (*Glyptemys insculpta*, a state-listed species) can be provided by sections of riverine point bars that are higher up and contain larger amounts of gravel than other sections. More generally, the report noted that "the Housatonic River is the major migration and dispersal corridor in the PSA. It provides opportunity for aquatic and semi-aquatic organisms, including numerous fish species, wood turtles, beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*), to seek out and navigate into suitable habitat. It also allows for transport of nutrients, sediment, and food items from upstream terrestrial and aquatic communities to downstream areas" (RCMS Report, pages 5-16 to 5-17). Finally, the report provided

extensive detail on state-listed species mapping and habitats in Reaches 5B and 5C, including many that use riverine habitats at least for certain life cycle requirements (see also Section 8.2 of this BRA Report).

3.1.5 Example Area Evaluations (2010)

In February 2010, GE submitted a Supplement to Interim Response presenting detailed evaluations of six Example Areas within Reaches 5A to 5C that were selected by EPA, two of which were located within Reaches 5B and 5C (AECOM 2010). Those evaluations contain considerable information on the existing ecological conditions and functions in the selected Example Areas, as well as the impacts of remedial alternatives on those conditions and functions. Example Area #5 includes a section of the Housatonic River within Reach 5B, and Example Area #6 includes a section of the Housatonic River within Reach 5C. These two Example Areas are shown on **Figures 3-1b, c, and e** (also discussed in Section 3.2).

Example Area #5 contains approximately 1,800 linear feet of riverine habitat, characterized by a channel 80 to 110 feet in width and 5 to 18 feet in depth in the thalweg. It consists of primarily silt substrate with smaller components of organic muck, sand, and very limited gravel areas. This section of river includes five prominent bends with deep areas connecting the meander bends, no riffle habitat, and three exposed point bars. Example Area #6 contains approximately 2,000 linear feet of riverine habitat, characterized by a channel 60 to 80 feet in width and exceeding eight feet in depth, and has primarily fine-grained silt and organic muck substrate, with some sand. This section of river includes two prominent bends.

The Example Area evaluations provide considerable detail on the riverine habitats in both sections of the river in Reaches 5B and 5C. The following points summarize the riverine habitat descriptions provided about Example Areas #5 and #6:

- Example Areas #5 and #6 consist entirely of low-gradient stream (LGS).
- Silt and organic muck are dominant in these LGS areas. Very limited areas of gravel occur where increased water velocity transports the silt and muck downstream.
- From a surficial inspection, large woody debris was relatively uncommon within both Example Areas. There are a few overhanging trees that provide coarse woody debris in Example Area #5, but otherwise there are not many sources for large woody debris in these areas. Additional large woody debris is transported from forested areas upstream.
- Aquatic vegetation in Example Area #5 is limited to narrow silt/sand bars adjacent to riverbanks downstream of the inside of meander bends. Aquatic vegetation in Example Area #6 is limited to shallower peripheral areas. Aquatic plant growths are generally limited by decreased light at depth and the instability of the soft, depositional sediment in these areas.

3.1.6 Natural Heritage Information (2010-2022)

Investigations, data, mapping, and reports from the Massachusetts Natural Heritage and Endangered Species Program (MNHESP) of the Massachusetts Division of Fisheries and Wildlife (MassDFW) have been ongoing for at least the last two decades. These efforts included designation of Priority Habitats of state-listed rare species (i.e., threatened, endangered, and special concern species) and documentation of state-listed rare species within the Priority Habitat limits delineated. In 2008-2009, MNHESP conducted rare species field surveys to identify populations of state-listed rare species within the Upper Housatonic River Valley (MNHESP 2010). As of 2010, this research confirmed the presence of at least 15 state-listed species associated with riverine habitats throughout the Primary Study Area and resulted in the preparation of updated Priority Habitat mapping for each of these species, which was included in the 2010 RCMS Report. MNHESP also published two documents summarizing much of its investigations (MNHESP 2010, 2011).

In July 2012, MassDFW issued a letter to EPA reporting on the designation of Core Habitat Areas within the ROR that were based upon the MNHESP state-listed species data and analyses (MassDFW 2012). This letter, which was attached to the Revised Permit, included maps depicting the locations of the different types of Core Areas, designated Core Area 1, 2, and 3, and presented the criteria for the

designations.[4] All three types of Core Areas include some riverine habitats. There are four specific sections in Reaches 5B and 5C where riverine habitat (and possibly riverbank habitat) is included in Core Area 1. It is noted that one of the species included in the MNHESP listing of Core Area 1 species is the triangle floater, which is no longer a state-listed species. However, one of the Core Area 1 plant species, the wapato (*Sagittaria cuneata*), may potentially be found in the riverine habitat in Reaches 5B and 5C.

In October 2022, MNHESP provided GE with updated Species Habitat mapping of the state-listed species in the ROR, including Reaches 5B and 5C.[5] As described in Section 3.3.3, at least 13 of these species utilize habitats consistent with those present in the riverine habitat of Reaches 5B and 5C and have mapped Species Habitat that includes the river channel in Reaches 5B and 5C.

3.1.7 Other Existing Information

U.S. Geological Survey (USGS) Gage Station Data

USGS maintains two flow monitoring stations (gages) along the Housatonic River that provide information on the hydrology of the aquatic habitats in Reaches 5B and 5C. The first gage is located along the East Branch of the Housatonic River in Coltsville, Massachusetts (Station 01197000—East Branch Housatonic River at Coltsville, Massachusetts), accessed at: Housatonic River at Coltsville, MA – USGS Water Data for the Nation (USGS 2025a). The dataset for the USGS Coltsville gage includes the daily stream flows from 1936 to present. A second gage was installed by USGS in September 2022 (in coordination with GE) along the Housatonic River downstream of Woods Pond Dam (Station 01197145—Housatonic River at Lenoxdale, Massachusetts; USGS 2025b)), accessed at: Housatonic River at Lenoxdale, MA - USGS Water Data for the Nation. Data pertinent to this gage include drainage area (171 mi^2), discharge, stage, and stage elevation.

Hydrologic/Hydraulic Analysis

A hydrologic/hydraulic analysis (HHA) of the watershed for Reaches 5 and 6 was performed in 2023 to evaluate the statistical characteristics of flows within the ROR, and this information forms a part of the understanding of hydrologic conditions in Reaches 5B and 5C, which strongly influences habitat. The hydraulic model used for this project was the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center – River Analysis System (HEC-RAS) version 6.3.1 modeling software (USACE 2022). A summary of the HHA was provided as Appendix G of the Reach 5A Conceptual RD/RA Work Plan (Anchor QEA 2023). The following flow information is excerpted from the HHA, showing data for Reaches 5B and 5C at Mill/Roaring Brook confluence (border of Reach 5B with 5C) and in Reach 5C at the confluence with Yokun Brook and at the downstream end at the "Woods Pond Headwaters."

Within the bounds of Reaches 5B and 5C, the tributaries Mill Brook, Roaring Brook, and Yokun Brook each flow into the Housatonic River and were incorporated into the HHA. The HHA indicates that the drainage area of the Housatonic River at the confluence with Mill and Roaring Brooks is 156.17 square miles, with a flow increment ratio (relating measured flow at the Coltsville gage station to this downstream location) of 2.71. At the confluence with Yokun Brook, the Housatonic River was determined to have a drainage area of 163.02 square miles and a flow increment ratio of 2.83. Resulting flow values for the Housatonic River were also determined at the confluences with these tributaries. The flow values for the Housatonic River at the confluence with Mill/Roaring Brook were determined to be 16,664 cubic feet per second (cfs) for a 100-year event, 8,223 cfs for a 10-year event, 3,886 cfs for a two-year event, and 1,317 cfs for a one-year event. Resulting flow values for the Housatonic River for at the confluence with Yokun Brook were determined to be 17,538 cfs for a 100-year event, 8,654 for a 10-year event, 4,068 cfs for a two-year event, and 1,386 cfs for a one-year event

[4] Core Areas 1, 2, and 3 are defined in a footnote in Section 6.1.5 of this report.

[5] As discussed further in Section 8, Species Habitat Maps are species-specific maps prepared by MNHESP using the "best scientific evidence available," examining individual occurrence records and other set criteria to delineate the anticipated habitat area for an individual state-listed species. MNHESP also provides on-line, publicly available mapping of Priority Habitats of state-listed species, which is a regulatory layer consisting of combined Species Habitat Maps with "supporting habitat" added, where applicable.

For calibration purposes, the reported Federal Emergency Management Agency (FEMA) water surface elevation (WSE) profile was compared to the HEC-RAS model outputs. The results showed good agreement between the model and the FEMA Flood Insurance Study. Accordingly, the model is capable of reasonably predicting WSEs, water depths, average flow velocities, and inundation extents under various flow events. The 2023 HHA is a 1D model, suitable to support conceptual remedial design, but will be expanded to a 2D model for the final design of the Reach 5A remediation (as well as for subsequent remedial activities) to more effectively evaluate flow patterns and velocities at locations with complex stream geometry.

Fisheries and Aquatic Ecology Surveys in 1992 and 1993 by Chadwick & Associates

On behalf of GE, Chadwick & Associates conducted fisheries survey of the Housatonic River in 1992 and 1993, including benthic invertebrates in the 1993 survey (Chadwick & Associates, 1993 and 1994). These studies included one survey area within lower Reach 5B and upper Reach 5C where the highest sediment PCB levels had been recorded to date. This area was sampled with an electrofishing boat in both years, and the following species were observed: rock bass, black crappie (*Pomoxis nigromaculatus*), bluegill, largemouth bass, pumpkinseed (*Lepomis gibbosus*), eastern chain pickerel (*Esox niger*), yellow perch, brown bullhead, white sucker, goldfish (*Carassius auratus*), and common carp.

Benthic macroinvertebrates were also sampled at this site with the kick sampling method in 1993. Diptera and/or Oligochaetes were dominant, with 47 taxa identified. The species present in the sampling indicated a healthy and balanced community.

3.2 2024 Riverine Habitat Investigations

3.2.1 Overview of Approach and Methods

The consolidation and assimilation of the information described above were supplemented by additional field surveys of the baseline riverine habitat conditions in Reaches 5B and 5C in September through November of 2024. The surveys utilized the Habitat Assessment and Physiochemical Parameters methods from the EPA's Rapid Bioassessment Protocols (RBP) (Barbour et al. 1999), focusing on the structural parameters of the riverine habitat. Specifically, the physical characterization protocol of the RBP was implemented to document the riverine habitat conditions in Reaches 5B and 5C, the macroinvertebrate sampling protocol for multi-habitat conditions was implemented, and additional fisheries surveys were also conducted, as described below. The RBP provided for an integrated assessment, comparing habitat (e.g., physical structure, flow regime), water quality, and biological measures. Use of the RBP provides for a systematic documentation of baseline conditions which could serve as a reference for post-remediation restoration assessment.

3.2.2 RBP Physical Habitat Survey

3.2.2.1 Methods

Use of the RBP employed the standard inventory forms for the physical characterization and habitat assessment. Those forms were completed for three riverine stations in Reach 5B and five riverine stations in 5C; those forms are provided in **Appendix A**. The forms include standard measures for documenting a variety of watershed, riparian, bank, and in-stream features. Included in the characterization are in-stream physical measures, large woody debris, aquatic vegetation, basic water quality parameters, sediment/substrate conditions, epifaunal habitat, flow regime, channel conditions, bank stability, and vegetative cover, as well as incidental wildlife observations. Details for each parameter collected are provided in **Table 3-2**. Substrate type areas were derived from side-scan sonar (SSS).

To assist in the benthic habitat mapping and characterization in the impoundment, GE conducted SSS surveys in Reaches 5B and 5C. SSS methods were employed consistent with the Revised Reaches 5B-8 BRA Work Plan. This survey was conducted in November 2024; this time period was specifically selected to survey the riverine habitat after the aquatic macrophyte growth had senesced. The following points summarize the approach, which is further described in **Appendix A**:

- The objective of the SSS survey was to identify the percent of habitat types underwater within subsections of the aquatic habitats in Reach 5B and 5C, particularly where the habitat cannot be observed from above the water. The survey was performed on a jon boat during fall to avoid navigation and sonar conflicts with submerged aquatic vegetation (SAV).
- The SSS has capabilities to display habitat features while the boat is moving and while stationary using a rotating transducer mount and advanced image processing. A subsample of georeferenced images was obtained to document special features and to document methods for reporting.
- Habitat polygons were drawn onto paper maps in the field, then digitized to GIS (Geographic Information System) for area calculations and display.
- The following habitat types were differentiated and identified: rock (gravel, cobble, boulder, ledge), large woody debris (LWD), and manmade structures (e.g., rip rap, concrete). Silt/sand/mud was considered the default substrate.
- Each observed habitat type with SSS was verified at 57 ground truth locations in the field using visual observations of surficial sediments, sediment grab texture observations, and observations using intrusions in the sediment with steel poles Visual observations were aided by a view tube (device that smooths the surface of the water and deflects glare) and a lighted high-definition underwater camera (see Appendix A.3).

Estimates of habitat areas were calculated through GIS analysis of georectified side-scan images, and then calculated in proportion to the overall area. The eight river segments at which RBP assessments were conducted (RBP areas) constituted the entire extent of Reaches 5B and Reach 5C, as shown on **Figure 3-2**. The extents of RBP areas were determined based on field evaluations of stream morphology patterns by AECOM scientists. RBP areas were selected to include roughly proportional ratios of stream morphology types. This allowed for evaluation of the entirety of the habitat without the potential error associated with subsampling in small portions of the river. Each area was selected to encompass an approximately proportionate amount of each river habitat feature type (run, riffle, pool) based on the river morphology as depicted on high-resolution aerial imagery. River habitat features are often correlated with the river morphology. For example, pools are typically located in meander bends and riffles and runs are typically found in straight sections. The field team recorded qualitative and quantitative habitat parameters in this pattern.

The summer and early fall prior to the survey had relatively low river flows due to the drought in 2024. Some storms in early November helped bolster the flow, but the flow was approximately 1/3 the normal flow rate during the survey (approximately 50 cfs).

3.2.2.2 Results

The entirety of the resulting field data from the RPB data collection is provided in the completed forms in **Appendix A**. The results for the RBP are summarized in **Tables 3-3**, **3-4**, and **3-5**. Observations from the eight RBP areas provide a comprehensive evaluation of riverine habitat in the entirety of Reaches 5B and 5C.

Figure 3-2 provides the results of the SSS survey in Reaches 5B and 5C. As indicated, the entirety of the aquatic habitat was thoroughly covered by SSS and visual observations. The SSS survey indicates that roughly 85% of the aquatic habitat area in both Reaches 5B and 5C contains a silt and sand dominant substrate.

The number of occurrences and amount of surface area recorded for each of these benthic habitat conditions have been separated out into the eight RBP sections of Reaches 5B and 5C aquatic habitat, as shown in **Table 3-4**. While silty-mud benthic habitats predominate in Reaches 5B and 5C, woody debris was documented in at all locations.

The key findings are as follows:

- River morphology is a top-level indicator of habitat in both flow regime and substrate. Total river morphology proportions observed in Reach 5B are Pool 95%, Run 5%, and Riffle 0%. Total river morphology proportions observed in Reach 5C are Pool 100%, Run 0%, and Riffle 0%. Riffle was not found, and proportions of run decrease downstream into a lower gradient regime.
- Substrate is the foundation of riverine habitat and creates habitat for the forage base of the biological community. Average substrate proportions in Reach 5B are as follows: Sand 17%, Gravel 4.2%, Silt 68%, Clay 6%, Cobble 4.2%, Boulder 0.7%, and Bedrock 0.0%. Average substrate proportions in Reach 5C are as follows: Sand 16.5%, Gravel 3.1%, Silt 68.9%, Clay 8%, Cobble 2.8%, Boulder 0.8%, and Bedrock 0.0%. See **Figure 3-2** for general location prevalence and **Table 3-4** for more information.
- Rocky substrate slightly decreased from upstream to downstream.
- Average organic substrate distributions are as follows in Reach 5B: Detritus (leaves, small wood, and other organic matter) 10.3%, and Muck-Mud 3.3%. In Reach 5C, Detritus and Muck-Mud covered 6.6% and 7.5% of the substrate, respectively. See **Table 3-4**.
- LWD was a consistent habitat component, and the density is estimated at 86,507 m^2/km^2 (8.7 % coverage) and 44,065 m^2/km^2 (4.4 % coverage) of riverine habitat across all stations in Reaches 5B and 5C, respectively. Large embedded root wads and trees demonstrably entrapped other LWD in the flow and created substrate for epifauna and cover for fish and other aquatic organisms, as well as suitable basking habitat for reptiles and perching sites for birds.
- Average aquatic vegetation cover was sparse and comparable in Reaches 5B and 5C (11.7% and 11.8%, respectively). Canadian waterweed (*Elodea canadensis*) was the dominant aquatic vegetation in two of three RBP stations in Reach 5B, while broad-leaved cattail (*Typha latifolia*) was identified as dominant aquatic vegetation in four of five RBP stations in Reach 5C.
- The qualitative habitat assessment parameters for the overall area (see **Table 3-5**) ranked from highest (optimal) to lowest (marginal) weighted scores in Reach 5B are:
    1. Channel Alteration- 17.6,
    2. Channel Flow Status- 17,
    3. Vegetative Protection- 16,
    4. Pool Variability- 15.8,
    5. Channel Sinuosity- 15.7,
    6. Pool Substrate Characterization- 15.5,
    7. Available Cover- 14.4,
    8. Riparian Vegetative Zone Width- 12.7,
    9. Bank Stability- 12.5, and
    10. Sediment deposition- 12.
- The qualitative habitat assessment parameters for the overall area (see **Table 3-5**) ranked from highest (optimal) to lowest (marginal) weighted scores in Reach 5C are:
    1. Channel Alteration- 20,
    2. Vegetative Protection- 19.2,
    3. Bank Stability- 19
    4. Riparian Vegetative Zone Width- 18.7,
    5. Channel Flow Status- 17,
    6. Available Cover- 15.5,

7. Pool Substrate Characterization- 13.7,
8. Pool Variability- 12.9,
9. Sediment deposition- 12.7, and
10. Channel Sinuosity- 9.3.

- Vegetative protection and channel alteration had the highest scores because most of Reaches 5B and 5C has not been armored or dredged and there is a large riparian buffer. Bank stability and sediment deposition were observed to be in poor condition as banks erode and unconsolidated sediments move through the river. Although there are higher gradient flows in the upper sections of the reach, there was no concurrent trend in habitat quality.
- The dominant riparian vegetation type in two of three Reach 5B RBP stations was shrub cover, composed primarily of common buckthorn (*Rhamnus cathartica*) and silky dogwood (*Cornus amomum*). Dominant herbaceous species included reed canary grass (*Phalaris arundinaceae)*, Japanese knotweed (*Fallopia japonica*), and purple loosestrife *(Lythrum salicaria*). The dominant riparian vegetation type in all five Reach 5C RBP stations was likewise shrub cover. with dominant species including silky dogwood, Asian bittersweet (*Celastrus orbiculatus*), Morrow's honeysuckle (*Lonicera morrowii*), and red osier dogwood (*Cornus sericea).* Dominant herbaceous species were reed canary grass, common reed (*Phragmites australis*), and broad-leaved cattail.
- In Reach 5B, average water depth was approximately 1.5 meters (~ five feet) and average surface velocity was estimated to be approximately 0.5 m/s. Reach 5C had an estimated average water depth of 3.2 meters (~10.5 feet) and average estimated surface velocity of 0.2 m/s.
- Pool habitats were usually found in outside bends, as is common in rivers dominated by soft substrate. Many of these pool habitats also featured large woody debris and undercut banks that provide habitat for forage fish, larger fish, turtles, muskrat, and other wildlife.

It is notable that surficial sediments are dynamic in rivers. Changes in surficial sediment type distribution are largely due to flow conditions before the survey. In this case, the low flows experienced during the late spring, summer, and fall of 2024 may have caused harder substrate and woody debris to be covered by fine sediments that would be otherwise cleared by flow.

3.2.3 Benthic Macroinvertebrate Survey

Benthic macroinvertebrate surveys can play a useful role in assessing aquatic habitat quality. Benthic macroinvertebrates (small aquatic animals and the aquatic larval stages of insects) can provide valuable insights into the health and quality of an aquatic habitat. They are sensitive to pollution and changes in their habitats, have a relatively long-life cycle, and are indicators of water quality over a period of time. Their presence, diversity, and abundance can help to assess the overall health of the aquatic ecosystem.

3.2.3.1 Methods

A survey of the benthic macroinvertebrate community was conducted in Reaches 5B and 5C in September of 2024. Two sampling stations were sampled in Reach 5B and five stations were sampled in Reach 5C, including one duplicate sample in each reach. The sampling stations are shown on **Figures 3-1a-f**. The objective of the macroinvertebrate sampling was to obtain updated information on the general species composition and relative abundance in the prevalent benthic habitats in Reaches 5B and 5C. The sampling method was carried out as follows:

1. Approximately 150-foot-long sampling areas were selected based upon the physical habitat inventory, to include representative benthic substrates and flow regimes while considering potential influence from nearby anthropogenic factors. These sampling areas are shown on **Figures 3-1a-f**. They were selected primarily based on their representation of benthic substrates and flow regimes in Reaches 5B and 5C, respectively.

2. Field documentation worksheets were completed, and a sketch map of the sampling area was prepared, including in-stream attributes, flow direction, and approximate station designation.
3. Benthic macroinvertebrates were collected systematically by utilizing two standard sampling methods: kick sampling and jab sampling. When the kick method was used, a D-shaped dip net was held in place on the substrate at the downstream end of the sampling area while the substrate immediately upstream of the net was disturbed with the wader boot. When the jabbing approach was used, the dip net was forcefully thrust into the substrate multiple times. Epifauna on rocks and wood were manually removed (by hand rolling and cleaning rocks, woody debris, etc. as necessary) and added to the samples during the sampling. These methods continued until 20 individual substrate samples were collected. The distribution of the 20 samples was combined to represent the proportion of each of the substrate types (sand, gravel, cobble, wood, aquatic plants) in that sampling area.
4. Upon completion of each round of sampling, the net was removed from the water column, allowed to drain free of water, and inspected for the presence of macroinvertebrates. Large debris (leaves, sticks, rocks, etc.) were removed from the net, and the remaining contents transferred to a labeled sample jar (continuing to fill the same jar after each round) and preserved using ethanol.
5. This process was repeated by moving upstream across the sampling area until 20 individual samples were collected from the sampling area. The individual samples collected by the kick or jab method from the multiple habitats were composited in one sample jar to obtain a single homogeneous sample for the sample area. The process was then repeated at each of the remaining sampling areas.

Each composite sample was labeled with sampling date and collection location and sent to the Haley Ward (formerly Lotic Inc.; https://haleyward.com/maine/) laboratory in Bangor, Maine for taxonomic identification (to species level where possible). A total of five composite samples, plus a duplicate sample from one of the sample areas, were sent to the laboratory for such identification. Samples were sorted with a target of 300-500 organisms.

An analysis of water quality and riverine habitat from the macroinvertebrate data was performed with assistance by Haley Ward in a manner that is consistent with its analysis of previous monitoring of restoration efforts on the 1½-Mile Reach and Reach 5A situated upstream from Reaches 5B and C (e.g., GE 2017, Reach 5A BRA). Given the lack of a reference site for this effort, many of the metrics in the RBP manual cannot be used, since the RBP uses comparisons with the reference condition to make evaluations of benthic communities. However, Haley Ward has developed an in-house model based on 23 years of aggregated benthic community data; that model is further bolstered by its consistency with Maine Department of Environmental Protection's linear discriminant model (Davies and Tsomides, 2014). The Haley Ward model is designed for similar habitats and macroinvertebrate communities in western Massachusetts, and, as noted above, was used in previous macroinvertebrate surveys in the 1½-Mile Reach.

3.2.3.2 Results

The macroinvertebrate community assessment involved the collection of seven samples and two duplicate samples. **Table 3-6** presents the taxonomic identification results of the samples collected at all stations to the nearest order. The full results of the benthic macroinvertebrate sampling are provided in **Appendix A**. Across all stations, a total abundance of 3,457 organisms was identified. Total species richness for all stations was 99. Richness reflects the health of the community through the measurement of the number of distinct taxa. It generally increases with increasing water quality, habitat diversity, and habitat suitability.

In general, these data are considered normal for this habitat. The data do not show signs of impairment. The high numbers of Hydropsychid caddisflies and midges are indicative of particulate organic material more than pollution, which is normal in rivers of this size.
Table 3-7 presents the taxa measures from each station. The Haley Ward model described above assigns the following classifications based on benthic community structure to aid in interpretation of the data in comparison to other similar streams in New England:

1. Class A - High quality; aquatic life as naturally occurs,
2. Class B - Good quality; no detrimental changes to the biological community,
3. Class C - Fair quality, some changes to aquatic life; maintains the structure and function of the resident biological community,
4. Non-attainment (NA) - Does not attain Class A, B or C classifications.

Capital letters in the table following the richness and dominant organism metrics indicate the estimated water quality classification based on the Haley Ward model. All samples attained a classification in this system with good or higher indicators of quality.

The average taxa (genus) richness of 49 is indicative of good water quality with no detrimental effects to the biological community. The dominant organism and its proportional presence in each sample was also evaluated. Species with higher water quality requirements translate to higher classifications for aquatic habitat quality. EPT richness refers to the relative abundance of three major orders of stream insects: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). Overall EPT richness among all stations was 30. These insects are very sensitive to many pollutants in the stream environment, and thus their presence or absence can be used as an indicator of water quality. A large proportion of EPT taxa indicates high water quality (Lenat and Penrose 1996). In this survey, the EPT at each station ranged from 14 to 24 with an average of 18. Average EPT richness in Reach 5B was 16 and average EPT richness in Reach 5C was 19. This EPT proportion is an indicator of good to high water quality.

The dominant organism was caddisflies (specifically *Cheumatopsyche* sp.), comprising 8.7% of the total abundance. The second most dominant organism was the non-biting midge (*Cricotopus bicinctus*), comprising 7.8% of the total abundance. While both species could be considered pollution-tolerant, their low abundance, combined with the overall high species richness (particularly EPT richness) and distribution of species across samples, reflect diverse benthic habitats and moderate/good water quality. *Cheumatopsyche* was the dominant organism in Reach 5B and *Cricotopus bicinctus* was dominant in Reach 5C.

Large numbers of pollution-tolerant Chironomids often indicate poor water quality conditions. These species have a substance similar to hemoglobin in their blood, which allows them to survive in places where the oxygen has become depleted. However, the Chironomidae family incorporates taxa with a large ecological and physiological diversity and different sensitivity to impairment. Therefore, while some species are tolerant of pollution and can thrive in degraded sites, others may be more sensitive (Saether 1975). In this survey, the Chironomidae richness average ranged from 12 to 19, with an average of 14. The average Chironomidae richness in Reach 5B was 12, and the average in Reach 5C was 14. The abundance was also distributed among these genera without one strongly dominant genus. This is indicative of good water quality, especially when considering the long drought season.

Overall, this high species richness and other taxa measures are indicative of sufficient long-term water quality, the diverse microhabitats available in the Reaches 5B and 5C channel, the abundant vegetation/habitat in riparian zone for adult emergent insects, and the soft sediment that provides forage and habitat for macroinvertebrates.

3.2.4 Assessment of Fish Species

3.2.4.1 Methods

In accordance with Section 3.1.1.3 of the Revised BRA Work Plan, a fish community composition sampling event was performed on September 27, 2023 in Reaches 5B and 5C, using an electrofishing boat, along with the first round of fish tissue sampling in GE's ROR baseline monitoring program. The community survey occurred by boat for approximately 30 minutes and covered each side of approximately 500 meters of river length collectively in Reaches 5B and 5C.

The entire community survey area can be viewed in **Figures 3-1a-f**. The transect started at the furthest upstream point (approximately 1,400 feet upstream from the confluence of Yokun Brook and extended around a bend downstream just downstream from the Yokun Brook confluence) before continuing back and finishing upstream. A total of 13 different fish species were identified, including bluegill, bluntnose minnow (*Pimephales notatus*), common carp, comely shiner (*Notropis amoenus*), golden shiner (*Notemigonus crysoleucas*), largemouth bass, northern pike (*Esox lucius*), chain pickerel, pumpkinseed, rock bass, spottail shiner (*Notropis hudsonius*), white sucker, and yellow perch. **Table 3-8** displays the numerical community survey data. Species, age class and any apparent diseases or deformities were recorded for each fish by an AECOM scientist as the fish were captured.

Small fish traps (known as minnow traps) were deployed in October of 2024 to obtain information on small fish species that may not be affected or observed while electrofishing. The traps were deployed at two locations in Reach 5B and two locations in Reach 5C, which were distributed to account for diversity in habitat and location. Each location had four traps placed in prime small fish habitat representative of Reaches 5B and 5C.

As noted above and shown on **Figures 3-1a-f**, the four trap locations were spread throughout Reaches 5B and 5C. At each of those locations, baited traps (baited with white bread and canned fish-based cat food) were deployed in the morning, checked late in the afternoon, and then pulled from the water the next morning, so that each trap was in place for approximately 24 hours. At the checks, the small fish species (and other species) present in the traps were identified and total length was measured as the fish were captured.

3.2.4.2 Results

Fish Community Survey

As described above, data on the fish community in Reaches 5B and 5C were obtained concurrently with the fish tissue collection task associated with GE's baseline monitoring program. Results are presented in **Table 3-8**. Spottail shiners were the most numerous by far (N=370). This was followed by bluntnose minnow, largemouth bass, and yellow perch. Largemouth bass and northern pike comprised the highest fish biomass. This is consistent with this species' habitat preference for slow moving or still waters with aquatic vegetation, woody debris, and access to deep water. While these data may not be representative of the whole reach, the composition of species found in this survey is typical of low gradient rivers. There were no diseases or deformities observed in any of the sampled fish.

In general, the data from the fish community surveys and sampling show the following:

- The fish species assemblage is indicative of a productive slow moving warm/cool water river with abundant habitat.
- The balanced species distribution and high abundance in the survey area reflect the dense cover and varied habitat provided by curly-leaf pondweed (*Potamogeton crispus*), Eurasian watermilfoil (*Myriophyllum spicatum*), and woody debris. Some proportions of individuals are typically passed over and not collected because the effectiveness of electrofishing is not 100%; therefore, the true abundance is likely higher. For example, sampling effectiveness is limited to the top four to eight feet of the water column, and in many cases the fish are not accessible to the nets when they are stunned in dense cover such as woody debris and vegetation.
- There are many ambush locations for larger predatory fish created by woody debris, sinuous channels, aquatic vegetation, and steep drop offs
- Abundant forage fish (shiners, minnows), indicate dense vegetation habitat and abundant plankton availability. They also provide prey for the large and medium predator species.
- Abundant medium-sized predator species (yellow perch, rock bass, juvenile northern pike, juvenile largemouth bass) further indicate that there is a forage base for large predators.
- The high population of plankton in Reaches 5B and 5C provides forage for young-of-the-year (YOY) and juvenile fish, minnows, macroinvertebrates, mussels, and larger plankton.

Minnow Traps

The results of the small fish trapping effort are presented in **Table 3-9**. The diversity of habitats represented areas that are typically suitable habitat for small fish species. There were no diseases or deformities observed in any of the sampled fish. Results of the overall trapping effort may be an indicator that the biomass of juvenile fish species was more proportionally dominant than that of small fish species (e.g., minnows such as shiner and dace) at the time of the survey. Biomass and numbers of forage species such as minnows are typically higher than that of juvenile species of predatory and bottom-feeding fish, but no forage species were caught. Forage fish can have a small home range and it is possible that the traps were not coincidental with the home range of a forage fish school. Pumpkinseeds and bluegill were the only species caught and they were caught only in the trap set in the middle of Reach 5C. These species are moderately tolerant of pollution and soft unconsolidated substrates (see Grabarkiewicz and Davis 2008). The vegetation and depth in the middle of Reach 5C are also conducive as a nursery for these YOY fish.

The low representative catch numbers and habitats that the species represent may have been influenced by the drought conditions during the time of the minnow trapping effort in October 2024. The drought conditions brought low water and relatively warm water conditions. The low water limited the volume of habitat available to fish in the upper and middle of Reach 5B because of less submerged substrate and woody debris available. Moreover, warm water conditions are not ideal for many cold or cool water-adapted fish. Fish in small rivers are known to migrate to find suitable conditions. Although the trap locations in this study included relatively deep areas, many fish may have migrated to deeper, cooler waters or found refugia in groundwater or stream confluences, like those that have been documented throughout Reaches 5B and 5C.

3.2.5 Incidental Direct Wildlife Observations

During the course of the riverine habitat surveys, field observers recorded all direct observations of wildlife species (including evidence of species presence, such as tracks or scat). **Table 3-10** provides a summary of these observations. Overall, a total of 35 species (or evidence of their use) were observed in or around the river in Reach 5B and 5C. These consisted of 13 bird species, four species of herpetofauna, five mammal species, eight invertebrate species, and five fish species. In addition to this listing, **Appendix A** provides documentation of wildlife observations by RBP area.

3.2.6 Aquatic Plant and Invasive Species Observations

Submerged aquatic plant cover is generally sparse in the riverine environment in Reaches 5B and 5C. Periphyton algae covers some rocks, woody debris, and shallow silty/clayey bottoms. Curly-leaf pondweed, an invasive species, was located in two RBP areas (5B RBP #2 and 5C RBP #1). The invasive Eurasian watermilfoil was also found in these same stretches during the riverine investigations. Common reed, another invasive species, was also observed on the banks of 5C RBP #2. Other species of aquatic plants found include waterweed and broadleaf cattail. Other than the three invasive species noted above, no other invasive species (plant or animal) was observed during the in-river surveys.

3.3 Description of Riverine Habitats in Reaches 5B and 5C

3.3.1 Habitat Types Within the Riverine Environment

The Housatonic River in Reaches 5B and 5C includes two primary flowing water habitat designations, as defined by MNHESP (Swain and Kearsley 2000): medium-gradient stream (MGS) and low-gradient stream (LGS). Extending approximately 5.9 river miles, the total riverine habitat in Reaches 5B and 5C is approximately 69.8 acres in area. Based upon current findings, approximately 1.5 acres of MGS occurs in Reach 5B, with the remainder of Reach 5B and all of Reach 5C as LGS. Reach 5B is approximately 2.6 river miles long with 26.5 acres of river habitat. Reach 5C is approximately 3.3 river miles long with 43.4 acres of river habitat.

Reach 5B includes significantly more pool (95%) than run (5%) habitat across the entirety of the reach; and while some run habitat does appear in the lower stretches of Reach 5B, this habitat is more prevalent in the upstream stretches. Reach 5C is composed entirely of pool habitat.

Two other aquatic habitats are distinguished from the stream itself by MNHESP (Swain and Kearsley 2000) – riverine point bars and mud flats. Riverine point bars include deposits of coarse material near the edge of the river, typically at an inner bend, and are spread throughout Reach 5A. Since these are transitional features between the river and riverbank, they are also discussed in Section 4 on riverbanks. Mud flats are composed of finer material deposits, usually of higher organic content, also along the river edge. The extent of mud flats has not been quantified, but they are noted as a seasonally available habitat, associated with low late summer and early autumn water levels.

Several tributary waterbodies occur along Reaches 5B and 5C that contribute flow and sediment to the riverine habitat. At the downstream end of Reach 5B, along the left bank (or east side) of the Housatonic River, the combined flows of Mill Brook and Roaring Brook diffuse into the main channel along several hundred feet of an alluvial fan. Roughly one-third downstream into Reach 5C, Yokun Brook discharges through the right bank under the railroad causeway that parallels the river along both of these reaches. A short distance downstream of Yokun Brook, Willow Creek (also known as Sawmill Creek) similarly flows west to east under the rail line into a large backwater bordering the Housatonic River.

3.3.2 Hydrology and Physical Features

Hydrologic and hydraulic conditions in the Housatonic River in Reaches 5B and 5C ultimately determine the physical and biological conditions. Streams carry the water and sediment supplied by their watershed. The resulting hydrology and hydraulic processes provide the foundation for all other functions that streams provide. The relationships among precipitation, runoff, infiltration, and groundwater flow determine the amount of water that the stream carries at any given time, the energy of the water to move sediment, the physicochemical processes that affect water quality, and the biological processes that the stream will support. In this respect, the watershed setting of Reach 5B is a critical factor determining its form and function. Reach 5B starts at the confluence with the WWTF outfall, with a combined watershed area of approximately 146 square miles. The general character of the watershed upstream of New Lenox Road is very similar to that of Reach 5A: it consists of very rural wooded hills draining into and through developed urban landscapes. This setting can lead to a fairly “flashy” hydrologic setting, with flow stages and volumes reacting quickly and with substantial magnitude to storm events. Further, this headwater setting can lead to low flow conditions where minimal flow is available. Low flow conditions in Reach 5B typically drop below 20 cfs.

In contrast, storm events increase flows in Reach 5B dramatically, and these conditions strongly affect the physical conditions of the river channel and banks, which in turn affect the biological communities which comprise the riverine habitats. As reported in the recently completed HHA in Appendix G to the Reach 5A Conceptual RD/RA Work Plan, a one-year storm event generates flow at the Mill/Roaring Brook confluence of 1,317 cfs, while the 100-year storm event flow is roughly 13 times higher (16,664 cfs). Further, the HHA notes that recent analyses indicate that these storm flows have increased in magnitude. More detailed hydrologic analysis is anticipated as the HHA is expanded for final remedial design of Reach 5A and is anticipated to contribute further to the understanding of habitat conditions related to hydrology and hydraulics. For example, the current 1D HHA model will be expanded to a two-dimensional (2D) model to support the final design of the Reach 5A remediation. A 2D model will more effectively evaluate flow patterns and velocities at locations with complex stream and floodplain geometry, aiding in the assessment of relationships between flow parameters and habitat conditions.

The Housatonic River within Reaches 5B and 5C transitions from low/moderate to low channel slope. Stream gradient generally declines downstream; however, as noted above, the change is quite gradual and even intermittent. Elevational gradient along the river length is a primary factor in establishing the features of the riverine environment and the associated habitat types. Water velocity, channel depth, river width, substrate, and bank slope are all affected by stream gradient. In the few MGS areas, water velocities are at least moderate and the substrate is dominated by coarse sand to gravel or even cobble, with some boulders present. Maximum water depth during “normal” (i.e., non-flood/non-drought)

conditions are 3-4 feet. Maximum water depths in Reach 5B lower gradient areas during normal conditions approach 10 feet in the main channel, but lower gradient areas in Reach 5B are more typically 3-6 feet deep. In Reach 5C, the lower gradient habitat typically is 6-12 feet deep with a maximum depth of approximately 19 feet.

Progressing downstream in the subject river channel, the substrate typically becomes more frequently dominated by silts, organic muck, and fine sand in the lower gradient areas. Some gravel, cobble, or boulders are present even in the lower areas of Reach 5B and in Reach 5C, particularly along the outside of bends, but are not a major component of the submerged substrate.

Dead trees and branches, or LWD, that fall into the river create habitat features that provide physical structure, localized flow pattern, substrate features, and overall habitat value for many aquatic species. Such LWD is a consistent visual aspect of Reaches 5B and 5C. Woody debris is present but often submerged in lower gradient areas. While such debris may not be visible, it adds structure and affects depositional patterns. Woody debris creates variation in habitat over space and time in the river; old debris eventually decays, crumbles, and moves downstream, while newer debris replaces it, although not at a uniform rate and often not in the same locations. Larger aggregations of LWD containing multiple large trunks, limbs, and/or root wads were thoroughly mapped. Disparate and small areas of exposed LWD that likely have minor effects on the river morphology and habitat were not mapped. However, even some of these more minor LWD areas would be accounted for in the riverine and riverbank qualitative ratings (as indicated in the riverine forms in forms in **Appendix A-1a** and the bank forms in **Appendix B**).

3.3.3 Biological Communities

The biological communities in the riverine habitat in Reaches 5B and 5C are interrelated with the surrounding habitats. The river serves as a pathway for nutrients, forage, and animals themselves. Observations of wildlife during the riverine habitat effort, which are summarized in **Table 3-10** and shown in detail in **Appendix A-1b**, contain a variety of signs and direct observations of wildlife using the river. Many species of birds, dragonflies, reptiles, amphibians, and mammals were observed using this habitat.

The upper area of the Reach 5B channel hosts relatively sparse aquatic vegetation due to the unconsolidated sand and gravel substrate and higher water velocity. Where shading by shoreline trees and shrubs occurs, light is restricted and temperature rise is limited, and these conditions control aquatic plant growth. Sporadic aquatic vegetation beds begin approximately 400 feet downstream of the New Lenox Road Bridge, just upstream of where the current slows down. The primary aquatic plant species identified in Reach 5B were various periphyton algae, Eurasian watermilfoil, curly-leaf pondweed, and waterweed. In Reach 5C, the primary aquatic vegetation observed was curly-leaf pondweed and broad-leaved cattail. The watermilfoil and curly-leaf pondweed are invasive species and are found in large patches in riverine areas in Reaches 5B and 5C.

A wide range of aquatic invertebrates utilize the Housatonic River within the PSA (Woodlot, 2002a), including a number of state-listed species. Two of these have MNHESP mapped Species Habitat in Reach 5B: the rapids clubtail (*Phanogomphus quadricolor)* and spine-crowned clubtail (*Hylogomphus abbreviates);* mapped Species Habitat for the rapids clubtail also occurs in Reach 5C. The clubtail dragonflies can be found in sandy or silty sediments which comprise much of these reaches. Other invertebrates commonly found in these reaches include other dragonfly species, damselflies (suborder Zygoptera), beetles (order Coleoptera), caddisflies, a wide range of true flies, freshwater scuds (order *Amphipoda*), two native species of crayfish (order Decapoda), and three species of mussels (the formerly state-listed triangle floater, the eastern floater, and the eastern elliptio). Three species of fingernail clam (family *Sphaeriidae*) also inhabit the river.

The dragonfly species and other insect species live in the river in a larval form, morphing into a flying adult stage during spring and/or summer, although with long-lived larval stages or multiple generations in a year. The river is never without invertebrates. Some species, like mussels and some true bugs and beetles, never leave the stream in any life form. The adult stages of many aquatic invertebrates utilize the adjacent riverbanks and floodplain, as do many terrestrial insects. Several of the above-listed species were observed during riverine surveys and macroinvertebrate surveys within Reaches 5B and 5C: a full list can be found in **Table 3-6** and **Table 3-10**.

Fish in the overall PSA are mostly warmwater species, with 25 species detected in surveys from 1998-2000, including sunfish species, yellow perch, various minnow species, sucker species (family *Catostomidae*), largemouth bass, chain pickerel, northern pike, brown bullhead, goldfish, and common carp. Three cold water trout species – brook trout (*Salvelinus fontinalis)*, brown trout (*Salmo trutta)*, and rainbow trout (*Oncorhynchus mykiss*) – have been found in surveys since 1998, but are not abundant, and only brook trout is native. Brook trout are found in the mountain streams on October Mountain (Roaring Brook and Mill Brook), and larger trout (typically longer than 6 inches) likely use the Housatonic River as winter refugia, as a population connector, and/or for forage.

In 2000, as previously noted, the most abundant fish species in Reaches 5B and 5C was the white sucker, but other commonly occurring species included yellow perch, largemouth bass, common carp, rock bass, and bluegill (Woodlot 2002a). The recent fish community surveys in 2023-2024 are consistent with these previous findings, with the addition of spottail shiners, golden shiners, and pumpkinseeds as other commonly occurring species.

There are nine state-listed plant and animal species that have MNHESP-mapped Species Habitat within the river channel in Reaches 5B and 5C and that could be found in the aquatic riverine habitat in this reach (based upon habitat requirements). The list consists of two species of dragonflies (described above), two species of emergent vegetation that could occur along the river edges, three species of birds, one reptile, and one mammal. (There are no state-listed fish or other species that are solely dependent on the riverine environment.) These state-listed species are listed in **Table 3-11** and are discussed further in Section 8. Further, as also discussed on Section 8, riverine habitat in Reaches 5B and 5C is included in portions of Core Areas 1-3 as designated by MNHESP (Mass DFW 2012).

In addition, review of the U.S. Fish and Wildlife Service (USFWS) on-line Information, Planning, and Consultation System (IPaC) for identification of federally listed rare species (USFWS 2024) resulted in the identification of habitat for one such listed species – the northern long-eared bat (*Myotis septentrionalis*) – and two species proposed for listing – the tricolored bat (*Perimyotis subflavus*) and the monarch butterfly (*Danaus plexippus*). Habitat for these species is mapped within the entirety of Reaches 5B and 5C, and potential foraging habitat for the two bat species occurs along most of the riverine stations. These species are also discussed further in Section 8.

3.4 Riverine Habitat Functional Assessment for Reaches 5B and 5C

This section presents an assessment of the ecological functions and services of the riverine habitat in Reaches 5B and 5C. As stated above, assessment of the existing functions and services is based primarily on the information consolidated and collected on measurable and observable structural parameters that are known to give rise to the functions of the relevant habitat.

The consolidation of pre-existing information along with the results of the EPA RBP and the other field surveys described in Section 3.2 have served as the basis for the riverine functional assessment for Reaches 5B and 5C, focusing on the measurable and observable structural parameters derived from those activities. Riverine functions are also qualitatively described in terms of the functional categories described in **Table 3-12** using the parameters or factors listed in that table for each functional category. The Stream Functions Pyramid developed by Harman (2009) and Harman and Starr (2011) provides an approach that organizes stream functions in a pyramid form to illustrate goal setting for restoration assessments. These functions (listed from bottom to top) are: hydrologic/hydraulic, geomorphological, physiochemical, and biological. Within this hierarchical framework, higher-level functions are supported by lower-level functions. For example, hydraulic functions cannot occur without hydrologic functions, and these “water-based” functions drive river geomorphology, which in concert determine physicochemical conditions, and the collective association of these foundational functions determine stream biology. **Table 3-12** is adapted from this approach, in which the functional categories have been modified from Fischenich (2006) to more closely match functions with parameters that are commonly used in the fields of hydrology, hydraulics, geomorphology, physiochemistry, and ecology. These functional relationships are summarized below, drawing from guidance from EPA’s *A Function-Based Framework for Stream Assessment and Restoration Projects* (EPA 2012).

The intent of the assessment process is to use the inventoried structural parameters to describe the overall function of each category. **Table 3-12** shows, for each function, the parameters from **Table 3-1** that have been used to describe and assess that function. These parameters are primarily observable structural or physical measures, although some are actual functions (e.g., flood storage). Through the inventory and data collection process before remedial design, baseline conditions are incorporated into the design process to address means and measures to maintain riverine functions under post-restoration conditions. Restoration success largely depends on addressing these functions from bottom to top in the order of the hierarchy through restoring the structural and physical parameters that give rise to those functions. The following summarizes the Reaches 5B and 5C riverine functions using the functional categories presented in **Table 3-12.**

Hydrologic Support Function

As a general matter, a stream reach and its watershed comprise a dynamic balance where the floodplain, channel, and riverbed evolve through natural processes that erode, transport, sort, and deposit sediments. The hydrology of the reach is fundamentally defined by the transport of water from the watershed through the channel. The hydrologic processes (precipitation, infiltration, runoff, and evaporation) that occur at the watershed level influence the character and functions of the river reach. Hydrologic support functions include water conveyance and transport, watershed connectivity, floodwater dynamics (flood flow amelioration, flood storage and desynchronization, and peak rate control), base flow maintenance (groundwater discharge and recharge), and the broader ecological function as a migration and dispersal corridor.

Streams carry the water supplied by their watershed. The resulting hydrology and hydraulic processes provide the basic foundation for all other functions that streams provide. The relationships among precipitation, runoff, infiltration, and groundwater flow determine the amount of water that the stream carries at any given time, the energy of the water to move sediment, the physicochemical processes that affect water quality, and the biological processes that the stream will support. Stream channels like Reaches 5B and 5C are connected with their floodplains, attenuate flood pulses, and spread nutrients and organic matter during flooding events. Streamflows rise and fall with precipitation and snowmelt events, resulting in a dynamic range of flows. This range of flow defines the channel form and creates the basic structure on which many other processes and functions rely. The sinuous channel form and gradual vertical profile changes also aid in attenuation and suppression of floodwater and stream flow forces. Groundwater is also both recharged and discharged along the Reaches 5B and 5C channel, providing another hydrologic link between the stream channel and the landscape.

The hydrologic and hydraulic conditions prevailing in the riverine habitat in Reaches 5B and 5C create a dynamic environment that provides the characteristic elements described above to support hydrologic functions. Water conveyance and transport are apparent relative to the range in flow conditions, and this hydrologic regime also reflects a watershed connectivity function, particularly given the setting at the confluence of the three major tributaries in these reaches. The transport of water and sediment is also reflected in the in-stream features that are formed within the stream channel. Transport of sediment and nutrients is demonstrated by the unconsolidated riverbed sediment formed throughout Reaches 5B and 5C. Evidence of the dynamic channel path and direction of flow are apparent in the channel bathymetry and surrounding oxbow channels and ponds. Newly formed channel segments are evident when the channel has not been fully formed and the banks have evidence of recent scour. The topography and bathymetry of the area exhibit previous channel paths of various ages. Hydraulic factors also affect many functions because they determine the amount of force and power that is exerted by the water on aquatic habitats. Despite many signs of instability and disturbance to the desired equilibrium of sediment transport (discussed below), the river channel in Reaches 5B and 5C maintains sufficient connectivity with the expansive floodplain and backwaters to promote flood storage and peak flow/stage desynchronization.

Geomorphology Functions

The geomorphology functional category includes the following functions: channel formation and maintenance, floodplain connectivity, transport of organic and mineral sediment material, transport of

woody debris, and transport of nutrients and food sources. The channel forms (dimension, pattern, and profile) of Reaches 5B and 5C are variable and somewhat complex due to the watershed and hydrologic factors described above, with highly sinuous meandering sections interspersed with straighter runs. While again indicative of some instability, these conditions also contribute to aquatic habitat diversity. As noted above, the transport of water and sediment is reflected in the bed features that are formed within a stream channel. Similarly, a key geomorphologic function is the transport of wood to create diverse flow conditions, which affects sediment transport/deposition and resulting aquatic habitat such as bed forms. The amount of woody debris cover generally decreases through Reach 5B to Reach 5C. This is indicative of the tendency for woody debris to settle and become lodged in the substrate as the flow energy decreases. It is also indicative of the decreased sources of wood along the banks of lower Reach 5B and in Reach 5C. These areas are scrub/shrub dominant with a relatively low numbers of trees along the banks.

The river channels in Reaches 5B and 5C contain sequences of pools and runs that maintain channel slope and stability and contribute to aquatic habitat diversity. Runs and pools in this reach form a diversity of aquatic habitats and provide the foundation for many of the biological and water quality functions that the riverine habitat provides. The meanders, breakouts and cutoffs throughout these reaches create variability in depth, breaks in the current, and changes in the surficial sediment composition. This creates habitat for predators and prey alike. Macroinvertebrate benthic organisms in run areas filter food from the flowing water and feed on the deposited detritus, providing food for fish and other predators.

Pools at the meanders create diverse habitats. LWD and undercut banks are often associated with these pools. Many fish species utilize meander pool areas due to the cover provided for protection and ambush and for cooler water temperatures afforded by the deeper water environment. Even within a single meander pool, there are aquatic organisms that prefer to live at varying water depths and locations within the pool. Macroinvertebrates that feed upon deposited detritus and other organic material thrive in pool habitats, providing a food source for many predators.

Physicochemical Functions

Physicochemical functions include water quality maintenance, temperature and oxygen regulation, and processing of organic matter and nutrients. These functions are closely associated with, and largely determined by, the hydrologic and geomorphologic conditions. For example, deep pools and cuts (bed form diversity), along with shade and a wide buffer, help regulate stream temperature. Trees and shrubs along the riverbanks regulate water temperatures through shading and provide organic matter to the system, which is stored and transported forming the energy web that supports aquatic life and diversity. Groundwater intrusions and relatively cool and clear flow from mountain streams (Roaring Brook and Mill Brook) create cool water refugia with relatively high dissolved oxygen for mobile aquatic organisms within the river. Minerals and nutrients are also supplied by these streams and springs.

Biological Functions

Biology is located at the top of the Stream Functions Pyramid because the biological functions are dependent on all the underlying functions. Specific biological functions include biodiversity and sustaining life stages of aquatic and riparian life, habitat for aquatic and other water-using biota, and rare species habitat.

The Housatonic River in Reaches 5B and 5C provides diverse habitat for aquatic organisms. Due to the range of substrate types, vegetative cover, and depth features, this area provides a range of functional uses for many fish and invertebrate species. Fish found in this reach are primarily warmwater species, including sunfish, various minnow species, and bass. These species forage throughout the river in this reach, taking advantage of complex habitat features to locate food resources and shelter, and providing a food source for piscivorous (fish-eating) mammals and birds. A wide range of aquatic invertebrates also utilize this area. These include several freshwater mussels (e.g., the previously state-listed triangle floater) and two state-listed rare dragonfly species – the rapids clubtail and spine-crowned clubtail dragonflies. These invertebrates rely on foraging, shelter, and emergence habitat provided by the river.

Many areas within Reaches 5B and 5C contain abundant woody debris, which is both embedded in the river bottom and free-floating. This woody debris both above and below the water line provides structure for invertebrates, fish, amphibians, turtles, and several small mammals. Invertebrates seek out woody debris for shelter and for its linkage to food sources. Predatory fish seek out the same structures for food and shelter, particularly bass and sunfish. Deeper pool habitat created because of the hydraulic and geomorphic influence of large woody debris offer shade, cover, and deeper, cooler water during summer months.

Pool habitat has many benefits. Most fish species will seek out this cooler water during extreme heat if it is available. Likewise, many fish will also seek the refuge of deeper water for cover in the winter and early spring when aquatic vegetation is not present to offer cover in shallower water. Pool habitat in Reaches 5B and 5C also provides aquatic organisms with refuge from high velocities during flood and storm events, as well as thermal refuge during droughts and hot summer months. The ability to seek shelter in pool habitat to avoid high velocity flows or elevated temperature is energetically beneficial to fish and other aquatic organisms which might otherwise be misplaced, expend too much energy to remain in place, or otherwise become metabolically stressed.

Finally, the Housatonic River, including in Reaches 5B and 5C, is the major migration corridor in the watershed. It provides opportunity for aquatic and semi-aquatic organisms to seek out and navigate into suitable habitat, and allows for transport of nutrients, sediment, and food items from upstream terrestrial and aquatic communities to downstream areas.

4. BRA of Riverbank Habitats in Reaches 5B and 5C

Riverbank conditions in the ROR have been included in numerous investigations over the past 20+ years. Although the Revised Permit requires remediation only for the riverbanks in Reach 5B (as well as Reach 5A) and not in Reach 5C, the BRA for the riverbanks included the riverbanks in Reach 5C as well as Reach 5B for completeness and due to potential impacts from the river remediation in Reach 5C on the riverbanks. As with the riverine BRA approach, the BRA of riverbanks within Reaches 5B and 5C initially drew from previous investigations to the extent practicable, as well as from additional field surveys. As with the riverine inventory and assessment, and consistent with the Revised Reaches 5B-8 BRA Work Plan, information on riverbank structural parameters was obtained for all riverbanks in Reaches 5B and 5C, with data collection applied within discrete bank segments that have similar characteristics.

For purposes of this BRA, the riverbank in these reaches has been defined based on field determinations of the toe and top of bank using a combination of morphologic, hydrologic, and biological criteria. The toe of bank, which is intended to identify the interface between the riverine sediment and the riverbank soils, was defined based on consideration of the following: a decrease in slope near the bottom of the sloping bank (morphological), the mean low water level measured during bank field surveys conducted between July and October (hydrologic), and the growth of annual plants along the lower limit of the bank (biological), which aids in determining the mean low water level. The top of bank, which is intended to define the interface between the riverbank and the floodplain, was defined in Reach 5B and the upstream part of Reach 5C as being slightly above the level of bankfull field indicators (themselves a combination of morphology, hydrologic indicators, and biological features), marked in many locations by a clear break in slope extending up the sloping bank at the edge of the floodplain. In the lower portions of Reach 5C, where marsh and backwater conditions border much of the river channel, the top of bank was defined as the point where persistent (rather than annual) marsh or swamp vegetation formed a predominant cover to represent the floodplain wetland cover condition or the edge of the defined river flow channel along inundated backwaters. It is recognized that determinations of the toe and top of riverbank for remediation purposes will be established through later field surveys as part of the PDIs of these RUs and may vary from the foregoing determinations for the habitat assessment.

Table 4-1 provides a summary of the parameters that have been incorporated into the assessment of riverbank habitat conditions in Reaches 5B and 5C. Those parameters collectively contribute to the formation of habitat functions, including hydrologic conditions, floodplain connectivity, stability/erosional status, and specific habitat features such as large woody debris, cut banks, and vegetative cover.

4.1 Background Ecological Information

As noted in **Table 4-1**, some of the riverbank habitat assessment parameters were based on information consolidated from the sources cited previously in Section 2 of the Revised Reaches 5B-8 BRA Work Plan. Other information, such as hydrologic/hydraulic data pertinent to riverbank conditions, was obtained from available sources (as also noted in **Table 4-1**), as well as updated data presented in the HHA in Appendix G to the Reach 5A Conceptual RD/RA Work Plan.

4.1.1 Woodlot Ecological Characterization (2002)

The Woodlot Ecological Characterization of the PSA (Woodlot 2002a) included some information on the riverbanks in Reaches 5B and 5C. In describing the area in the vicinity of New Lenox Road, Woodlot stated that "[c]hannel banks are . . . vertically cut and a number of mucky sand beaches and accretion bars were located." Woodlot also noted that near the Yokun Brook confluence the "river channel lacks the well-defined, vertically cut banks of the upper portions of the PSA," and that as the river slows and widens somewhat moving downstream, the stream banks [remain] generally vertically cut, [but] a number of sand beaches were found" *(*Woodlot 2002a, page III-1-11*).*

In its extensive listing of wildlife species associated with the various classified habitats, Woodlot did not specifically break out riverbank habitat as a distinct class. However, it did list wildlife species associated

with riverine point bar and beach habitat, both of which may fall within riverbank areas to some degree. However, the species break-downs for these habitat classes do not specify those found in Reaches 5B and 5C, but rather are more broadly listed for the entire PSA.

4.1.2 RCRA Facility Investigation Report (2003)

GE's 2003 RFI Report provided substantial information characterizing ecological resources in the ROR area, including riverbank habitats in Reaches 5B and 5C. Although the focus of that report was on documenting the extent of PCBs in the river, some relevant information on the riverbanks in Reaches 5B and 5C was provided (e.g., total organic carbon content of riverbank soils). Minimal specific riverbank habitat characterization was provided for Reaches 5B and 5C, but rather conditions in the overall Reach 5 were typically referred to, much of which is related to riverbank form and function.

For example, the RFI Report noted that the Housatonic River has a moderate gradient upstream of New Lenox Road (two feet per mile), which drops to a low gradient (0.6 feet per mile) between New Lenox Road and the Woods Pond headwaters. It noted that "water velocities in a river control the energy exerted at the sediment-water interface and, consequently, is the driving force for sediment resuspension, bank erosion, and channel meandering." (p 8-4). The RFI Report summarized bank erosion investigations conducted by EPA in 2000-2002, which included the use of toe pins in Reach 5B to measure bank elevations over a 20-month period as well as bank migration measurements at locations including Reach 5B. An overall bank erosion rate of -0.7 ft/yr was determined by these studies. As the RFI Report noted, these values are not necessarily representative of Reach 5B as a whole because specific bends where bank erosion is more likely to occur were targeted in the surveys.

4.1.3 EPA's Modeling (2006)

EPA's documentation of its modeling efforts for the ROR, notably its use of the EFDC, included extensive descriptions of riverbank conditions, some of which can be attributed to conditions in Reaches 5B and 5C. As part of the field data collection for the EFDC modeling, detailed test pits were conducted along the riverbanks, including at five locations in Reaches 5B and 5C. These test pits defined the soil/substrate profile to depths approaching six feet below the surface. The test pits were excavated to measure soil horizon depths, colors, and texture. Sampling locations were chosen such that results provide an estimate of rates and locations of sediment deposition during flood events. They were excavated either at the bank edge or approximately 50 feet from the bank. The observed soil profiles were reported as indicative of repeated flooding and associated sediment deposition. This was noted by the presence of alternating A horizons (a pedogenic or biologically active surface layer) with C horizons (not affected by pedogenic processes); the C horizons were considered indicative of flood deposition events, followed by non-flood years in which A horizons develop.

In addition, these investigations characterized sediment grain size on riverbank soils collected from all the locations studied in Reaches 5B and 5C. Riverbank soils generally consisted of a lower layer of silt loam to loam that was overlaid by a loamy sand. The silt loam generally extended from the water surface to two to six feet up the riverbank. Riverbank heights (annual high-water line to top-of-bank) averaged five to six feet. At low flow, resistant silt loam benches were observed below the high-water line. As noted, riverbank erosion may be initiated where these benches meet the riverbank; at those points, the toe of the riverbank is undermined and riverbanks subsequently fail and the river is able to move laterally.

4.1.4 Revised Corrective Measures Study Report (2010)

GE's 2010 RCMS Report included an expanded description of the affected habitats in the ROR, including Reaches 5B and 5C riverbank habitats, and the ecological impacts of the remedial alternatives.

Section 5.0 of the RCMS Report provided the following summary of the Reaches 5B and 5C riverbanks:

> "Riverbanks in Reaches 5B and 5C are markedly different from those in Reach 5A. Consisting of fine sands and silts, these riverbanks generally range in height from 2 to 4 feet and are well vegetated. Vertical banks are present on the outside bends of the river, while inside bends tend to be gently sloped. Undercut banks are present in Reach 5B but are less prevalent than in

Reach 5A. Mature overhanging trees are present in most of Reach 5B but decrease in abundance near the downstream boundary. Riverbanks in Reach 5C consist of fine silts and are almost entirely low and gently sloped. Vertical and undercut banks are not present in this portion of the river."

Additional descriptive information on the Reaches 5B and 5C riverbanks from the RCMS Report includes the following regarding Reaches 5B and 5C:

- Vegetation along the riverbanks grades from mostly trees in most of Reach 5B to a shrub-dominated mix with some trees and herbaceous growths in Reach 5C. Silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), eastern cottonwood (*Populus deltoides*), and box elder (*Acer negundo*) form much of the canopy in the upstream area, while the subcanopy, shrub and herbaceous layers are minimized by light limitation. Further downstream, the canopy tends to be sparse and includes mainly red and silver maple, black willow (*Salix nigra*), and gray birch (*Betula populifolia*). A variety of shrubs are abundant there, including silky and red osier dogwoods, silky and pussy willows (*Salix sericea* and *Salix discolor*, respectively), winterberry (*Ilex verticillata*), speckled alder (*Alnus incana*), meadowsweet (*Spiraea alba*), buttonbush (*Cephalanthus occidentalis*), highbush blueberry (*Vaccinium corymbosum*), and northern arrowwood (*Viburnum dentatum*). Herbaceous species in lighted areas include various ferns (order Polypodiales), grasses (order Poales), the genus *aster*, goldenrod (genus *Solidago*), and the invasive purple loosestrife.
- The riverbanks in Reaches 5B and 5C also perform a variety of wildlife functions. Although exposed vertical banks and undercut banks are less prevalent in Reach 5B than in Reach 5A, they are present in Reach 5B, where they provide similar wildlife functions.
- Similarly, mature overhanging trees are present in portions of Reach 5B, particularly in the upstream portions; and they offer shaded microhabitats within the river and foraging and perching sites for piscivorous and insectivorous birds. In the downstream portions of Reach 5B and in Reach 5C, where the banks are well vegetated with a shrub-dominated mix with some trees and herbaceous growth, those banks provide foraging habitat for a variety of birds and mammals.

In addition, Appendix G of the RCMS Report provided an assessment of riverbank stabilization techniques that could be applied under a range of remedial alternatives, including options that may be applicable in Reach 5B. These were based on an initial visual assessment of bank conditions, as well as review of other existing information, to evaluate geomorphic characteristics and hydraulics affecting particular bank sections.

4.1.5 Stantec Bank Studies (2009)

In 2009, EPA's consultants at Stantec conducted an evaluation of erosion from the riverbanks in Reaches 5A and 5B, using Bank Erosion Hazard Index (BEHI) and Near-Bank Stress (NBS) ratings (Stantec 2009). In those reaches, data were collected in May of 2009 from approximately 41,000 linear feet of stream channel and 82,000 feet of streambank (both banks were surveyed). Stantec noted that field surveys of bank erosion were stopped near the end of Reach 5B because the BEHI and NBS values began to decline due to the backwater effect of Woods Pond. An average bank erosion rate of 0.32 feet/year was calculated for Reaches 5A and 5B. The data did not specify results only for Reach 5B.

Stantec described the areas of high bank erosion as being out of phase with the form of the river, with many areas of high and extreme erosion located upstream of point bars and inside banks, indicating active channel migration and horizontal instability; no specific habitat factors were addressed in relation to this analysis.

4.1.6 Example Area Evaluations (2010)

As discussed in Section 3.1.5, GE's February 2010 Supplement to Interim Response presented detailed evaluations of six Example Areas in Reaches 5A to 5C, one of which was located within Reach 5B (Example Area #5) and one in Reach 5C (Example Area #6). Both of these Example Areas encompassed riverbank habitat, shown on **Figures 3-1b, 3-1c,** and **3-1e.** Example Area #5 extended along 1,800 linear

feet of the Housatonic River just below New Lenox Road, providing 3,600 linear feet of riverbank habitat. Example Area #6 extended along 2,000 linear feet of the Housatonic River in the center of Reach 5C (approximately 7,800 feet upstream from the Woods Pond Dam), providing 4,000 linear feet of riverbank habitat. The descriptions provided of riverbank habitat conditions within those Example Areas included the following:

- The river channel is more sinuous than in upstream areas due to the reduction in the water surface slope resulting from the backwater effects of Woods Pond Dam.
- The riverbanks are not as high as in upstream areas and are predominantly vegetated with herbaceous and shrub vegetation with several clusters of large trees. The banks range from gently sloped (on the inside of bends) to vertical (on the outside bends), with some severe erosion in places.
- Riverbanks along the river in Example Areas #5 and #6 are typically composed of fine sands and silts. The low, gently sloping banks provide regular connectivity with the floodplain during smaller (less than two-year) flood events.
- The banks are vegetated with shrub species such as silky dogwood and herbaceous plants such as pickerel weed (*Pontederia cordata*) and American bur-reed (*Sparganium americanum*).
- The banks are relatively uniform in height, on the order of about two to four feet above the normal water elevation (ordinary high water line). On the outsides of the bends, they are typically vertical, while on the inside of the bends they are gently sloped. The banks on the runs between the bends tend to be moderate to gently sloping.
- While the banks are generally well vegetated with herbaceous vegetation, dense grasses such as reed canary grass (an invasive species), and scattered shrubs including silky dogwood, portions of the banks are exposed. During periods of low water, exposed mud flats occur along the bank edges of the river and accumulate woody debris.
- Undercut banks are uncommon but present in several locations. There are periodic breaks in the banks that provide hydraulic connections to the wetland areas in the floodplain. Several animal runs and/or slides occur along the banks throughout the example area.
- Dense vegetation on the riverbanks provides cover and food for various species of reptiles, amphibians, birds, and mammals. During periods of low water, exposed mud flats along the river edges provide feeding habitat for birds and mammals.

4.1.7 Natural Heritage Information (2000-2022)

As described in Section 3.1.6, MNHESP conducted extensive investigations of rare species from 2000 to 2010 in the Housatonic River watershed, including Reaches 5B and 5C, and summarized the results in two reports (MNHESP 2010, 2011). These reports did not distinguish occurrences of such species in riverbank habitats from other occurrences in the floodplain. However, the reports listed occurrences of invertebrate, turtle, and amphibian target species that may be encountered in riverbank habitats at certain stages of life. The tables provided in the reports do not specify wildlife found in Reaches 5B and 5C, and there were no specific descriptions of the riverbanks in Reaches 5B and 5C. Similarly, while the Core Area designations by MNHESP in 2012 encompass riverbanks in Reaches 5B and 5C, they do not specifically cite this habitat.

As also noted in Section 3.1.6, in October 2022, MNHESP provided GE with updated Species Habitat mapping of the state-listed species in the ROR, including Reaches 5B and 5C. As described in Section 4.2.2.7, 17 of these species have mapped Species Habitat overlapping the riverbanks in Reaches 5B and 5C, but only 14 of these species utilize habitats consistent with those present on these riverbanks.

4.2 2023-2024 Riverbank Habitat Investigations in Reaches 5B-5C

4.2.1 Methods

In addition to reviewing the background information discussed above, field surveys were conducted in 2023 and 2024 to further document the physical/structural and biological conditions of the riverbank areas in Reaches 5B and 5C. In accordance with the Revised Reaches 5B-8 BRA Work Plan, bank characteristics documented in these field surveys included bank morphology (height, slope, sinuosity, etc.), bank stability, soil/substrate composition, and vegetative composition. Based on an evaluation of apparent changes in riverbank morphology conditions in Reaches 5B and 5C, the field bank habitat assessments occurred at 18 stations in Reaches 5B and 5C (nine in Reach 5B and nine in Reach 5C). Those stations are shown on **Figures 4-1a-f**. The stations were established in a stratified random manner to encompass a range of riverbank morphologic conditions (e.g., some straight runs, different bends, etc.) along the entire span of Reaches 5B and 5C. In each case, "stations" were not discrete transects across the river, but rather encompassed a 100-200 foot length of riverbank on both sides of the river to better characterize the range of conditions observed. Bank field surveys were conducted from October of 2023 through October of 2024.

This habitat characterization of the Reaches 5B and 5C riverbanks included, at each of the 18 stations, completion of Form RB-1 (provided in **Appendix B**), which is adapted from **Table 4-1** for documenting the riverbank characteristics. Form RB-1 provides for detailed documentation of the following conditions on the banks: physical metrics, soil/substrate composition, bank stability, hydrologic indicators (e.g., bankfull), floodplain connectivity, vegetative cover, bordering habitats, corridor connectivity capacity, and habitat degradation (e.g., invasive species), as well as incidental wildlife observations. These investigations also included the identification of special habitat features on the Reaches 5B and 5C banks – e.g., cut banks, turtle hibernacula or observed nesting sites, belted kingfisher (*Megaceryle alcyon*) or bank swallow (*Riparia riparia*) nest sites (which consist of vertical sandy banks), otter slides, rock basking sites, beaver bank dens, burrows, and tree cavities. For most characteristics, the documentation of bank conditions includes the overall characterization on both the left and right banks for each station length; for a few characteristics, such as vegetative composition, data are distinguished between the left and right banks. Finally, during the course of the field surveys, riverbank restoration opportunities were assessed. This included noting the presence of potential restoration resources that may be considered in the bank/river restoration design, such as the presence of boulders, large trees or woody debris, root wad material, or plant propagation source materials.

Some of the characteristics provided in Form RB-1 required review of other source information followed by completion in the office. For example, the overlap of each bank station with Core Areas and Species Habitat mapping provided by MNHESP was determined in the office, with the information added to each form as applicable. Further, field survey data obtained from riverine and floodplain habitat investigations for Reaches 5B and 5C were consulted during completion of the riverbank forms to ensure consistency between these findings. These included estimates of bankfull conditions, bank slopes, and riparian zone vegetative composition. Finally, Form RB-1 at each of the 18 riverbank stations was completed by adding an aerial photograph of the bank station location as well as photographs of the station.

4.2.2 Results

Appendix B contains the completed riverbank Form RB-1 for each of the 18 stations in Reaches 5B and 5C. As noted above, these station locations are shown on **Figures 4-1a-f**, and they are also shown on an aerial photograph section at the end of each completed form. Summary data obtained from consolidating the information from all 18 RB-1 forms are provided in tabular form in **Tables 4-2** through **Table 4-14**. That field survey information is described in the following subsections.

4.2.2.1 Physical Characterization

The 18 riverbank stations surveyed within Reaches 5B and 5C encompass a total of approximately 7,700 linear feet of the total reach, or 8.3% of the roughly 62,700 total linear feet (11.9 miles) of riverbank in these two reaches (counting both sides of the river). The stratified random selection of bank segments included in the survey area resulted in various morphological settings being surveyed, including six

relatively straight runs, eight segments with right bends and five with left bends. Physical characterization of the Reaches 5B and 5C riverbanks included bank height, slope, substrate composition, stability/erosional condition, and degree of channel incision. **Table 4-2** summarizes the physical characterization data obtained for riverbanks in Reaches 5B and 5C, with additional details on bank substrate conditions provided in **Table 4-3**; some of this characterization pertains more broadly to the river channel at the location of each of the riverbank stations, which is included in **Table 4-4**. Some of the key physical (and biotic) characteristics of the Reaches 5B and 5C riverbanks summarized in **Tables 4-2** through **Table 4-7** are as follows:

- The average height of the riverbanks in Reaches 5B and 5C was estimated to be 4.6 feet (range of two to nine feet).
- The average slope of the riverbanks in Reaches 5B and 5C was estimated to be 47% (range of 20-95%).
- Riverbank substrate surveys recorded a predominance of silt material (61%) followed by sand 27%), with 10% cover of organic matter and 2% gravel/cobble material.
- Stream channel widths at the bank stations ranged from 85 to 120 feet.
- Stream gradient at the 18 stations was limited to low-gradient conditions, based primarily on visible flow characteristics at low water.
- The degree of channel incisement at the survey stations was most often rated as not incised (55%) or somewhat incised (28%), with 17% rated as moderately incised (no segments were rated as deeply incised or entrenched).
- Riverbanks were generally rated to be stable. Roughly 90% of the left bank segments were rated as stable, while 79% of the right bank segments were rated as stable.

In addition to these physical characteristics, the observed erosional condition at each station was generally characterized and described on Form RB-1, along with the location of the thalweg, where observable.

4.2.2.2 Bordering Habitats

The habitats bordering each riverbank station were recorded using the natural community cover types described for the floodplain in Section 6.2.1 (as adapted from Woodlot 2002a). In general, for a habitat to be considered as "bordering" a riverbank station, the habitat was either directly adjacent to the bank or in sufficient proximity and with no encumbrances for wildlife to readily access the river from the habitat unit. These are separated into wetland or upland categories. Wetland habitat types include four forested wetland cover types – shrub swamp, shallow or deep marsh, wetland meadow, and vernal pool. Upland habitat types include five forested cover types, cultural or agricultural fields, or developed/disturbed cover types. **Table 4-5** summarizes the bordering habitat conditions at each of the 18 riverbank survey stations. The following points summarize the key points related to these bordering habitat conditions:

- The most prevalent wetland habitats bordering the riverbank stations are shrub swamp and red maple swamp habitats, each bordering 12 of the 18 riverbank stations (67%) to some extent.
- Wetland habitats that border the riverbank stations include deep emergent marshes (at 56% of stations), shallow emergent marsh (50%), transitional floodplain forest (33%), black ash-red maple-tamarack calcareous seepage swamp (17%), and wet meadow (11%).
- Vernal pool habitat borders 39% of the riverbank stations.
- The riverbank stations all border multiple wetland habitats except for one (Bank Station 50) which borders only red maple swamp.
- Upland habitats border 61% of the riverbank stations, with upland forest occurring at 39% of the stations, followed by upland fields (28%) and disturbed/developed conditions (11%).

- Two upland forested habitats (red oak-sugar maple transition forest and northern hardwoods-hemlock-white pine forest) collectively border 44% of the riverbank stations, with both forest types occurring at 17% of the stations.

4.2.2.3 Hydrologic Characterization

Hydrologic characterization at each bank station encompassed conditions in the channel between the riverbanks as well on the banks themselves. These included an estimate of the stream gradient (primarily based on flow conditions), degree of channel incision and connectivity with the floodplain, bankfull indicators, and other field-derived indicators of hydrologic/flow conditions. The hydrologic characteristics at the 18 riverbank stations in Reaches 5B and 5C are summarized in **Table 4-4**, with key points as follows:

- Stream channel widths at the bank stations ranged from 85 to 120 feet (typically 20 feet wider than stream channel widths in Reach 5A).
- Stream gradient at the 18 stations were restricted to low-gradient conditions (based primarily on visible flow characteristics at low water).
- All (100%) of the bank survey segments contained some topographic break which could contribute flow into the adjacent floodplain, and 68% of the bank stations bordered floodplain with high-flow channels which could function to disperse flood waters through the floodplain.
- Bankfull indicators on the riverbank segments averaged a height of 2.7 feet (range of 2-4 feet) above the field-estimated mean low water level, although the actual bankfull flows will be determined by hydrologic references and subsequent field assessments.

4.2.2.4 Plant Community Composition

Riverbank plant community composition data obtained include estimates of vegetative cover from bank vegetation, overhanging vegetation, and riparian vegetation, with data collected for each strata (i.e., tree, shrub, liana/vines, herb); these data were collected separately for each side of the riverbank. Plant species composition was recorded overall for each bank station, including designation of any invasive species. **Tables 4-8 through 4-11** provide summary data on the plant community composition surveyed at the riverbank stations. The data reflect relatively diverse tree, shrub and herbaceous communities along the banks in Reaches 5B and 5C, with decreasing tree coverage along the riverbanks downstream of New Lenox Road. The following points summarize the vegetative community composition along the riverbanks within the surveyed segments:

- Overall vegetative cover along the surveyed bank segments was estimated at 90% (range of 60-100%). Overhanging vegetation covered an estimated 64% of the bank surface area.
- Riverbank vegetative cover by the tree strata averaged 22% (range of 0-85%), 49% by the shrub strata (range of 0-100%), 66% by the herbaceous strata (range of 10-100%), and 9% by vines (range of 0-40%).
- Riparian zone vegetative cover along the riverbank segments was an estimated 82% overall (range of 0-100%).[6] This consisted of 29% average cover by the tree strata (range of 0-85%), 56% by the shrub strata (range of 10-80%), 72% by the herb strata (range of 45-90%), and 10% by vines (range of 0-20%).
- A total of 114 different plant species were identified in the 18 bank survey segments in Reaches 5B and 5C. These included 14 tree species, 20 shrub species, seven species of vines, and 73 herbaceous species (including three aquatic species along the lower margins of the banks). Fifteen different invasive species were recorded (one invasive tree species, four invasive shrub species, one invasive vine species, and nine invasive herbaceous species).

[6] Some riparian zones adjacent to riverbanks consisted of backwaters, resulting in limited recorded vegetative cover for some strata.

- Silver maple was the most common tree species, occurring in 60% of the survey segments, followed by red maple (19%), black willow (17%) and box elder *(*24%). All other tree species occurred in only one or two survey segments. One state-listed tree species (bur oak *(Quercus macrocarpa*)) was noted on one bank in the southern part of Reach 5C (**Table 4-8**).
- Of the 20 shrub species, silky dogwood was the most prevalent (83% frequency), followed by red osier dogwood (47%), the invasive Morrow's honeysuckle (39%) and common buckthorn (36%). All other shrub species occurred in less than 10% of the survey segments.
- River grape (*Vitis riparia;* 28%) was the most common vine, followed by the invasive vine Asian bittersweet (*25%*).
- Five herbaceous species were identified in at least 50% of the survey segments; the most common herbaceous species were purple loosestrife (89%), American bur-reed (72%), reed canary grass (67%), water purslane (*Ludwigia palustris*) (56%), and water forget-me-not (*Myosotis scorpioides;* 50%). Eight other herbaceous species occurred with 30% frequency or more (**Table 4-8**).
- The most prevalent invasive species (by frequency of occurrence in 38 bank survey segments) were purple loosestrife (89%), Morrow's honeysuckle (78%) common buckthorn (72%), Asian bittersweet (50% frequency), and water forget-me-not (50%). While purple loosestrife was observed in the most survey segments, it rarely formed an abundant percent of the foliage cover on any riverbank survey segment. Japanese knotweed was recorded on only one bank survey segment, whereas this invasive species was present on roughly one-half of the bank survey segments in Reach 5A. Invasive species are discussed further in Section 9 of this BRA Report.

Tables 4-9 through 4-11 provide additional data summarizing the plant community along the surveyed bank segments. These include differentiation of the plant communities on the right bank and the left bank to provide an assessment of whether conditions noticeably vary between sides of the river. In general, there are no distinct trends indicating consistent differences between the left and right banks. Also, in reviewing the riverbank data from the upstream to the downstream end of Reaches 5B and 5C, there are few discernible or significant trends or differentiation of the conditions apparent in progressing down the reach. For example, while forested cover along the riverbanks generally decreases moving downstream in these reaches, there remain some significant forested zones along the Housatonic River in the middle portions of Reach 5C.

4.2.2.5 Other Habitat Features

Form RB-1 includes a broad selection of other habitat features that were recorded for each riverbank station. These include wildlife food plants; a variety of cover, perching, basking, denning, and nesting habitat features; and specific features such as vertical sandy banks, undercut banks, and nesting sites for bank-specific species such as bank swallows. The connectivity of each bank station with adjoining natural habitats was also classified. These habitat features are shown in **Table 4-12** and summarized as follows:

- Most (79%) bank segments contained wetland and upland plants that provide food sources for wildlife.
- Most (67%) of the bank segments contained large (>30" diameter at breast height [dbh]) live or dead standing trees, and this same proportion contained cavities in the tree trunks or limbs. In addition, live or dead tall standing trees near water offering visibility for avifauna were abundant at 39% of the bank stations or present at 44% of the stations.
- Habitat features for small mammals and herpetofauna occurred at most of the bank segments, including burrows (94%), dense herbaceous cover (83%) and undercut or overhanging banks (94%), and large woody debris on the ground (67%).
- Vertical sandy banks offering habitat for bank swallows or kingfisher nesting occurred in only one of the 18 bank survey segments, although no evidence of active bank swallow nesting colonies were observed.

4.2.2.6 Incidental Direct Wildlife Observations

During the course of the riverbank surveys, field observers recorded all direct observations of wildlife species (including evidence of species presence, such as tracks or scat). **Table 4-13** provides a summary of these observations. Overall, a total of 30 species (or evidence of their use) were observed along the riverbanks. These consisted of 22 bird species, three species of herpetofauna, two mammal species, and three invertebrates or fish species.

4.2.2.7 Rare Species Habitat

Both federal and state-listed rare species habitats were assessed for each of the 18 riverbank stations in Reaches 5B and 5C. The Core Area designations from MNHESP were overlain on the riverbank station mapping to determine whether the riverbank stations occur within any of the Core Areas. Further, the Species Habitat mapping provided by MNHESP was reviewed to record each state-listed species that has such mapping within any of the bank stations. Seventeen state-listed species have such Species Habitat mapping that overlaps the 18 riverbank stations, but only 14 of those species have habitat requirements consistent with habitat conditions on these riverbanks. **Table 4-14** lists both the Core Area designations which apply at each bank station and the state-listed species that have mapped habitat overlaying each bank station.[7] In addition, as noted above, review of the USFWS IPaC resulted in the identification of habitat for one federally listed species (the northern long-eared bat) and two species proposed for listing (the tricolored bat and the monarch butterfly) within Reaches 5B and 5C; and potential habitat for these species occurs along most of the riverbank stations in these reaches. Rare species are further addressed in Section 8 of this BRA Report.

4.3 Description of Riverbank Habitats in Reaches 5B and 5C

4.3.1 Physical Description

The physical characteristics of the riverbanks in Reaches 5B and 5C vary considerably from the upstream transition out of Reach 5A to the downstream transition heading into Reach 6. The general progression of change follows the increasing effect of Woods Pond Dam on the hydrology and hydraulics of the river; the river channel and bank conditions in places also appear to reflect the historic straightening of the river before 1900, as the river continues to adjust to these historic alterations. The general physical changes in riverbanks moving downstream through these reaches include lower bank height (or even no bank formation in the downstream portions of Reach 5C along the expansive backwaters), finer grained substrates (less sand to more silt), decreasing tree cover, increasing prevalence of topographic breaks through the riverbanks connecting the river channel with adjacent floodplain wetlands, and an overall reduction in riverbank geomorphic features that are associated with variations in river flow (e.g., point bar development, undercutting).

These general trends are not consistent with distance downstream along these two reaches. Variations in riverbank morphology occur in distinct areas, typically related again to hydrologic variations. The riverbanks in Reach 5B upstream of New Lenox Road are more similar to the Reach 5A banks than those further downstream in these two reaches, as reduced backwater effects from Woods Pond Dam occur in this section due to the road crossing, allowing for the growth of mature forested cover along much of the riverbank and the resulting stabilized condition. Downstream of New Lenox Road, the riverbanks are dominated by shrub and herbaceous vegetative cover, as is the bordering floodplain, with only scattered trees. At the confluence with Roaring Brook, roughly 1.5 miles downstream of the New Lenox Road Bridge, the river channel and banks appear strongly influenced by the anastomosing channel flow (i.e., multiple braided channels that branch off and rejoin) from this tributary, resulting in multiple bank cuts and associated channel siltation and flow adjustments. The extreme channel sinuosity of the Housatonic River from New Lenox Road to Roaring Brook, associated with bank erosion along the outer meander

[7] Of the 17 rare species listed in Table 4-14 that have mapped Species Habitat overlapping with the riverbanks, the three species whose habitat requirements are not consistent with the riverbank habitat are Jefferson salamander, common gallinule, and Gray's sedge.

bends through the non-forested habitat, is an expected consequence of the hydrologic effects of the confluence with Roaring Brook.

Moving into Reach 5C below the Roaring Brook confluence, the river has a long straight run from the east side of the floodplain with a broad curve to the west (often referred to as “the harp”), ending at the Yokun Brook confluence. Portions of this forested zone may reflect the historic (pre-1900) straightening of the river along the east side of the floodplain, as has been documented in past investigations (Weston 2011). At the confluence with Yokun Brook (flowing in from the west), the river channel and banks exhibit similar evolving geomorphologic conditions (meanders/breakouts/cutoffs) expected from the hydrologic effects of this tributary inflow, adjustments from the remnant historic straightening, and the backwater effects from Woods Pond Dam. These patterns continue moving downstream in Reach 5C, with the added factor of increasing prevalence of large backwaters along the river, creating many segments where no bank formation occurs along the river edges.

4.3.2 Biological Communities

As described above, the overall character of the riverbanks in Reaches 5B and 5C varies considerably from the portion of Reach 5B upstream of New Lenox Road to the remaining portions of Reach 5B and all of 5C below New Lenox Road, largely due to the hydrologic influence of Woods Pond Dam extending upstream to New Lenox Road, along with the effects of tributary inflow. In general, the riverbank habitat in the upper portion of Reach 5B consists predominantly of trees, with interspersed sections being a shrub-dominated cover mixed with some trees, vines, and herbaceous growths. Box elder, silver maple, and American elm (*Ulmus americana*) form much of the bank canopy in upper Reach 5B, while the subcanopy, shrub and herbaceous layers are variable based upon factors such as light (from shading) and elevation relative to river water stages and flooding. While the upper Reach 5B riverbanks are primarily mature woodland, specific vegetative composition varies considerably based on factors such as location across the bank section (e.g., bank toe versus top of bank), hydrology, bank slope, and substrate. Lower portions of these banks often support dense herbaceous growth which develop annually as the water levels recede. A variety of shrubs are abundant, most commonly silky and red-osier dogwood and several invasive species – Morrow’s honeysuckle and common buckthorn in particular. The latter two invasive species, along with Asian bittersweet, water forget-me-not, reed canary grass, and purple loosestrife are the most abundant invasive species on and near to the riverbanks in upper Reach 5B. Herbaceous species composition is a diverse mix of perennials and annuals, with the presence and distribution of the annuals expected to vary considerably between years based on river water levels and flows. One steep sandy bank occurs in the upper part of Reach 5B (the left bank at Station BA-36) where a tight meander borders the Electric Power Research Institute (EPRI) Facility, providing unique habitat for species such as bank swallows and belted kingfisher. As in Reach 5A, undercut banks and woody accumulations in this upper portion of Reach 5B offer hibernacula sites for wood turtles to overwinter. Large overhanging trees in this area provide shaded microhabitats and variability in water temperature within the river for fish, invertebrates, and shade-tolerant plant species, as well as foraging and perching sites for piscivorous and insectivorous birds.

Downstream of New Lenox Road, the flow in the river is noticeably slacker, resulting in less undercutting of the riverbanks and the habitat associated with such features. Trees are more scattered for roughly the next two miles, creating more open habitat attractive for species such as American bittern (*Botaurus lentiginosus*) and the mustard white butterfly (*Pieris oleracea*), both state-listed species that have mapped Species Habitat in this area.

At the lower end of Reach 5B to the upstream end of Reach 5C, the braided flow from Roaring Brook diffuses into the left bank of the river, creating very diverse bank habitat consisting of interspersed tree, shrub, and emergent marsh plant species with numerous cuts into the bordering wetlands, providing attractive for species such as wood turtles, river otter (*Lutra canadensis*), muskrat, mink (*Neogale vison*), and several species of wading birds. Over the next few miles of river, to the downstream inflows of Yokun Brook and associated drainage from the west side of the river (beyond the train tracks), a diverse assemblage of woodland mixed with emergent and deep marshes borders much of the river. While bank habitat features such as point bars and eroding banks are less prevalent here (due to the minimal slope

of the river and resulting slack water), the riverbank adds to the overall habitat complexity for a wide variety of species.

The downstream portions of Reach 5C (roughly the last 1-1.5 miles) exhibit numerous segments where riverbank formation is very weak or even non-existent. In many parts of this lower segment the river channel merges imperceptibly with adjacent backwaters which can extend more than 1,000 feet off the main stem of the channel. In other places, the riverbank is marked only by a thin fringe of emergent marsh and/or shrub vegetation. More aquatic species are attracted to these conditions, including state-listed species like the wapato arrowhead, American bittern, and bald eagle (*Haliaeetus leucocephalus*), all with mapped Species Habitat in this area. The riverbanks in this lower portion of Reach 5C in particular provide lodging habitat and slides for beaver and muskrat and foraging habitats for birds and mammals, including mink and raccoons (*Procyon lotor*). In particular, beaver activity along the banks is common in many places, with frequently occurring burrows, slides, and dens evident.

As noted above, a total of 17 state-listed plant and animal species have NHESP-mapped Species Habitat that encompass the riverbanks in Reaches 5B and 5C, 14 of which could utilize those bank habitats based upon habitat requirements of each species and the riverbank habitats documented in these areas. See **Table 4-14**. As also noted above, there are also three federally listed or proposed rare species that could utilize the riverbank habitat in Reaches 5B and 5C (two of which are also state-listed species, but for which MNHESP has not provided Species Habitat maps).

4.4 Riverbank Habitat Functional Assessment for Reaches 5B and 5C

Table 4-15 lists the applicable functional categories for the riverbank assessment, summarizes the primary bank functions that will be assessed, and lists, for each, the inventoried parameters from **Table 4-1** that contribute to developing the functional assessment. While the functional categories of riverbanks are the same as those assessed for riverine functions, the specific functions and parameters considered in assessing the functions vary between riverbank and riverine habitats. In addition to the hydrologic and geomorphologic functions, the bank assessment focused on the ecological and wildlife habitat functions that have been recognized in past investigations and that are related to specific habitat features such as vertical sandy banks and cut banks. The assessment of riverbank functions in Reaches 5B and 5C has drawn from the information documented for that reach on Form RB-1, and addresses the functions and considerations presented in **Table 4-15** to qualitatively relate the physical/structural conditions of the riverbank to the listed functions.

Hydrologic/Hydraulic Functions

Riverbank hydrologic support functions, as used here, include water conveyance and transport, watershed connectivity, and floodwater dynamics (flood flow amelioration, flood storage and desynchronization, and peak rate control). The hydrologic and hydraulic functions of the river were discussed in Section 3.4, and the riverbank is inseparable from the river in terms of these functions, with the bank conditions often reflecting the stream hydrology in terms of flow conveyance energy and sediment dynamics (transport, erosion, deposition). A key function of the riverbanks is the role they play in affecting floodwater dynamics between the river channel and the floodplain. The channel-forming flow, or bankfull discharge or flow, which transports most of the flow and sediment over time, forms and maintains the river channel. While the riverbank conditions in Reaches 5B and 5C indicate some instability (e.g., tight meander bends with eroding outer banks, poor point bar development), the bankfull flow parameters generally indicate only slight stream incision, such that overbank flooding into the floodplain appears to generally occur during flows generated by the 1.5- to two-year storm events (i.e., a normal flooding regime). Based on the recent HHA results, this equates to a flow of roughly 3,800 cfs at the Housatonic River confluence with Roaring Brook (at the Reach 5B/5C border).

Geomorphology Functions

The geomorphology functional category includes the following functions: supply of organic and mineral sediment material, supply/processing of woody debris, effects on flow, and role in determining stream planform and geomorphic diversity. As described in Section 3.4, the riverbank is subject to and indicative of the same geomorphologic factors as the river channel. The riverbanks in Reaches 5B and 5C reflect

and affect the geomorphic diversity and functions driven by the hydrologic factors. Bank erosion and deposition of sediment, vegetative conditions (including woody debris transport and deposition), and overall channel form (dimension, pattern, and profile) collectively reflect riverbank geomorphologic functions. As described previously, the riverbanks (and the overall channel) in Reaches 5B and 5C (especially downstream of New Lenox Road) reflect the historic (pre-1900) straightening of the river along the east side of the floodplain, as has been documented in past investigations (Weston 2011). At the confluences with Roaring Brood and Yokun Brook, the river channel and banks exhibit similar evolving geomorphologic conditions (meanders/breakouts/cutoffs) expected from the hydrologic effects of this tributary inflow, adjustments from the historic straightening, and the backwater effects from Woods Pond Dam.

Physiochemical Functions

Physicochemical functions of the riverbanks include water quality maintenance and water temperature and oxygen regulation for in-stream habitat. A key factor in the provision of this function in the Reach 5B riverbanks is the extent of overhanging mature vegetation. This vegetative cover contributes to temperature moderation, which in turn aids in oxygen regulation. In addition, the variation in flow regime from woody debris and other bed features (riffles/runs/pools) also contribute to water quality maintenance for in-stream habitat. Overhanging trees become much less common downstream of New Lenox Road and throughout Reach 5C, and the slack water in this area likely contributes to warmer temperatures. The effects of deeper water, and the flows from major tributaries such as Roaring Brook and Yokun Brook may counter this temperature change to some extent.

Biological Functions

Section 4.3.2 above describes many of the diverse biological functions provided by the riverbanks in Reaches 5B and 5C. These riverbanks provide lodging habitat and slides for beavers and foraging habitat for birds and mammals, including mink and raccoons. Habitat conditions are suitable along the riverbanks in these reaches for a number of state-listed species, including eight plant species, three insect species, three species of birds, and two herpetiles, For example, the exposed and/or undercut banks, and wood debris accumulations along portions of the river in this area provide potential hibernacula for the state-listed wood turtle; the confluences of Roaring Brook and Yokun Brook offer particularly high quality wood turtle habitat along the riverbanks. The muddy shorelines along the riverbanks provide suitable habitat for several state-listed plant species including the wapato and matted spike-sedge. Along portions of the Reaches 5B and 5C riverbanks, the overhanging mature trees and other dense riparian vegetation also provide shaded microhabitats and variability in water temperature within the river for fish, invertebrates, and shade-tolerant plant species, as well as foraging and perching sites for piscivorous and insectivorous birds. The state-listed bur oak was documented throughout Reach 5C, including along the riverbank.

5. BRA of Backwater Habitats in Reaches 5B and 5C

The Revised Permit defines "backwaters" as "areas that are typically inundated or open water adjacent to the main channel of the river in Reaches 5, 6, and 7" (page 1). EPA's earlier *Final Supplemental Investigation Work Plan* (EPA 2000) provided a more refined definition: "Backwater areas are quiescent areas adjacent to the main river channel that maintain a hydraulic connection to the river channel" (page 5-8). Similarly, *GE's Supplement to Response to EPA's Interim Comments on CMS Report* (GE 2010) noted that, "[f]or remediation purposes, backwaters are generally addressed by the sediment (rather than floodplain) remedial alternatives, reflecting the fact that they generally have a direct surface water connection to the river" (page IN-3).

Backwaters refer more to a hydrologic condition than a distinct habitat type, encompass both riverine and floodplain natural community types, and generally have a direct surface water connection to the river. However, from the perspective of habitat, backwaters are predominantly deep marshes with either shallow (i.e., less than six feet deep) open water and/or floating and/or submerged aquatic vegetation. These areas have open surface water connections to the Housatonic River that allow unimpeded backwater flow from the river into them annually, and that backwater flow is the primary hydrologic input (versus other surface water inputs). Each backwater area is typically accessible to fish annually, which can occur much of the year. Backwaters were not a mapped community type in the Woodlot 2002 Ecological Characterization.

Table 5-1 provides a summary of the parameters that were incorporated into the assessment of backwater habitat in Reaches 5B and 5C. The habitat inventory process for backwaters in Reaches 5B and 5C first incorporated pre-existing information consolidated from sources listed in Section 2 of the Revised BRA Work Plan where applicable to Reaches 5B and 5C. In addition, information on physical conditions within each confirmed backwater in these two reaches was generated from the updated LiDAR mapping and associated topographic/bathymetric mapping and data conducted for the PSA under the Revised PDI Work Plan for Reach 5A Sediment and Riverbanks (Anchor QEA and AECOM 2022). This information was then supplemented by a more detailed field inventory and characterization of the habitat within each of the backwaters in Reaches 5B and 5C in 2023 and 2024.

5.1 Background Ecological Information

5.1.1 Woodlot Ecological Characterization (2002)

Although the 2002 Woodlot ecological characterization of the PSA did not map backwaters as a distinct community type, it did contain numerous references to backwaters and the associated deep marsh habitat. It also referred to the larger backwaters to the immediate north of Woods Pond as moderately alkaline lake/pond areas. The discussion and information on backwaters in the Woodlot report pertain mainly to the main backwater areas just north of Woods Pond (most of which are in Reach 5C, although some extend north on New Lenox Road into Reach 5B). Woodlot noted that beaver lodges were common along these backwaters in Reach 5C north of Woods Pond, and reported on the warm-water fish species common in those backwaters (including common carp, goldfish, and brown bullhead). Woodlots noted that "[u]nder high flow conditions, the numerous backwater areas are hydrologically connected to flow in the main river channel; under low flow conditions, however, the backwater areas are largely isolated from the influence of flows in the main river channel" (Woodlot 2002a, page III-3-12)

5.1.2 RCRA Facility Investigation Report (2003)

The RFI Report included several references to backwaters, separating those that are hydraulically connected to the main channel from those that are disconnected (including vernal pools). However, the focus of the RFI Report discussions was on PCB fate and transport rather than on habitat. The RFI Report presented sediment depths in the backwaters of Reaches 5B and 5C, indicating average sediment thicknesses of 11 feet in Reach 5B and seven feet in Reach 5C. It also noted that "the majority of backwaters, defined as quiescent areas adjacent and hydraulically connected to the main channel of the

Housatonic River, lie within the lower half of Reach 5" (p. 2-10), and it presented a detailed physical description of the backwaters (size, depth, elevation, etc.).

5.1.3 Revised Corrective Measures Study Report (2010)

Section 5.3.6 of the RCMS Report summarized information on backwater habitats, noting that they are considered in the same category as deep marshes from a habitat standpoint. A preliminary identification of backwaters in Reaches 5 through 7 was depicted on **Figure 3-17** of the RCMS Report. That mapping depicted four areas that were mapped as backwaters within Reach 5B and 22 such areas in Reach 5C. Section 5 of the RCMS Report described the habitat of backwaters and deep marshes together, noting that backwaters from a remedial standard are addressed by sediment alternatives while deep marshes are addressed by floodplain alternatives. The report noted that "larger backwater areas in the vicinity of Woods Pond contain open water year round and provide suitable habitat for fish, including brown bullhead, common carp, goldfish, bluegill, largemouth bass, yellow perch, and white sucker" (page 5-71). In summarizing the habitat functions of the backwaters, including those in Reaches 5B and 5C, the RCMS Report noted that backwater areas are utilized by a range of bird and mammal species (especially wading birds) for foraging, shelter, breeding, and nesting, and are also used by amphibian and reptile species for foraging, breeding, and thermal regulation.

5.1.4 Example Area Evaluations (2010)

As noted previously, the Example Area evaluations conducted by GE in 2010 included two areas within Reaches 5B and 5C (one in each reach). Both Example Areas encompassed (and bordered) backwater habitat, shown on **Figures 3-1a and 3-1b**. Example Area #5 extended along a large backwater on the west side of the Housatonic River just below New Lenox Road, and included part of this backwater (now labeled 5B-BW-6). Example Area #6 encompassed a large backwater on the west side of the Housatonic River in the downstream one-third section of Reach 5C (now labeled 5C-BW-13). Little detail was provided about the backwater associated with Example Area #5. The description provided of the backwater within Example Area #6 noted that the backwater is deep enough to have open water all year, but shallow enough to support rooted aquatic plant growth over a substantial portion of its bottom, that native aquatic plants in the backwater include threadleaf crowfoot (*Ranunculus trichophyllus*) and spatterdock (*Nuphar advena*), and that invasive species such as Eurasian milfoil are also present.

5.1.5 Natural Heritage Information (2000-2022)

As with other habitats in the 2010 and 2011 reports, MNHESP also included these areas in its designation of Priority Habitats of state-listed species, without distinguishing occurrences within backwaters from those within the riverine and floodplain environments. However, the reports listed occurrences of state-listed mussel, fish, turtle, and amphibian target species, which may be encountered in backwater habitats at certain stages of life. The tables provided in the reports do not specify target species found in the Reaches 5B and 5C backwaters, and the figures are provided for larger general regions which include these reaches. There were no specific descriptions of the conditions of backwaters in Reaches 5B and 5C.

As noted In Section 3.1.6, MassDFW's July 2012 letter to EPA, which was attached to the Revised Permit, included maps depicting the locations of the different types of Core Areas, designated Core Area 1, 2, and 3.[8] All three types of Core Areas include some backwater habitats.

As also previously noted, in October 2022, MNHESP provided to GE updated Species Habitat mapping of the state-listed species in the ROR, including Reaches 5B and 5C (which has Species Habitat mapping for 17 state-listed species). As described in Section 5.2.2.9, at least seven of those species utilize habitats consistent with those present in the backwaters in Reaches 5B and 5C and have mapped Species Habitat overlapping those backwaters.

[8] As noted above, Core Areas 1, 2, and 3 are defined in a footnote in Section 6.1.5 of this report.

5.1.6 Pre-Design Investigations of Reach 5A

Backwaters in Reaches 5B and 5C were also included in the updated bathymetry and LiDAR mapping conducted as part of the PDI activities for Reach 5A. As part of these investigations, a bathymetric survey was conducted throughout the main channel and backwaters within Reaches 5 and 6. This survey was conducted in late April and early May 2022, and was used with LiDAR survey to generate updated topographic/bathymetric mapping. The updated topographic/bathymetric mapping of the backwaters in these reaches contributes to the documentation and understanding of backwater habitat conditions.

5.2 2023-2024 Backwater Habitat Investigations

5.2.1 Methods

In addition to the information described in Section 5.1, a more detailed delineation, field inventory, and characterization of the habitats within the backwaters of Reaches 5B and 5C were conducted during field surveys in 2023 and 2024. As described below, eight backwaters have been identified in Reach 5B and 20 backwaters have been identified in Reach 5C.[9] **Table 5-1** provides a summary of the parameters that were incorporated in the assessment of backwater habitats in these reaches. The parameters inventoried are documented on Form BW-1 (blank version provided in **Appendix C-1**), which includes documentation of physical connectivity with the river, sediment composition, aquatic biota, rare species habitat, and invasive species presence, as well as incidental wildlife observations. That form was completed for each backwater within Reaches 5B and 5C.

GE also collected water quality data from the backwaters during the 2024 growing season, consistent with the Revised Reaches 5B-8 BRA Work Plan. A Yellow Springs Instrument (YSI) Pro Dss Sonde 4M and data logger was used to collect information on water quality, and a YSI EXO Sonde and data-logger was used to collect chlorophyll and phycocyanin (total algae) data at three discrete point locations within each of the identified backwaters in Reaches 5B and 5C. These data were collected three times in each backwater during the 2024 growing season.

The Pro Dss Sonde 4M YSI was calibrated for each parameter prior to use daily. Deploying both the Pro Dss and EXO YSIs was conducted by lowering the sensors into the water column to a depth that allowed each sensor to be submerged but not disturb the pool bottom. The optical sensors remained in the water column until the parameter sensor readings stabilized, approximately 10 minutes, and then the readings were documented before removal. The YSI sonde and sensors were rinsed with clean water between each deployment to ensure accurate measurements. YSIs were cleaned and stored in provided cases at the end of each day. The resulting water quality data are recorded on Form BW-1, which includes a section to record those data.

5.2.2 Results and Description of Backwater Habitats in Reaches 5B and 5C

The detailed site investigations in 2023 and 2024 resulted in the identification and delineation of eight backwaters in Reach 5B and 20 backwaters in Reach 5C. These backwaters are shown on **Figures 5-1a and 5-1b**. While the backwaters are too numerous to describe each one individually, a general overview description is provided herein by grouping the backwaters geographically. Representative photographs of each backwater are provided in **Appendix C-2**.

Upstream of New Lenox Road, Reach 5B contains four backwaters (5B-BW-1 through BW-4). The most upstream backwater (5B-BW-1) is a distinct oxbow at the Reach 5A boundary on the east side of the river. Historical mapping shows this oxbow as the main channel of the Housatonic River until circa 1950 (Weston 2011). However, it is currently closed to the river at the north or upstream end (which is within Reach 5A across from the Pittsfield WWTP discharge). The downstream end of the oxbow is connected to the River via a distinct swale, which appears to draw down to bare sediment only at low flow periods.

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[9] The habitat classification and mapping survey process used to identify backwater, floodplain, and vernal pool habitats in Reaches 5B and 5C is described in detail in Section 6.2. As part of the comprehensive field surveys, determinations were proposed for the identification and delineation of backwater areas as distinct habitats from floodplain and vernal pool habitats.

This backwater currently provides a combination of open water, deep marsh, and shallow marsh habitat with some shrub swamp. The three other backwaters upstream of New Lenox Road are smaller depressions along the river and likely formed in remnant meander scars. Each of these are connected to the river with smaller fluvial swales which tend to be close to the mean low water elevation.

Downstream of New Lenox Road, there are an additional four backwaters in Reach 5B. Two small backwaters occur on the east side of the river, one set in marshland just downstream of the bridge and one associated with flow from Roaring Brook at the downstream end of Reach 5B (5B-BW-8). Another small backwater has formed across the river from BW-8, while a much larger backwater (5B-BW-6) is found west of the river just upstream of Reach 5C and is associated with a small tributary that flows west to east under the railroad tracks and through the Lenox Sportsmen Club. Backwater 5B-BW-6 provides high quality deep and shallow marsh habitat for secretive species such as American bittern and common gallinule (*Gallinula galeata*).

A total of 20 backwater areas have been identified, delineated, and inventoried in Reach 5C. Several of these have formed within what appears to be the remnant historical river channel along the east side of the valley when the river was reportedly straightened pre-1900s. Others have formed in remnant meander scars or oxbows that occur along the current main channel. The Yokun Brook drainage, which flows into the Housatonic floodplain roughly one-quarter of the distance down Reach 5C, along with additional tributary flow from the west going downstream of Yokun Brook, contribute to the formation of at least six backwaters in the low-lying portions of the floodplain (with many in remnant channel scars). Beaver activity also contributes to the confused drainage through this area, creating standing water behind their small dams and often contributing to backwater hydrology. Finally, the most expansive backwaters have formed over the last half-mile upstream of Woods Pond. Willow (or Sawmill) Brook is another tributary from the west that flows into the upper end of the largest of these backwaters (5C-BW-17) and contributes to the backwater hydrology. These largely ponded backwaters have extensive growth of submerged and floating-leaved aquatic vegetation, and provide habitat for bald eagle foraging, along with habitat for bittern, gallinule, and numerous other wading birds and waterfowl, as discussed further below.

5.2.2.1 Physical Characterization

The physical characteristics of the backwaters in Reaches 5B and 5C are important in assessing the habitat functions that these areas may support. These backwaters are quite varied in size, ranging from 0.14 to 22.3 acres in area. Backwaters comprise a total of 86.8 acres in these two reaches, with 10.5 acres in Reach 5B (range of 0.14 to 5.7 acres) and 76.3 acres in Reach 5C (range of 0.28 to 22.3 acres). The backwaters also vary considerably in spatial configuration; many are linear formations (likely due to their formation in remnant river meanders or oxbows), but others are broadly dispersed across the floodplain (often due to other hydrologic inputs, biotic factors such as beaver dams, or river flow dynamics). Based on inspection of soil profiles taken during characterization of the backwaters, substrates in all the backwaters typically consist of relatively high organic silty muck soils, consistent with the deep marsh habitats which comprise most of these areas. There were no signs of instability or erosion at any of the backwaters, consistent with the slack water that these areas generally receive during backwater flooding events.

5.2.2.2 Bordering Habitats

Figures 5-1a and 5-1b show the habitat cover types which border the Reaches 5B and 5C backwaters. Virtually all habitat cover types border the extensive network of backwaters through these reaches, including riverine, deep and shallow marshes, shrub swamp, wetland forests, and vernal pools. Upland habitats rarely border any of the backwaters to any appreciable degree.

5.2.2.3 Hydrologic Characterization

Integral to the definition of backwater areas, all backwaters in these reaches share a similar hydrologic regime based upon ephemeral surface water connections to the river. While the physical dimensions of the surface water connections between the backwaters and the river vary, each connection allows for surface water backflooding from the river during river water levels more frequent than the annual flood level. In general, the elevation of the swales that connect these backwaters to the river appear to be at

least two to three feet below bankfull level and are typically near mean low water. In several of the backwaters, there are also other surface water connections between the backwater and other wetlands or surface waters, which also affect the hydrologic conditions in and around the backwater. In all cases, the backwater connections to the river result in flooding of the backwaters during high flow periods (often several feet deep), followed by very shallow water or near dry conditions during summer low flow periods. The large backwaters in the downstream portions of Reach 5C typically retain shallow water (~one foot deep) throughout even the low flow period.

5.2.2.4 Plant Community Composition

During the 2024 surveys, a combined total of 88 plant taxa (82 identified to species and six identified to genus) were documented within the eight backwaters of Reach 5B and the 20 backwaters of Reach 5C. They are listed in **Table 5-2**. They include 69 herbaceous species (including submerged, emergent, and floating-leaved aquatics), 11 shrubs, eight trees, and no woody vines.

The most frequently occurring species in Reach 5B were purple loosestrife and swamp smartweed (*Persicaria hydropiperoides*), both of which occurred in all eight backwaters. Woolgrass (*Scirpus cyperinus*) and great bur-reed (*Sparganium eurycarpum*) each occurred in six backwaters of Reach 5B. Ditch stonecrop (*Penthorum sedoides*) occurred in five backwaters in this reach. The most observed tree in Reach 5B was silver maple, which occurred in four backwaters (**Table 5-2**).

The most frequently occurring species in Reach 5C were purple loosestrife, swamp smartweed, and pickerelweed, all of which occurred in the 20 backwaters in that reach. Canada waterweed was observed in 18 backwaters and Eurasian milfoil was observed in 17. The herbaceous species broad-fruit bur-reed and the shrub silky dogwood each occurred in 10 backwaters of Reach 5C. Water chestnut (*Trapa natans*) was observed in 12 of the Reach 5C backwaters. The most observed trees in Reach 5C were silver maple and red maple, both of which occurred in four backwaters (**Table 5-2**).

AECOM observed a total of 11 invasive plant species in the backwater habitats of Reaches 5B and 5C. These include three aquatic plants – Eurasian watermilfoil, water chestnut, and curly pondweed. Observed invasive grasses included common reed and reed canary grass, the latter of which is a native invasive species. Observed invasive forbs were pale yellow iris (*Iris pseudacorus*), purple loosestrife, and true forget-me-not. Woody invasive species in Reaches 5B and 5C included two shrubs, multiflora rose (*Rosa multiflora*) and Morrow's honeysuckle, and one tree, common buckthorn (**Table 5-2**).

Invasive plant species were observed in all the backwaters in Reaches 5B and 5C. The backwaters with the most such species were as follows: In Reach 5B, five invasive species were observed in backwater 5B-BW-4, and four invasive species were observed in 5B-BW-1 and 5B-BW-6; and in Reach 5C, 10 invasive species were observed in backwater 5C-BW-10, seven were observed in 5C-BW-8, and five were observed in 5C-BW-20 (see **Table 5-2**).

5.2.2.5 Fish Habitat

The larger, persistently inundated backwaters in these reaches offer high quality habitat for many warmwater fish species. The open connection to the river provides for movement of fish between habitats, facilitating higher fish diversity through more varied habitat conditions. As the shallow slow-moving water and dark bottom are exposed to the sun, backwaters provide warm water refugia in the early spring and late fall. Warmer waters early in the year provide opportunities for early spring spawning. Spawning occurs on vegetation and in areas with sand and gravel. Later in the year as submerged vegetation grows, these areas provide habitat for forage fish and provide nurseries for YOY fish from late spring to early fall. Common carp, bluegill, largemouth bass, and catfish (order Siluriformes) were frequently observed foraging, resting, and warming in the larger backwaters in these reaches.

5.2.2.6 Amphibian Breeding Habitat

As discussed in detail in Section 7.2.1 below, all backwaters in Reaches 5B and 5C were surveyed in 2023-2014 for evidence of amphibian breeding. These investigations identified 11 backwater areas (one in Reach 5B and 10 in 5C) where amphibian breeding by an obligate vernal pool species (i.e., spotted salamanders) was documented. A list of these backwater habitats in provided in **Table 5-3**. All but one of

these backwaters (BW5C-5) is located on the east side of the river. Between five and 38 spotted salamander egg masses (mean = 20.5) were observed within and along the edges of these backwater areas. Eggs were typically deposited in shallow and deep marsh areas along the edges of the backwaters, as well as in deep channels through buttonbush swamp that extend laterally out from open water areas. All areas are permanently flooded to intermittently exposed, are accessible by predatory fish and permanently connected to open waters of the adjacent river and backwater habitats. Species typical of permanently flooded habitats were also observed in these habitats, including painted turtles, snapping turtles, green frog adult and larvae and adult/aquatic phase red-spotted newts. As described in Section 7.2.1, due to the open permanent flow of surface water between the river and these backwater areas and accessibility for fish to move into and out of these permanently flooded areas, these areas are not considered to meet the MNHESP criteria for certification as vernal pools

5.2.2.7 Other Habitat Features

Form BW1 included a broad selection of other habitat features that were recorded for each backwater. These include wildlife food plants; a variety of cover, perching, basking, denning, and nesting habitat features; and specific features such as turtle nesting sites, undercut banks, and habitats specific to bank swallows, wading birds, and waterfowl. These data are presented by observation plot in **Table 5-4** and summarized in **Table 5-5** and as follows:

- Wetland and/or aquatic food plants were present or abundant in all backwaters.
- Structural features, such as cavities in trunks or limbs of live trees, large woody debris, root wads, dense herb cover, or hummocks that provide for perching, breeding, nesting and/or escape cover, were also found in all the backwaters.
- All backwaters offer nearby live or dead tall standing trees for species such as hawks and bald eagle to perch in and hunt from.
- There were no observations of open sandy to gravelly soils with sparse vegetation suitable for turtle nesting or vertical sandy banks typically used by kingfishers and bank swallows.

5.2.2.8 Incidental Wildlife Observations

During field surveys in the backwaters in Reaches 5B and 5C, observations were recorded on the backwater form (**Appendix C-1**) to document wildlife use of these areas. Among the wildlife observations were eight species of birds: great blue heron (*Ardea herodias)*, belted kingfisher, blue jay (*Cyanocitta cristata*), gray catbird (*Dumetella carolinensis*), cedar waxwing (*Bombycilla cedrorum*), goldfinch (*Carduelis carduelis*), tufted titmouse (*Baeolophus bicolor*), and yellow warbler (*Setophaga coronate*). Herpetofauna observed included snapping turtle (*Chelydra serpentina*), pickerel frog (*Lithobates palustris*), green frog (*Lithobates clamitans*), American toad (*Anaxyrus americanus*), and garter snake (*Thamnophis sirtalis*). Mammal signs included tracks or scats of raccoon, white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), and black bear (*Ursus americanus*).

5.2.2.9 Rare Species Habitat

There are eight state-listed plant and animal species that have MNHESP-mapped Species Habitat within the backwaters of Reaches 5B and 5C and that could utilize those habitats based upon habitat requirements of each species and the backwater habitat conditions documented to occur there. These species are listed in **Table 5-6**. Further, as noted previously, all three Core Areas designated by MNHESP include backwater areas. Additionally, the backwaters provide suitable habitat for two of the three federally listed or proposed rare species with habitat identified in Reaches 5B and 5C (the northern long-eared bat and the tricolored bat, which are also state-listed but do not have mapped Species Habitat from MNHESP). Rare species are further discussed in Section 8.

5.2.2.10 Water Quality

Baseline water chemistry was collected from the backwaters in 2024, using a YSI meter, three times during the growing season – on August 12-13, August 30, and September 5-6.

Each sample collection event included sampling in three locations equally spaced throughout the pooled/submerged portions of the backwater. Sample readings occurred at the same location during each event. Parameters measured included pH, temperature (°C), specific conductivity, dissolved oxygen (% and mg/l (milligram/liter)), and chlorophyll-a (mg/l). Results are presented in **Table 5-7**. The backwaters generally have levels of pH (7.69 average) and specific conductivity (463 average) that indicate the influence of calcareous groundwater discharge. Chlorphyll-*a* readings were generally within the normal range of surface waters in non-eutrophic lotic habitats (1-3 mg/l).

5.3 Backwater Habitat Functional Assessment for Reaches 5B and 5C

The functions provided by backwater areas in Reaches 5B and 5C are summarized by category in **Table 5-8**. Key functions consist of flood storage, water quality, wildlife habitat, and fisheries habitat. These are described qualitatively in this BRA Report, using the data obtained during the 2023-2024 field surveys as well as background information, with a focus on describing key characteristics and parameters to be considered in future restoration plans for the affected backwaters. The site-specific information collected for each backwater as documented on Form BW-1 has been used in the functional assessment, considering the physical and hydrologic characteristics, substrate conditions, specific habitat features, connectivity with surrounding habitats, and the presence of both rare and invasive species habitats.

Flood Storage Function

Backwaters contribute to flood storage functions given that they tend to be accessible to overbank flooding by more frequent storm events. The surface water connections between all backwaters in Reaches 5B and 5C and the river appear to be at least two feet below the bankfull stage, such that floodwaters can flow into these storage basins several times per year, and for some backwaters there is a permanent surface water connection with the river. The depressional storage provided by the backwaters along with the continuity they provide for floodflows across the floodplain contribute to the net storage and flood peak desynchronization function of the floodplain in Reaches 5B and 5C.

Water Quality Function

Water quality functions of the backwaters in Reaches 5B and 5C include the capacity to settle suspended solids as backwater flooding is dispersed into the quiescent waters of these areas during flood events, along with associated removals/settling of adsorbed constituents which could impair surface water quality.

Wildlife Habitat Function

The backwaters in Reaches 5B and 5C and associated deep and shallow emergent marshes provide habitat for a variety of bird, mammal, amphibian, and reptile species that rely on these areas for foraging, shelter, and breeding. Backwaters such as these are typically used by multiple reptile species, including snapping turtle, spotted turtle (*Clemmys guttata*), state-listed wood turtle, eastern painted turtle (*Chrysemys picta*), northern water snake (*Nerodia sipedon sipedon*), and ribbon snake (*Thamnophis sauritus*), and serve as breeding habitat for amphibians such as green frog and bullfrog. Reptiles and amphibians also use these habitats to regulate body temperatures and rehydrate during the summer. Persistently inundated wetlands like the large backwaters in the downstream portion of Reach 5C are important for a variety of bird species, including the state-listed American bittern and common moorhen (*Gallinula chloropus*), as well as wood duck (*Aix sponsa*), great blue heron, green heron (*Butorides virescens*), marsh wren (*Cistothorus palustris*), and red-winged blackbirds (*Agelaius phoeniceus*). The wading birds prefer this type of open water with minimal current, as do common backwater plants such as pickerelweed and arrowhead, which are important food sources for a variety of birds and mammals.

Fisheries Habitat Function

During periods when the backwaters are connected to the Housatonic River (which is true year-round for many of the backwaters), fish can migrate between the backwater habitat and mainstem of the River. In smaller backwater areas of Reaches 5B and 5C, as the high water recedes, fish would be expected to return to the river, although some may be trapped within the backwaters. During specific hydrologic conditions such as major storms, these habitats may provide refuge habitat, particularly for smaller fish.

In some cases, the backwaters may be “sinks” for fish, where they are trapped internally as water levels recede and succumb to lack of surface water during low flow periods. As noted in Section 5.2.2.5, the larger, persistently inundated backwaters in these reaches offer high quality habitat for many warmwater fish species. The open connection to the river provides for movement of fish between habitats, facilitating higher fish diversity through more varied habitat conditions. Common carp, bluegill, bass, and catfish (order Siluriformes) have been observed in the larger backwaters in these reaches.

6. BRA of Floodplain Habitats in Reaches 5B and 5C (excluding Vernal Pools)

Reaches 5B and 5C together encompass approximately 408 acres of floodplain habitat between the riverbanks and the 1 mg/kg PCB isopleth (which approximates the 10-year floodplain). The BRA of the floodplain in Reaches 5B and 5C involved: (1) review and consolidation of background ecological information from other sources; (2) generation of base mapping and classification of the habitats within the floodplain; (3) field assessment of baseline conditions in the floodplain wetland habitats; and (4) field assessment of baseline conditions in floodplain upland habitats. Vernal pools are discussed separately in Section 7.

6.1 Background Ecological Information

The floodplain habitat inventory process for Reaches 5B and 5C was initiated by incorporating information from the sources referenced in Section 2 of the Revised Reaches 5B-8 BRA Work Plan (where applicable to the Reaches 5B and 5C floodplain). A summary of information on floodplain habitats in Reaches 5B and 5C from those investigations is provided below.

6.1.1 Woodlot Ecological Characterization (2002)

As described in Section 3.1.1, the ecological characterization carried out by Woodlot for the PSA included a variety of biological investigations (Woodlot 2002a). In the overall mapping of community types, Woodlot provided a baseline of the aerial distribution and extent of different floodplain habitat types that occur in Reaches 5B and 5C. For example, the Woodlot mapping included 566 acres of floodplain habitat in Reaches 5B and 5C, with approximately 47% characterized as forested wetlands and 53% characterized as other non-forested wetland types. Comparison of the Woodlot mapping with the current habitat mapping is discussed in Section 6.2.2

Specific to Reaches 5B and 5C, Woodlot noted: “In the lower portion of the PSA, the floodplain forests give way to black ash–red maple–tamarack calcareous seepage swamps. These forested communities are low-lying wetlands that are enriched by high-pH groundwater discharge. These discharge areas can be recognized by the occurrence of standing water in depressions and a calciphilic (i.e., calcium-loving) flora. Red maple swamps, another type of forested wetland in the PSA, are primarily found in the transition between the floodplain forests and calcareous seepage swamps” (Woodlot 2002a, page II-13).

6.1.2 RCRA Facility Investigation Report (2003)

Although, as previously noted, GE’s 2003 RFI Report was focused on documenting the extent of PCBs in the river, it did provide some relevant floodplain habitat information. In general, the RFI Report referred to the depiction of habitat conditions provided by Woodlot (2002a). For example, Figure 2-14 of the RFI Report provided mapping of floodplain vegetation that includes Reaches 5B and 5C, and the depicted community types are based on those presented in the Woodlot ecological characterization.

6.1.3 Revised Corrective Measures Study Report (2010)

GE’s 2010 RCMS Report presented expanded information on ecological baseline conditions in the PSA, including the floodplain habitats in Reaches 5B and 5C. Other than describing potential impacts from remedial alternatives, however, it included few details specific to Reaches 5B and 5C, such as descriptions of floodplain habitat conditions which apply directly or only to these reaches.

6.1.4 Example Area Evaluations (2010)

As discussed in Section 3.1.5, GE’s February 2010 Supplement to Interim Response presented detailed evaluations of six Example Areas, including one in Reach 5B and one in Reach 5C, both of which included portions of the floodplain. Those example areas are shown on **Figure 6-1**. Those evaluations

contain considerable information on the existing ecological conditions and functions in the selected Example Areas, as well as the impacts of remedial alternatives on those conditions and functions.

The two Example Areas in Reaches 5B and 5C contain a variety of floodplain habitats, including transitional floodplain forest, black ash-red maple-tamarack calcareous seepage swamp, shrub swamp, shallow and deep marshes, and wet meadow. These habitats were subject to detailed field investigations and reporting on the ecological conditions found there, including detailed discussions of the wildlife species present or anticipated to use each area (including state-listed species). Detailed mapping of the existing habitat features were created for each area. The following points summarize the floodplain habitats described for these two Example Areas:

- Example Area #5 includes floodplain areas on both sides of the Housatonic River, featuring various wetland habitats such as shrub swamp, wet meadow, shallow and deep emergent marshes, and transitional floodplain forest. Wetlands in this area provide a variety of habitat functions, including foraging and nesting opportunities for small mammals and birds; and the floodplain provides habitat for a number of state-listed species, including American bittern, wood turtle, mustard white butterfly, rapids clubtail, and rare plant species.
- Example Area #6 contains a large backwater in the center which grades into a deep emergent marsh, as well as a smaller backwater to the northeast. These habitats provide foraging/breeding movement corridors and cover opportunities for a variety of reptile, amphibian, and fish species. Persistently inundated wetlands like these are important foraging habitats for a variety of bird species (including the state-listed American bittern). This area also contains shrub swamp habitat, which provides foraging and nesting opportunities for many bird species; forested floodplain areas, which include snags that provide perching habitat for raptors and cavities for nesting of other bird species; and dense herbaceous cover, which provides suitable habitat for a variety of small mammals and reptiles.

6.1.5 Natural Heritage Information (2000-2022)

The MNHESP 2010 and 2011 investigations and reports on the Housatonic River watershed (described in Section 3.1.6) provided information on state-listed species in Reaches 5B and 5C, many of which are associated with floodplain habitats; and they included Priority Habitat mapping for each of those species, which was included in the 2010 RCMS Report.

As also discussed previously, MassDFW's July 2012 letter to EPA included maps depicting the locations of the different types of Core Areas, along with the criteria for the designations.[10] Core Areas 1, 2, and 3 all include floodplain habitats in Reaches 5B and 5C. Core Area 1 comprises approximately 38 acres in Reach 5B and 114 acres in Reach 5C and includes four state-listed species with mapped Species Habitat in the Reach 5B floodplain and five state-listed species with mapped Species Habitat in the Reach 5C floodplain. Reach 5C also includes two state listed floodplain forest community types – the high terrace floodplain forest and the red maple-black ash-hemlock-bur oak swamp – both of which are included in the Core Area 1 criteria. Core Area 2 comprises approximately 164 acres in Reach 5B and 238 acres in Reach 5C and includes three state-listed species with mapped Species Habitat in the Reach 5B floodplain habitat and two state-listed species with mapped Species Habitat in the Reach 5C floodplain. Core Area 3 comprises approximately 44 acres in Reach 5B and 13 acres in Reach 5C.

Further, as previously noted, in October 2022, MNHESP provided to GE updated Species Habitat mapping of the state-listed species in the ROR, including Reaches 5B and 5C. As described in Section

[10] Core Area 1 is classified by MNHESP as the highest quality habitat for species that are most likely to be adversely impacted by PCB remediation activities. Core Area 2 is classified by MNHESP as the highest quality habitat for more mobile species that may be less vulnerable to remediation impacts, species where the habitat is likely to be somewhat more easily restored, and listed species that may be more of somewhat lower conservation concern, given their state-wide distribution. Core Area 3 consists of areas where Species Habitat mapping of at least eight state-listed species overlap.

6.3, all 17 of the state-listed species mapped in Reaches 5B and 5C could potentially utilize the floodplain habitats in these reaches.

6.2 Baseline Mapping and Classification of Floodplain Habitats

6.2.1 Methods

In addition to consolidating information from the sources described in Section 6.1, updated base mapping of the floodplain in Reaches 5B and 5C was generated, including classification of floodplain natural communities, wildlife habitat features, and dense monoculture stands of invasive plant species. For this purpose, floodplain habitats have been divided generally into wetland habitats and upland habitats. Vernal pools in the floodplain are discussed separately in Section 7. The classification and delineation of habitats described in this section also included assessments of which areas constitute vernal pools and which areas constitute backwaters.

Characterization of floodplain habitats and natural communities along the Housatonic River in the PSA was originally performed by Woodlot and presented in its 2002 ecological characterization report. As part of that characterization, ecological community type mapping was produced for the PSA, including all floodplain habitats, and that work was incorporated into updated mapping of Reaches 5B and 5C. Updated mapping of floodplain natural communities and cover type was created based on 2023 and 2024 field surveys in Reaches 5B and 5C. River morphology surveys were also incorporated into the floodplain classification and mapping process. Portions of the floodplain within Reaches 5B and 5C showed significant changes in habitat boundaries since the 2002 Woodlot survey (primarily resulting from changes in hydrologic conditions and small shifts in channel morphology of the Housatonic River).

The Woodlot 2002 ecological characterization followed natural communities as described in Swain and Kearsley's 2000 *Classification of Natural Communities of Massachusetts* (2000) and referred to wetland habitats as "palustrine communities" and to upland habitats as "terrestrial communities." **Tables 6-1** and **6-2** describe, respectively, the wetland and upland natural community types present in Reaches 5B and 5C, as characterized by Woodlot. Palustrine communities described in **Table 6-1** included cover types ranging from deep emergent marsh habitats to open wet meadow, shrub swamp, and forested habitats. Moderately alkaline ponds in the floodplain were classified as a lacustrine community with the Housatonic River and tributaries classified as low, medium, and high-gradient streams, as described by Weatherbee and Crow (1992). Upland habitats included several forest types as well as "cultural grasslands," which included hay fields, former agricultural areas, and residential lawns (**Table 6-2**).

For purposes of this BRA, the updated natural community mapping was consistent in many respects with the Woodlot 2002 ecological characterization, with a number of differences (discussed in Section 6.2.2). The 2023-2024 field surveys and floodplain mapping for the BRA also included a review of the recently updated *Classification of Natural Communities of Massachusetts* (Swain 2020).

To prepare the updated mapping including the wetlands and natural community/cover types, a combination of desktop analyses and field surveys was performed, followed by aerial photographic-interpretation and heads-up digitizing in ArcGIS. In addition, these activities identified and mapped areas with 25% or greater invasive plant species cover and included an assessment of degraded habitats as potential areas for access roads and staging areas in the floodplain. Data layers compiled for the desktop analyses and subsequent mapping updates include:

- Existing community type classification mapping from the Woodlot 2002 ecological characterization;
- Mapping and photographs from Example Area characterizations conducted for the RCMS (2010);
- Aerial photography (from 2021 and earlier years) and related imagery (e.g., bare earth Digital Elevation Model imagery, which are particularly useful for delineating wetter areas of the floodplain based on microrelief) available from MassGIS, and other publicly available GIS data sources, as needed; and

- Surface topography generated from the LiDAR and other surveys conducted of the river and floodplain in the PSA in December 2021 and April-May 2022 as part of the PDI for Reach 5A.

Prior to conducting field surveys, the above-listed mapping data were compiled and overlain to produce preliminary resource mapping and aerial images that include the natural community cover types, vernal pools, delineated hydrologic zones, and other features. The updated LiDAR mapping and 2021 MassGIS aerials were the primary baseline field resource maps with these other data layers added. These resource maps then had a 100-meter grid overlain across the limits of the Reaches 5B and 5C floodplain for use in the field surveys of the floodplain.

Field surveys were conducted by walking transects along the 100-meter grid lines across the floodplain habitats in Reaches 5B and 5C; these surveys occurred from July through September in both 2023 and 2024. Transect locations along with the resource base mapping were uploaded to ArcGIS Online and viewed in the field using the ArcGIS Collector application. When used in conjunction with an Arrow-100 GPS unit (capable of one-foot accuracy), real-time tracking of location and collection of highly accurate GPS data points were conducted. In addition, the lateral extent of certain features that are visible on the aerial photographs in ArcGIS Collector (e.g., dense stands of scrub-shrub habitat and large patches of Japanese knotweed) were interpreted, field-verified, and digitized while in the field from one vantage point, as opposed to surveying individual points by GPS and connecting them later in GIS. This approach provided efficient field efforts and post-processing of field data. Representative photographs of different community types in Reaches 5B and 5C are provided in **Appendix D-1**.

6.2.2 Results

Upon completion of the field surveys, surveyed GPS data points, polygons, and polylines were overlayed with existing site data in GIS for post-processing and mapping. The new ArcGIS data layers produced for Reaches 5B and 5C are as follows:

- An updated version of the natural community mapping originally prepared as part of the Woodlot 2002 ecological characterization, including vernal pools, as shown on **Figures 6-2a-e**;
- A polygon and a point data layer showing areas with 25% or greater cover of invasive plant species, with polygons identified with species observed (discussed further in Section 9); and
- A polygon data layer showing areas of disturbed or degraded habitats that could be used for access roads or staging areas during remediation and restoration stages of the project (discussed further in Section 10).

Natural community mapping based on the 2023-2024 field surveys and other recent investigations conducted in Reaches 5B and 5C is presented on **Figures 6-2a-e**. There were some differences between the Woodlot natural community mapping and the latest (2024) mapping (i.e., changes in community type and spatial juxtaposition). Notable changes are identified in **Table 6-3** and described further below. In the latest field survey, a total of 699 individual polygons representing 17 natural community and cover types were mapped over the approximately 569-acre survey area in Reaches 5B and 5C. They include:

- Three open water categories totaling 160.1 acres;
- Two open field / early successional categories totaling 8.9 acres;
- Three forested upland categories totaling 31.6 acres;
- Four forested wetland categories totaling 139.3 acres;
- Four non-forested wetland categories totaling 227.0 acres; and
- One developed/disturbed category totaling 2.2 acres.

During the approximately 21-year period between the Woodlot 2002 surveys and the 2023-2024 AECOM surveys, there have been some notable changes in the natural community cover types in Reaches 5B and 5C. Observed differences in community type mapping were documented and delineated in both reaches, with most changes occurring along the fringes of habitats or in small discrete patches. Two particularly large patches of floodplain habitat exhibited shifts in community type mapping, one in Reach 5B and one in Reach 5C.

In Reach 5B, although the total acreages are similar between the two survey periods, there are a number of small habitat patches that have shifted from shrub swamp to forested habitats (e.g., red maple swamp, transitional floodplain forest) or from shallow emergent marsh into shrub swamp habitats. These changes can be seen throughout the floodplain and are likely associated with natural succession. However, some areas that differ may be due to interpretation of conditions on the ground and/or during the remote mapping exercise. In addition to the small shifts in community types, there is an approximately six-acre area on the west side of the river along the Reach 5A-5B boundary that was previously mapped as red maple swamp but is now shown as shallow emergent marsh and shrub swamp habitats. This type of retrogressive succession is typically associated with a change in hydrology caused by beaver activity.

In Reach 5C, small shifts in community types were likewise observed across the floodplain. In addition, there was an overall substantial change in the amount of shrub swamp (increase of 44 acres) and red maple swamp (increase of 12 acres) between the two survey periods. Most of this shift occurred within an approximately 60-acre area of floodplain along the west side of the Housatonic River, west of backwaters BW5C-13, 17 and 20, and east of the railroad tracks. Nearly all of this area was previously mapped as black ash-red maple-tamarack calcareous seepage swamp and appears to have undergone some level of retrogressive succession likely associated with down-gradient beaver activity. Approximately 70% of this area is now composed of shrub swamp, shallow emergent marsh and deep emergent marsh habitats, with 30% mapped as red maple swamp. During the 2023-2024 surveys, 23 vegetation plots were inspected while walking transects through these areas and only a few black ash saplings and only one tamarack (*Larix laracina*) was documented, even though this area had been previously mapped by Woodlot as forest. Such previously forested areas are now dominated by shrubs such as speckled alder, buttonbush, silky dogwood, winterberry and assorted sedges, forbs, and grasses. Other areas which were previously mapped as black ash-red maple-tamarack calcareous seepage swamp and were still forested in 2023-2024 have been reclassified as red maple-black ash-bur oak swamp due to the absence of tamarack in these areas and a proliferation of bur oak trees.

6.3 2023-2024 Floodplain Wetland Habitat Investigations

In addition to the consolidation of existing information and the mapping and classification of floodplain habitats, an inventory was conducted of the floodplain wetland habitats, as described in this section.

6.3.1 Methods

The floodplain wetland habitat inventory characterization consolidated and incorporated information on a broad range of floodplain wetland parameters that collectively contribute to wetland functional capacity. These parameters consisted of wetland hydrology, vegetative conditions, soils, rare species habitat, invasive species, surrounding habitats, and juxtaposition with other wetland and surface water systems. **Table 6-4** summarizes the floodplain wetland parameters that were included in this characterization.

As described above for the baseline mapping procedures, field surveys were conducted by walking transects along the 100-meter grid lines across the floodplain in Reaches 5B and 5C; these surveys occurred from July through September in each of 2023 and 2024. As noted, field surveys consisted of walking each transect and surveying points using GPS at changes in community/cover types, wetland and vernal pool edges, wetter/lower zones such as swales and depressions, and areas that are dominated by invasive plant species or are heavily disturbed/degraded. In addition, representative points along wetland edges between the transect lines were surveyed by GPS in areas where this boundary was difficult to photo-interpret, such as boundaries located under a coniferous tree canopy. At each 100-meter grid point (with possible adjustments where appropriate), a Floodplain Habitat Inventory Form

(Form FP-1, which was provided in Appendix E to the Revised Reaches 5B-8 BRA Work Plan and a blank version of which is provided in **Appendix D-2** hereto) was completed in the field.[11] The form has eight sections (i.e., Section I through VIII) and provides site-specific information on wetland hydrology, soils, vegetation, specific wildlife habitat features (wolf trees, tree cavities, standing dead trees, large woody debris, mammal burrows, connectivity/juxtaposition with other habitat, signs of degradation, etc.), and the presence of or habitat for listed rare species for each wetland cover type unit.

The first two sections (Sections I and II) were completed to document the conditions listed in those sections, including natural community types, plant inventory, estimates of percent vegetation cover, hydrology, and characterization of soils. In general, community cover type patches distinguished for mapping/data collection were greater than 0.5 acre in size (or roughly 25% of one grid in the 100-meter grid), except for vernal pools, which were mapped independently of this size threshold (as discussed in Section 7).

The remaining sections of Form FP-1 (Sections III-VIII) were completed, along with a compiled summary of the information collected for Sections I and II, at the 100-meter grid points within each wetland cover type unit larger than 0.5 acre. The habitat features listed in Section III of Form FP-1 were recorded by the field observers for each wetland cover type unit during the traversing of the grid lines and were used in the characterization of the overall cover type unit. In addition, as part of this assessment, the presence of Core Area 1, Core Area 2, and Core Area 3 habitats (as designated by MNHESP) in the floodplain wetland areas was incorporated into the mapping and inventory, as was the presence of any other designated habitat for any federally listed or state-listed rare species; and any direct observation of a federal or state-listed rare species was documented and surveyed by GPS. Form FP-1 contains a section (Section V) to document these observations. Further, other incidental direct wildlife observations were recorded, as provided in Section VI of Form FP-1.

In addition to the above data collection and survey procedures, other available information on habitat and wildlife observations was incorporated into the wetland assessments. This included information from Cornell's eBird web site on bird observations (https:/ebird.org). Further, as discussed in Section 10, the field survey activities included the identification of degraded habitats that could potentially be used for access roads and/or staging areas, and observations were also recorded on restoration opportunities that may be integrated with the remedial design and implementation. Sections VII and VIII of Form FP-1 provided for the documentation of such observations.

In addition to the characterization of wetlands by community type and physical and biological parameters, the floodplain wetlands in Reaches 5B and 5C were assessed for wetland functions

6.3.2 Results

The following text and **Tables 6-5 through 6-10** provide a summary of field data collected during the 2023-2024 floodplain surveys using Form FP-1. To be more efficient, the six-page Form FP-1 was converted into a two-page table format with 17 rows (i.e., one for each data collection point) to be completed in the field and included all components of Form FP-1 that could not be determined through remote means (i.e., through interpretation of aerial photographs or inspection of GIS mapping data). These data were also collected digitally using ArcGIS Online Field Maps and are presented in tabular form rather than in a collection of completed forms. Vegetation and soils data were also collected in a tabular format that allowed for data from more than one sample location to be collected on one page.

The following sections include discussion on plant community composition including invasive species, soil types mapped by the U.S. Department of Agriculture Natural Resource Conservation Service (USDA NRCS 2023) and observed in the field, physical features needed to support wildlife habitat (including

[11] Due to the large number of survey points and the digital collection of information on the forms, the completed forms are not themselves included in this report, but the resulting information is presented in tabular form, as discussed in Section 6.3.2.

access to food sources and suitable habitats for nesting, breeding, and escape cover), incidental wildlife observations, and rare species habitat.

6.3.2.1 Plant Community Composition

A total of 264 plant species were documented from 159 plots surveyed on the floodplains in Reaches 5B and 5C, as shown in **Table 6-5**. These included 189 species of herbs, forbs, and grasses, 36 shrubs, 31 trees, seven vines, and one moss. The frequency of species occurrence and total number of species per plot ranged considerably among each plant stratum. Observations of herbaceous species ranged from the identification of one to 20 species per plot, with 115 plots having between two and 10 herbaceous species. The most frequently encountered herbaceous species were purple loosestrife, sensitive fern (*Onoclea sensibilis*), moneywort (*Lysimachia nummularia*), and green arrow-arum (*Peltandra virginica*). Up to seven species of woody shrubs occurred in six plots while 130 plots had between one and six species plus 23 plots with no shrub species observed. The most frequently encountered shrub species were silky dogwood, Morrow's honeysuckle, and speckled alder. Eight species of trees occurred in only one plot, while 96 plots had between one and seven tree species plus 62 plots with no tree species observed. The most frequently encountered tree species were red maple, silver maple, and American hornbeam (*Carpinus caroliniana*). Finally, seven species of vines (four of which are woody) were observed during the surveys, with poison ivy (*Toxicodendron radicans*) being the most frequently encountered species occurring in 25 plots.

Data were collected on invasive species presence at the 159 plot locations across the floodplain (**Figure 6-3**). Invasive plant species were observed at 148 of these plots (94%). In 11 plots, greater than 25% cover of one invasive plant was documented. Cumulative cover of greater than 25% was also observed in 96 plots with two to four invasive plants, and 14 plots with five to eight invasive plants. As shown in **Table 6-5**, a total of 19 species listed as invasive or likely invasive were observed growing in the floodplain plots that contained such species (11 herbaceous species, seven shrubs, and one woody vine). The most frequently encountered invasive plants were purple loosestrife, reed canary grass, and moneywort in the herbaceous layer, common buckthorn and Morrow's honeysuckle in the shrub layer, and Asian bittersweet in the woody vine layer.

A total of 371 invasive plant records were recorded in the floodplain from within the 148 plots. Based on mid-point of cover ranges, the estimated percent cover for each individual species observation was less than 3% for 132 observations. The remaining observation included 180 with 10-38% cover, and 59 observations with 68-98% cover (mean=18% and 71%, respectively). Species with the highest estimated percent cover (greater than or equal to 38%) included reed canary grass, purple loosestrife, water forget-me-not, and multiflora rose. In several plots, reed canary grass exhibited nearly 100% cover. Of the 148 plots with invasive species, only 38 plots had just one invasive plant, 96 plots had two to four and 14 plots had five to nine invasive plants. Although percent cover of individual plants were often low, the cumulative effect of multiple invasive herbs, shrubs and vines in one plot could be quite high. For plots with two or more invasive plants, percent cover ranged from approximately 10% to well over 100% (mean=63%).

In addition, species considered non-native but not listed as invasive or likely invasive in Massachusetts were observed at 52 (33%) of these plots (23 in Reach 5B and 29 in Reach 5C). There were 24 such non-native species, which included 22 herbaceous species and two shrub species. Presence of non-native plants was similar between the two reaches with 16 herbs and two shrubs in Reach 5B and 12 herbs and one shrub in Reach 5C.

A total of 221 native plants (158 herbaceous species, 28 shrubs, 31 trees, and three woody vines) were observed on the floodplain. In addition, there was one moss identified to genus (i.e., *Sphagnum spp.*), which is also considered to be native. Fewer native plant species were observed in Reach 5B (n=148) than in Reach 5C (n=184). However, as described above, invasive species tended to occur more frequently and with greater percent cover in Reach 5B than in Reach 5C

Percent cover of mosses, herbs, shrubs, woody vines, and trees was also estimated at all 158 plot locations across the floodplain. Floodplain communities in Reaches 5B and 5C included wet meadow,

shallow emergent marsh, deep emergent marsh, shrub swamp, red maple swamp and transitional floodplain forest. Red maple-black ash-bur oak swamp community was mapped in Reach 5C only. The percent cover results are presented in **Table 6-6** for each cover type. Absolute cover (i.e., considering all overlapping vegetation layers combined) was typically well over 100%. As would be expected, tree cover on average was generally low or non-existent in shallow emergent marsh, deep emergent marsh, shrub swamp, and wet meadow habitats. Tree cover in red maple swamps was greater than 50% on average in Reach 5B. However, the tree canopy of red maple swamps in Reach 5C was comparatively sparse, which explains the denser shrub layer also observed in those wetlands. Cover of herbaceous vegetation in red maple swamps and transitional floodplain forests was also high in both reaches. Tree and shrub layers were approximately equal (50/50) in transitional floodplain forests in both Reaches 5B and 5C. The red maple, black ash, bur oak swamp exhibited the highest canopy cover on average, with a corresponding decrease in woody shrubs. This community also had the highest herbaceous cover of the forested floodplain habitats sampled. Cover of woody vines and mosses was typically low on average (less than 3-4%).

6.3.2.2 NRCS Soils

The USDA NRCS soil survey has mapped 14 different soil series in Reaches 5B and 5C, plus one mapping unit that represent disturbed conditions (i.e., Udorthents, smoothed; USDA NRCS 2023). These soil types are listed in **Table 6-7** and depicted on **Figure 6-5**. Approximately 66 acres in Reach 5B and 70 acres in Reach 5C contain soils that have formed in alluvial deposited sediments (i.e., on floodplains) and consist of very fine sandy loam (Winooski) to silty alluvium (Saco). Saco series soils are very poorly drained soils and indicate true wetland conditions and often have significant organic accumulation at the soil surface. In addition, both the Natchaug and Catden soils are very poorly drained organic mucks that form in depressions on floodplains and typically exhibit 10 (Natchaug) to 60 (Catden) inches of organic accumulation. Other poorly drained and very poorly drained mineral soils include Fredon, Limerick. and Halsey soil series. In total, approximately 371 acres (65%) of the floodplain in Reaches 5B and 5C together contain poorly and very poorly drained wetland soils.

Except for two soil series (Peru-Marlow and Berkshire-Marlow, which consist of soils formed in lodgment till), all other soil series in Reaches 5B and 5C formed in eolian deposits (i.e., wind-blown soils) over sandy and gravelly glaciofluvial deposits (Copake, Fredon, Halsey, and Hero) and in loose sandy or loamy glaciofluvial deposits (Oakville and Merrimac).

6.3.2.3 Other Habitat Features

Form FP-1 includes a broad selection of other habitat features that were recorded for each plot location. These include wildlife food plants; a variety of cover, perching, basking, denning, and nesting habitat features; and specific features such as four-toed salamander (*Hemidactylium scutatum*) habitat, presence of vernal pools, and habitats specific to wading birds and waterfowl. These data are presented by observation plot for the floodplain wetland habitats in **Table 6-8** and summarized in **Table 6-9**.

In general, all plot locations contain wetland, upland, or some combination of wetland and upland food plants that provide food sources for wildlife. Other habitat features encountered with high frequency were shrub and herbaceous vegetation suitable for bird nesting (abundant for 83% of plot locations in Reach 5B and 76% in Reach 5C) and dense herbaceous cover suitable for small mammals, amphibians, and reptiles (abundant in 60% of locations in both Reaches 5B and 5C). LWD on the ground and standing water at least part of the growing season were characterized as present or abundant in 44% to 88% of the locations in both reaches. Standing live or dead trees with cavities in the trunks or limbs, rocks, crevices, logs or roots at the water's edge, and areas with fine-leaved emergent vegetation were more prevalent in Reach 5C than in Reach 5B.

6.3.2.4 Incidental Direct Wildlife Observations

During the course of the floodplain surveys, field observers recorded all direct observations of wildlife species (including evidence of species presence, such as tracks or scat). **Table 6-10** provides a listing of these observations. Overall, a total of 82 species (or evidence of their use) were observed in the wetland areas of the floodplain. These include 57 bird species, 13 species of herpetofauna, eight mammal

species, and four invertebrates. A detailed listing of the incidental wildlife observations is provided in **Appendix D-3**.

In addition, in accordance with the Revised Reaches 5B-8 BRA Work Plan, collection of data from Cornell's ebird website (https:/ebird.org) was conducted to include observations from the birding public of bird usage in Reaches 5B and 5C.[12] These are presented in **Table 6-11**. These data were derived from hot spots located within each of two locations in these reaches. which combined had over 1,650 site visits (642 visits to Reach 5B and 1,035 visits to Reach 5C). More than 170 species of birds were recorded at sites within Reaches 5B and 5C. While these observations encompass all habitats in Reaches 5B and 5C, not just the floodplain wetlands, the list is provided as part of this summary.

6.3.2.5 Rare Species Habitat in Wetland Floodplains

A total of 17 state-listed plant and animal species (13 in Reach 5B and 15 in Reach 5C) have MNHESP-mapped Species Habitat that encompass the floodplain wetlands in Reaches 5B and 5C and that could utilize those wetlands based upon habitat requirements of each species and the floodplain habitat conditions documented to occur there. These species are listed in **Table 6-12**. The same applies to the three federally listed or proposed rare species with identified habitat in Reaches 5B and 5C. The rare species with habitat in these reaches are further discussed in Section 8.

6.3.3 Description of Floodplain Wetland Habitats in Reaches 5B and 5C

Floodplain wetlands in Reaches 5B and 5C are composed of eight different plant community cover types and one open water community type. The total area of each cover type by reach is presented in **Table 6-3**. These habitats are described below.

Floodplain Wetland Forest Habitats

Based upon the 2023-2024 community type mapping described herein, approximately 139 acres of forested wetland floodplains occur within Reaches 5B and 5C – 42 acres in Reach 5B and 98 acres in Reach 5C. These account for approximately 21% and 26% of the total mapped area in Reaches 5B and 5C, respectively. Four different natural community types are represented within these forested wetlands – transitional floodplain forest (total of 59 acres), red maple swamp (total of 52 acres), high terrace floodplain forest (1.3 acres in Reach 5B only), and red maple, black ash, bur oak swamp (27 acres in Reach 5C only).

In the portion of Reach 5B located north of New Lenox Road, transitional floodplain forest is the dominant matrix habitat connecting all other intervening floodplain natural communities (e.g., vernal pools, shrub swamps, emergent marsh, etc.). South of New Lenox Road, in both reaches, this community occurs as smaller isolated patches and as linear features along the river. This community accounts for approximately 23% of the total floodplain area in Reaches 5B and 5C.

North of New Lenox Road in Reach 5B and within portions of Reach 5C (e.g., in the vicinity of 5C-VP-7), topography is more complex, involving fluvial swales, depressions, and meander scars that are often connected directly to the river by deep, narrow swales, beaver slides and burrows through the riverbanks, and other microtopographic features. The complexity of this system is enhanced by debris dams and sediment deposition, which can modify these flow paths on a seasonal basis. As a result, these swales and other lower-lying areas are flooded more frequently (i.e., seasonally) than the rest of the floodplain forest (which is only temporarily flooded), creating intervening habitats with different soil conditions, hydrologic regimes, plant communities, and wildlife functions, as detailed in the following paragraphs.

Due to slightly higher ground surface elevations, the majority of the transitional floodplain forest is temporarily flooded during seasonal high water and periodic flood events when the river overtops its banks; but during much of the growing season, the groundwater lies well below the surface. Soil textures

[12] eBird is a citizen science site, so identification is not verified. However, eBird does vet observations to make sure the occurrence is reasonable for the time and location.

range from very fine loamy sands to sandy loams with variations in coloring below 18 inches in depth reflecting the groundwater table.

The hydrologic regime and soil textures present in the transitional floodplain forest result in a vegetation community dominated by facultative plant species that occur as dense herbaceous stands, shrub thickets, and large diameter trees, including silver maple, box elder, and cottonwood. Dominant herbaceous species are ostrich fern (*Matteuccia struthiopteris*), bedstraws (e.g., *Galium asprellum*, *G. palustre*), and wood nettle (*Laportea canadensis*). However, due to the dynamic nature of floodplain habitats and transport of non-native plants and seeds down the river, a number of invasive species are present in this habitat, including dames rocket (*Hesperis matronalis*), bishop's goutweed, moneywort, forget-me-nots, Japanese knotweed, garlic mustard (*Allaria petiolata*), Japanese barberry (*Berberis thunbergii*), Morrow's honeysuckle, common buckthorn, glossy buckthorn (*Rhamnus frangula*), and Asian bittersweet.

Woody debris is abundant throughout the transitional floodplain forest habitats in Reaches 5B and 5C. This debris is variable in length, width, and ground surface coverage, and is in various stages of decomposition. Standing dead snags with numerous cavities of variable sizes occur throughout the transitional floodplain forest and large diameter trees (over 30" dbh) are common. Silver maples in this habitat tend to grow in large clumps with multiple large trunks ranging in size from 12" to 36" dbh.

High terrace floodplain forests occur on raised banks adjacent to rivers and streams, on steep banks bordering high-gradient rivers, on high alluvial terraces, and on raised areas within floodplain forests. They are river-influenced and mesic (i.e., characterized by organic-rich moist soils), but they typically are not flooded annually, as indicated by the presence of a distinct surface soil organic layer. Soils are typically silt loams. The canopy is a mixture of floodplain taxa, such as red and silver maple and mesic deciduous hardwoods. The shrub layer varies from sparse to well-developed, and the herbaceous layer is a mixture of the characteristic floodplain forest ferns. High-terrace floodplain forests can contain low wet depressions that function as vernal pools.

Red maple swamp habitats often occur in groundwater depressions within the floodplain or areas which are more poorly drained than transitional floodplain forest areas. Along with the dominant red maple canopy coverage, other tree species in this habitat include silver maple, American elm, box elder, and black willow. Red maple swamp areas in both Reaches 5B and 5C tended to exhibit relatively open canopies forming conditions suitable for development of a dense shrub understory. The more common shrubs in this habitat are silky dogwood, speckled alder and winterberry. The invasive Morrow's honeysuckle was also observed with regular frequency. The herbaceous vegetation comprises most commonly ferns such as sensitive fern, royal fern (*Osmunda regalis*) and cinnamon fern (*Osmundastrom cinnamomeum*). The invasive purple loosestrife and moneywort were also frequently observed in this community. Open canopy and wetter conditions observed in the red maple swamps of Reaches 5B and 5C are mostly attributed to areas impounded by beavers. Beavers affect the flow patterns and thus the hydrology of these areas, creating wetter conditions (i.e., longer durations of flooding), and their foraging affects vegetation growth patterns both by altering hydrology and by the cutting and removal of trees and branches for food. These activities can change the vegetative succession of the forested community from a closed canopy with sparse shrubs and herbaceous vegetation, and a prevalence of sphagnum mosses, to one with open canopy and extremely dense shrub and herbaceous layers.

Red maple-black ash-bur oak swamp habitats are located along the western side of the Housatonic River in Reach 5C north of Woods Pond. This community exhibits a closed (or nearly closed) canopy over a flat but hummocky terrain, with abundant woody debris. Trees and shrubs are growing on the hummocks while the hollows support a diverse herbaceous plant community. Dominant plants include bur oak and red maple canopy trees with black ash, green ash (*Fraxinus pensylvanica*), and American hornbeam in the sub-canopy. Common shrubs and herbs include viburnums, (e.g., *Viburnum dentatum*), silky dogwood, winterberry, a variety of smartweeds (e.g., *Persicaria arifolia*, *P. sagittata*), ferns including sensitive fern, royal fern, and New York fern (*Parathelypteris noveboracensis*), and several species of sedges (e.g., fringed sedge [*Carex crinita*], retrorse sedge [*C. retrorsa*]). In these areas, the duration of surface flooding and water at or near the ground surface tends to be shorter than in the red maple swamps observed along the Housatonic River.

Shrub Swamp Habitats

Shrub swamp is the most prevalent cover type mapped in the floodplains of Reaches 5B and 5C, and accounts for approximately 50% (149 acres) of the total area – 43 acres in Reach 5B and 106 acres in Reach 5C. Shrub swamps in Reaches 5B and 5C are present in small discrete patches within fluvial swales, isolated depressions, and vernal pools surrounded by wet meadow and/or transitional floodplain forests, and occur as broad seasonally flooded or seasonally flooded/saturated wetland systems that cover extensive portions of the floodplain (see **Figures 6-2a-e**).

Shrub swamp habitat situated within the smaller isolated depressions and vernal pools ranges in size from less than 0.01 acre to approximately one acre. Soils in the smaller depressions are hydric and consist of mineral or mucky-mineral textures at the surface underlain by silt loam, fine sandy loam and loamy sand soils; however, there are a few vernal pools with thicker organic layers at the surface. Larger shrub swamp systems occur along the west side of the river north of backwater BW5B-6 (11 acres), and at the confluences of Mill Brook and Roaring Brook with the Housatonic River (eight acres) in Reach 5B, and a 20-acre area in Reach 5C located west of backwater BW5C-13. These larger systems tend to have much deeper mucky mineral and organic soil horizons associated with them.

Variations in topography, soil texture, and hydroperiod in the shrub swamp habitat have resulted in a vegetation community dominated by dense shrub thickets and herbaceous cover that are, in many cases, associated with medium to large openings in the tree canopy. The most frequently encountered species in these systems was silky dogwood, with lesser amounts of pussy willow, speckled alder, white meadowsweet (*Spiraea alba*), and elderberry (*Sambucus canadensis*). Invasive species such as glossy buckthorn, multiflora rose, and Morrow's honeysuckle were often observed around the periphery of the shrub swamps, and occasionally in drier inclusions (e.g., on hummocks or other topographic features above the water table). Moneywort was very common in shallowly flooded basins and vernal pools with shorter hydroperiods and greater canopy cover, and purple loosestrife and water forget-me-not were observed in wetter open canopy habitats.

Shallow Emergent Marsh Habitats

Shallow emergent marshes in Reaches 5B and 5C are primarily associated with large, flooded areas on the floodplain and occur in a mosaic with shrub swamp and deep emergent marsh habitats, although this habitat does occur in some small depressions and vernal pools as well. Shallow emergent marsh habitat is a less prevalent natural community in Reaches 5B and 5C and accounts for approximately 11% of the total area (25 acres). Shallow emergent marsh habitats tended to occur as narrow fringes and small patches within and along vernal pools and backwater habitats. However, one large (approximately five-acre0 area of shallow emergent marsh is located on the west side of the Housatonic River near the Reach 5A/5B boundary. Soils are variable but tend to exhibit thicker mucky mineral and organic soils saturated to the surface and with numerous pockets of standing water. The most frequently encountered species in the shallow emergent marsh habitats were purple loosestrife, a variety of sedges and smartweeds, American bur-reed, green arrow-arum, broad-leaved cattails, jewelweed, and bedstraws.

Deep Emergent Marsh Habitats

The deep emergent marsh habitat occupies approximately 26 acres (10%) of the Reaches 5B and 5C floodplain – 10 acres in Reach 5B and 16 acres is Reach 5C. Deep emergent marshes are composed of herbaceous vegetation and form in saturated, mucky mineral soils that are seasonally inundated and permanently saturated. The substrate is flooded by waters that are not subject to wave action and with water depths ranging from six inches to six feet. Water levels may fluctuate seasonally, but the substrate is rarely dry, and there is usually standing water throughout the year. Deep emergent marsh habitats are quite variable. They may be co-dominated by a mixture of species or have a single dominant species. In Reaches 5B and 5C, dominant plant species within this natural community include sedges, rushes, purple loosestrife, smartweeds, floating pondweed (*Potamogetan natans*), coontail (*Ceratophyllum demersum*), American bur-reed, great bur-reed, and occasionally buttonbush, a woody shrub. Deep emergent marshes are closely associated with open backwater habitats in Reaches 5B and 5C.

Wet Meadow Habitats

Wet meadow habitat occupies approximately 28 acres (14%) of the Reaches 5B and 5C floodplain – 26 acres is Reach 5B and two acres in Reach 5C. Extensive areas of this community occur from New Lenox Road down to backwater BW5B-6 along both sides of the Housatonic River, with small, isolated patches occurring sporadically throughout Reach 5C. Wet meadows are wetlands that often resemble grasslands, are typically drier than other marshes except during periods of seasonal high water and are often dominated by one or a few plant species. For most of the year, wet meadows are devoid of standing water, although a high-water table allows the soil to remain saturated. The wetland substrate consists of mineral soils with redoximorphic features, sometimes with a surface layer of well decomposed organic material. A variety of water-loving grasses, sedges, rushes, and wetland wildflowers proliferate in the fertile soil of wet meadow habitat. In Reaches 5B and 5C, dominant plant species within this natural community include several invasive species (reed canary grass, moneywort, and purple loosestrife), plus jewelweed, spotted joe-pye weed (*Eutrochium maculatum*), stinging nettle (*Urtica dioica*), marsh bedstraw, ostrich fern, and silky dogwood.

Moderately Alkaline Lake/Pond (Open Water) Habitats

Dispersed among the Reaches 5B and 5C floodplain are a number of smaller open-water habitats, also called moderately alkaline lake/pond (following Woodlot 2002 terminology). Collectively these areas comprise only about seven acres (2.2%) of the Reaches 5B and 5C floodplain, including one approximately two-acre area in Reach 5C located north of backwater BW5C-17. Other open water areas range in size from 0.02 acre up to approximately 1.5 acres (mean = 0.4 acres). These are typically depressions in the floodplain, and often areas where beaver activity has resulted in impounding surface drainage in combination with deepening the ponded area forming behind the beaver dam by on-going digging of the organic soils.

6.3.4 Floodplain Wetland Functional Assessment for Reaches 5B and 5C

This section presents an assessment of the ecological functions and values of the floodplain wetlands in Reaches 5B and 5C. This functional assessment utilized the information obtained in the wetland inventory described above. The assessment of the existing functions was based primarily on the consolidation and collection of data on measurable and observable structural parameters that are known to give rise to the functions of the wetland habitats.

The floodplain wetland functional assessment draws upon the criteria and functions described in the USACE New England District's *The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach* (USACE Wetland Workbook Supplement; USACE New England District 1995). This approach is a multi-disciplinary assessment of wetland functions, including the following: groundwater recharge/discharge; floodflow alteration; fish and shellfish habitat; sediment, toxicant, and pathogen retention; nutrient removal, retention, and transformation; production export; sediment and shoreline stabilization; wildlife habitat; recreation; education and scientific value; uniqueness and heritage; visual quality and aesthetics; and threatened or endangered species habitat. The assessment is a qualitative description of the physical characteristics of the wetlands, including a determination of the principal functions exhibited. This method is not based on quantitative metrics, but rather provides criteria for assessing whether a wetland's characteristics could contribute to providing the functions listed above.

Table 6-13, which has been developed and adapted from the USACE Wetland Workbook Supplement cited above, lists the functions assessed in this process. In addition to a description of each function, that table lists the characteristics or criteria from **Table 6-4** used in assessing the function. As described in the Revised Reaches 5B-8 BRA Work Plan, this functional assessment was conducted for three evaluation units extending through Reaches 5B and 5C. Reach 5B was divided into two functional units: Area 5B-1 extends from the Reach 5A/5B boundary to New Lenox Road; and Area 5B-2 extends from New Lenox Road to the Reach 5B/5C boundary. Reach 5C comprises a single functional unit. These three units are shown on **Figure 6-4**. The functional assessment process was documented on a Wetland Function Form

(Form FP-2). These forms list each function and records the criteria considered in documenting the wetland characteristics that contributed to the functional assessment of each of the wetland functional unit.

The results of the floodplain wetland functional assessment are summarized in tabular form in **Appendix E**, which also includes the completed Form FP-2 for each of the three wetland functional evaluation units. The results are discussed below. Although these results are discussed in this floodplain wetland section, the combined assemblage of the riverine, riverbank, floodplain, and vernal pool habitats in Reaches 5B and 5C has been incorporated into the functional assessment.

Groundwater Recharge/Discharge

Based upon landscape setting, soil conditions, and surficial geologic conditions, the floodplain wetlands in Reaches 5B and 5C provide conditions suitable for interactions between ground and surface waters. Much of the forested wetland area contains floodplain soils that are sufficiently sandy to afford vertical and horizontal movement of surface and ground waters. More permanently saturated wetland conditions typically contain finer grained and organic soils which tend to inhibit vertical groundwater interflow. Overbank flooding that is stored in the forested floodplain wetlands is at least partially infiltrated to the shallow groundwater table and moves laterally to discharge in the river. At other times, groundwater flow from the adjacent highlands may intersect the land surface within the floodplain of Reaches 5B and 5C (especially along the margins of vernal pools and other lower depressions) and discharge to the surface, contributing to base flow. The Housatonic River is a reflection of the regional groundwater table, and groundwater discharge to it provides base flow.

Floodflow Alteration

Given the location and characteristics of Reaches 5B and 5C within the 10-year floodplain of the Housatonic River, this area provides floodflow alteration functions. These include not only the general provision of flood storage capacity, but also the function of providing temporary attenuation of the floodwaters, followed by a delayed and gradual release of the floodwaters draining back into the river. The characteristics within the floodplain wetlands that contribute to the latter floodflow alteration function include the surface topography and varied microtopographic surface features, the sinuous surface flow paths, the presence of dense herbaceous cover and shrubs in some pockets, and the dense mature woody vegetation that produces coarse woody debris. For example, vegetation impedes surface water flow and reduces the energy of storm runoff, causing water to deposit sediment and debris. Heavy vegetation, including dense areas of herbaceous and shrub species and mixed age classes of trees, slows flow and provides areas of slack water, allowing more water to seep down through soil and be stored as groundwater. Microtopographic complexity increases the tortuosity of flow pathways, reduces average velocity, and increases the gradient of moisture conditions. Coarse woody debris, derived from large trees, blocks flows and modifies flow patterns. These characteristics create naturally produced roughness, which increases flow resistance on the floodplain. This flow resistance, in turn, enhances retention of floodwaters, reduces erosion, increases infiltration, increases retention of inorganic sediments and organic particulates, and diversifies both moisture gradients and microhabitats for biota. Downstream of New Lenox Road, particularly in the lower portion of Reach 5C, the floodflow attenuation functions become integrated with the storage and release functions afforded by Woods Pond Dam.

Water Quality Maintenance, Nutrient Processing, and Production Export

The separate but related functions of water quality maintenance, nutrient processing, and production export are generally related to the cumulative effects of hydrology, sediment transport and deposition, and plant productivity. Sediment is transported into and through Reaches 5B and 5C from upstream sources, and bank erosion within these reaches contributes further to this sediment load. When overbank or backwater flooding occurs from the main stem of the Housatonic River into the adjacent floodplains, inorganic sediment carried by the river is deposited within the floodplain, and adsorbed constituents (such as nutrients) settle out with the sediment; some sediment also settles within the quiescent pools of the river itself. This function maintains surface water quality by removing sediments, nutrients, and other

pollutants from the water column. In addition, nutrients are processed within the floodplain as primary plant productivity converts inorganic forms into organic forms of nutrients. The floodplain then serves as a source of organic forms of nutrients back to the river, either during further flood flows or by direct deposition of leaves and related vegetative parts, and these contribute to sustaining the base food chain in the river and ultimately the entire biotic community. This is the production export function.

Wildlife Habitat Function

The floodplain wetlands in Reaches 5B and 5C consist of varied wetland cover types interspersed throughout the floodplain; the specific cover type in a particular area is typically first and foremost related to the surface hydrology. The wildlife habitat value of the floodplain wetlands is ultimately related to the collective contribution of the habitat features in each cover type, discussed below.

The floodplain forest habitat in Reaches 5B and 5C contains numerous dead tree snags of varying diameter and height, which have resulted from periodic flooding, sediment deposition, and beaver activity. Standing dead timber provides foraging habitats for all the woodpecker species and provides summer roosting sites for bats such as the big brown bat *(Eptesicus fuscus*) and little brown bat (*Myotis lucifugus*). Abundant live trees with greater than 12-inch dbh are also present. Many of these trees are greater than 30 inches dbh. Both the dead standing trees and large living trees contain cavities ranging in size from less than six inches to 18 inches or larger and are used during the breeding season for nesting and as escape cover by a wide variety of birds such as wood duck, woodpeckers, tree swallow (*Tachycineta bicolor*), owls, bluebird (*Sialia sialis)*, black-capped chickadee (*Poecile atricapillus*), hooded merganser (*Lophodytes cucullatus*), and common merganser (*Mergus merganser*). These cavities also provide habitat for several mammals, including mink, fisher (*Pekania pennanti*), raccoon, porcupine (*Erethizon dorsatum*, black bear, Virginia opossum (*Didelphis virginiana*) and flying squirrels. Larger live trees in the forest can be as tall as 100 feet with a fairly open understory, which can provide suitable foraging and nesting habitat for raptors such as the great horned owl (*Bubo virginianus*) and red-shouldered hawk (*Buteo lineatus*).

The dense herbaceous cover and other characteristic features of the transitional floodplain forest also play a role in providing non-breeding habitat for amphibians around the vernal pools in this area (the in-pool habitat functions of these vernal pools themselves are discussed further in Section 7.3). Amphibian species, such as the wood frog (*Lithobates sylvaticus*) and northern spring peeper (*Pseudacris crucifer*), rely on the shade, deep litter, and woody debris in forested areas immediately surrounding the pools. Such areas within 100 feet from a vernal pool's edge, sometimes referred to as the vernal pool protection zone or envelope, protect the vernal pool amphibians, especially juveniles, from dessication and predation, protect the water quality in the pools from runoff and sedimentation, and provide shade and litter for the pool ecosystem.

In many parts of the floodplain in Reaches 5B and 5C, a system of fluvial worked swales, depressions, and meander scars directs flood flows across the floodplain and reduce water velocities, allowing the accumulation of very fine silt loams and formation of organic muck soils that perch and retain surface waters for extended periods. As a result, these areas have developed shrub swamp thickets of silky dogwood and nannyberry (*Viburnum lentago*), which can be used for a variety of foraging and nesting birds. Shrub swamp habitat also provides suitable conditions for earthworms and insects which are preyed upon by birds, small mammals, and bat species including the big brown bat and little brown bat.

Shallow and deep emergent marsh habitats present in the Reaches 5B and 5C floodplain are typically used for early season forage by several reptile species and as breeding habitat for several amphibian species. Reptiles also often use these moist habitats to regulate body temperatures and rehydrate during the summer. Wet meadow associated with drier portions of the floodplain provides open and edge habitat used by birds such as the American bittern, common yellowthroat (*Geothlypis trichas)*, yellow warbler (*Dendroica petechia)*, and ruby-throated hummingbird (*Archilochus colubris*).

Finally, the Reaches 5B and 5C wetland areas provide habitat for rare wildlife species, as described above.

Other Functions and Values

As described in **Appendix E**, other principal functions and values of the Reaches 5B and 5C wetlands, as indicated by the evaluation process, include recreation, educational/scientific, uniqueness/heritage, and visual quality/aesthetics.

Comparison with Earlier Functional Assessment

An earlier wetland functional assessment was conducted that included Reaches 5B and 5C as well as areas upstream and downstream of this reach (TechLaw 1998). That effort also employed the USACE Highway Method as well as other methods in use at the time. Reach 5B was grouped with Reach 5A as one evaluation unit and Reach 5C was grouped with Woods Pond (Reach 6) as another evaluation unit; therefore, comparison of the results should consider these differences in evaluation units. TechLaw assessed the principal wetland functions and values to include: floodflow alteration, wildlife habitat, sediment/toxicant retention, sediment/shoreline stabilization, fish and shellfish habitat, production export, uniqueness/heritage, educational/scientific value, recreation, and visual/aesthetics. The only difference between that earlier wetland assessment and the current one is that the current one also found groundwater recharge/discharge to be a principal function.

6.4 2023-2024 Floodplain Upland Investigations

As noted in the Woodlot 2002 Ecological Characterization Report:

> "[V]ery little terrestrial or upland habitat is found in the PSA. Red oak–sugar maple transition forests are located in a few widely scattered locations. Cultural grasslands, which are open, upland habitats periodically disturbed by mowing or grazing, do occur near New Lenox Road. A few upland inclusions of northern hardwoods–hemlock–white pine forest also occur north of Yokum Brook. Most of the upland habitats occur adjacent to the PSA as cultural grassland, northern hardwoods–hemlock–white pine forest, and rich mesic forest." (Woodlot 2002a, page II-15.)

The 2002 Woodlot community type delineations indicated that less than 20% of the floodplain in Reaches 5B and 5C consisted of upland habitats. As described in Section 6.2, the updated floodplain habitat mapping and classification process identified these upland floodplain habitats. Agricultural fields were considered a subset of cultural grasslands and developed/disturbed parts of the floodplain were also distinguished in the mapping and classification. In addition, as with the floodplain wetland habitats, an inventory was conducted of the floodplain upland habitats, as described below.

6.4.1 Methods

The methods employed to survey conditions in the floodplain uplands of Reaches 5B and 5C followed the same procedures as those described above for the wetland areas and were implemented along with those wetland surveys. The 100-meter grid described in Section 6.2 extended across the floodplain habitats, including both upland and wetland community cover types. Field observers traversed the grid lines using GPS location tracking and characterize/document conditions.

Table 6-14 summarizes the parameters considered in characterizing the floodplain upland habitats and indicates the information sources from which such information has been drawn. The relevant information includes information on flood frequency and depth, soil composition, vegetation, wildlife habitat features, identified rare species habitat, invasive species, and juxtaposition with surrounding habitats. That information was obtained from existing data sources (as specified in **Table 6-14**), supplemented by field surveys, again using the Floodplain Habitat Inventory Form (Form FP-1 in **Appendix D-2**). As described in Section 6.2, Sections I and II of Form FP-1 were completed as part of the natural community mapping at roughly 100-meter points in the floodplain (with adjustments as appropriate). For each discrete upland cover type unit larger than 0.5 acre, the remaining sections of Form FP-1 (Sections III-VIII) were completed, along with a compiled summary of the information collected for Sections I and II at the 100-meter grid points within that same cover type unit. As with the floodplain wetland assessment, the habitat

features listed in Section III of Form FP-1 were noted and recorded by the field observers for each upland cover type unit during the traversing of the grid lines and were used in the characterization of the overall cover type unit.

In addition to the collection of this information, the same additional inventory information described in Section 6.3 for floodplain wetland habitats was collected in the floodplain upland habitats. This included the presence of Core Area habitats (as designated by MNHESP; MassDFW 2012) or other designated habitats for federal or state-listed rare species, any observation of a listed rare species, information from Cornell's ebird web site on bird observations, incidental wildlife observations, identification of degraded habitats that could potentially be used for access roads and/or staging areas, and identification of items that could potentially be used in restoration.

6.4.2 Results

The floodplain within the 1 mg/kg isopleth in Reaches 5B and 5C includes 44.7 acres of upland consisting of five natural community types, two of which of which are fields and three are forests. Northern hardwood-hemlock-white pine forest is the most extensive cover type in these upland floodplains. Other upland forest communities include red oak-sugar maple-transition forest and rich mesic forest. Open field and cultural grassland habitats are limited in Reaches 5B and 5C, with nearly all of these cover types located within Reach 5B. Areas of developed or disturbed cover within the floodplain upland were also observed in Reaches 5B and 5C.

As might be expected, these upland habitats are generally situated along the outer margins of the floodplain area (see **Figures 6-2a-e**). Upstream of New Lenox Road, floodplain uplands are present in Reach 5B, primarily around the EPRI facility, many of which are either open grassland or disturbed for the EPRI functions. Open floodplain uplands (shrub/grassland/managed habitats) occur in Reach 5B just upstream of the Reach 5C boundary; these are associated with post-agricultural land east of the river and the Lenox Sportsman Club west of the river. Floodplain upland forested areas are present in Reach 5C in several dispersed locations: north of Yokun Brook in the middle portion of the floodplain and at several areas along the periphery of the floodplain on both sides of the river down to the Woods Pond transition zone.

6.4.2.1 Plant Community Composition

Table 6-15 provides a list of plants recorded in the upland natural communities during the 2023-2024 floodplain surveys, with the frequency of occurrence. The upland forests contain a diversity of tree species (28 species). The most frequently encountered trees were red maple, eastern hemlock (*Tsuga canadensis*), northern red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), and American hornbeam. A total of 17 shrub species were recorded in the upland habitats, with Morrow's honeysuckle the most common. Woody vines typically occurred in low densities in many of the upland communities, with Asian bittersweet, poison ivy, and river grape the most common species. Only a few of the 48 herbaceous species appeared in more than several of the 26 upland plots, with Canada-mayflower (*Maianthemum canadense*), New York fern, sensitive fern, Christmas fern (*Polystichum acrostichoides*), and star flower (*Lysimachia borealis*) being most frequently encountered. **Table 6-16** provides additional summary data of the vegetative cover in the different upland floodplain plant communities.

6.4.2.2 Other Habitat Features

A summary of the data on recorded biotic habitat features for the upland floodplain natural community cover types is provided in **Tables 6-17** and **6-18**. Physical and biological habitat features encountered in more than 50% of the plots in Reaches 5B and 5C were upland food, trees greater than 30 inches dbh, standing dead trees and live trees with cavities, and shrub and herbaceous cover suitable for bird nesting and small mammal burrows. Woody debris was more common in Reach 5B than in Reach 5C.

6.4.2.3 Incidental Direct Wildlife Observations

Since the floodplain upland habitat surveys were integrated with the floodplain wetland surveys, wildlife observations incidental to the floodplain surveys are incorporated into the species listing in **Table 6-10** and the detailed documentation in **Appendix D-3**. However, tracking of specific wildlife observed within or while on the upland portions of the floodplain resulted in the identification of 21 species of birds,[13] three amphibians (wood frog, pickerel frog and green frog), one reptile (garter snake) and four mammals (white-tailed deer, black bear, coyote, and porcupine.[14]

6.4.2.4 Rare Species

A total of 10 state-listed plant and animal species have MNHESP-mapped Species Habitat encompassing the floodplain upland habitats in Reaches 5B and 5C and could utilize these habitats based upon habitat requirements and the habitat characteristics identified during these surveys. These species are listed in **Table 6-19**. The same applies to the three federally listed or proposed rare species with identified habitat in Reaches 5B and 5C. See Section 8 for further discussion.

6.4.3 Description of Floodplain Upland Habitats in Reaches 5B and 5C

Based upon the updated community type mapping conducted in 2023-2024, five different natural community cover types are present in the 43 acres of floodplain upland habitat areas in Reaches 5B and 5C. These are listed below along with a brief summary of each cover type and the area that each comprises within the upland floodplains of these reaches.

Red-Oak Sugar Maple Transition Forest

This upland forest type was not observed in Reach 5B but comprises 7.3 acres within the Reach 5C floodplain (33% of the upland floodplain habitats in Reach 5C). The red oak-sugar maple transition forests consist of relatively level to sloping upland forests dominated by larger canopy trees of red oak, white ash, sugar maple, American beech, and eastern hemlock. This forest type includes a sparse subcanopy of American hornbeam and striped maple (*Acer pensylvanicum*), as well as a sparse shrub layer of maple-leaved viburnum (*Viburnum acerifolium*) and witch-hazel (*Hamamelis virginiana*). The herbaceous layer is dominated by ferns including New York fern, sensitive fern, and hay-scented fern (*Dennstaedtia punctilobula*), white wood aster (*Eurybia divaricate*), and wild sarsaparilla *(Aralia nudicaulis*). Invasive shrubs species were also observed including Morrow's honeysuckle and Japanese barberry.

Rich Mesic Forest

This upland forest type was likewise not observed in Reach 5B, but comprises 5.1 acres within the Reach 5C floodplain (23% of the floodplain in Reach 5C). Rich mesic forests are usually situated in areas where downslope movement of nutrients and organic matter accumulate and have a moderate moisture regime. Dominant plants are shade-tolerant due to the closed canopy of sugar maple, white ash, elm species and basswood (*Tilia americana*) above. Subcanopy species include hop hornbeam (*Ostrya virginiana*), with red elderberry (*Sambucus racemosa*), bloodroot (*Sanguinaria canadensis*), Dutchman's breeches (*Dicentra cucullaria*), blue cohosh (*Caulophyllum thalictroides*), zig-zag goldenrod (*Solidago flexicaulis*), and wild leeks (*Allium tricoccum*) in the understory.

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[13] These were the cedar waxwing, red-tailed hawk (*Buteo jamaicensis*), northern cardinal (*Cardinalis cardinalis*), yellow-shafted flicker, American crow (*Corvus brachyrhynchos*), gray catbird, bald eagle , Baltimore oriole (*Icterus galbula*), hairy woodpecker, pileated woodpecker (*Dryocopus pileatus*) belted kingfisher, black capped chickadee, American robin *(Turdus migratorius*),mourning dove (*Zenaida macroura*), eastern wood-pewee (*Contopus virens*), goldfinch (*Spinus tristis*), indigo bunting (*Passerina cyanea*), American kestrel (*Falco sparverius*), red-eyed vireo (*Vireo olivaceus*), song sparrow (*Melospiza melodia*), and American woodcock (*Scolopax minor*).

[14] In addition, birds observational data from Cornell's ebird website (https:/ebird.org) for Reaches 5B and 5C (including, but not limited to, the floodplain uplands) have been collected, as described in Section 6.3.2.4 above.

Northern Hardwoods-Hemlock-White Pine Forest

This upland forest type comprises 19.2 acres (45% of the floodplain) within the Reaches 5B and 5C floodplain (10.7 and 8.5 acres in Reaches 5B and 5C, respectively). The northern hardwoods-hemlock-white pine upland forests are situated on relatively level to uneven ground vegetated with a mixture of broad-leaved and needle-leaved trees. The canopy layer is dominated by red oak, eastern hemlock, white pine, and sugar maple, and a poorly developed subcanopy is dominated by gray birch, white pine, and American beech. Shrub layer plants include highbush blueberry, hobblebush (*Viburnum lantanoides*), and striped maple. The herbaceous layer, which is variable and dependent on canopy dominants, includes Christmas fern, shining firmoss (*Huperzia lucidula*), evergreen woodfern (*Dryopteris intermedia*), Canada mayflower, bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), southern ground cedar (*Diphasiastrum digitatum*), and partridge berry (*Mitchella ripens*).

Agricultural Fields

There is only about 0.2 acre of active upland agricultural fields within the Reach 5B, and none within Reach 5C floodplain. This habitat is located at the northern limits of Reach 5B and is part of a large open field area located outside of the ROR boundary. Agricultural upland fields in Reach 5B are open fields situated on level ground within floodplains of actively farmed areas and include crop cultivation, hayfields, and/or grazing. Because of their proximity to rivers and streams, agricultural fields typically contain fertile soils.

Cultural Grasslands

Cultural grasslands comprise 8.7 acres (20% of the floodplain) of upland area within the Reaches 5B and 5C floodplain – 8.6 acres in Reach 5B and 0.1 acre in Reach 5C, respectively. Nearly all of this habitat is associated with existing rights-of-way and fallow fields located near the Reach 5A/5B boundary west of the EPRI facility. Cultural grasslands are open, upland fields dominated by grass-like herbs that are periodically disturbed, generally by mowing practices. Situated on relatively level ground, this community type lacks a canopy and subcanopy; however, sparse patches of stunted shrubs that are confined to dense colonies are present along the grassland edges and as isolated patches. Shrubs found within this community include pussy willow, beaked willow (*Salix bebbiana*), red-osier dogwood, and staghorn sumac (*Rhus hirta*). Herbaceous vegetation is dense and includes red fescue (*Festuca rubra*), common Timothy (*Phleum pratense*), Kentucky blue-grass (*Poa pratensis*), poverty grass (*Danthonia spicata*), little bluestem (*Schizachyrium scoparium*), tall goldenrod (*Solidago altissima*), common milkweed (*Asclepias syriaca*), wild carrot (*Daucas carota*), common evening primrose (*Oenothera biennis*), and spreading dogbane (*Apocynum androsaemifolium*).

Other Developed/Disturbed Areas

Other developed/disturbed areas are present within the floodplains of Reaches 5B and 5C, but make up only a small portion of those areas (a total of 2.2 acres, 0.05% of the floodplain). These include developed areas associated with the EPRI facility located near the Reach 5A/5B boundary and disturbed areas such as gravel access roads and parking areas in Reach 5B, totaling approximately 0.8 acre in Reach 5B, and areas of historical fill and a portion of the railroad located along the western limits of the floodplain in Reach 5C, totaling approximately 1.4 acres.

6.4.4 Floodplain Upland Habitat Functional Assessment for Reaches 5B and 5C

The information obtained for the inventory and characterization of floodplain upland habitats in Reaches 5B and 5C has been incorporated into a qualitative assessment of the ecological functions that these habitats contribute to. In general, the floodplain uplands provide similar functions as those in the floodplain wetlands. Functions which have been assessed in this qualitative process are groundwater recharge, flood storage, wildlife habitat, rare species habitat, buffer capacity, and corridor connectivity, as listed in **Table 6-20**. The impact of invasive species in the floodplain upland habitats was also considered. The site-specific information collected for each floodplain upland in these reaches, as documented on Form FP-1, forms the basis of the functional assessment, again considering the physical

and hydrologic characteristics, substrate conditions, specific habitat features, connectivity with surrounding habitats, and the presence of both rare and invasive species habitats.

Groundwater Recharge

Based upon landscape setting, soil conditions, and surficial geologic conditions, the floodplain uplands in Reach 5B and 5C provide conditions suitable for interactions between ground and surface waters. Much of the upland floodplain forest contains floodplain soils that are sufficiently sandy to afford vertical and horizontal movement of surface and ground waters. As in the wetlands, overbank flooding that is stored in the floodplain is at least partially infiltrated to the shallow groundwater table and moves laterally to discharge in the river. Due to the greater differential vertical distance between the land surface and the water table in upland areas versus wetlands, the upland portions of the floodplain may actually have more significance for groundwater recharge than wetland areas. Groundwater flow from these uplands typically moves laterally to intersect the land surface within lower portions of the floodplain (especially along the margins of vernal pools and other lower depressions) or along the river's edge and discharges to the surface, contributing to base flow.

Flood Storage and Floodflow Alteration

As with floodplain wetlands, the location and characteristics of the uplands within the 10-year floodplain in Reaches 5B and 5C provide floodflow alteration functions. These include not only the general provision of flood storage capacity, but also the function of providing temporary attenuation of the floodwaters, followed by a delayed and gradual release of the floodwaters draining back into the river. Given their higher elevation and less frequent flooding than floodplain wetlands, the floodplain uplands would be expected to have an overall lesser floodplain function; however, they do provide storage and flood peak desynchronization functions during major flood events. As in the wetlands, the characteristics within the floodplain uplands that contribute to the latter floodflow alteration function include the surface topography and varied microtopographic surface features, the sinuous surface flow paths, the presence of dense herbaceous cover and shrubs in some pockets, and the dense mature woody vegetation that produces coarse woody debris.

Wildlife Habitat Function

The structural components of the floodplain upland community cover types in Reaches 5B and 5C are generally similar to those of the floodplain wetland community cover types, and therefore many of the wildlife species and functions provided are similar across the floodplain, whether wetland or upland. There are obviously some species which may be drawn to a slightly drier condition that the upland areas provide. For example, the upland habitat may provide sandier soils for turtle nesting, and the area is less prone to flooding of the nests of ground-nesting species. There tends to be greater diversity in the tree stratum in the upland forest than in the wetland forest, so additional food sources and nesting opportunities may be available. However, the overall significance of the upland floodplain for wildlife habitat is not greatly different from that of the wetland areas in reaches.

Other Functions and Values

As described in **Appendix E**, other principal functions and values of the Reaches 5B and 5C floodplain uplands, as indicated by the evaluation process, include recreation, educational/scientific, uniqueness/heritage, buffer capacity, corridor connectivity, and visual quality/aesthetics.

7. BRA of Vernal Pool Habitats in Reaches 5B and 5C

The scope of the BRA of vernal pools in Reaches 5B and 5C was presented in the Revised Reaches 5B-8 BRA Work Plan. In accordance with that Work Plan, the first step in this BRA was to identify areas that could potentially constitute vernal pools by reviewing information from prior surveys that identified potential vernal pool habitat areas and then assessing those areas, as well as identifying and delineating any additional areas which could potentially support temporary pools for vernal pool breeding activity. This was followed by updated investigations of these potential vernal pools in in 2023 and 2024 in accordance with the Revised Reaches 5B-8 BRA Work Plan.

7.1 Initial Identification of Potential Vernal Pools from Existing Information

Vernal pool investigations were previously conducted as part of the TechLaw (1998) and Woodlot (2002a) ecological characterizations of the PSA , which identified 33 potential vernal pools in Reaches 5B and 5C. Woodlot noted, however, that some of these areas in the lower portions of Reach 5C were backwaters, and it acknowledged that, although spotted salamanders (*Ambystoma maculatum*) were observed breeding in these backwaters, those areas did not meet the strict vernal pool definition. It thus recognized that not all areas where egg deposition by obligate vernal pool-breeding amphibians is documented constitute vernal pool habitat.

In accordance with Section 3.6.1 of the Revised Reaches 5B-8 BRA Work Plan, the 33 pools and backwaters identified by Woodlot were subject to further assessment as part of this BRA. In addition, remote sensing data (e.g., aerial photographs from various dates over the past 20+ years) and the results of previous or current field surveys (e.g., the Example Area surveys in 2009 and the PDI topographic survey of the PSA) were reviewed to determine if other potential amphibian breeding/vernal pool habitat areas in Reaches 5B and 5C could potentially constitute vernal pools. This effort resulted in the identification of 29 potential backwaters (including the 28 backwaters discussed in Section 5.2)[15] and 62 potential vernal pools (46 in Reach 5B and 16 in Reach 5C). Therefore, a total of 91 potential vernal pools and backwater habitats were inspected during the spring breeding periods in 2023 and 2024.

7.2 2023-2024 Vernal Pool Investigations

7.2.1 Methods and Vernal Pool Determinations

For the 91 potential vernal pools and backwater habitats in Reaches 5B and 5C identified as described in Section 7.1, the characterization activities in 2023 and 2024 consisted of the following, as provided in the Revised Reaches 5B-8 BRA Work Plan: (1) compiling the existing information collected during previous surveys on relevant attributes of potential vernal pools – namely, flora, topography, bottom sediment/soil composition, in-pool physical structure, surrounding land use, and relationship/proximity to other vernal pools; (2) the performance of field surveys to collect the information to determine whether those pools meet the MNHESP criteria for vernal pool certification and thus constitute vernal pools for the purposes of remedial activities; and (3) for those pools that meet the MNHESP criteria for vernal pools, collection of additional detailed field information on pertinent characteristics, as described below.

Field investigations were conducted in 2023 and 2024 to assess the applicability of MNHESP vernal pool certification criteria to the 91 potential vernal pools and backwater habitats that had been identified as described above. During the vernal pool breeding season between late March and early June in 2023, all of these areas were visited in the field, and detailed investigations were conducted to determine whether they constitute certifiable vernal pools – i.e., whether they meet the biological and physical criteria for MNHESP vernal pool certification. All of these areas were first surveyed for biological evidence during the primary vernal pool breeding period in 2023, consistent with the seasonal conditions observed for that

[15] Of these 29 areas, one was later identified as part of the floodplain, while the other 28 (eight in Reach 5B and 20 in Reach 5C) were identified as backwaters as discussed in Section 5.2.

particular year. Subsequent investigations were conducted later in the 2023 growing season and in 2024, as necessary, to document conditions relative to the MNHESP certification criteria. During the 2023-2024 field surveys, eight additional potential vernal pools were found while traversing the floodplain, and they were also inspected and evaluated to determine whether they meet the MNHESP vernal pool criteria.

The vernal pool surveys were first intended to address the biological criteria encompassed in the MNHESP guidelines, and additional field visits were conducted to assess the physical criteria for pools that meet the biological criteria (i.e., whether there is a "permanently flowing outlet" and/or reproducing fish population). The latter assessment required monitoring the hydrology in each such pool, assessing the presence or absence of fish, and establishing the hydrologic connectivity with the Housatonic River or tributary streams, primarily in terms of the annual duration of a surface water connection. In general, the critical time period for assessing this hydrologic connection consists of the months of July through September. In performing this assessment for pools that meet the biological criteria, the relative meteorologic/hydrologic conditions during the monitoring period versus the long-term average conditions were considered (i.e., whether conditions were relatively dry or wet).

As part of the vernal pool surveys, all backwaters in Reaches 5B and 5C (as discussed above), as well as flooded shrub swamp/shallow emergent marsh habitats along the edges of the river, were surveyed for evidence of amphibian breeding and to assess the potential for any such areas of identified amphibian breeding to meet the vernal pool certification criteria. These investigations did identify areas of amphibian breeding in various locations such as along the flooded edges of the bordering backwaters, as discussed previously in Section 5.2.2.6. However, these flooded areas are hydrologically open to the backwaters and river, such that predatory fish can enter into these areas for most of every year. Thus, the surface water hydrologic connection between these areas and the river constitutes a "permanently flowing outlet," and these areas could have a reproducing fish population. As a result, these locations did not meet the vernal pool physical criterion of having "no permanently flowing outlet" and thus were not considered to constitute certifiable vernal pools. For example, of the 33 potential vernal pools identified by Woodlot in Reaches 5B and 5C, seven were determined by the 2023-2024 investigations to be backwaters rather than meeting the criteria for certification as vernal pools (consistent with Woodlot's acknowledgment that even though such backwaters provide amphibian breeding habitat, they do not meet the vernal pool criteria).

The net result of the vernal pool survey process in Reaches 5B and 5C was the identification of 29 certifiable vernal pools in Reach 5B and 11 such vernal pools in Reach 5C. A Vernal Pool Characterization Form (Form VP-1), which was provided in Appendix H to the Revised Work Plan, was completed for each certifiable vernal pool.

For the vernal pool areas determined to meet the MNHESP certification criteria, estimates of percent cover of tree canopy, woody shrubs, herbaceous plants (including sedges, rushes, and grasses), and woody vines within each vernal pool were made using a line-intercept sampling procedure. This involved stretching a 100-foot tape across the pool from shoreline to shoreline and tallying the total length of each cover type that projects through that plane over the line. Percent cover was then calculated as a function of total length of a particular cover type divided by the total length of the transect. Two to three transects were measured across each pool and the dominant plant species within each of the various plant strata recorded, including observations of any invasive plant species. Representative photographs of each pool are provided in **Appendix F-1.**

A comprehensive list of plant species observed within each pool was collected and plant species were identified using accepted current taxonomic references (e.g., Native Plant Trust (Gobotany.nativeplanttrust.org; the USDA NRCS Plants Data Base (USDA Plants Database) for the Massachusetts region (USDA NRCS 2024)).

In accordance with the Revised Reaches 5B-8 BRA Work Plan, water depths (or evidence of water depths depending upon the seasonal conditions) were measured or determined at two- to five-foot intervals (depending on how flat or steep the topography was) along the vegetation transect from shoreline to shoreline to map the relative topography within each pool. The start and stop location of

each transect was surveyed by GPS and points with corresponding water depths were plotted along that line in GIS. Significant topographic or physical features within the pool (e.g., large hummocks or windthrown trees) that were not intercepted by the transect were characterized and located by GPS.

Vernal pool sediment/soil composition was categorized in the field using a hand auger and/or tile spade shovel and generally inspected to a depth of 18-24 inches. One profile description per pool was documented between the outer edge and deepest part of the pool. The information collected for each soil profile included soil horizons, depth, texture, color, and the presence or absence of redoximorphic features (mottles and other features). Colors of the soil matrix and mottles were identified using Munsell Soil Color Charts (Munsell Color 2021). Hydric soil determinations were based on criteria established in *Field Indicators for Identifying Hydric Soils in New England* (NEIWPCC, 2018) and guidance in the 2012 USACE Regional Wetland Delineation Manual (USACE 2012).

In-pool physical structure other than the plants measured during the line-intercept sampling described above was quantified within each pool. Observations of LWD, large boulders, or exposed root wads were located via GPS during the pool inspection with the approximate length, width, and/or diameter recorded in inches. Fine woody debris was estimated as a total percent cover of the entire pool area.

The habitat and land use conditions in the immediate vicinity of each vernal pool were characterized in the field, and percent of total area consisting of forest, development, open space, and scrub/shrub habitats in the broader landscape was quantified in GIS. The four habitat cover types are from Calhoun and Klemens (2002) and were quantified within both the 100-foot buffer around the vernal pool (the vernal pool envelope) and the 100-750 foot zone (the critical terrestrial habitat) using aerial photograph interpretation and ground-truthing. The landscape setting of the pool was also characterized, noting whether it is a discrete depression in the floodplain or part of a larger wetland, and also the juxtaposition with other vernal pools to assess the potential for vernal pool network factors.

7.2.2 Results of Vernal Pool Investigations

As discussed above, a total of 99 discrete areas were subject to detailed field surveys and assessment of vernal pool certification eligibility. The net result of the 2023-2024 vernal pool survey process in Reaches 5B and 5C was the identification of 29 certifiable vernal pools in Reach 5B and 11 such pools in Reach 5C, for a total of 40 vernal pools identified as meeting certification criteria, with all other areas identified as either backwaters or other floodplain habitat based upon the observed conditions.[16] The location and individual identifying label for each certifiable vernal pool in these two reaches are shown on **Figure 7-1**, as well as on **Figures 6-2a-e**. **Table 7-1** presents biological and physical attributes of all 40 certifiable vernal pools in Reaches 5B and 5C collected during the 2023-2024 surveys as well as historical data from Woodlot (2002a) work. As noted above, a Vernal Pool Characterization Form (Form VP-1), which was provided in Appendix H to the Revised Work Plan, was completed for each certifiable vernal pool. The data from Form VP-1 are presented in tabular format herein in **Table 7-2** and include summary data on within-pool parameters and habitat characteristics of the adjacent landscape, as described previously. The following sub-sections summarize the specific habitat characteristics of the vernal pools for these two reaches, while an overview description of the vernal pool habitats and their functions follows in Sections 7.2 and 7.3.

[16] The data obtained by GE on the identified vernal pools in these reaches will be submitted to MNHESP for certification of those areas as vernal pools (with the exception of two vernal pools that have already been certified – 5B-VP-22 and 5C-VP-5). As provided in the Revised Permit, EPA will make the final determination as to which areas constitute vernal pools. For any areas that are determined not to meet the criteria for certification as a vernal pool, an assessment will be provided as to whether each such area should be classified as backwater or floodplain habitat based upon the observed conditions (as has been done to date for the 99 areas investigated as described in this section).

7.2.2.1 Plant Community Compositions and Other Habitat Features of Vernal Pools in Reaches 5B and 5C

As shown in **Table 7-2**, cover types within the vernal pools occur along a gradient from wetter to drier conditions – i.e., from open water to deep and shallow emergent marsh with fringes of shrub swamp and wetland floodplain forest cover – which typically correlate well with pool maximum depth and hydroperiod. Most pools exhibited multiple cover types within their estimated flooding limits.

Percent cover of vegetation layers, measured from line-intercept transects across each vernal pool to which access was available (n = 35) and estimated for pools with restricted access (n = 5), is presented in **Table 7-2** and summarized in **Table 7-3**. Only 10 vernal pools, all located in floodplain forested areas north of New Lenox Road and just south of the Reach 5B-5C boundary, had more than 50% canopy cover. Shrub cover was present in all but nine pools, with six pools exceeding 50% cover. Additionally, all 40 pools contained some herbaceous vegetation. Pools with >90% herbaceous vegetation tended to have lesser amounts of tree canopy cover.

Pools varied in size from 0.02 to 2.5 acres (mean = 0.4 acres) and had depths ranging from 5 to 54 inches (mean = 21 inches). Most (63%) were discrete depressions in the floodplain, with nearly half (48%) part of larger wetland systems. About 90% were seasonally to semi-permanently flooded, but four deeper pools (≥0.9 acres) may be permanently flooded. Of the 40 pools, 24 were isolated with no inlet/outlet, and 16 had seasonal or temporary inlets/outlets. No pools had a permanently flowing outlet. Woody debris was sparse, and hummocks composed of tussock forming grasses and sedges or woody shrubs was low, with only three pools having >30% cover. The majority (75%) of pools had a highly organic mineral substrate, with textures ranging from silt loam to fine sandy loam, while two pools had mucky-mineral soils and eight had deep organic soils.

Data were collected on species presence at all 40 certifiable vernal pools in Reaches 5B and 5C. The species found are listed in **Table 7-4**. A total of 111 plant species were documented and included five species of trees, 12 shrubs, and 95 herbaceous species. The most frequently encountered tree was silver maple. Shrubs included silky dogwood and buttonbush. The most frequently encountered herbs were false water-pepper smartweed, purple loosestrife. and sensitive fern. A total of seven species listed as invasive or likely invasive were observed growing in vernal pools (six herbs, and one shrub, as shown in **Table 7-4**). In addition, two species (all herbaceous) were identified as non-native but are not listed as invasive in Massachusetts.

A total of 11 state-listed plant and animal species have MNHESP-mapped Species Habitat that encompasses the vernal pools in Reaches 5B and 5C and could utilize those vernal pool habitats based upon habitat requirements of these species and the habitat conditions documented in these vernal pools. These species are listed in **Table 7-5.** The same is true of the three federally listed or proposed rare species with identified habitat in Reaches 5B and 5C.

7.2.2.2 Habitat Characteristics in the Adjacent Landscape

As shown in **Tables 7-2 and 7-3**, the vernal pool envelope (0–100 feet from the pool edge) in Reaches 5B and 5C remains largely undeveloped. All pools have at least 36% cover consisting of forest, scrub-shrub, and other open space habitats, with 22 pools exceeding 90% cover. Within the critical terrestrial habitat zone (100–750 feet from the pool edge), only six pools have more than 90% cover, although the average cover across all pools is 83%.

Development within the vernal pool envelope is limited, affecting seven pools – five in Reach 5B and two in Reach 5C. One pool, located within the EPRI property (5B-VP-7) has approximately 43.2% development in this zone. In the critical terrestrial habitat, five pools (one in Reach 5B and four in 5C) remain entirely undeveloped, while 32 of the remaining 35 pools have less than 10% development. Aside from the EPRI property, other disturbed and developed areas are associated with paved roads and residential developments.

Forest cover varies widely, ranging from 0% to 100%. Pools with no forest cover within 100 feet are located between New Lenox Road and the southern end of Reach 5B. Other pools with less than 50% forest cover are also primarily in Reach 5B, with only two in Reach 5C.

On average, each pool has 7.4 vernal pools within 1000 feet, with a range of one to 12 pools within that distance. The largest cluster of pools is located upstream of New Lenox Road with seven pools in that area having between 10 and 12 pools within 1000 feet. Another cluster of 10 pools located just south of New Lenox Road has between 9 and 12 pools within 1000 feet. One smaller cluster of pools is located at the northern end of Reach 5C with the remaining vernal pools distributed throughout the floodplain of Reaches 5B and 5C.

7.3 Description of Vernal Pool Habitat in Reaches 5B and 5C

The vernal pools in Reaches 5B and 5C consist of depressions in the wetland floodplain habitats which are capable of holding standing water through at least a portion of the amphibian breeding season. Many of the identified 40 certifiable vernal pools in these reaches have formed in remnant meander scars reflecting past riverine flow paths. Another common setting for vernal pools in these reaches is where surface inflow from tributaries and runoff have collected in minor depressions of the floodplain or from past beaver activity. Habitat cover in the vernal pools is variable, including open standing water, deep and shallow marshes, shrub swamps, and forested swamps. These depressions function as vernal pool breeding habitat for obligate vernal pool species, such as wood frog, spotted salamander, and fairy shrimp (*Eubranchipus vernalis*), as well as breeding, foraging, and rehydration/thermoregulation habitat for other amphibians and reptiles, including northern spring peeper, northern leopard frog, green frog, snapping turtle, painted turtle, garter snake, American toad, and bullfrog, all of which have been documented in the vernal pools of these reaches. In addition, ribbon snakes (*Thamnophis sauritus*), wood turtles, and spotted turtles frequently forage and estivate in riparian pools.

During the 2023-2024 surveys, evidence of breeding by both wood frogs and spotted salamanders was documented in 12 vernal pools, 19 pools are certifiable based on the presence of wood frogs alone, six are certifiable based on the presence of spotted salamanders alone, and two are certifiable based on the presence of fairy shrimp in addition to either wood frog or spotted salamander breeding. (In one pool, 5B-VP-22, no obligate vernal pool-breeding amphibians were observed, but this pool is already a certified vernal pool in Massachusetts.) Pools supporting only wood frog breeding were more prevalent in Reach 5B (86% of the pools in that reach) than in Reach 5C. One cluster of pools in Reach 5C is within mapped habitat for the state-listed Jefferson salamander, but the presence of this species could not be confirmed during the 2023-2024 surveys.

7.4 Vernal Pool Functional Assessment for Reaches 5B and 5C

For the vernal pools in Reaches 5B and 5C, their functional assessment is based primarily on their status as vernal pools that meet the applicable MNHESP criteria. In short, since each of the 40 vernal pools in these reaches meets the biological and physical criteria for vernal pools, the primary function performed by each of these pools is to function as a vernal pool. More specifically, these vernal pools function to provide suitable breeding habitat for obligate vernal pool species, the most common being wood frogs and spotted salamanders, and/or they provide breeding habitat for at least two facultative vernal pool species. In addition, these pools collectively provide a network of vernal pools within the context of the overall floodplain system.[17]

[17] While vernal pools may function as singular aquatic systems, they more often occur in clusters due to their geologic setting. Juvenile amphibians disperse among the pools, maintaining a balance between local extinctions and colonization (Gibbs and Read 2008) – that is, when the hydrologic or other factors of a pool are not sufficient during a given year to allow breeding, or a given species is otherwise temporarily lost from a particular breeding pool, that pool may be recolonized by individuals from adjacent pools when adequate breeding conditions return. It is the proximity of vernal pools with slightly differing, but suitable, characteristics which can provide the necessary network to keep the local population of a species intact. In addition, part of the reproductive success for a vernal pool population is predicated upon having opportunities for occasional exchange of genetic material among individuals from different subpopulations (*id*.).

To further evaluate the relative ecological value of each of the vernal pools in Reaches 5B and 5C, a tier ranking system developed by Calhoun and Klemens (2002) has been utilized, using Form VP-2 (which was provided in Appendix I to the Revised Reaches 5B-8 BRA Work Plan). **Table 7-6** summarizes the results of the vernal pool tier ranking, as provided by Form VP-2. This is a rating system designed strictly as a planning tool to determine the relative ecological value of pools in a community. According to Calhoun and Klemens, pools with a Tier I rating denote exemplary pools. Approximately half of the pools in Reaches 5B and 5C (22 of 40) met criteria of having two or more indicator species and/or greater than 25 egg masses, with very little development in the adjacent vernal pool envelope or critical terrestrial habitat, and therefore are classified as Tier I. The remaining 18 pools did not have two or more indicator species breeding in the pool, nor were more than 25 egg masses encountered; therefore, these pools fall into the Tier III category. No pools were rated as Tier II.

8. Assessment of Rare Species in Reaches 5B and 5C

This section provides an assessment of the presence of federally listed and state-listed rare species and their associated habitats in Reaches 5B and 5C. Federally listed rare species are those determined to be endangered or threatened under the Endangered Species Act (ESA: 16 U.S.C 1531 et seq.). Species that have been proposed for federal listing are also included in this assessment. State-listed species are those identified under the Massachusetts Endangered Species Act (MESA; M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00) as endangered, threatened, or of special concern. Under MESA, a particular species may be identified and listed as "endangered" (in danger of extinction throughout all or a significant portion of its range or in danger of extirpation), "threatened" (likely to become endangered within the foreseeable future), or of "special concern" (a species which has suffered a decline that could threaten the species if allowed to continue unchecked, or that occurs in such small numbers or with such a restricted distribution or specialized habitat requirements that it could become threatened within Massachusetts) (321 CMR 10.03(6)). As previously noted, both the federally listed and state-listed species encompassed by these definitions are collectively referred to as rare species herein.

8.1 Methods

8.1.1 Federally Listed and Proposed Species

The potential presence of species protected under the ESA or proposed for such listing and/or their habitats in Reaches 5B and 5C was based on the USFWS IPaC online mapping tool, consulted on February 5, 2025. The habitat requirements for these species were researched using current source material, primarily that available from the USFWS (ECOS: Home [fws.gov]). The habitat requirements were then assessed relative to the documented habitat conditions in Reaches 5B and 5C.

8.1.2 State-Listed Species

The potential presence of state-listed species or their habitats in Reaches 5B and 5C was determined based on information provided by MNHESP. As discussed above, in October 2022, MNHESP provided GE with updated Species Habitat maps, presenting its delineation of state-listed species habitats in Reaches 5 through 8 of the ROR. These maps are prepared by MNHESP using the "best scientific evidence available," examining individual occurrence records in the context of species listing status and applying a set of specified criteria. These criteria include the nature and/or significance of the occurrence as it relates to the conservation and protection of the species, including, but not limited to, evidence of breeding, persistence, life stages present, number of individuals, extent of necessary supporting habitat, and proximity to other occurrences (321 CMR 10.12(2)). Species observations in close proximity, grouped into occurrences (also known as "element occurrences"), indicate the geographic location presumably inhabited by a population of that species. MNHESP has advised GE that it will not allow presentation of the Species Habitat maps by individual species, but that GE may show the overall area in Reaches 5B and 5C mapped for all state-listed species collectively, may report the overall acreage in those reaches mapped for each state-listed species individually, and may generally describe that area.

MNHESP also provides on-line, publicly available mapping of Priority Habitats of state-listed species. Priority Habitat mapping is a regulatory layer which consists of combined Species Habitat maps with "supporting habitat" added, where applicable, and may exclude certain Species Habitat mapping of low-ranked occurrences, Species Habitats based on historic occurrence sources, and Species Habitats for listed species that are not regulated.

8.2 Results

8.2.1 Federally Listed and Proposed Species

The USFWS IPaC consultation determined that the northern long-eared bat *(Myotis septentrionalis)* is the only federally listed species indicated to potentially occur within the limits of Reaches 5B and 5C. In addition, two species proposed for federal listing under the ESA, the monarch butterfly (*Danaus plexippus*) and the tricolored bat (*Perimyotis subflavus*), potentially occur within Reaches 5B and 5C. Summaries of the habitat requirements for these three species are provided below. This information will be used as guidance in the remedial design process to minimize impacts on habitats of federally listed and proposed species to the extent practicable. The USFWS IPaC consultation indicates that potential habitats for the three species described below occur throughout all of Reaches 5B and 5C.

Northern Long-Eared Bat (*Myotis septentrionalis*; Endangered): This is a small, brown bat with unique large, long ears that distinguish it from other species in Massachusetts. The northern long-eared bat is found in forested habitats in the warm months of the year where it roosts in trees and forages. Although found in other tree roosts, it prefers roosts in large, tall cavities of large, live or dead trees in clustered hardwood stands. Northern long-eared bat populations, once common in the northern United States, have been devastated by the spread of the white-nose syndrome (WNS) fungus. Infected hibernacula in caves in the Northeast have caused catastrophic population losses of 90-100% (USFWS, ECOS: Home (fws.gov)).

Tricolored Bat (*Perimyotis subflavus*; Proposed Endangered): In September 2022. the USFWS proposed the tricolored bat for listing as federally endangered; this proposal is still under review. This bat has uniquely tricolored fur; the hairs of its back are dark gray at the base, yellowish-brown in the middle, and dark brown at the tips. On its underside, the fur is a uniform yellowish brown. This bat can also be identified by its weak, fluttery, erratic flight. During the warmer months in Massachusetts, tricolored bats occupy day and night roosts in forest vegetation in the canopy, most typically in dead leaves on mature live or recently dead deciduous trees. Tricolored bats forage at the treetop level, in partly open country with large trees, over water courses, and at forest-field edges, and avoid deep woods and open fields. As with the northern long-eared bat, the WNS fungus has decimated the population of the tricolored bats (USFWS, ECOS: Home (fws.gov)).

Monarch Butterfly (*Danaus plexippus*; Proposed Threatened): The monarch butterfly migrates each year from as far as Canada and across the United States to a few forested overwintering sites in the mountains of central Mexico and coastal California (USFWS 2022). Over the last two decades, numbers have declined, and therefore this species was proposed for listing by the USFWS in December 2024. Primary threats to this species appear to be conversion of grasslands to agriculture, urban development, widespread use of herbicides, logging/thinning at overwintering sites in Mexico, unsuitable management of overwintering groves in California, drought, continued exposure to insecticides, and effects of climate change (*id*.). The monarch butterfly is not currently a state-listed species in Massachusetts. Open meadows (both wetland and upland) in Reaches 5B and 5C provide potentially suitable habitat for monarch butterflies. These habitats support several milkweed species which serve as the larval host plants for monarch butterflies (Species Pr https://ecos.fws.gov/ecp/species/9743ofile for Monarch butterfly(Danaus plexippus).

8.2.2 State-Listed Species

Based upon information provided by MNHESP in October of 2022, a total of 17 state-listed plant and animal species have MNHESP-mapped Species Habitat that encompass the various habitats in Reaches 5B and 5C. As previously noted, two additional state-listed species – the northern long-eared bat and tricolored bat – were indicated by the IPaC consultation as potentially occurring in these reaches, but MNHESP did not include Species Habitat mapping for either of these bat species. Specifically, the MNHESP has mapped Species Habitat for one mammal, three birds, one reptile, one amphibian, three insects, and eight plants within Reaches 5B and 5C. These 17 species are listed in **Table 8-1**, along with the acreage of mapped habitat for each species, the MESA status of each, and each species' taxonomic

group. **Figure 8-1** shows the limit of the latest Priority Habitat mapping from MNHESP in Reaches 5B and 5C.

As previously discussed, MassDFW's July 2012 letter to EPA, which was attached to the Revised Permit, included maps depicting the locations of the different types of Core Habitat areas. **Figure 8-2** shows the areas in Reaches 5B and 5C that were designated as Core Area 1, Core Area 2, and Core Area 3.[18]

Each of the state-listed species with mapped habitat in Reaches 5B and 5C, along with its habitat requirements, the extent (acreage) of its mapped Species Habitat in these reaches, and a general description of that area, are summarized below. The general information on each species is largely taken from rare species fact sheets prepared by MNHESP, as available on its website at List of Endangered, Threatened, and Special Concern species | Mass.gov, with additional information for some species based upon historical information and published literature. The extent of mapped Species Habitat for each species in Reaches 5B and/or 5C is taken from the Species Habitat maps provided by MNHESP.

Mammals

Water Shrew (*Sorex palustris*; Special Concern): The water shrew measures 5.7-6.2 inches long, with its tail accounting for more than half of its total length. The unique feature of the water shrew is its big, "feathered" hind foot. The water shrew is slender with a long, narrow snout that is highly movable and incessantly rotating. The water shrew is seldom found more than a few yards from the nearest water, most commonly the banks of a swift rocky-bedded stream usually near a conifer or mixed forest. It prefers heavily wooded areas and is rarely found in marshes that are devoid of bushes and trees. It may be found in beaver lodges and muskrat houses in winter (MNHESP 2015h). MNHESP maps 90.71 acres of Species Habitat for the water shrew in the central part of Reach 5C.

Birds

American Bittern (*Botaurus lentiginosus*; Endangered): The American bittern is a wading bird that inhabits freshwater wetlands, spending most of its time secretly dwelling in emergent vegetation of marshlands (MNHESP 2015a). In Massachusetts, the American bittern inhabits freshwater meadows, marshes, fens, and bogs dominated by cattails, bulrushes, sedges, and grasses, and may also be found in brackish wetlands. It prefers expansive areas of contiguous wetlands but will occasionally utilize upland grasslands for foraging and nesting. The American bittern migrates from its winter habitat in the southern United States and arrives in Massachusetts marshes in April. Migration to habitats in the southern U.S. occurs during October and November, and by December, most American bitterns have left Massachusetts. MNHESP maps 65.3 acres of Species Habitat for the American bittern in the southern half of Reach 5B, and 26.97 acres in the southern part of Reach 5C. An American bittern was observed in the southern part of Reach 5C during 2024 field investigations.

Bald Eagle (*Haliaeetus leucocephalus*, Special Concern): The bald eagle is the largest bird of prey in Massachusetts, attaining a wingspan of 2.0 to 2.2 meters (6.5 to 7.0 feet) with a body length of 0.9 meter (3.0 feet), and a weight ranging from 3.6 to 6.6 kilograms (8 to 15 lbs.). Bald eagles usually inhabit coastal areas, estuaries, and larger inland waters. This species requires a great amount of shoreline habitat containing stands of forest for nesting and "emergent" trees projecting above the forest canopy for perching (MNHESP 2019a). MNHESP maps 135.58 acres of Species Habitat for the bald eagle in most of the southern half of Reach 5C. Bald eagles were occasionally observed in this area during 2023-2024 field investigations.

Common Gallinule (*Gallinula galeata*; Special Concern): The common gallinule is a duck-like swimming bird that inhabits large freshwater or brackish marshes and water bodies with cattails and other emergent vegetation (MNHESP 2019b). Its preferred habitat consists shallow bodies of water with dense stands of emergent vegetation interspersed with areas of open water. In Massachusetts, preferred habitats of the common gallinule are waterbodies that are at least one foot deep with dense cattail beds, and occasionally shrub marsh adjacent to open water with aquatic bed vegetation. Although common gallinules prefer emergent wetlands as foraging, breeding, nesting, and protective cover habitat, they also

[18] The definitions of those Core Areas are provided in a footnote in Section 6.1.5 above.

utilize margins of lakes, ponds, and slow-flowing rivers and streams as feeding areas. MNHESP maps 241.46 acres of Species Habitat for the common gallinule in most of Reach 5C, except for the northern part.

Reptiles

Wood Turtle (*Glyptemys insculpta*, Special Concern): The wood turtle is a medium-sized turtle (14-20 cm; 5.5-8 in) that can be recognized by its sculpted shell and orange coloration on the legs and neck. The carapace is rough, and each scute rises upwards in an irregularly shaped pyramid of grooves and ridges. The head is black but may be speckled with faint yellow spots. The preferred habitat of the wood turtle is riparian areas. Slower moving mid-sized streams are favored, with sandy bottoms and heavily vegetated stream banks. The stream bottom and muddy banks provide hibernating sites for overwintering, and open areas with sand or gravel substrate near the streams edge are used for nesting. Wood turtles spend most of the spring and summer in mixed or deciduous forests, fields, hay fields, and riparian wetlands, including wet meadows, bogs, and beaver ponds (MNHESP 2015i). MNHESP maps 193.55 acres of Species Habitat for the wood turtle in the entirety of Reach 5B and 173.31 acres in the northern half of Reach 5C.

Amphibians

Jefferson Salamander (*Ambystoma jeffersonianum*, Special Concern): The Jefferson salamander is a large, gray to brownish-gray salamander with fine markings of light blue to silvery flecks on the limbs, lowers sides, and tail. Adults measure 4–7 inches (10–18 cm) in total length. The tail is laterally compressed and is approximately the length of the body. Adult and juvenile Jefferson Salamanders inhabit relatively mature deciduous and mixed deciduous-coniferous forests and woodlands. The species breeds almost exclusively in isolated vernal pools and shrub swamps. Abandoned agricultural ponds and other man-made impoundments are used in some situations, but Jefferson salamanders tend to avoid other wetland types (e.g., red-maple swamps, floodplain marshes, beaver impoundments) used frequently by other salamander species. Vernal pools and shrub swamps nested between upland ridges ("saddle pools") are used often (MNHESP 2020). MNHESP maps 52.23 acres of Species Habitat for the Jefferson salamander at the boundary of Reach 5B (12.57 acres) and Reach 5C (39.66 acres).

Insects

Mustard White (butterfly) (*Pieris oleraceae*; Endangered): The mustard white is a medium-sized, white butterfly member of the Pieridae family. The mustard white is typically found in moist, rich, (mesic) openings in woodlands and riparian floodplains, edges of fens, marshes and streams, and open wet meadows, fields, and pastures. Two herbaceous woodland plants are essential larval hosts: the native two-leaved toothwort (*Cardamine diphylla*) and the introduced cuckoo-flower from Eurasia (*Cardamine pratensis*) growing in forests, floodplains, and meadows. Other larval hosts may include several species of the mustard family, including the invasive garlic mustard (Nelson 2015). MNHESP maps 597.44 acres of Species Habitat for the mustard white throughout Reaches 5B and 5C, with 192.72 acres in Reach 5B and 355.22 acres in Reach 5C.

Rapids Clubtail (*Phanogomphus quadricolor; Endangered*): The rapids clubtail is a dragonfly (Order Odonata, Suborder Anisoptera) in the Gomphidae family. The rapids clubtail inhabits clear, cold streams and rivers with intermittent sections of rocks and rapids (MNHESP 2019e). MNHESP maps 169.89 acres of Species Habitat for the rapids clubtail in all of Reach 5B and 81.64 acres in the northern part of Reach 5C.

Spine-Crowned Clubtail (*Hylogomphus abbrevi*ates; Special Concern): The spine-crowned clubtail is a large dragonfly (Order Odonata, Suborder Anisoptera) in the Gomphidae family. In Massachusetts, spine-crowned clubtails have been found on the Connecticut River and other medium to large rivers that have silty and sandy bottoms. During maturation, spine-crowned clubtail adults fly from woodland to forest clearings and fields, feeding on small aerial insects such as flies and mosquitos (MNHESP 2019f). MNHESP maps 109.85 acres of Species Habitat for the spine-crowned clubtail in most of Reach 5B, except for the southern part.

Plants

Bristly Buttercup (*Ranunculus pensylvanicus*; Special Concern): Bristly buttercup is an annual or short-lived perennial member of the buttercup family. Suitable habitats for colonization have open to filtered light and wet to periodically flooded conditions, including marshes, bogs, moist clearings, wet woods, stream banks, and ditches. Bristly buttercups may often inhabit disturbed riverbanks and managed wetland communities in utility corridors, as well as other disturbed areas. Massachusetts populations have been documented in marsh edges, vernal pools, seasonally flooded riverbanks, wet swales, drawn down glacial kettle holes, shrub swamps, and edges of or openings in floodplain forests (MNHESP 2015b). MNHESP maps 2.40 acres of Species Habitat for the bristly buttercup in the northern tip of Reach 5B and 0.77 acre in the southern part of Reach 5C. Bristly buttercups were observed in the mapped area on July 23, 2024.

Bur Oak (*Quercus macrocarpa*, Special Concern): The bur oak is a deciduous tree with alternately arranged leaves, twigs, and branches. It grows to a maximum height of about 30 m (100 feet) and has gray, scaly or flat-ridged bark. In Massachusetts, bur oak is most often found in wet locations and often in calcareous soils. Such locations include fen-like seepage swamps, forested swamps, floodplains, seepage slopes, wet meadows, and moist uplands (MNHESP 2015c). MNHESP maps 15.31 acres Species Habitat for the bur oak in the southern limit of Reach 5B and 227.53 acres throughout Reach 5C. Observations of bur oak were recorded in several areas within both Reaches 5B and 5C during 2023-2024 field investigations.

Foxtail Sedge (*Carex alopecoidea*; Threatened): Foxtail sedge, a member of the Sedge family (Cyperaceae), is a perennial plant found in calcareous wet meadows of river floodplains. It is a densely tufted, stout but soft, plant that is 1-2.5 feet tall with fruiting stems that are usually shorter than the thin, soft leaves. Foxtail sedge grows in floodplain meadows and thickets, generally in alkaline alluvial soils. In Massachusetts, foxtail sedge is typically found with other sedges, grasses, and herbs in open swales within floodplain forests (MNHESP 2015d). MNHESP maps 65.81 acres of Species Habitat for the foxtail sedge in the southern part of Reach 5B (mostly south of the New Lenox Road Bridge) and 0.29 acre in the northern part of Reach 5C.

Frank's Lovegrass (*Eragrostis frankii*; Special Concern): Frank's Lovegrass is an annual grass with repeatedly branched, erect culms, 10 to 30 cm high. The narrow blades are 5 to 13 cm long and 1 to 3 mm wide. This species prefers sandy riverbanks and sandbars. The flowering season is August-September. In Massachusetts, it has been found only along the Housatonic and Connecticut Rivers (MNHESP 2015e). MNHESP maps 38.84 acres of Species Habitat for Frank's lovegrass along the Housatonic River throughout Reach 5B.

Gray's Sedge *(Carex grayi*; Threatened): Gray's sedge, a member of the sedge family (Cyperaceae), is a clump-forming plant with an identifying striking "spiked-ball looking" inflorescence. Gray's sedge is found in rich, mesic soils of forests, calcareous seepage swamps. marshes, and wet meadows, usually within riparian systems. In Massachusetts, Gray's sedge inhabits the moist alluvial soils of floodplain forests and adjacent meadow edges of large rivers (MNHESP 2015f). MNHESP maps 61.38 acres of Species Habitat for the Gray's sedge in the central part of Reach 5C.

Matted Spike-Sedge (*Eleocharis intermedia*; Threatened): Matted spike-sedge is an annual herb belonging to the sedge family. The matted spike-sedge is typically found in marshes, freshwater mudflats, or in other wet areas with muddy substrates (MNHESP 2019c). MNHESP maps 84.41 acres of Species Habitat for the matted spike-sedge along the Housatonic River in Reach 5B and 71.15 acres along the river in the northern half of Reach 5C.

Narrow-Leaved Spring-Beauty (*Claytonia virginica*; Endangered): Narrow-leaved spring-beauty is a spring ephemeral wildflower of the Purslane Family Portulacaceae). This delicate perennial has slender leaves and stems. Plants are 10 to 30 cm (4 to 12 in.) in height, with green leaves, white or light pink flowers, and fruit containing shiny black seeds. Narrow-leaved spring-beauty flowers and fruits in early spring; by summer, the above-ground parts of the plant disappear. Narrow-leaved spring-beauty typically occurs in deciduous forests on upper floodplain terraces and adjacent toe slopes (MNHESP 2019d). MNHESP maps 16.07 acres of Species Habitat for the narrow-leaved spring-beauty within the northern

half of Reach 5B and 1.65 acres in the northern part of Reach 5C. During field investigations, a small colony of narrow-leaved spring beauty was observed in Reach 5C, outside of the area shown on the Species Habitat map, in April of 2023 and April of 2024.

Wapato (*Sagittaria cuneata*; Threatened): Wapato is an aquatic herbaceous perennial of the water-plantain or arrowhead family (Alismataceae), found in nearly neutral to slightly basic, open-water habitats. In Massachusetts, wapato is found in very slow-moving or stagnant waters of riverine floodplain habitats in alkaline backwaters, oxbow ponds, small shallow depressions with muddy substrate, and a few occurrences on pond shores. Wapato displays high variability in its growth form as an emergent and emersed plant, a floating plant, or submerged plant, depending on its habitat (MNHESP 2015g). MNHESP maps the entire shoreline of the Housatonic River as Species Habitat for the wapato, with 98.79 acres in Reach 5B and 203.57 acres in Reach 5C.

9. Assessment of Invasive Species in Reaches 5B and 5C

Assessment of invasive species in Reaches 5B and 5C was initiated by establishing a definition of "invasive species," including the plant and animal species that will be considered invasive. For this purpose, the approach used for the Reach 5A and Reach 6 BRA reports has been applied here for consistency. For plants, the definition of invasive species included those listed by the Massachusetts Invasive Plant Advisory Group (MIPAG) as "invasive" or "likely invasive" (MIPAG 2005; https://www.massnrc.org/mipag), those listed by the USACE New England District in its focused list of invasive species to be controlled at wetland mitigation sites, and those listed as invasive by the Invasive Plant Atlas of New England (IPANE 2007).[19]

For animals, guidance on what aquatic species are considered invasive was obtained from both the Massachusetts Department of Conservation and Recreation (e.g., List of Current and Potential Aquatic Invasive Species | Mass.gov) and the U.S. Geological Survey (e.g., Nonindigenous Aquatic Species (usgs.gov); USGS 2025c). In this determination, it is important to distinguish "exotic invasives" from other non-native species (which may or may not be invasive).[20] Based on this assessment, the zebra mussel (*Dreissena polymorpha*) and Asian clam (*Corbicula fluminca*) have been identified as exotic aquatic invasive animals which could potentially occur in the Reaches 5B and 5C. Non-native fish species documented in Reaches 5B and 5C are addressed in this BRA, but are not treated as invasive species. This is consistent with both the state and federal guidance referenced above.

9.1 Methods

The initial effort in identifying invasive species involved consolidating available information on the general occurrence of each invasive species in Reaches 5B and 5C. As with the habitat inventories described above, the identification and location of invasive species were then conducted using site base mapping and aerial photographs in combination with field verification. This work was conducted in conjunction with the associated surveys in the various habitats described previously.

For Reaches 5B and 5C, as described in Section 6.1.2, an aerial photograph overlay provided an initial depiction of known areas of invasive species based on the available information and aerial photographic interpretation. The aerial photographic base mapping was then used during field surveys to document the location and extent of invasive species. For the purposes of this documentation, invasive plant species occurrence was ranked by relative abundance of foliage cover in a given plant stratum (e.g., canopy, understory, ground layer) on a scale of 1-5%, 6-15%, 16-25%, 26-50%, 51-75%, 76-95% and 95-100%. For instances of invasive plant species exceeding 50% cover in discrete contiguous units, GPS instrumentation was used to document their location**.** An exception to this procedure applies to extensive areas of ground cover foliage such as moneywort or garlic mustard, which are impractical to map across the floodplain forest floor; in such cases, the presence of the species was documented in the data collection form for the subject habitat. For areas where mapping the spatial extent of invasive plants was impractical, floodplain plots with greater than 25% cover or where two or more invasive plant species cumulatively exceeded 25% are presented on **Figures 6-3a and 6-3b**. Aquatic invasive species (both plant and animal) in the aquatic habitat areas were documented during the field surveys for that habitat, including location references in the base mapping.

[19] It should be noted that the USACE New England District's list of invasive plant species to be controlled does not include any species that are not listed as invasive or likely invasive by MIPAG or IPANE.

[20] Under the federal definition, "invasive" species "cause significant economic harm, ecological harm, or harm to human health. 'Native species' means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem" (Executive Order 13112).

9.2 Results

Data on the occurrences of invasive species were recorded in all habitats (riverine, riverbanks, backwaters, floodplain wetlands, floodplain uplands, and vernal pools) during the field investigations in 2023-2024 (**Table 9-1**). The results were reported in the above sections of this report addressing each of those habitats. However, for completeness, the primary findings on invasive species are summarized again in this section, as discussed below for each habitat.

Overall, among the Reach 5B and 5C habitats surveyed, only one invasive tree species was observed (black locust). Seven invasive shrub species, one woody vine, and 14 herbaceous species were observed (including three aquatic species). In terms of "invasive aquatic animals," only one such potential species is suspected of occurring in these reaches, as described below, but it has not been verified. The following summarizes the primary findings on invasive species for each of the habitats.

Riverine Invasive Species

- Eurasian milfoil and curly-leaf pondweed were detected on small patches throughout Reaches 5B and 5C; and the invasive yellow iris was observed along the river edge.
- Asian clams are suspected to be present in these reaches based on observation of small clam shells, but identification could not be verified.
- No invasive fish or any other potential invasive animal species such as zebra mussels were detected.

Riverbank Invasive Species

- Twelve different invasive species were recorded (one invasive tree species, three invasive shrub species, one invasive vine species, and seven invasive herb species).
- The most prevalent invasive species (by frequency of occurrence in 38 bank survey segments) are purple loosestrife (89%), Morrow's honeysuckle (78%) common buckthorn (72%), Asian bittersweet (50% frequency), and water forget-me-not (50%).
- While purple loosestrife was observed in the most survey segments, it rarely formed an abundant percent of the foliage cover on any riverbank survey segment. It is noted that Japanese knotweed was recorded on only one bank survey segment (whereas this invasive species was present on roughly one-half of the bank survey segments in Reach 5A). The invasive purple loosestrife was the most commonly occurring herbaceous species (89% frequency).

Backwater Invasive Species

- A total of seven invasive plant species were observed in the backwater habitats of Reaches 5B and 5C.
- No invasive shrubs, trees, or vines were observed in the backwaters, but only invasive herbaceous species, including two aquatic plants.
- Invasive plant species in the backwaters included five herbaceous species: yellow iris, moneywort, purple loosestrife, water forget-me-knot, and reed canary grass. Two aquatic species were also observed: Eurasian watermilfoil and water chestnut
- Three of the invasive species were observed in three backwaters, two of the invasive species were observed in two backwaters, and the remaining two invasive species were observed in one backwater.
- The backwater observed to have the most species of invasive plants was 5C-BW-8 with eight invasive plant species, followed by 5C-BW-10 with six invasive plant species.

Floodplain Invasive Species (including Floodplain Wetlands, Floodplain Uplands, & Vernal Pools)

- Invasive plant species were observed at 193 of 225 floodplain plots, including floodplain wetlands, floodplain uplands, and vernal pools (86%).
- A total of 19 species listed as invasive or likely invasive were observed growing in floodplain plots (11 herbs, seven shrubs, and one woody vine).
- No invasive tree species were observed in the floodplain or vernal pool plots.
- The most common invasive shrub species were Morrow's honeysuckle (23.6%), common buckthorn (13.7%), and multiflora rose (6.2%).
- The most prevalent invasive herbaceous species encountered were purple loosestrife (52%) and moneywort (34.7%), followed by reed canary grass (20%), water forget-me-not (17.3%), yellow iris (12%), and garlic mustard (3.6%).
- Looking specifically at the vernal pools, a total of seven species listed as invasive or likely invasive were observed growing in vernal pools (six herbs and one shrub). These included yellow iris, moneywort, purple loosestrife, water forget-me-not, reed canary grass and common reed in the herbaceous layer, and Morrow's honeysuckle in the shrub layer.

In addition to the overall data summary provided above on invasive species, three species of invasive plants in Reaches 5B and 5C have developed discrete areas of dominance in the floodplain that are large enough in area to map (i.e., > 0.5 acre). These three species include Japanese knotweed, reed canary grass, and common reed. The limits of the discrete areas of dominance by these species were therefore mapped, as shown on **Figures 10-1a-e** (discussed in Section 10.1), and were incorporated into the assessment of degraded or disturbed areas to be considered in the layout of access roads and staging areas, as further described in Section 10.1. The other areas of invasive species do not present such discrete areas of dominance that afford an ability to map specific zones.

Additional information on several of the primary invasive species observed in Reaches 5B and 5C (common buckthorn, morrow's honeysuckle, multiflora rose, Asiatic bittersweet, Japanese knotweed, purple loosestrife, reed canary-grass, and common reed) was provided in Appendix H to the Revised Reach 5A BRA Report and Appendix F to the Reach 6 BRA Report.[21] That information is incorporated by reference herein and is not repeated here to avoid duplication.

[21] Information on all of these species was provided in Appendix H to the Revised Reach 5A BRA Report, and information on all of them except Japanese knotweed and common reed was provided in Appendix F to the Reach 6 BRA Report.

10. Preliminary Identification of Degraded Habitats and Restoration Opportunities in Reaches 5B and 5C

The Revised Reaches 5B-8 BRA Work Plan provided that, during the course of the BRA activities in floodplain areas, disturbed or degraded habitats would be identified that could be suitable for access roads or staging areas during remediation and restoration stages of the project with the objective of minimizing ecological impacts. It also provided that, during BRA activities, GE would evaluate restoration opportunities. GE conducted these activities during the BRA of Reaches 5B and 5C. Those activities and their results are described in this section. It is noted that Reaches 5B and 5C offer very limited areas of degraded habitats or disturbed conditions, given the large unfragmented extents of high-quality habitats within the floodplain of these reaches.

10.1 Identification of Disturbed or Degraded Habitats

The approach used for the identification of disturbed or degraded habitats in Reaches 5B and 5C followed the approach used for this assessment in Reach 5A. For the purposes of assessing levels of degradation and the types of disturbance factors in Reaches 5B and 5C that may be useful in defining access and staging areas, four types of disturbance conditions have been identified that are distinct from less disturbed floodplain areas. They are: (1) areas where utility lines have been constructed through or in proximity to the floodplain; (2) areas that have a strong dominance of invasive plant species; (3) other areas that are influenced by ongoing land uses such as mowing or similar land management uses, or existing roads/cart paths and rail lines; and (4) areas that have been impacted by historical disturbances. Accordingly, these four disturbance conditions were delineated on cover maps of these reaches. **Figures 10-1a-b** show the resulting delineation of those portions of the floodplain that contain degraded or disturbed conditions; some of these disturbance conditions immediately adjacent to the floodplain are also indicated with the intention of considering such areas for access or staging areas. These are summarized as follows:

- Utility lines: Utility lines traverse or extend along the margins of the Reaches 5B and 5C floodplain in various areas. In the upstream portion of Reach 5B, overhead transmission lines cross the floodplain and river at two locations near the EPRI facility. The upstream crossing also extends south below New Lenox Road and parallels the west side of the floodplain through both Reaches 5B and 5C. All of these utility lines have infrastructure installed which have affected the subsoils, soils, topography, and vegetative growth within the corridors to various extents, and therefore are classified as disturbed/degraded habitat which may be considered for access routes.
- Areas that have a strong dominance of invasive plant species: As discussed in Section 9.2, three species of invasive plants within Reaches 5B and 5C have developed discrete areas of dominance in the floodplain that are large enough in area to map (i.e., > 0.5 acre) or have been recorded at more than 25% foliage cover. These three species are Japanese knotweed, reed canary grass, and common reed. The discrete areas of dominance by these species are shown on **Figures 10-1a-b**. Reed canary grass was the most prevalent of these invasive species, with 23 polygons mapped totaling 8.8 acres). This was followed by common reed, with three areas mapped totaling 1.2 acres, and then Japanese knotweed, with two areas mapped totaling 0.16 acres. Note that, as also stated in Section 9.2, other areas of invasive species do not present such discrete areas of dominance that afford an ability to delineate specific zones as are shown on those figures.
- Disturbed land uses: This category consists of areas that are subject to recent or ongoing land uses such as agriculture, mowing, or similar land management uses (i.e., cultural grasslands), as well as where existing roads/cart paths or rail line activities occur. These land uses have been noted where they occur in close proximity to the floodplain isopleth with the intention that they may be considered for access and staging areas.

- Areas impacted by historical disturbances: This category consists of areas that have been impacted by historical disturbances such as filling. In particular, in the lower portions of Reach 5C there are three locations where causeways were constructed in the past extending out across the floodplain to the river's edge.

These delineated areas of specific degradation/disturbance will be considered in the preliminary selection of access roads and staging areas to be presented for the future Conceptual RD/RA Work Plans for Reach 5B and Reach 5C, with the objective of minimizing ecological impact from those activities.

10.2 Identification of Restoration Opportunities

In accordance with the Revised BRA Work Plan for Reaches 5B-8, during the BRA activities, GE has also evaluated potential restoration opportunities within the various habitats in Reaches 5B and 5C in the course of surveying the ecological conditions. These considerations included the following:

- Identification of plant species and locations that may be used as propagation material;
- Identification of other features/materials that may be used for post-remediation restoration (e.g., trees, root wads, coarse woody debris, boulders, other rock material);
- Tracking of areas where invasive species dominance may warrant management efforts even if off the target of remedial activities (to impede invasive species growth post-remediation);
- The identification of species that may warrant collection/preservation or re-location prior to remediation; and
- Evaluation of data needed for avoidance and/or mitigative measures to be optimized.

For the riverine and riverbank areas, the field surveys included noting the presence of potential restoration resources that may be considered in the bank/river restoration design, such as the presence of boulders, large trees or woody debris, root wad material, or plant propagation source materials. For the riverbanks, these are listed in Form RB-1 (in **Appendix B**) for each bank station and summarized in **Table 4-16**. Other noted potential restoration resources included coarse woody debris at most (78%) of the 18 bank stations, large trees at 70% of the stations, and root wads at 30% of the stations.

Other restoration opportunities listed for each bank survey segment are those considered as potential stabilization/restoration measures appropriate for each bank station, based upon the assessment provided in Appendix G to the RCMS Report and consistent with Natural Channel Design options. These apply only to Reach 5B. Bank stabilization/restoration opportunities based upon this assessment include measures such as coir matting, reshaping point bars, compartmentalized fill, log or rock vanes, and vegetated riprap. These were noted on Form RB-1 for each station (in **Appendix B**); however, these opportunities were not based on design assessments and are independent of potential bank stabilization/restoration measures that may be ultimately incorporated into the Reach 5B riverbank remediation/restoration design.

For the backwater, floodplain, and vernal pool areas, restoration opportunities tracked during the surveys included identification of the following: fill or other debris that could be removed; features/materials that may be used for restoration (e.g., trees, root wads, coarse woody debris, rock material); the presence and extent (where possible) of invasive plant species to consider for pre- or post-remediation control efforts; and the location of specific plant resources which may warrant consideration in use for post-remediation re-vegetation efforts. The documentation of these floodplain restoration opportunities has been tracked on spreadsheets using the observation plot identifiers for future consideration in the remedial design and restoration process. For example, the MNHESP fact sheet for the state-listed bur oak, observed in various parts of Reach 5C, notes that this species may be propagated fairly easily, and therefore collection of bur oak acorns may be a viable means of expanding the presence of this species in the Housatonic River floodplain. Any such restoration measures will be described further in the Restoration Corrective Measures Coordination Plan and the Restoration Plans for Reaches 5B and 5C, as warranted.

11. Supplemental BRA Activities and Anticipated Schedule

The information presented in this BRA will be considered in the development of the Conceptual RD/RA Work Plan for each of Reach 5B and Reach 5C in an effort to minimize ecological impacts in the design process to the extent practicable. As the remedial design process advances, supplemental BRA activities for each RU will need to be conducted after submittal and approval of the Conceptual RD/RA Work Plan for that RU to take account of the specific areas to be remediated and the specific locations of the support areas (to the extent identified in the Conceptual RD/RA Work Plan). Such supplemental BRA activities will be identified in the Conceptual RD/RA Work Plan or an associated Supplemental Data Collection Plan (or other appropriate deliverable) for the subject RU. The results of any supplemental BRA activities will be reported in a Supplemental BRA Report for each such RU, to be submitted after the additional BRA data collection and before development of the Final RD/RA Work Plan for that RU.

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Tables

Table 3-1: Riverine Habitat Characterization in Reaches 5B and 5C

Parameter	Description of Parameter	Reaches 5B and 5C Inventory Approach*
Mapping and classification	Mapping of physical location and limits; high gradient/mid-gradient/low gradient	Updated LiDAR and bathymetric mapping; consolidate existing information (from sources below); 2023-2024 site reconnaissance and RBP field surveys
Hydrology	Flooding and flow characteristics (volume/velocity from peak to base flow, bankfull discharge); hydrologic indicators (mean low water, mean high water, bankfull stage)	Consolidate existing information from prior hydrologic modeling, USGS gauge data, and other relevant sources below; discharge volume of 1.5-2 yr flood flow in channel cross-section; field indicators via site reconnaissance and updated LiDAR and bathymetric mapping
Geomorphology	Channel form (type)/sinuosity; channel-forming flow; physical dimensions (length, area, depth, width, thalweg); floodplain connectivity (entrenchment status; side channel connections); stream bedform variability (riffle/pool/run)	Sinuosity (stream length/valley length) and other morphology to be measured from updated LiDAR and bathymetric mapping; consolidate existing information (from sources below); 2023-2024 site reconnaissance and RBP field surveys
Bank characteristics	Range in observed bank heights relative to mean low water, mean high water, and bankfull stages; substrate composition; vegetative cover; stability/erosiveness	BEHI/NBS information from Stantec 2009 evaluation (in R5B only), 2010 Example Area evaluations; consolidate other bank-related information (from sources below); 2023-2024 site reconnaissance and field surveys using Form RB-1
In-stream habitat characteristics	Sediment/substrate composition (% clay/silt/sand, gravel/cobble; boulder/bedrock; organic matter); sediment depositional/erosion features (bars, benches, fans, cut banks); riffle/pool/run presence; large woody debris	Consolidate existing information (from sources below); 2023-2024 site reconnaissance and RBP surveys
Water quality	Temperature, pH, TSS, turbidity, clarity, dissolved oxygen	Consolidate existing information (from sources below); 2024 RBP field surveys
Habitat for and presence of aquatic and other water-using biota	Species composition and relative abundance of aquatic macrophytes, fish, benthic habitat/organisms, and other water-using biota; presence/abundance of invasive plant and animal species	Review of invasive plant species lists from USACE New England District and MIPAG and invasive aquatic animal species guidance from MassDCR and USGS; consolidate existing information (from sources below); 2023-2024 site reconnaissance and RBP field surveys; benthic macroinvertebrate and fish community surveys; incidental wildlife observations.
Rare species habitat	Priority Habitat/Core Area Habitat mapping; IPaC results from USFWS on-line data base	MNHESP investigations and designations (including updated outreach to MNHESP); IPaC results; direct observations during 2023-2024 RBP field surveys and other site investigations
Riparian zone conditions	Riparian vegetative cover; overhanging vegetation; rare species habitat; invasive species	Consolidate existing information (from sources below); aerial photography; site reconnaissance and 2023-2024 field surveys (RBP, bank, and floodplain inventories)

* The existing information to be used for the Reaches 5B and 5C riverine habitat characterization will include information from the following sources: the 2002 Woodlot Ecological Characterization reports, the 2003 RFI Report, the 2010 Example Area evaluations and RCMS Report, the MNHESP investigations of state-listed species through 2012, as well as USGS gauge data and previous hydrologic modeling (e.g., EFDC model).

Table 3-2: RBP Riverine Parameters Collected in Reaches 5B and 5C

Category	Name	Parameter Details
INSTREAM FEATURES	Reach Length (m)	Reach length measured along river centerline by GIS
	Stream Width (m)	Average width of river calculated in GIS
	Sampling Reach Area (m^2)	Calculated in GIS using delineated reach polygons
	Depth (m)	Average estimated depth of all riverine areas
	Surface Velocity (m/sec)	Average estimated surface velocity during survey
	High Water Mark (m)	Average distance from normal water level to high water mark
	Canopy Cover	Open, Partly open, Partly shaded, or Shaded
	% Riffle	% of river reach in each stream morphology type
	% Pool	
	% Run	
LWD	Large Woody Debris (LWD; m^2)	Total area covered by LWD
	Density of LWD (m^2/km^2)	Area of LWD/ Sampling reach area
Riparian Vegetation	Dominant Riparian Vegetation	Vegetation Type (e.g.- Trees, Shrubs, Herbs)
	Dominant Riparian Species	1-4 dominant riparian vegetation species
Aquatic Vegetation	Dominant Aquatic Veg	1-4 dominant aquatic vegetation species
	% Aquatic Vegetation	% coverage of aquatic vegetation species (including algae)
Water Quality	Water Temp (deg C)	Collected by water quality sonde
	Specific Conductance (ms/cm)	
	DO (mg/L)	
	pH	
	Turbidity	Observations
	Odor	
	Oils	
Substrate (Inorganic)	Bedrock %	% coverage of each inorganic substrate type as estimated using georeferenced side scan and shallow water observations, totals to 100%
	Boulder %	
	Cobble %	
	Gravel %	
	Sand %	
	Silt %	
	Clay %	
Substrate (Organic)	Detritus %	% coverage of organic substrate on top of the inorganic substrate. Does not total to 100%, detritus includes fine wood cover
	Muck-Mud %	
	Marl %	

Category	Name	Parameter Details
HABITAT ASSESSMENT PARAMETERS	Epifauna; Substrate/ Available Cover	Qualitative rating of each characteristic, following RBP method guidance for rating of each parameter. (Each Scored 0-20, 0=Poor and 20=Optimal)
	Pool Substrate Characterization	
	Pool Variability	
	Sediment Deposition	
	Channel Flow Status	
	Channel Alteration	
	Channel Sinuosity	
	Bank Stability (LB)	
	Bank Stability (RB)	
	Vegetative Protection (LB)	
	Vegetative Protection (RB)	
	Riparian Vegetative Zone Width (LB)	
	Riparian Vegetative Zone Width (RB)	
	Total Score	Sum of ratings above

Table 3-3: RBP Results for R5B and R5C – Instream Features and Large Woody Debris (LWD) Coverage

	INSTREAM FEATURES								LWD		
RBP Station #	Reach Length (m)	Stream Width (m)	Sampling Reach Area (Sq. Meter)	Depth (m)	Surface Velocity (m/sec)	% Riffle	% Pool	% Run	% LWD	LWD (m^2)	Density of LWD (m^2/km^2)
	Reach 5B										
1	775	30	20,192	1	0.5	0	91	9	18.0	3,647	180,600
2	1,368	30	34,977	1.5	0.5	0	90	10	5.6	1,947	55,669
3	1970	30	51,909	2	0.5	0	100	0	7.1	3,669	70,685
Average	**1,371**	**30**	**35,693**	**1.5**	**0.5**	**0**	**94**	**6.3**	8.7	**3,087**	**102,318**
Total 5B	**4,113**	-	**107,078**	-	-	**0**	**95.0**	**5.0**	**8.7**	**9,263**	**86,507**
	Reach 5C										
1	1,235	35	34,474	2	0.3	0	100	0	9.6	3,314	96,121
2	1,531	35	44,862	3.5	0.3	0	100	0	5.9	2,660	59,288
3	838	35	26,244	3	0.1	0	100	0	1.6	410	15,632
4	1,109	35	42,196	3.5	0.1	0	100	0	2.1	864	20,486
5	626	35	27,669	4	0.1	0	100	0	1.8	483	17,458
Average	**1,068**	**35**	**35,089**	**3.2**	**0.2**	**0**	**100**	**0**	**4.4**	**1,546**	**41,797**
Total 5C	**5,339**	-	**175,445**	-	-	**0**	**100**	**0**	**4.4**	**7,731**	**44,065**
Total 5B & 5C	**9,452**	-	**282,523**	-	-	**0%**	**98.1%**	**1.9%**	**6.0%**	**16,994**	**60,151**

Table 3-4: RBP Results for Reaches 5B and 5C – Aquatic Vegetation and Substrate Characteristics

	Aquatic Vegetation		Substrate (Inorganic)							Substrate (Organic)		
RBP Station #	Dominant Aquatic Veg	% Aquatic Vegetation	Bedrock %	Boulder %	Cobble %	Gravel %	Sand %	Silt %	Clay %	Detritus %	Muck-Mud %	Marl %
Reach 5B												
1	Elodea canadensis	5	0	0	2	5	18	70	5	18	5	0
2	Potamogeton crispus, myriophyllum	10	0	1	6	6	15	66	6	6	5	0
3	Elodea canadensis	20	0	1	4.5	1.5	18	68	7	7	0	0
Average		**11.7**	**0.0**	**0.7**	**4.2**	**4.2**	**17.0**	**68.0**	**6.0**	**10.3**	**3.3**	**0.0**
Reach 5C												
1	Algae, Potamogeton crispus, myriophyllum	5	0	1	2	4	15	70	8	10	0	0
2	Typha latifolia, phragmites, elodea canadensis	10	0	1	3	5	14	69	8	6	10	0
3	Typha latifolia, elodea canadensis	10	0	1	1	1	17	70	10	2	5	0
4	Typha latifolia	15	0	1	4	2	15	68	10	2	15	0
5	Typha latifolia, elodea canadensis	20	0	0	0	0	20	70	10	2	20	0
Average		**11.8**	**0**	**0.8**	**2.8**	**3.1**	**16.5**	**68.9**	**8**	**6.6**	**7.5**	**0**

Table 3-5: RBP Habitat Assessment Parameters in Reaches 5B and 5C

RBP Section #	Epifauna; Substrate/ Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability	Vegetative Protection	Riparian Vegetative Zone Width	Total Score
Reach 5B											
1	18	15	15	17	17	15	11	11	16	14	149
2	16	15	16	12	17	17	15	14	16	10	148
3	12	16	16	10	17	19	18	12	16	14	150
Average weighted by RBP area	**14.4**	**15.5**	**15.8**	**12**	**17**	**17.6**	**15.7**	**12.5**	**16**	**12.7**	**149.2**
Reach 5C											
1	15	11	14	10	17	20	10	15	16	20	148
2	16	18	12	17	17	20	14	20	20	18	172
3	15	13	13	10	17	20	8	20	20	20	156
4	16	12	13	11	17	20	6	20	20	18	153
5	15	13	13	14	17	20	7	20	20	18	157
Average weighted by RBP area	**15.5**	**13.7**	**12.9**	**12.7**	**17**	**20**	**9.3**	**19**	**19.2**	**18.7**	**158**

Each Scored 0-20; 0-5=Poor, 6-10=Marginal [red], 11-15=Sub-optimal [yellow/orange], 16-20=Optimal [green]

Table 3-6: Reaches 5B and 5C Macroinvertebrate Survey Results Compiled by Order

				5B-1	5B-2	5B-2DUP	5B Average	5C-1	5C-1DUP	5C-2	5C-3	5C-4	5C-5	5C Average	Total by Order	Average by Order
				Station Number (from N to S)												
Phylum	Class	Order	Common Name	1	2	2*	-	3	3*	4	5	6	7	-		
Annelida	Clitellata	Tubificida	Segmented Worms	17	8	5	**12.5**	8	3	11	10	5	3	**7.4**	62	8.9
Arthropoda	Arachnida	Trombidiformes	Mites	0	1	0	**0.5**	0	0	0	0	0	0	**0.0**	1	0.1
	Insecta	Coleoptera	Beetles	6	1	13	**3.5**	8	5	13	18	5	6	**10.0**	57	8.1
		Diptera	True Flies	110	110	131	**110.0**	126	137	107	107	142	89	**114.2**	791	113.0
		Ephemeroptera	Mayflies	46	52	72	**49.0**	79	60	51	39	50	37	**51.2**	354	50.6
		Megaloptera	Dobsonflies	0	1	0	**0.5**	2	0	0	0	2	0	**0.8**	5	0.7
		Odonata	Dragonflies/Damselflies	5	8	7	**6.5**	16	9	3	19	13	3	**10.8**	67	9.6
		Plecoptera	Stoneflies	2	1	0	**1.5**	3	4	0	0	1	1	**1.0**	8	1.1
		Trichoptera	Caddisflies	89	90	98	**89.5**	108	100	80	102	68	119	**95.4**	656	93.7
	Malacostraca	Amphipoda	Scuds	2	9	9	**5.5**	17	4	0	11	2	22	**10.4**	63	9.0
		Decapoda	Crayfish	0	0	1	**0.0**	0	0	0	2	0	1	**0.6**	3	0.4
		Isopoda	Woodlice	0	0	0	**0.0**	0	0	2	0	1	0	**0.6**	3	0.4
	Bivalvia	Sphaeriida	Clams/Mussels	1	0	9	**0.5**	2	7	4	5	4	2	**3.4**	18	2.6
		Unionoida	Freshwater Mussels	0	0	0	**0.0**	1	0	0	0	2	0	**0.6**	3	0.4
	Gastropoda	Basommatophora	Snails	8	1	10	**4.5**	6	6	2	9	6	4	**5.4**	36	5.1
			SUM	**286**	**282**	**355**	**284.0**	**376**	**335**	**273**	**322**	**301**	**287**	**311.8**	**2127**	**303.9**

*Station 2 and 3 included duplicate samples, which were not included in average and total statistics

Table 3-7: Reaches 5B and 5C Macroinvertebrate Survey Results- Taxa Measures and Benthic Community Classifications (A, B, C)

Station	Sample ID	Taxa Richness	Abundance	EPT Richness	Dominant Organism	Chironomidae Richness
1	5B-C-1	42 B	286	14 B	Cheumatopsyche 15.4% B	10 A
2	5B-C-2	43 B	282	17 A	*Cricotopus bicinctus* 11.3% B	14 A
2*	5B-C-2 DUP	49 B	355	16 A	Cheumatopsyche 10.7% B	15 A
5B Average	**-**	**43 B**	**284**	**16 A**	***Cheumatopsyche***	**12 A**
3	5C-C-1	60 B	376	24 B	*Cricotopus bicinctus* 6.6% B	19 A
3*	5C-C-1 DUP	51 B	335	22 B	*Cricotopus bicinctus* 9.3% B	17 A
4	5C-C-2	43 B	273	16 A	Cheumatopsyche 14.3% B	13 A
5	5C-C-3	48 B	322	16 A	*Cricotopus bicinctus* 14.3% B	14 A
6	5C-C-5	51 B	287	20 B	Cheumatopsyche 17.1% B	14 A
7	5C-C-4	53 B	301	19 B	*Cricotopus bicinctus* 12.6% B	12 A
5C Average	-	**51 B**	**312**	**19 B**	***Cricotopus bicinctus***	**14 A**
Overall Average	**NA**	**48 B**	**304**	**18 B**	**--**	**13 A**

Notes:

*Station 2 and 3 include a duplicate sample, averages and sums were not calculated with these numbers.

1. Richness metrics were summed at the genus level per the Haley Ward Inc. model used to evaluate water quality and habitat. Richness calculated at the species level would be higher.
2. The Lotic Inc. classification model used above assigns the following classifications based on benthic community structure to aid in interpretation of the data in comparison to other similar streams in New England:

    - Class A- High quality; aquatic life as naturally occurs,
    - Class B- Good quality; no detrimental changes to the biological community,
    - Class C- Fair quality, some changes to aquatic life; maintains the structure and function of the resident biological community,
    - Non-attainment (NA)- Does not attain Class A, B or C classifications (not present in these samples).

Table 3-8: Reaches 5B and 5C Community Fish Sampling Results on 9/27/2023

Common name	Scientific name	YOY	Juvenile	Adult	Large Adult	Total
Bluegill	*Lepomis macrochirus*	1	4	0	0	5
Bluntnose minnow	*Pimephales notatus*	0	0	23	0	23
Common carp	*Cyprinus carpio*	0	0	6	0	6
Comely shiner	*Notropis amoenus*	0	0	20	0	20
Golden shiner	*Notemigonus crysoleucas*	0	0	5	0	5
Largemouth bass	*Micropterus salmoides*	4	7	11	0	22
Northern pike	*Esox lucius*	0	3	9	0	12
Chain pickerel	*Esox niger*	0	3	0	0	3
Pumpkinseed	*Lepomis gibbosus*	0	3	0	0	3
Rock bass	*Ambloplites rupestris*	0	2	2	0	4
Spottail shiner	*Notropis hudsonius*	0	0	0	370	370
White sucker	*Catostomus commersonii*	0	0	1	0	1
Yellow perch	*Perca flavescens*	0	12	9	0	21
Grand Total		**5**	**34**	**86**	**370**	**495**

Table 3-9: Reaches 5B and 5C Small Fish Species Trapping Results

Upper 5B- North of New Lenox Rd

N1- In pool under LWD			N2- Co-located with N1		
Species	**Life stage**	**Length (mm)**	**Species**	**Life stage**	**Length (mm)**
No Catch	NA	NA	No Catch	NA	NA

Middle 5B- Adjacent to Decker Boat Ramp

M1- In SAV			M2- Co-located with N1		
Species	**Life stage**	**Length (mm)**	**Species**	**Life stage**	**Length (mm)**
No Catch	NA	NA	No Catch	NA	NA

Middle 5C – Near Roaring Brook Road

M1- Located at the edge of a pool in SAV			M2- Co-located with M1 in SAV		
Species	**Life stage**	**Length (mm)**	**Species**	**Life stage**	**Length (mm)**
pumpkinseed	juvenile	52	bluegill	juvenile	73
bluegill	juvenile	60	bluegill	juvenile	41
pumpkinseed	juvenile	63	bluegill	juvenile	68
pumpkinseed	juvenile	57	bluegill	juvenile	43
pumpkinseed	juvenile	57	bluegill	juvenile	48
pumpkinseed	juvenile	51			
bluegill	juvenile	52			
pumpkinseed	juvenile	52			

Lower 5C- North of Woods Pond

N1- In pool under LWD			N2- Co-located with N1		
Species	**Life stage**	**Length (mm)**	**Species**	**Life stage**	**Length (mm)**
No Catch	NA	NA	No Catch	NA	NA

Table 3-10. Wildlife Observations Made During the 2024 Aquatic Habitat Surveys in Reaches 5B and 5C

Common Name	Scientific Name
Amphibians and Reptiles	
Snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
Green frog	*Lithobates clamitans*
Eastern garter snake	*Thamnophis sirtalis*
Fish	
White sucker	*Catostomus commersonii*
Common carp	*Cyprinus carpio*
Pumpkinseed	*Lepomis gibbosus*
Bluegill	*Lepomis macrochirus*
Largemouth bass	*Micropterus salmoides*
Invertebrates	
Common water strider	*Aquarius remigis*
Crayfish	*Cambarus spp.*
Eastern Elliptio	*Elliptio complanata*
Whirligig beetles	Family *Gyrinidae*
Freshwater Clams	Family *Veneridae*
Dragonflies	Order *Anisoptera*
Caddisflies	Order *Trichoptera*
Damselflies	Order *Zygoptera*
Mammals	
Coyote	*Canis latrans*
Beaver	*Castor canadensis*
Muskrat	*Ondatra zibethicus*
Grey Squirrel	*Sciurus carolinensis*
Black bear	*Ursus americanus*
Birds	
Mallard	*Anas platyrhynchos*
Great egret	*Ardea alba*
Great blue heron	*Ardea herodias*

Common Name	Scientific Name
Birds (cont.)	
Red-tailed hawk	*Beteo jamaicensis*
American bittern	*Botaurus lentiginosus*
Green heron	*Butorides virescens*
Willow flycatcher	*Empidonax traillii*
Bald eagle	*Haliaeetus leucocephalus*
Gull	Larinae sp.
Belted kingfisher	*Megaceryle alcyon*
Red-bellied woodpecker	*Melanerpes carolinus*
Osprey	*Pandion haliaetus*
Black capped chickadee	*Poecile atricapillus*

Table 3-11: State-Listed Rare Species Associated with the Riverine Habitats of Reaches 5B and 5C[1]

Common Name	Scientific Name	Taxonomic Group	MESA Status
American Bittern	*Botaurus lentiginosus*	Bird	Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Bird	Special Concern
Common Gallinule	*Gallinula galeata*	Bird	Special Concern
Matted Spike-Sedge	*Eleocharis intermedia*	Plant	Threatened
Rapids Clubtail	*Phanogomphus quadricolor*	Dragonfly	Endangered
Spine-Crowned Clubtail	*Hylogomphus abbreviatus*	Dragonfly	Special Concern
Wapato	*Sagittaria cuneata*	Plant	Threatened
Water Shrew	*Sorex palustris*	Mammal	Special Concern
Wood Turtle	*Glyptemys insculpta*	Turtle	Special Concern

[1] [1] This list includes only species for which MNHESP provided Species Habitat mapping. In addition, review of the U.S. Fish and Wildlife Service (USFWS) on-line Information, Planning, and Consultation System (IPaC) for identification of federally listed rare species (USFWS 2023) resulted in the identification of habitat for one such listed species – the northern long-eared bat (*Myotis septentrionalis*) – and two species proposed for listing – the tricolored bat (*Perimyotis subflavus*) and the monarch butterfly (*Danaus plexippus*). Habitat for the two bat species is mapped within the entirety of Reaches 5B and 5C, and potential foraging habitat for these bat species occurs over the riverine habitats of Reaches 5B and 5C.

Table 3-12: Reaches 5B and 5C Riverine Function Assessment Factors

Functional Category	Description of Functions	Parameters Considered in Assessing Function (see Table 3.1.1)
Hydrologic Support	Water conveyance and transport; watershed connectivity; floodwater dynamics (flood flow amelioration, flood storage and desynchronization, peak rate control); base flow maintenance (groundwater discharge); migration and dispersal corridor	Hydrology; geomorphology; bank characteristics
Geomorphology	Channel formation and maintenance; floodplain connectivity; transport of organic and mineral sediment material; transport of woody debris; transport of nutrients and food sources	Hydrology; geomorphology; bank characteristics; in-stream habitat features
Physicochemical	Water quality maintenance; temperature and oxygen regulation; processing of organic matter and nutrients	Hydrology; in-stream habitat features; water quality; aquatic biota habitat
Biological	Biodiversity and sustaining life stages of aquatic and riparian life; habitat for aquatic and other water-using biota; rare species habitat	Hydrology; geomorphology; bank characteristics; in-stream habitat features; water quality; habitat for aquatic and other water-using biota; riparian zone conditions; rare species habitat (mapped Priority Habitat and Core Area habitat and IPaC results); connectivity; invasive plant and animal species; benthic macroinvertebrate and fish community surveys; incidental wildlife observations

Table 4-1: Riverbank Habitat Characterization in Reaches 5B and 5C

Parameter	Description of Parameter	Reach 5BC Inventory Approach[1]
Mapping and physical measures	Mapping of physical location and limits; length, depth, slope	Updated LiDAR and bathymetric mapping.
Bank height (relative to water stage); bankfull stage/discharge	Range in observed bank heights relative to mean low water, mean high water, and bankfull stages.	Consolidate existing information (from sources below); updated LiDAR and bathymetric mapping; 2023-24 field surveys using Form RB-1; discharge volume of 1.5-2 yr flood flow in channel cross-sections
Floodplain connectivity	Hydrologic connection between the river and floodplain; degree of river incisement/entrenchment along with breaks in the bank or conduits for floodwater dispersement into the floodplain	Consolidate existing information (from sources below); 2023-24 field surveys using Form RB-1
Soil/substrate composition	Relative % clay/silt/sand and gravel/cobble; boulder/bedrock presence; organic matter	Consolidate existing information (from sources below); 2023-24 field surveys using Form RB-1
Bank stability and migration	Observed erosional conditions; documentation of river channel/bank migration	BEHI information from Stantec 2009 evaluation in 5B; 2010 Example Area evaluations; consolidate other bank-related information (from sources below); 2023-24 field surveys using Form RB-1
Large woody debris (LWD)	Density of LWD; woody debris on the bank	Consolidate existing information (from sources below); 2023-24 field surveys using Form RB-1
Vegetation, including on-bank, overhanging, and riparian vegetation	Species composition and relative abundance; presence/abundance of invasive species	Review of invasive plant species lists from USACE New England District and MIPAG; consolidate existing information (from sources below); aerial photography; 2023-24 field surveys using Form RB-1
General wildlife habitat	Species composition and relative abundance of riverbank and riparian wildlife	Consolidate existing information (from sources below); 2023-24 field surveys using Form RB-1; incidental wildlife observations
Rare species habitat	Priority Habitat/Core Area Habitat mapping; IPaC results from USFWS on-line data base	MNHESP investigations and designations (including updated outreach to MNHESP); IPaC results; 2023-24 field surveys using Form RB-1
Unique habitat features	Cut banks; turtle hibernacula or nesting sites, kingfisher or bank swallow nest sites (vertical sandy banks); otter slides; rock basking sites; beaver bank dens; burrows; tree cavities; bars and benches	Consolidate existing information (from sources below); 2023-24 field surveys using Form RB-1

[1] The existing information used for Reaches 5B and 5C riverbank habitat characterization includes information from the following sources: the 2002 Woodlot Ecological Characterization, the Stantec 2009 bank erosion evaluation, the 2003 RFI Report, the 2010 Example Area evaluations and RCMS Report, the MNHESP investigations of state-listed species through 2012, – all described and referenced in Section 2 of the Revised Reaches 5B-8 BRA Work Plan.

Table 4-2: Riverbank Summary Data for Reaches 5B and 5C*

Parameter		Average	Range
Bank Height		4.2 ft	0-9 ft
Bank Slope		48%	0-95%
Bankfull Indicators		3 ft	2-4 ft
Bank Substrate	Sand	28%	0-45%
	Silt	60%	40-80%
	Clay	0%	N/A
	Gravel/Cobble	2.2%	0-20%
	Boulder/Bedrock	0%	0%
	Organic	10%	5-20%
Stream Gradient	Low	100%	
Total Vegetative Cover	Bank	91%	60-100%
	Overhanging	64%	0-100%
	Riparian	82%	0-100%
Vegetative Cover by Strata	Tree	22%	0-90%
	Shrub	49%	0-100%
	Herb	66%	0-90%
	Vine	9%	0-70%
	Moss	0%	0%
Riparian Zone Vegetative Cover by Strata	Tree	29%	0-85%
	Shrub	56%	10-80%
	Herb	72%	45-90%
	Vine	10%	0-20%
	Moss	0%	0%

*Data summarized from 18 riverbank stations ranging from 100-200 feet in length (~7600 lf in total), combining both left and right bank data

Table 4-3: Riverbank Sediment/Substrate Composition for Reaches 5B and 5C

Bank Station*	%Sand	%Silt	%Clay	%Gravel/ Cobble	%Boulder/ Bedrock	%Organic Matter
35	30	65	0	0	0	5
36	40	55	0	0	0	5
37	35	60	0	0	0	5
38	30	60	0	0	0	10
39	40	50	0	0	0	10
40	40	50	0	0	0	10
41	45	50	0	0	0	5
42	40	50	0	0	0	10
43	40	50	0	0	0	10
44	40	50	0	0	0	10
45	30	40	0	20	0	10
46	20	70	0	0	0	10
47	20	70	0	0	0	10
48	20	70	0	0	0	10
49	20	70	0	0	0	10
50	15	55	0	20	0	10
51	0	80	0	0	0	20
52	0	80	0	0	0	20

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-4: Reaches 5B and 5C Riverbank Hydrology Ratings: Channel Gradient, Incisement, and Floodplain Connectivity

			Floodplain Connectivity	
Bank Station*	Stream Gradient	Incisement Rating	High-flow Channels in Floodplain	Topographic Breaks in Bank
35	Low-gradient	Somewhat incised	√	√
36	Low-gradient	Somewhat incised		√
37	Low-gradient	Not incised	√	√
38	Low-gradient	Somewhat incised		√
39	Low-gradient	Moderately incised		√
40	Low-gradient	Somewhat incised	√	√
41	Low-gradient	Moderately incised		√
42	Low-gradient	Not incised	√	√
43	Low-gradient	Not incised	√	√
44	Low-gradient	Moderately incised	√	√
45	Low-gradient	Not incised	√	√
46	Low-gradient	Somewhat incised	√	√
47	Low-gradient	Not incised	√	√
48	Low-gradient	Not incised	√	√
49	Low-gradient	Not incised	√	√
50	Low-gradient	Not incised	√	√
51	Low-gradient	Not incised		√
52	Low-gradient	Not incised		√

**Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-5: Riverbank Bordering Habitat Types in Reaches 5B and 5C

Bank Station*	Bordering Wetland Habitats[1]							Bordering Upland Habitats[2]		
	TFF	SS	SEM	DEM	VP	RMS	HTF	HPF	CG-AF	DD
35	√	√		√	√	√			√	√
36	√	√							√	√
37	√	√			√			√		
38	√	√	√	√	√	√		√		
39		√	√		√				√	
40		√	√		√				√	
41		√	√	√	√					
42	√	√	√	√	√	√				
43	√	√	√	√	√	√		√		
44		√	√	√	√	√				
45		√	√	√		√		√		
46		√	√	√		√		√		
47		√	√	√	√	√				
48		√	√	√		√		√		
49		√	√	√						
50						√		√		
51		√	√	√		√	√			
52		√	√	√		√	√			

[1] TFF: Transitional Floodplain Forest; SS: Shrub Swamp; SEM: Shallow Emergent Marsh: DEM: Deep Emergent Marsh; VP: Vernal Pool; RMS: Red Maple Swamp; HTF: High Terrace Floodplain Forest

[2] HPF: Hardwoods/Hemlock/Pine Forest; CG-AF: Cultural Grassland-Agricultural Field; DD: Disturbed/Developed

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-6: Riverbank –Biotic Habitat Features in Reaches 5B and 5C

	Wildlife Food					Cover/Perches/Basking/Denning/Nesting Habitat						
Bank #*	Wetland and Aquatic Food	Upland Food	Live or Dead Trees >30" DBH	Standing Dead Trees	Tree Cavities	Small Mammal Burrows	Dense Herb Cover[1]	Large Woody Debris[2]	Rocks, Crevices, Logs, Roots at Water Edge[3]	OH+ Branches ≤ 1 m to Water Surface[4]	Rock Piles, Crevices, or Hollow Logs[5]	Live or Dead Tall Veg. OH/Near Water[6]
35	*	√	*	√	√	√	*	*	*	√	√	*
36	√	Ø	Ø	Ø	Ø	√	√	Ø	√	√	√	√
37	√	Ø	√	Ø	√	Ø	√	Ø	√	√	Ø	*
38	√	Ø	Ø	Ø	Ø	√	*	Ø	Ø	√	Ø	√
39	√	Ø	Ø	Ø	Ø	√	√	√	√	√	Ø	Ø
40	√	Ø	√	√	√	√	√	√	√	√	Ø	√
41	Ø	Ø	Ø	Ø	Ø	√	Ø	√	Ø	Ø	Ø	Ø
42	√	Ø	√	√	√	√	√	Ø	Ø	√	Ø	√
43	√	Ø	√	√	√	√	√	√	√	√	Ø	√
44	√	Ø	√	√	√	√	Ø	√	√	*	Ø	*
45	√	*	√	√	√	√	Ø	Ø	√	*	Ø	*
46	√	Ø	√	Ø	Ø	√	√	√	√	*	Ø	√
47	√	Ø	√	*	√	√	√	√	√	√	√	*
48	Ø	Ø	√	√	√	√	√	√	√	*	√	*
49	√	Ø	Ø	Ø	Ø	√	*	Ø	Ø	Ø	Ø	Ø
50	√	√	Ø	√	√	√	√	√	√	√	√	*
51	√	Ø	√	√	√	√	√	√	√	Ø	√	√
52	√	√	√	√	√	√	√	√	√	Ø	√	√

* =Abundant; √=Present; Ø=Absent

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

+ OH: Overhanging

[1] Habitat suitable for voles, small mammals, amphibians and reptiles

[2] Habitat suitable for small mammals, mink, amphibians and reptiles

[3] Habitat suitable for turtles, snakes, frogs

[4] Habitat suitable for turtles, snakes, frogs, wading birds, wood duck, mink, raccoon

[5] Habitat suitable for various mammals, e.g., otter, mink, porcupine, raccoon

[6] Habitat offering good visibility of open water for, e.g., osprey, kingfisher, flycatchers, cedar waxwings

Table 4-7: Riverbank Habitat—Physical Bank Habitat Features for Reaches 5B and 5C

	Physical Bank Habitat Features					Wildlife Dens/Nests	
Bank #*	Underwater Banks Fine silt and/or clay[1]	Undercut or OH+ banks[2]	Vertical Sandy Banks[3]	Mud Flats	Exposed, Well-Drained, Sandy Areas[4]	Turtle Nesting Sites[5]	Bank Swallow Colonies
35	*	*	ø	√	√	ø	ø
36	√	√	√	√	√	ø	ø
37	√	√	ø	√	ø	ø	ø
38	√	√	ø	√	ø	ø	ø
39	√	√	ø	√	ø	ø	ø
40	√	√	ø	√	ø	ø	ø
41	√	√	ø	ø	ø	ø	ø
42	√	√	ø	√	ø	ø	ø
43	√	√	ø	ø	ø	ø	ø
44	*	*	ø	√	ø	ø	ø
45	√	*	ø	√	ø	ø	ø
46	√	√	ø	ø	ø	ø	ø
47	√	ø	ø	ø	ø	ø	ø
48	√	√	ø	ø	ø	ø	ø
49	√	ø	ø	*	ø	ø	ø
50	*	*	ø	√	ø	ø	ø
51	√	ø	ø	√	ø	ø	ø
52	√	√	ø	√	ø	ø	ø

+ OH: Overhanging; *=Abundant; √=Present; ø=Absent

[1] Features suitable for beaver, muskrat, otter

[2] Features suitable for small mammals, mink, weasels, turtles

[3] Features suitable for bank swallow, kingfisher

[4] Features suitable for turtle nesting

[5] Only applies to any actual observed turtle nesting sites, not potential nesting sites

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-8: Riverbank Plant Species Summary Data for Reaches 5B and 5C

	Common Name	Scientific Name	Status[1]	Occurrence (Number of Survey Segments N=36)[2]
Tree Species	boxelder	*Acer negundo*	Native	5
	striped maple	*Acer pensylvanicum*	Native	1
	red maple	*Acer rubrum*	Native	7
	silver maple	*Acer saccharinum*	Native	18
	black birch	*Betula lenta*	Native	1
	ironwood	*Carpinus caroliniana*	Native	1
	American beech	*Fagus grandifolia*	Native	2
	swamp white oak	*Quercus bicolor*	Native	1
	bur oak	*Quercus macrocarpa*	Native	1
	northern red oak	*Quercus rubra*	Native	1
	black locust	*Robinia pseudocacia*	Invasive[A,C]	1
	black willow	*Salix nigra*	Native	6
	American linden	*Tilia americana*	Native	1
	American elm	*Ulmus americana*	Native	1
Shrub Species	Japanese barberry	*Berberis thunbergii*	Invasive[A,B,C]	1
	common buttonbush	*Cephalanthus occidentalis*	Native	6
	silky dogwood	*Cornus amomum*	Native	30
	flowering dogwood	*Cornus florida*	Native	1
	red-osier dogwood	*Cornus sericea*	Native	17
	hawthorn	*Crataegus spp.*	Native	2
	winterberry	*Ilex verticillata*	Native	1
	mountain laurel	*Kalmia latifolia*	Native	1
	Morrow's honeysuckle	*Lonicera morrowii*	Invasive[A,B]	14
	maleberry	*Lyonia ligustrina*	Native	1
	common buckthorn	*Rhamnus cathartica*	Invasive[A,B,C]	13
	staghorn sumac	*Rhus hirta*	Native	1
	eastern black currant	*Ribes americanum*	Native	2
	multiflora rose	*Rosa multiflora*	Invasive[A,B,C]	3
	swamp rose	*Rosa palustris*	Native	2
	red raspberry	*Rubus idaeus*	Native	3
	elderberry	*Sambucus canadensis*	Native	3
	white meadowsweet	*Spiraea alba*	Native	1
	maple-leaved viburnum	*Viburnum acerifolium*	Native	1
	arrowwood	*Viburnum dentatum*	Native	2
Vine Species	Asian bittersweet	*Celastrus orbiculatus*	Invasive[A,B,C]	9
	virgin's-bower	*Clematis virginiana*	Native	3
	hedge bindweed	*Convolvulus sepium*	Native	2
	wild cucumber	*Echinocystis lobata*	Native	6

Table 4-8: Reaches 5B and 5C Riverbank Plant Species Summary Data (continued)

	Common Name	Scientific Name	Status[1]	Occurrence (Number of Survey Segments N=36)[2]
	Virginia-creeper	*Parthenocissus quinquefolia*	Native	3
	poison-ivy	*Toxicodendron radicans*	Native	3
	river grape	*Vitis riparia*	Native	10
Herb Species	sweet flag	*Acorus americanus*	Native	6
	swamp milkweed	*Asclepias incarnata*	Native	3
	nodding beggar-ticks	*Bidens cernua*	Native	16
	purple-stemmed beggar-ticks	*Bidens connata*	Native	2
	devil's beggar-ticks	*Bidens frondosa*	Native	2
	small-spiked false-nettle	*Boehmeria cylindrica*	Native	5
	black mustard	*Brassica nigra*	Non-native	6
	blue joint grass	*Calamagrostis canadensis*	Native	1
	hop sedge	*Carex lupulina*	Native	1
	tussock sedge	*Carex stricta*	Native	1
	compact dodder	*Cuscuta compacta*	Native	1
	umbrella sedge	*Cyperus strigosus*	Native	4
	common barnyard grass	*Echinochloa crus-galli*	Non-native	1
	spike rush	*Eleocharis sp*	Native	7
	eastern willow-herb	*Epilobium coloratum*	Native	8
	little lovegrass	*Eragrostis minor*	Non-native	1
	spotted Joe-Pye weed	*Eupatorium maculatum*	Native	11
	Japanese knotweed	*Fallopia japonica*	Invasive[A,B,C]	1
	fall sneezeweed	*Helenium autumnale*	Native	1
	jewelweed	*Impatiens capensis*	Native	9
	yellow iris	*Iris pseudacorus*	Invasive[A,B]	7
	common soft rush	*Juncus effusus*	Native	5
	Canada wood nettle	*Laportea canadensis*	Native	1
	rice cut-grass	*Leersia oryzoides*	Native	6
	yellow-seeded false pimpernel	*Lindernia dubia*	Native	1
	common water-purslane	*Ludwigia palustris*	Native	20
	moneywort	*Lysimachia nummularia*	Invasive[A]	1
	purple loosestrife	*Lythrum salicaria*	Invasive[A,B,C]	32
	ostrich fern	*Matteuccia struthiopteris*	Native	6
	Allegheny monkeyflower	*Mimulus ringens*	Native	3
	water forget-me-not	*Myosotis scorpioides*	Invasive[D]	18
	giant chickweed	*Myosoton aquaticum*	Non-native	5
	Eurasian watermilfoil	*Myriophyllum spicatum*	Invasive[A,B]	2
	common evening primrose	*Oenothera biennis*	Native	3
	sensitive fern	*Onoclea sensibilis*	Native	17

Table 4-8: Reaches 5B and 5C Riverbank Plant Species Summary Data (continued)

Common Name	Scientific Name	Status[1]	Occurrence (Number of Survey Segments N=36)[2]
cinnamon fern	*Osmunda cinnamomea*	Native	2
arrow-arum	*Peltandra virginica*	Native	11
ditch-stonecrop	*Penthorum sedoides*	Native	11
water-pepper smartweed	*Persicaria hydropiper*	Native	2
false water-pepper smartweed	*Persicaria hydropiperoides*	Native	5
pale smartweed	*Persicaria lapathifolia*	Native	7
lady's-thumb smartweed	*Persicaria maculosa*	Native	11
dotted smartweed	*Persicaria punctata*	Native	3
arrow-leaved tearthumb	*Persicaria sagittata*	Native	8
reed canary grass	*Phalaris arundinacea*	Invasive[A,B,C]	24
Canada clearweed	*Pilea pumila*	Native	10
Christmas fern	*Polystichum acrostichoides*	Native	1
pickerelweed	*Pontederia cordata*	Native	7
floating pondweed	*Potamogeton natans*	Native	1
bracken fern	*Pteridium aquilinum*	Native	1
creeping yellow-cress	*Rorippa sylvestris*	Non-native	4
green-headed coneflower	*Rudbeckia laciniata*	Native	17
bitter dock	*Rumex obtusifolia*	Non-native	1
curly dock	*Rumex crispus*	Non-native	17
common arrowhead	*Sagittaria latifolia*	Native	4
dark-green bulrush	*Scirpus atrovirens*	Native	1
woolgrass	*Scirpus cyperinus*	Native	4
bittersweet nightshade	*Solanum dulcamara*	Invasive[B]	3
Canada goldenrod	*Solidago canadensis*	Native	3
American bur-reed	*Sparganium americanum*	Native	26
giant bur-reed	*Sparganium eurycarpum*	Native	2
lance-leaved American aster	*Symphyotrichum lanceolatum*	Native	8
calico aster	*Symphyotrichum lateriflorum*	Native	1
New England American aster	*Symphyotrichum novae-angliae*	Native	1
marsh fern	*Thelypteris palustris*	Native	3
coltsfoot	*Tussilago farfara*	Invasive[B,C,D]	1
narrow-leaved cattail	*Typha angustifolia*	Non-native	2
broad-leaved cattail	*Typha latifolia*	Native	1
stinging nettle	*Urtica dioica*	Native	3
water celery	*Vallisneria americana*	Native	1
blue vervain	*Verbena hastata*	Native	8
American speedwell	*Veronica americana*	Native	3
rough cocklebur	*Xanthium strumarium*	Non-native	5

[1] Invasive Ratings: A= MIPAG Invasive; B=IPANE Invasive; C=ACOE Invasive; D=MIPAG Likely Invasive

[2] Data are from 18 riverbank stations in Reaches 5B and 5C, with surveys of both left and right banks tabulated separately for total number of observation points of 36.

Table 4-9: Riverbank Plant Community Inventory – Left Bank in Reaches 5B and 5C

Bank Station	Total % Cover	OH[+] % Cover	Riparian % Cover	OH Tree % Cover	OH Shrub % Cover	OH Vine % Cover	OH Moss % Cover	OH Herb % Cover
35	95	70	100	70	10	5	0	80
36	70	70	100	40	70	20	0	20
37	95	95	100	50	70	10	0	40
38	60	60	90	5	60	10	0	40
39	100	0	100	0	5	0	0	100
40	100	60	95	0	60	0	0	100
41	95	50	95	0	10	0	0	95
42	95	90	100	10	90	20	0	50
43	90	100	95	30	80	10	0	30
44	100	100	95	0	100	10	0	75
45	85	75	100	85	85	10	0	40
46	95	95	95	75	75	20	0	25
47	95	80	90	30	70	10	0	70
48	100	90	75	20	80	20	0	50
49	90	10	90	0	10	0	0	90
50	90	90	70	75	80	25	0	20
51	90	60	N/A	0	30	0	0	75
52	70	70	90	10	30	5	0	70

[+] OH: Overhanging

Table 4-10: Riverbank Plant Community Inventory – Right Bank in Reaches 5B and 5C

Bank #*	Total % Cover	OH+ % Cover	Riparian % Cover	OH Tree % Cover	OH Shrub % Cover	OH Vine % Cover	OH Moss % Cover	OH Herb % Cover
35	80	80	100	60	50	30	0	80
36	90	0	100	0	10	0	0	90
37	100	20	100	0	10	10	0	100
38	100	80	90	5	10	0	0	90
39	95	50	90	0	50	10	0	60
40	95	80	95	25	25	10	0	70
41	70	50	90	10	50	10	0	70
42	100	60	80	0	60	10	0	95
43	95	60	95	0	0	0	0	100
44	90	100	95	40	100	40	0	10
45	70	70	95	40	70	10	0	75
46	95	95	90	0	95	5	0	30
47	100	40	95	30	20	10	0	80
48	100	100	N/A	50	80	10	0	50
49	90	10	90	0	10	0	0	90
50	95	50	95	20	50	20	0	50
51	90	80	80	0	70	0	0	80
52	90	20	N/A	0	10	0	0	90

+ OH: Overhanging

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-11: Riverbank Plant Community Inventory – Riparian Vegetation Cover in Reaches 5B and 5C

Bank Station*	Tree % Cover	Shrub % Cover	Vine % Cover	Moss % Cover	Herb % Cover
35	40	60	10	0	80
36	20	60	10	0	80
37	30	65	0	0	70
38	30	50	10	0	80
39	5	50	10	0	80
40	20	70	10	0	70
41	0	25	10	0	80
42	20	80	20	0	70
43	25	65	10	0	65
44	55	80	20	0	70
45	85	60	10	0	45
46	30	75	15	0	70
47	50	60	15	0	75
48	50	75	10	0	60
49	0	10	0	0	90
50	50	55	15	0	45
51	0	10	0	0	70
52	20	60	10	0	80

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-12: Reaches 5B and 5C Riverbanks: Other Wildlife Habitat Features*

Habitat Feature	Wildlife Use	% of Stations Abundant	% of Stations Present	% of Stations Absent
Imp. Wetland/Aquatic Food Plants	Overall food	6	83	11
Imp. Upland Food Plants	Overall food	6	16	78
Trees (live or dead) >30" DBH	Cover/perching/nesting	6	61	33
Tree Cavities in Trunks or Limbs	Cavities/perching/nesting	0	67	33
Small Mammal Burrows	Nesting/escape/cover	0	94	6
Dense Herbaceous Cover	Voles, small mammals, amphibians, reptiles	16	67	17
Large Woody Debris on Ground	Small mammals, amphibians, reptiles, invertebrate emergence	6	33	61
Rocks, Crevices. Logs, Tree Roots, or Hummocks Under or at Water's Edge	Turtles, snakes, frogs, invertebrate emergence	6	72	22
OH Branches $\leq$ 1M above Water	Turtles, snakes, frogs, wading birds, wood duck, mink, raccoon	22	56	22
Rock Piles, Crevices, Hollow Logs	Mammals: otter, mink, porcupine, raccoon	0	39	61
Live or Dead Tall Standing Veg. OH or Near Water Offering Visibility	Perching (Osprey Kingfisher, Flycatchers, Cedar Waxwings)	39	44	17
Underwater Banks of Fine Silt and/or Clay	Beaver, Muskrat, Otter	17	83	0
Undercut or OH Banks	Small mammals (Mink, Weasels), Turtles	22	61	17
Vertical Sandy Banks	Nesting bank swallows and kingfishers; Turtles	0	6	94
Mud Flats	Feeding sites for birds, small mammals, herps	6	67	27
Exposed Well Drained Soil	Turtle nesting	0	11	89
Turtle Nesting Sites Observed	Turtle nesting	0	0	100
Bank Swallow Colony Observed	Bank swallow nesting	0	0	100

Data summarized from 18 riverbank stations ranging from 100-200 feet in length (~7,600 lf in total)

Table 4-13: Incidental Direct Wildlife Observations at Bank Survey Stations in Reaches 5B and 5C

Bank Station*	Incidental Direct Wildlife Observations
35	Crows, Kingfisher, Muskrat/Beaver slides, Wood ducks
36	Bald Eagle, Beaver slide, Canada Goose, Coopers Hawk, Dragonflies, Great Blue Heron, Pileated Woodpecker, Red-bellied Woodpecker
37	Beaver channels, Beaver den, Beaver slides, Dragonflies, Kingfisher, Wood duck
38	Beaver den, Beaver slide, Dragonflies, Song Sparrow, Vulture
39	Beaver slide, Broad-winged hawk, Kingfisher, small fish jump
40	Beaver/Muskrat Slides, Raccoon tracks
41	Beaver/Otter/Muskrat Slides, Black-capped Chickadee, Cormorants, Mallards, Turtle
42	Black-capped Chickadees, Salamander, Wood ducks
43	Blue jay, Broad-winged Hawk, Crow, Fish (jump)
44	Blue jay, Cabbage White Butterfly, Catbird, Frogs (Pickerel or Leopard), Green Frogs
45	Cardinals, Great Blue Heron, Fish (large Carp, Minnows), Green Heron, Muskrat/Beaver Slides, Osprey, Painted Turtle, Red-tail Hawk, Song Sparrows, Spotted Sandpiper, Wood Duck
46	Catbird, Dragonflies, Garter snake, White-breasted Nuthatch
47	Catbird, Kingbird, Kingfisher, Flicker, Frogs
48	Evidence of Beaver chews/sticks, Red-bellied Woodpecker, Turtle
49	Goldfinches
50	Great Blue Heron, Spotted Salamander
51	Green Frogs, Green Heron, Sharp-shinned Hawk
52	Hairy Woodpecker, Painted Turtle, Turkey Vulture, Wood Duck, Bald Eagle, Beaver slides, Canada Geese, Coopers Hawk, Dragonflies, Great Blue Heron, Pileated Woodpecker, Red-bellied Woodpecker

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-14: MNHESP Rare Species and Core Area Habitat Designations[1] in Reaches 5B and 5C Riverbank Stations

Bank Station*	MNHESP Core Area	State-Listed Species Habitat[2]
35	Core Area 2	Frank's Lovegrass; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Spine-crowned Clubtail; Wapato; Wood Turtle
36	Core Area 1 Core Area 2	Frank's Lovegrass; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Spine-crowned Clubtail; Wapato; Wood Turtle
37	Core Area 1; Core Area 2; Core Area 4	Frank's Lovegrass; Matted Spike-sedge; Mustard White; Narrow-leaved Spring Beauty; Rapid's Clubtail; Spine-crowned Clubtail; Wapato; Wood Turtle
38	Core Area 1; Core Area 2; Core Area 3; Core Area 4	Frank's Lovegrass; Matted Spike-sedge; Mustard White; Narrow-leaved Spring Beauty; Rapid's Clubtail; Spine-crowned Clubtail; Wapato; Wood Turtle
39	Core Area 2; Core Area 3; Core Area 4	American Bittern; Foxtail Sedge; Frank's Lovegrass; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Spine-crowned Clubtail; Wapato; Wood Turtle
40	Core Area 1; Core Area 2; Core Area 3; Core Area 4	American Bittern; Foxtail Sedge; Frank's Lovegrass; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Spine-crowned Clubtail; Wapato; Wood Turtle
41	Core Area 1 Core Area 2	American Bittern; Foxtail Sedge; Frank's Lovegrass; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Spine-crowned Clubtail; Wapato; Wood Turtle
42	Core Area 2 Core Area 3	American Bittern; Bur Oak: Foxtail Sedge; Frank's Lovegrass; Jefferson Salamander; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Wapato; Wood Turtle
43	Core Area 2; Core Area 3; Core Area 4	Bur Oak; Frank's Lovegrass; Jefferson Salamander; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Wapato; Wood Turtle
44	Core Area 1; Core Area 3; Core Area 4	Bur Oak; Jefferson Salamander; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Wapato; Wood Turtle
45	Core 1	Bur Oak; Common Gallinule; Matted Spike-sedge; Mustard White; Narrow-leaved Spring Beauty; Rapid's Clubtail; Wapato; Wood Turtle
46	Core 1	Bur Oak; Common Gallinule; Matted Spike-sedge; Mustard White; Rapid's Clubtail; Wapato; Water Shrew; Wood Turtle
47	Core Area 1; Core Area 2; Core Area 3; Core Area 4	Bald Eagle; Bur Oak; Common Gallinule; Gray's Sedge; Matted Spike-sedge; Mustard White; Wapato; Water Shrew; Wood Turtle
48	Core Area 2 Core Area 4	Bald Eagle; Bur Oak; Common Gallinule; Gray's Sedge; Matted Spike-sedge; Mustard White; Wapato; Water Shrew; Wood Turtle

Table 4-14: Reaches 5B and 5C Riverbank – MNHESP Rare Species and Core Area Habitat Designation[1] (continued)

Bank Station*	MNHESP Core Area	State-Listed Species Habitat[2]
49	Core Area 1; Core Area 2; Core Area 4	Bald Eagle; Bur Oak; Common Gallinule; Gray's Sedge; Mustard White; Wapato; Water Shrew
50	Core Area 2	American bittern; Bald Eagle; Bur Oak; Common Gallinule; Mustard White; Wapato
51	Core Area 2	American Bittern; Bald Eagle; Bur Oak; Common Gallinule; Mustard White; Wapato
52	Core Area 2; Core Area 4	Bald Eagle; Bur Oak; Common Gallinule; Mustard White; Wapato

[1] Core Habitat Areas as designated by MNHESP, July 2012.

[2] State-Listed Species habitats as mapped by MNHESP. In addition, review of the USFWS IPaC resulted in the identification of habitat for one federally listed species (the northern long-eared bat) and two species proposed for listing (the tricolored bat and the monarch butterfly) within Reaches 5B and 5C. These two bat species are also state-listed species; however, MNHESP has not provided Species Habitat mapping for these bats. Habitat conditions in the riverbanks of Reaches 5B and 5C are suitable to support these three species for some functions.

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 4-15: Reaches 5B and 5C Riverbank Function Assessment Factors

Functional Category	Description of Functions	Parameters/Factors Considered in Assessing Function (see Table 4-1)
Hydrology/hydraulic	Water conveyance and transport; floodwater dynamics (flood flow distribution, flood storage and desynchronization, peak rate control)	Bank height; bank vegetation; bank stability/migration; floodplain connectivity
Geomorphology	Supply of organic and mineral sediment material; supply/processing of woody debris; effects on flow and role in determining stream planform and geomorphic diversity	Bank stability; substrate composition; large woody debris supply; bank stability/migration; bank vegetation
Physicochemical	Water quality maintenance; temperature and oxygen regulation for in-stream habitat	Vegetation (bank, overhanging, riparian); bank stability/migration
Biological	Biodiversity and sustaining aquatic and riparian life; migration and dispersal corridor; river access; rare species habitat	Bank stability/migration; vegetation (on-bank, overhanging, and riparian); large woody debris; general wildlife habitat; presence of unique habitat features; rare species habitat (mapped Species Habitat and Core Area habitat and IPaC results); floodplain connectivity; invasive species; incidental wildlife observations

Table 4-16: Reaches 5B and 5C Riverbank Restoration Opportunities

Bank Station*	Potential Restoration Resources Present
35	Coarse woody debris; large trees; root wad
36	Coarse woody debris; cobbles
37	Large trees
38	Large trees
39	Coarse woody debris
40	Coarse woody debris; Large trees; Cobble/boulder
41	Coarse woody debris; Cobble/boulder
42	Large trees
43	Coarse woody debris; Large trees
44	Coarse woody debris; Large trees; cobble/gravel
45	Coarse woody debris; Large trees; cobble/gravel/boulder
46	Coarse woody debris; Large trees
47	Coarse woody debris; Large trees; cobble/gravel
48	Coarse woody debris; Large trees; boulder
49	Coarse woody debris
50	Coarse woody debris; Large trees; cobble/boulder
51	Coarse woody debris; Root wads
52	Coarse woody debris; root wad

*Bank Stations 35-43 are in Reach 5B, and Bank Stations 44-52 are in Reach 5C.

Table 5-1: Backwater Habitat Characterization in Reaches 5B and 5C

Parameter	Description of Parameter	Reaches 5B and 5C Inventory Approach*
Mapping and classification	Mapping of physical location and limits	Updated LiDAR and bathymetric mapping
Physical dimensions	Length, width, area, depth, and volume	Updated LiDAR and bathymetric mapping; 2023-2024 field surveys using Form BW-1
Hydrology and connectivity to river	Flow dynamics; depth; water level fluctuation; mean low water; mean high water; hydrologic connection with river; other surface water inputs	Consolidate existing information (from sources below); 2023-2024field surveys using Form BW-1
Sediment composition	Relative % clay/silt/sand/gravel/cobble; boulder/bedrock; organic matter	Consolidate existing information (from sources below); 2023-2024field surveys using Form BW-1
Aquatic plant community	Species composition and relative abundance; rare species habitat; invasive species	Consolidate existing information (from sources below); 2023-2024field surveys using Form BW-1
Bordering habitat types	Species composition and relative abundance; rare species habitat; standing dead timber	2023-2024field surveys using Form BW-1; rare species habitat from MNHESP investigations/designations and IPaC results
Large woody debris (LWD)	Size, relative abundance and density of LWD above and below water	Consolidate existing information (from sources below); 2023-2024field surveys using Form BW-1
Water quality	Temperature, pH, TSS, turbidity, clarity, dissolved oxygen	Consolidate existing information (from sources below); collection of basic water quality data with field meter during field surveys
Habitat for aquatic and other water-using biota	Species composition and relative abundance of aquatic macrophytes, fish, benthic habitat/organisms, and other water-using biota	Consolidate existing information (from sources below); 2023-2024field surveys using Form BW-1; incidental wildlife observations
Rare species habitat	Priority Habitat/Core Area Habitat mapping; IPaC results from USFWS on-line data base	MNHESP investigations and designations (including updated outreach to MNHESP); IPaC results; 2023-2024field surveys using Form BW-1
Invasive species	Presence/relative abundance of invasive plant and animal species	Review of invasive plant species lists from USACE New England District and MIPAG and invasive aquatic animal species guidance from MassDCR and USGS; consolidate existing information (from sources below); 2023-2024field surveys using Form BW-1
Presence of special habitat features	Tree cavities; beaver/muskrat dens; otter slides	Consolidate existing information (from sources below); 2023-2024field surveys using Form BW-1

* The existing information used for the Reaches 5B and 5C backwater habitat characterization includes information from the following sources: the 2002 Woodlot Ecological Characterization, the 2003 RFI Report, the 2010 Example Area evaluations and RCMS Report, the MNHESP investigations of state-listed species through 2012 – all described and referenced in Section 2 of the Revised Reaches 5B-8 BRA Work Plan.

Table 5-2: Backwater Plant Species Summary Data for Reaches 5B and 5C

				Reach 5B								Reach 5C																				
Layer	Common Name	Scientific Name	Status[1]	BW5B-1	BW5B-2	BW5B-3	BW5B-4	BW5B-5	BW5B-6	BW5B-7	BW5B-8	BW5C-1	BW5C-2	BW5C-3	BW5C-4	BW5C-5	BW5C-6	BW5C-7	BW5C-8	BW5C-9	BW5C-10	BW5C-11	BW5C-12	BW5C-13	BW5C-14	BW5C-15	BW5C-16	BW5C-17	BW5C-18	BW5C-20	BW5C-21	Total
Aquatic Emergent	Yellow pond-lily	*Nuphar variegata*	Native						√		√	√		√	√	√	√	√	√		√	√		√			√	√	√	√		**16**
	Arrow-arum	*Peltandra virginica*	Native				√							√		√		√	√		√								√	√		**8**
	Pickerelweed	*Pontederia cordata*	Native		√				√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**22**
	Common arrowhead	*Sagittaria latifolia*	Native		√			√		√					√								√			√			√		√	**8**
	Arrowhead	*Sagittaria sp.*	Native															√														**1**
	Great bur-reed	*Sparganium eurycarpum*	Native		√	√		√	√	√	√		√			√			√	√	√	√	√		√			√	√			**16**
	Bur-reed	*Sparganium sp.*	Native											√	√			√			√											**4**
Floating and Submerged Aquatics	Water-shield	*Brasenia schreberi*	Native									√																				**1**
	Vernal water-starwort	*Callitriche palustris*	Native					√																								**1**
	Coontail	*Ceratophyllum demersum*	Native	√					√		√	√		√	√		√	√	√		√											**10**
	Common waterweed	*Elodea canadensis*	Native								√	√		√	√	√	√	√		√	√	√		√	√	√	√	√	√	√	√	**18**
	Common duckweed	*Lemna minor*	Native						√									√	√		√			√		√			√	√	√	**9**
	Common water-primrose	*Ludwigia palustris*	Native	√				√		√								√														**4**
	Eurasian water-milfoil	*Myriophyllum spicatum*	Invasive[A,B]									√	√		√	√			√	√	√	√	√	√		√	√	√	√	√	√	**16**
	Guadalupe waternymph	*Najas guadalupensis*	Native																√													**1**
	Big-leaved pondweed	*Potamogeton amplifolius*	Native											√	√				√		√											**4**
	Curly pondweed	*Potamogeton crispus*	Invasive[A,B,C]						√										√		√			√			√	√	√	√	√	**9**
	Ribbon-leaved pondweed	*Potamogeton epihydrus*	Native						√				√	√	√	√			√		√			√							√	**9**
	Floating pondweed	*Potamogeton natans*	Native																			√	√	√		√						**4**
	Long-leaved pondweed	*Potamogeton nodosus*	Native																						√		√	√	√	√		**5**
	Pondweed	*Potamogeton sp.*	Native										√				√	√														**3**
	Water chestnut	*Trapa natans*	Invasive[A,B,C]						√						√				√		√	√	√	√	√			√	√	√	√	**12**
	Common bladderwort	*Utricularia vulgaris*	Native														√															**1**
	American eelgrass	*Vallisneria americana*	Native												√				√													**2**
Herb, Forb, and Grass Species	Swamp milkweed	*Asclepias incarnata*	Native															√										√				**2**
	Nodding beggar-ticks	*Bidens cernua*	Native		√					√																						**2**
	Small-spiked false nettle	*Boehmeria cylindrica*	Native				√																									**1**
	Black mustard	*Brassica nigra*	Non-native				√																									**1**
	Lakeside sedge	*Carex lacustris*	Native				√																									**1**
	Hop sedge	*Carex lupulina*	Native		√																											**1**
	Retrorse sedge	*Carex retrorse*	Native															√														**1**
	Chara	*Chara sp.*		√																		√										**2**
	Common dodder	*Cuscuta gronovii*	Native				√																									**1**
	Red-root flatsedge	*Cyperus erythrorhizos*	Native			√																										**1**
	Flatsedge	*Cyperus sp.*	Native			√																										**1**

Table 5-2: Backwater Plant Species Summary Data for Reaches 5B and 5C (continued)

				Reach 5B								Reach 5C																					
Layer	Common Name	Scientific Name	Status[1]	BW5B-1	BW5B-2	BW5B-3	BW5B-4	BW5B-5	BW5B-6	BW5B-7	BW5B-8	BW5C-1	BW5C-2	BW5C-3	BW5C-4	BW5C-5	BW5C-6	BW5C-7	BW5C-8	BW5C-9	BW5C-10	BW5C-11	BW5C-12	BW5C-13	BW5C-14	BW5C-15	BW5C-16	BW5C-17	BW5C-18	BW5C-20	BW5C-21	Total
	Straw-colored flatsedge	*Cyperus strigosus*	Native	√																												**1**
	Common barnyard grass	*Echinochloa crus-galli*	Non-native			√																										**1**
	Wild cucumber	*Echinocystis lobata*	Native		√		√			√																						**3**
	Needle spikesedge	*Eleocharis acicularis*	Native															√														**1**
	Common spikesedge	*Eleocharis palustris*	Native			√		√																						√		**3**
	Tall scouring-rush	*Equisetum hyemale*	Native															√														**1**
	American burnweed	*Erechtites hieraciifolius*	Native			√																										**1**
	Spotted Joe-Pye weed	*Eutrochium maculatum*	Native	√																												**1**
	Rough bedstraw	*Galium asprellum*	Native				√											√														**2**
	Floodplain avens	*Geum laciniatum*	Native															√														**1**
	Jewelweed	*Impatiens capensis*	Native		√		√												√													**3**
	Yellow iris	*Iris pseudacorus*	Invasive[A,B]	√	√		√					√		√							√											**6**
	Rice cut grass	*Leersia oryzoides*	Native		√	√		√				√						√														**5**
	Cardinal-flower	*Lobelia cardinalis*	Native		√																											**1**
	Purple loosestrife	*Lythrum salicaria*	Invasive[A,B,C]	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	**27**
	Ostrich fern	*Matteuccia struthiopteris*	Native		√							√																				**2**
	Monkey-flower	*Mimulus ringens*	Native			√	√			√																						**3**
	Water forget-me-not	*Myosotis scorpioides*	Invasive[D]	√			√			√									√						√							**5**
	Sensitive fern	*Onoclea sensibilis*	Native	√	√				√	√		√																				**5**
	Ditch-stonecrop	*Penthorum sedoides*	Native	√	√		√	√		√																						**5**
	Water-pepper smartweed	*Persicaria hydropiper*	Native															√														**1**
	False water-pepper smartweed	*Persicaria hydropiperoides*	Native	√	√	√	√		√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	**26**
	Dock-leaved smartweed	*Persicaria lapathifolia*	Native	√																			√									**2**
	Pennsylvania smartweed	*Persicaria pensylvanica*	Native				√																									**1**
	Arrow-leaved tearthumb	*Persicaria sagittata*	Native				√											√														**2**
	Reed canary grass	*Phalaris arundinacea*	Invasive[A,B,C]			√	√												√		√		√							√		**6**
	Phragmites	*Phragmites australis*	Invasive[A,B,C]																							√						**1**
	Greater water dock	*Rumex britannica*	Native																	√								√				**2**
	Soft-stemmed club-bulrush	*Schoenoplectus tabernaemontani*	Native		√	√	√	√																				√				**5**
	Woolgrass	*Scirpus cyperinus*	Native	√	√	√		√	√	√											√							√				**8**
	White campion	*Silene latifolia*	Non-native																√													**1**
	Water-parsnip	*Sium suave*	Native				√											√														**2**

Table 5-2: Backwater Plant Species Summary Data for Reaches 5B and 5C (continued)

				Reach 5B								Reach 5C																				
Layer	Common Name	Scientific Name	Status[1]	BW5B-1	BW5B-2	BW5B-3	BW5B-4	BW5B-5	BW5B-6	BW5B-7	BW5B-8	BW5C-1	BW5C-2	BW5C-3	BW5C-4	BW5C-5	BW5C-6	BW5C-7	BW5C-8	BW5C-9	BW5C-10	BW5C-11	BW5C-12	BW5C-13	BW5C-14	BW5C-15	BW5C-16	BW5C-17	BW5C-18	BW5C-20	BW5C-21	Total
	Broad-leaved cattail	*Typha latifolia*	Native				√												√		√			√	√		√		√		√	**8**
	Blue vervain	*Verbena hastata*	Native	√		√																										**2**
	blue water speedwell	*Veronica anagallis-aquatica*	Non-native							√																						**1**
	Rough cocklebur	*Xanthium strumarium*	Native				√																									**1**
Shrub Species	Speckled alder	*Alnus incana*	Native															√														**1**
	Buttonbush	*Cephalanthus occidentalis*	Native		√		√					√			√	√				√		√	√	√		√	√	√	√	√		**14**
	Silky dogwood	*Cornus amomum*	Native		√		√		√	√				√	√	√		√	√	√		√					√	√	√			**14**
	Hawthorn	*Crataegus sp.*	Native																√													**1**
	Morrow's honeysuckle	*Lonicera morrowii*	Invasive[A,B]							√									√													**2**
	European buckthorn	*Rhamnus cathartica*	Invasive[A,B,C]																√													**1**
	Multiflora rose	*Rosa multiflora*	Invasive[A,B,C]	√																												**1**
	White willow	*Salix alba*	Non-native													√		√														**2**
	Pussy willow	*Salix discolor*	Native															√														**1**
	Black willow	*Salix nigra*	Native				√		√												√											**3**
	Silky willow	*Salix sericea*	Native																								√		√	√		**3**
	Smooth arrowwood	*Viburnum dentatum*	Native															√														**1**
Tree Species	Red Maple	*Acer rubrum*	Native									√				√											√	√				**4**
	Silver Maple	*Acer saccharinum*	Native	√	√		√		√			√							√	√		√										**8**
	American hornbeam	*Carpinus caroliniana*	Native											√																		**1**
	American linden	*Tilia americana*	Native	√					√	√																						**3**

[1] Invasive Ratings: A= MIPAG Invasive; B=IPANE Invasive; C=ACOE Invasive; D=MIPAG Likely Invasive

Table 5-3: Data Collected during 2023-2024 surveys on amphibian breeding in Backwater Habitats of Reaches 5B and 5C

	Historical Data			2023 Biological Data				Physical Data (2023-2024)	
Backwater ID	Obligate Species[1,3]	Facultative Species[1]	Other Species[1]	Obligate Species (egg mass counts)[1,3]	Facultative Species[1]	Other Species[1]	Fish Presence	Permanency[2]	Perm Flowing Outlet?
BW5B-8				SS (5)		RSN	Y	P	Y
BW5C-1	SS, WF	GTF, SP	ST, RSN, NLF, PF, GF	SS (8)			Y	P	Y
BW5C-5	None	None	RSN, GF	SS (5)	SP	PT	Y	P	Y
BW5C-7				SS (16)		PT, RSN	Y	P	Y
BW5C-10	SS	SP	RSN, NLF	SS (26)		RSN	Y	P	Y
BW5C-12	SS, WF	SP	ST, RSN, NLF, PF, GF	SS (18)		RSN	Y	P	Y
BW5C-14	SS, WF	SP	ST, RSN, NLF, PF, GF	SS (31)		PT	Y	P	Y
BW5C-15				SS (12)		RSN	Y	P	Y
BW5C-16				SS (38)	SP	PT, RSN	Y	P	Y
BW5C-18	SS	None	None	SS (33)	SP	ST, RSN	Y	P	Y
BW5C-21				SS (33)		ST, RSN	Y	P	Y

1. Species abbreviations:

Code	Meaning	Code	Meaning
Obligate Species		***Other Species***	
WF	Wood Frog	BF	Bull Frog
SS	Spotted Salamander	GF	Green Frog
JS	Jefferson Salamander	NLF	Northern Leopard Frog
FS	Fairy Shrimp	PF	Pickerel Frog
Facultative Species		PT	Painted Turtle
AT	American Toad	RSN	Red Spotted Newt
GTF	Gray Tree Frog	ST	Snapping Turtle
SP	Spring Peeper	WT	Wood Turtle

2. Hydrologic Code:

Code	Meaning
T[a]	Temporary pool, observed with no surface water
T[b]	Temporary pool, observed nearly dry in late spring, expected to dry out entirely during summer of a normal hydrological year
P	Expected to be permanently flooded

3. Obligate species listed consist of egg masses for amphibians except where adults and/or larvae are noted, or fairy shrimp.

Table 5-4: Reaches 5B and 5C Backwaters –Biotic Habitat Features

	Wildlife Food[1]			Cover/Perches/Basking/Denning/Nesting Habitat[1]													
Backwater ID	Wetland and Aquatic Food	Live or Dead Trees >30" DBH	Standing dead trees with cavities and perches	Cavities in trunks or limbs of Live Trees	Small mammal burrows on banks	Dense herb cover on banks	Large woody debris in contact with water	Rocks, crevices, logs, roots, hummocks under water surface	Rock, crevices, logs, branches, hummocks at or within 1 m above water	Live or Dead Tall Veg over/near water	Flat rocks or logs on banks or in exposed areas of backwater	Underwater banks of fine silt and/or clay	Undercut or overhanging banks	Mud flats	Vertical Sandy Banks	Open sandy to gravelly soils with sparse vegetation	Emergent wetlands
BW5B-1	√	ø	ø	√	ø	*	*	*	√	*	√	ø	ø	ø	ø	ø	√
BW5B-2	*	ø	√	√	ø	*	ø	ø	ø	*	√	ø	ø	ø	ø	ø	√
BW5B-3	*	√	ø	√	ø	*	ø	ø	√	*	ø	ø	ø	ø	ø	ø	ø
BW5B-4	√	√	ø	√	ø	*	ø	ø	ø	*	ø	ø	ø	ø	ø	ø	√
BW5B-5	*	ø	ø	√	ø	*	√	ø	*	*	ø	ø	ø	√	ø	ø	√
BW5B-6	√	ø	√	√	ø	*	√	√	√	*	√	ø	ø	ø	ø	ø	√
BW5B-7	*	√	√	√	ø	*	√	√	√	*	√	ø	ø	ø	ø	ø	√
BW5B-8	√	ø	ø	√	ø	*	ø	ø	ø	√	ø	ø	ø	√	ø	ø	ø
BW5C-1	√	√	ø	√	ø	*	√	√	√	*	√	ø	ø	ø	ø	ø	√
BW5C-2	√	√	√	√	ø	*	ø	ø	√	*	ø	ø	ø	ø	ø	ø	ø
BW5C-3	√	ø	√	√	ø	*	*	*	*	*	√	√	√	ø	ø	ø	√
BW5C-4	*	ø	√	√	ø	*	√	√	*	*	ø	ø	ø	ø	ø	ø	√
BW5C-5	*	ø	√	√	ø	*	ø	ø	√	√	ø	ø	ø	ø	ø	ø	√
BW5C-6	√	ø	ø	ø	ø	*	√	ø	ø	*	ø	ø	ø	ø	ø	ø	ø
BW5C-7	*	ø	√	√	*	*	√	√	*	*	ø	ø	√	ø	ø	ø	√
BW5C-8	√	ø	√	√	ø	*	*	√	*	*	ø	√	√	√	ø	ø	ø
BW5C-9	*	√	ø	√	ø	*	ø	ø	√	*	√	ø	ø	ø	ø	ø	√
BW5C-10	*	ø	√	√	ø	*	ø	√	√	√	ø	ø	ø	ø	ø	ø	√
BW5C-11	*	ø	√	√	ø	*	√	√	ø	*	ø	ø	ø	ø	ø	ø	√
BW5C-12	*	ø	ø	ø	ø	*	√	√	ø	*	ø	ø	ø	ø	ø	ø	√
BW5C-13	*	ø	*	√	ø	*	√	√	ø	*	√	ø	ø	ø	ø	ø	√
BW5C-14	*	ø	ø	ø	ø	*	√	√	ø	*	ø	ø	ø	ø	ø	ø	√
BW5C-15	*	ø	√	ø	ø	*	√	√	ø	*	ø	ø	ø	ø	ø	ø	√
BW5C-16	*	ø	ø	√	ø	*	√	√	ø	*	ø	ø	ø	ø	ø	ø	√
BW5C-17	*	ø	√	√	ø	*	√	√	√	*	√	ø	ø	ø	ø	ø	√
BW5C-18	*	ø	√	√	ø	*	√	√	ø	*	N/A	√	ø	ø	ø	ø	√
BW5C-20	*	ø	√	ø	ø	*	√	√	ø	*	√	ø	ø	ø	ø	ø	√
BW5C-21	*	ø	√	ø	ø	*	ø	√	√	*	√	ø	ø	ø	ø	ø	√

[1] See Table 5-4 for wildlife associations with listed habitat features

* =Abundant; √=Present; ø=Absent

Table 5-5: Reaches 5B and 5C Backwaters: Summary of Biotic Habitat Features

Habitat Feature	Wildlife Use	% of Stations Abundant	% of Stations Present	% of Stations Absent
Wetland and Aquatic Food	Overall food	69	31	0
Live or Dead Trees >30" DBH	Cover/perching/nesting	3	21	76
Standing dead trees with cavities and perches	Cavities/perching/breeding/nesting/feeding	7	55	38
Cavities in trunks or limbs of Live Trees	Cavities/perching/breeding/nesting	3	76	21
Small mammal burrows on banks	Hibernation/breeding/nesting/escape/cover	7	0	93
Dense herb cover on banks	Voles, small mammals, amphibians, reptiles	100	0	0
Large woody debris in contact with water	Small mammals, amphibians, reptiles, invertebrate emergence	14	55	31
Rocks, crevices, logs, roots, hummocks under water surface	Turtles, snakes, frogs, invertebrate emergence	10	59	31
Rock, crevices, logs, branches, hummocks at or within 1 m above water	Turtles, snakes, frogs, wading birds, wood duck, mink, raccoon	21	38	41
Live or Dead Tall Veg over/near water	Habitat offering good visibility of open water for, e.g., osprey, kingfisher, flycatchers, cedar waxwings. Vegetation closer to ground for turtles, snakes, frogs, wading birds, wood duck, mink, raccoon	90	10	0
Flat rocks or logs on banks or in exposed areas of backwater	Cover and basking for herpetofauna	7	38	55
Underwater banks of fine silt and/or clay	Beaver, muskrat, otter	3	10	86
Undercut or overhanging banks	Small mammals, mink, weasels, turtles	3	10	86
Mud flats	Feeding sites for birds, small mammals, herps	3	10	86
Vertical Sandy Banks	Nesting bank swallows and kingfishers; Turtles	3	0	97
Open sandy to gravelly soils with sparse vegetation	Turtle nesting habitat	3	0	97
Emergent wetlands	Habitat for common snipe, spotted sandpiper, sedge wren, least bittern, common moorhen (Flooded > 5cm) and pied-billed grebe (Flooded > 25cm)	3	79	17

Table 5-6: State-Listed Rare Species Potentially Associated with Backwater Habitats of Reaches 5B and 5C[1]

Scientific Name	Common Name	State Status
	Reach 5B	
Botaurus lentiginosus	American Bittern	Endangered
Eleocharis intermedia	Matted Spike-sedge	Threatened
Eragrostis frankii	Frank's Lovegrass	Special Concern
Glyptemys insculpta	Wood Turtle	Special Concern
Hylogomphus abbreviatus	Spine-crowned Clubtail	Special Concern
Phanogomphus quadricolor	Rapids Clubtail	Endangered
Sagittaria cuneata	Wapato	Threatened
	Reach 5C	
Botaurus lentiginosus	American Bittern	Endangered
Eleocharis intermedia	Matted Spike-sedge	Threatened
Gallinula galeata	Common Gallinule	Special Concern
Glyptemys insculpta	Wood Turtle	Special Concern
Haliaeetus leucocephalus	Bald Eagle	Special Concern
Phanogomphus quadricolor	Rapids Clubtail	Endangered
Sagittaria cuneata	Wapato	Threatened
Sorex palustris	Water Shrew	Special Concern

[1] This list includes only species for which MNHESP provided Species Habitat mapping. In addition, review of the U.S. Fish and Wildlife Service (USFWS) on-line Information, Planning, and Consultation System (IPaC) for identification of federally listed rare species (USFWS 2023) resulted in the identification of habitat for one such listed species – the northern long-eared bat (*Myotis septentrionalis*) – and two species proposed for listing – the tricolored bat (*Perimyotis subflavus*) and the monarch butterfly (*Danaus plexippus*) – in Reaches 5B and 5C. Although habitat for all of these species is mapped within the entirety of Reaches 5B and 5C, there is potential foraging habitat within backwaters of Reaches 5B and 5C only for the two bat species.

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5B-1				
8/12/2024	1	7.38	20.44	284.30	55.00	4.95	ND	4.4
	2	7.32	20.77	279.40	39.60	3.54	ND	5.0
	3	7.64	21.19	286.60	87.50	7.63	ND	8.3
8/30/2024	1	7.42	16.82	308.50	36.20	3.51	0.009	63.8
	2	7.50	18.94	325.20	21.60	2.01	ND	9.0
	3	7.59	19.53	354.30	51.80	4.75	0.011	27.9
Total Average		**7.48**	**19.61**	**306.38**	**48.62**	**4.40**	**0.200**	**19.9**
				BW5B-2				
8/12/2024	1	6.90	18.98	226.80	12.00	1.09	0.005	1.8
	2	6.97	17.86	233.80	30.20	2.87	0.007	1.2
	3	6.98	17.58	244.50	20.20	1.93	0.005	1.9
8/30/2024	1	7.71	17.97	274.70	68.10	6.45	0.006	42.1
	2	7.64	19.19	283.80	75.90	7.01	0.006	39.5
	3	7.34	18.54	295.20	48.20	4.52	0.006	43.4
Total Average		**7.26**	**18.35**	**259.80**	**42.43**	**3.98**	**0.006**	**21.7**
				BW5B-3				
8/12/2024	1	6.90	19.05	255.60	19.20	1.79	0.006	15.6
	2	6.91	19.21	262.60	20.30	1.87	0.009	6.3
	3	6.87	19.24	265.50	14.70	1.36	0.004	135.1
8/30/2024	Backwater was dry							
Total Average		**6.89**	**19.17**	**261.23**	**18.07**	**1.67**	**0.007**	**52.3**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5B-4				
8/12/2024	1	6.86	19.54	165.30	36.20	3.32	ND	31.1
	2	6.72	19.23	175.80	21.40	1.97	0.008	22.0
	3	6.54	18.76	120.80	23.80	2.24	0.010	16.5
8/30/2024				Backwater was dry				
Total Average		**6.71**	**19.18**	**153.97**	**27.13**	**2.51**	**0.232**	**23.2**
				BW5B-5				
8/12/2024	1	7.11	16.10	332.90	60.80	5.98	0.003	4.3
	2	7.18	15.13	330.40	60.80	6.14	0.008	177.5
	3	7.19	15.57	338.20	67.20	6.69	0.003	3.1
8/30/2024	1	7.72	18.49	376.20	104.70	9.80	0.004	87.5
	2	7.74	16.86	377.20	101.20	9.80	0.002	26.1
	3	7.71	16.50	378.70	100.40	9.80	0.001	41.8
Total Average		**7.44**	**16.44**	**355.60**	**82.52**	**8.04**	**0.004**	**56.7**
				BW5B-6				
8/12/2024	1	7.17	21.08	255.70	31.70	2.83	0.007	1.6
	2	7.14	20.70	268.60	7.30	0.66	0.013	2.4
	3	7.10	21.17	244.00	22.30	2.00	0.005	1.4
8/30/2024	1	7.52	20.99	395.40	70.60	6.29	0.011	34.0
	2	7.47	21.74	386.90	73.80	6.49	0.009	31.7
	3	7.29	22.16	451.60	34.50	3.00	0.007	25.4
Total Average		**7.28**	**21.31**	**333.70**	**40.03**	**3.55**	**0.009**	**16.1**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5B-7				
8/12/2024	1	6.87	18.32	245.10	14.50	1.36	0.005	7.3
	2	6.96	18.37	259.70	27.70	2.60	0.012	85.4
	3	6.89	18.00	260.20	30.60	2.95	0.006	80.0
8/30/2024				Backwater was dry				
Total Average		**6.91**	**18.23**	**255.00**	**24.27**	**2.30**	**0.008**	**57.5**
				BW5B-8				
8/12/2024	1	6.95	17.77	169.50	58.90	5.48	0.003	4.4
	2	7.18	18.97	167.20	55.30	5.24	0.003	13.3
	3	7.16	19.24	183.40	56.20	5.21	0.003	12.1
8/30/2024	1	8.55	20.57	137.00	150.50	13.52	0.003	31.7
	2	7.97	20.60	133.30	141.10	12.67	0.003	26.9
	3	8.45	20.58	151.50	127.00	11.40	0.002	31.3
Total Average		**7.71**	**19.62**	**156.98**	**98.17**	**8.92**	**0.003**	**19.9**
				BW5C-1				
8/12/2024	1	7.02	19.45	236.20	32.00	3.01	0.005	13.1
	2	6.98	19.45	213.20	34.10	3.15	0.005	18.0
	3	7.00	19.73	215.60	60.50	5.58	0.007	15.9
9/5/2024	1	7.79	15.44	337.10	68.50	6.83	0.007	31.0
	2	7.61	15.81	307.40	64.10	6.36	0.007	36.3
	3	7.30	15.69	259.50	45.60	4.54	0.014	34.8
Total Average		**7.28**	**17.60**	**261.50**	**50.80**	**4.91**	**0.007**	**24.8**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5C-2				
8/12/2024	1	7.53	20.55	278.60	79.00	7.17	0.002	16.0
	2	7.68	20.21	299.40	83.40	7.55	0.003	38.2
	3	7.66	20.04	301.70	81.90	7.44	0.003	20.6
9/5/2024	1	7.96	16.87	476.40	88.50	8.56	0.009	19.2
	2	7.98	19.13	458.30	83.60	7.73	0.008	25.4
	3	8.32	20.96	452.00	115.00	10.25	0.008	29.7
Total Average		**7.86**	**19.63**	**377.73**	**88.57**	**8.12**	**0.006**	**24.8**
				BW5C-3				
8/12/2024	1	7.15	20.50	220.90	48.30	4.39	0.004	22.6
	2	7.06	20.35	222.20	40.30	3.84	0.007	24.9
	3	7.06	19.86	217.10	44.00	4.01	0.005	13.4
9/5/2024	1	8.32	22.87	281.80	120.10	10.31	0.004	16.7
	2	7.52	18.35	267.40	62.00	5.83	0.011	37.6
	3	7.85	21.92	266.80	104.00	9.10	0.012	39.7
Total Average		**7.49**	**20.64**	**246.03**	**69.78**	**6.25**	**0.007**	**25.8**
				BW5C-4				
8/12/2024	1	7.63	20.75	287.00	80.30	7.20	0.003	12.4
	2	7.36	20.01	305.00	65.50	6.00	0.003	15.3
	3	7.76	19.68	323.90	96.40	8.80	0.003	22.0
9/5/2024	1	8.01	21.55	476.60	104.70	9.22	0.002	14.4
	2	8.09	21.88	468.90	120.20	10.52	0.009	18.4
	3	7.52	18.56	496.00	62.30	5.82	0.010	19.6
Total Average		**7.73**	**20.41**	**392.90**	**88.23**	**7.93**	**0.005**	**17.0**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5C-5				
8/12/2024	1	7.10	20.47	261.50	45.30	4.08	0.004	21.6
	2	7.08	20.26	269.40	36.00	3.26	0.003	16.5
	3	7.09	20.38	198.50	37.80	3.42	0.004	11.1
9/5/2024	1	8.61	24.08	458.60	152.30	12.79	0.009	25.8
	2	7.73	22.66	470.50	116.90	10.08	0.004	31.1
	3	7.35	21.63	460.80	92.10	8.10	0.004	44.3
Total Average		**7.49**	**21.58**	**353.22**	**80.07**	**6.96**	**0.005**	**25.1**
				BW5C-6				
8/12/2024	1	7.10	20.59	248.10	34.50	3.11	0.005	12.9
	2	7.07	20.94	234.20	44.60	4.00	0.009	25.3
	3	7.03	21.26	222.00	40.20	3.55	0.008	19.3
9/5/2024	1	7.71	24.38	376.00	121.50	10.14	0.008	25.0
	2	7.72	25.33	400.50	125.20	10.28	0.003	16.9
	3	7.49	24.78	450.70	92.30	7.65	0.004	35.4
Total Average		**7.35**	**22.88**	**321.92**	**76.38**	**6.46**	**0.006**	**22.5**
				BW5C-7				
8/12/2024	1	7.04	20.95	232.50	40.10	3.60	0.004	22.0
	2	7.17	21.35	205.20	52.30	4.60	0.005	25.2
	3	7.17	20.49	187.70	58.90	5.24	0.009	24.4
9/5/2024	1	7.54	24.79	166.90	106.90	8.85	0.003	37.7
	2	8.90	24.40	158.70	127.40	13.14	0.012	40.0
	3	8.58	22.98	160.60	140.30	12.03	0.014	38.5
Total Average		**7.73**	**22.49**	**185.27**	**87.65**	**7.91**	**0.008**	**31.3**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5C-8				
8/13/2024	1	7.08	18.14	283.40	32.00	3.02	0.007	14.4
	2	7.67	19.39	319.30	80.40	7.40	0.002	27.5
	3	7.66	19.66	318.40	79.40	7.26	0.003	7.3
9/5/2024	1	8.32	23.26	481.40	122.40	10.44	0.001	41.1
	2	8.03	21.59	487.40	105.20	9.26	0.001	41.1
	3	8.00	20.63	487.20	103.20	9.26	0.001	18.4
	4	8.61	24.65	470.80	140.70	11.67	0.006	65.2
Total Average		**7.91**	**21.05**	**406.84**	**94.76**	**8.33**	**0.003**	**30.7**
				BW5C-9				
8/13/2024	1	7.06	19.48	298.20	36.00	3.30	0.003	23.3
	2	6.93	18.92	288.20	26.30	2.45	0.004	14.9
	3	6.97	18.28	303.20	27.50	2.59	0.005	10.5
9/6/2024	Backwater was dry							
Total Average		**6.99**	**18.89**	**296.53**	**29.93**	**2.78**	**0.004**	**16.2**
				BW5C-10				
8/13/2024	1	7.68	20.19	315.60	81.50	7.37	0.002	3.2
	2	7.52	20.22	311.20	75.70	6.84	0.003	18.5
	3	7.30	19.07	303.30	51.80	4.79	0.004	25.7
9/6/2024	1	7.51	18.22	458.50	40.00	3.75	0.006	38.9
	2	7.97	18.08	470.20	81.30	7.68	0.002	12.1
	3	7.65	18.67	449.80	67.50	6.30	0.004	10.5
Total Average		**7.61**	**19.08**	**384.77**	**66.30**	**6.12**	**0.003**	**18.1**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5C-11				
8/13/2024	1	7.01	18.92	262.60	16.00	1.50	0.004	33.6
	2	6.99	18.53	269.50	16.70	1.56	0.007	7.7
	3	7.03	18.15	274.60	26.50	2.55	0.006	9.5
9/6/2024	1	7.94	18.94	492.90	96.20	8.92	0.002	18.6
	2	7.30	18.61	461.00	48.20	4.50	0.010	45.4
	3	7.51	19.25	436.10	73.70	6.80	0.006	32.4
Total Average		**7.30**	**18.73**	**366.12**	**46.22**	**4.31**	**0.006**	**24.5**
				BW5C-12				
8/13/2024	1	7.05	18.95	248.80	27.00	2.51	0.004	12.5
	2	7.14	18.86	265.90	37.00	3.44	0.005	21.8
	3	7.04	18.92	268.80	22.10	2.06	0.007	26.0
9/6/2024	1	7.65	19.95	392.90	79.10	7.19	0.005	26.5
	2	7.55	19.96	390.40	62.90	6.17	0.006	29.1
	3	7.56	20.05	394.30	83.60	7.59	0.010	30.6
Total Average		**7.33**	**19.45**	**326.85**	**51.95**	**4.83**	**0.006**	**24.4**
				BW5C-13				
8/13/2024	1	7.14	20.65	256.00	45.50	4.08	0.003	32.1
	2	8.47	21.73	276.60	105.00	9.21	0.021	20.0
	3	7.63	22.38	313.50	73.50	6.38	0.004	14.1
9/6/2024	1	8.58	21.18	43.40	125.70	11.15	0.018	41.4
	2	8.41	21.56	413.60	102.50	9.03	0.005	34.7
	3	7.80	21.48	417.50	78.50	6.93	0.004	20.0
Total Average		**8.01**	**21.50**	**286.77**	**88.45**	**7.80**	**0.009**	**27.0**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5C-14				
8/13/2024	1	8.96	19.26	170.00	174.60	16.11	0.005	20.7
	2	7.39	18.76	183.00	115.00	10.70	0.003	21.1
	3	7.20	18.35	187.50	87.60	8.17	0.002	6.8
9/6/2024	1	9.42	20.01	101.90	136.40	12.38	0.002	22.6
	2	9.56	18.90	93.80	140.30	13.03	0.002	39.6
	3	9.74	18.86	91.90	146.70	13.64	0.007	42.5
Total Average		**8.71**	**19.02**	**138.02**	**133.43**	**12.34**	**0.003**	**25.5**
				BW5C-15				
8/13/2024	1	7.03	20.52	217.80	53.30	4.78	0.005	33.2
	2	7.05	21.56	197.00	82.00	7.24	0.009	11.9
	3	7.33	21.01	264.00	76.80	6.82	0.006	11.0
9/6/2024	1	8.89	22.97	310.60	164.60	14.12	0.015	24.0
	2	7.79	26.06	307.70	96.30	8.40	0.005	34.1
	3	7.86	22.09	303.00	96.90	8.45	0.005	36.7
Total Average		**7.66**	**22.37**	**266.68**	**94.98**	**8.30**	**0.007**	**25.1**
				BW5C-16				
8/13/2024	1	6.74	18.35	179.20	16.00	1.52	0.006	12.0
	2	7.41	19.42	203.90	39.20	3.61	0.039	32.2
	3	7.06	19.40	252.10	15.70	1.45	0.007	28.3
9/6/2024	1	8.00	22.35	260.20	100.60	8.73	0.003	37.0
	2	7.99	21.45	225.80	98.50	8.70	0.008	8.2
	3	9.41	22.79	203.50	165.20	14.21	0.008	34.4
Total Average		**7.77**	**20.63**	**220.78**	**72.53**	**6.37**	**0.012**	**25.3**

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
				BW5C-17				
8/13/2024	1	7.03	20.33	288.60	15.60	1.42	0.012	27.0
	2	7.22	22.24	506.00	49.30	4.29	0.006	22.8
	3	7.37	22.14	510.00	67.00	5.89	0.018	13.0
9/6/2024	1	8.36	23.24	551.00	133.90	11.41	0.007	42.9
	2	7.35	18.04	619.00	36.90	3.46	0.013	43.2
	3	8.32	21.33	622.00	133.40	11.84	0.005	35.8
Total Average		**7.61**	**21.22**	**516.10**	**72.68**	**6.39**	**0.010**	**30.8**
				BW5C-18				
8/13/2024	1	8.35	22.82	302.50	134.20	11.54	0.003	11.8
	2	8.0	22.90	286.60	94.10	8.07	0.004	21.0
	3	7.67	21.83	257.70	67.60	5.97	0.009	19.6
9/6/2024	1	8.65	21.93	385.00	125.00	10.99	0.007	25.3
	2	8.42	22.78	402.30	120.00	10.33	0.007	33.5
	3	8.69	23.40	354.70	117.10	9.96	0.003	20.9
Total Average		**8.30**	**22.61**	**331.47**	**109.67**	**9.48**	**0.006**	**22.0**
				BW5C-20				
8/13/2024	1	7.38	23.58	504.00	73.00	6.19	0.003	25.3
	2	7.32	22.22	532.00	52.90	4.60	0.004	16.0
	3	7.61	23.34	513.00	86.90	7.38	0.003	4.2
9/6/2024	1	8.98	22.52	469.80	194.20	16.80	0.021	69.2
	2	8.68	23.51	474.70	160.40	13.59	0.002	32.7
	3	8.61	22.07	457.60	145.10	12.62	0.005	29.5
Total Average		**8.10**	**22.87**	**491.85**	**118.75**	**10.20**	**0.006**	**29.5**
				BW5C-21				

Table 5-7: Water Chemistry of Backwater Habitats of Reaches 5B and 5C (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen %	Dissolved Oxygen mg/l	Chlorophyll-a mg/l[1]	Turbidity NTU
8/13/2024	1	7.81	20.73	314.10	91.20	8.17	0.002	37.3
	2	8.23	22.47	310.50	117.00	10.18	0.002	27.7
	3	7.61	22.24	260.00	87.50	7.60	0.002	10.3
9/6/2024	1	8.27	20.97	481.70	122.50	10.89	0.005	27.9
	2	8.52	21.88	474.30	147.80	12.94	0.006	14.2
	3	8.52	21.86	475.70	147.50	12.90	0.005	18.4
Total Average		**8.16**	**21.69**	**386.05**	**118.92**	**10.45**	**0.004**	**22.6**

1. ND = No Data, chlorophyll sensor would not stabilize.

Table 5-8: Reaches 5B and 5C Backwater Function Assessment Factors

Functional Category	Description of Functions	Parameters/Factors Considered in Assessing Function (see Table 5-1)
Hydrology/hydraulic	Floodwater dynamics (flood flow amelioration, flood storage and desynchronization, peak rate control)	Physical dimensions; hydrology and connectivity to river
Geomorphology	Deposition and storage of organic and mineral sediment material	Hydrology and connectivity to river; sediment composition; aquatic plant community; large woody debris; aquatic biota
Physicochemical	Water quality maintenance; temperature and oxygen regulation; processing of organic matter and nutrients	Hydrology and connectivity to river; water quality; aquatic plant community; aquatic biota habitat
Biological	Biodiversity and sustaining life stages of fish and other aquatic biota; habitat for aquatic and other water-using biota; rare species habitat	Hydrology and connectivity to river; aquatic plant community; bordering habitat types; large woody debris; water quality; habitat for aquatic and other water-using biota; rare species habitat (mapped Priority Habitat and Core Area habitat and IPaC results); invasive plant and animal species; presence of special habitat features; incidental wildlife observations

Table 6-1: Wetland Community Types* in Reaches 5B and 5C

Community Type	Description
Wet Meadow	Herbaceous emergent wetlands that are periodically disturbed by mowing or grazing or possibly sustained by hydrologic factors.
Shallow Emergent Marsh	Herb-dominated wetland community with saturated soils or inundated at some locations. Vegetation diverse, but lacking robust, grass-like herbs characteristic of deep emergent marshes.
Deep Emergent Marsh	Herb-dominated wetland community that often remains inundated with water through the growing season. Dominated by robust graminoids grass-like plants or aquatic, broad-leaved herbs.
Shrub Swamp	Hydric shrublands lacking a closed canopy.
Red Maple Swamp	Hydric forests dominated by red maple.
Red Maple, Black Ash, Bur Oak Swamp	Hydric forests dominated by red maple, black ash, and bur oak. Occur in high pH groundwater discharge areas.
Black ash-red maple-tamarack calcareous seepage swamp	Hydric forests dominated by red maple, black ash, and bur oak. Occur in high pH groundwater discharge areas.
Transitional Floodplain Forest	Riparian forests dominated by silver maple, box-elder, and American elm.
High-terrace Floodplain Forest	Riparian forests with a mixture of trees from wetter sites (e.g., silver maple, American elm) and trees from rich, upland sites (e.g., sugar maple, white ash, basswood). Herb layer with characteristic species of high-nutrient forests.
Moderately alkaline lake/pond	Ponds located in the central valley region with calcareous bedrock underneath.
High-gradient stream	Steep slopes >1% with rapid water flow, often with bed materials including bedrock, boulders, cobbles, and coarse gravel.

* Adapted From MNHESP Natural Community Fact Sheets and Woodlot (2002a) Ecological Characterization

Table 6-2: Upland Community Types* in Reaches 5B and 5C

Community Type	Description
Rich Mesic Forest	Upland forest with deep well drained mineral soils, rich in nutrients and species diversity. Typical species include sugar maple, white ash, bitternut hickory, basswood and elm species (slippery elm, American elm). Subcanopy is often dominated by hop hornbeam with a sparse shrub layer. Herbaceous layer is usually a dense mix of species including bloodroot, dutchman's breeches, toothwort, maidenhair fern, blue cohosh and zigzag goldenrod.
Red Oak–Sugar Maple Transition Forest	Upland forest with well drained upland mineral soils. Species are transitional between southern and northern types and include red oak, white ash, sugar maple, American beech, eastern hemlock, black birch in the canopy with maple-leaved viburnum, witch hazel, Christmas fern, and wild sarsaparilla beneath.
Northern Hardwoods–Hemlock–White Pine Forest	Upland forest with well drained upland mineral soils. Plant species are a mixture of broad-leaved and needle-leaved trees including red oak, eastern hemlock, white pine, and sugar maple. Other species may include hobblebush, striped maple, Christmas fern, Canada mayflower, bracken fern, princess-pine, and partridge berry.
Agricultural Field	Agricultural fields are upland areas of land used for farming activities, such as growing crops, raising livestock, or grazing animals. When not utilized for row crops, these fields may feature exposed or plowed soils, or be covered with varying levels of vegetation, often consisting of a mix of herbaceous plants, with upland grasses typically being the dominant species.
Cultural Grasslands	Includes open, upland fields dominated by grass-like herbs that are periodically disturbed (mowed) but may include sparse and stunted shrubs in unmanaged areas. Typical vegetation includes reed fescue, Timothy, Kentucky blue-grass, poverty grass, little bluestem, goldenrods, common milkweed, wild carrot, common evening primrose, spreading dogbane, common flat-topped goldenrod, and spotted knapweed. Shrubs may include willows, dogwoods, staghorn sumac, buckthorn. Upland mineral Soils are well drained.
Developed and Disturbed Areas	Includes dirt/gravel and paved surfaces, manmade structures, maintained lawns and upland scrub-shrub areas that have been disturbed (e.g., powerline corridors and old field habitats).

* Adapted From MNHESP Natural Community Fact Sheets and Woodlot (2002a) Ecological Characterization

Table 6-3: Comparison of Natural Community Cover Types Mapped between 2002 and 2024 in Reaches 5B and 5C

Natural Community / Cover Type	Woodlot 2002 (Acres)[1]	Natural Community / Cover Type	AECOM 2024 (Acres)[2]
		Reach 5B	
Moderately alkaline lake/pond	1.0	Moderately alkaline lake/pond	1.1
Low gradient stream	37.0	Low gradient stream	38.3
High gradient stream	0.0	High gradient stream	0.1
Wet meadow	27.0	Wet meadow	25.9
Shallow emergent marsh	18.4	Shallow emergent marsh	16.0
Deep emergent marsh	6.9	Deep emergent marsh	10.1
Shrub swamp	37.4	Shrub swamp	42.6
Red maple swamp	20.9	Red maple swamp	9.8
Transitional floodplain forest	26.6	Transitional floodplain forest	30.4
High-terrace floodplain forest	0.8	High-terrace floodplain forest	1.3
Northern hardwoods-hemlock-white pine forest	5.6	Northern hardwoods-hemlock-white pine forest	10.7
Red oak-sugar maple transition forest	0.8	Red oak-sugar maple transition forest	0.0
Successional northern hardwoods	0.5	Successional northern hardwoods	0.0
Agricultural Field	3.1	Agricultural Field	0.2
Cultural grasslands	9.8	Cultural grasslands	8.6
Riverine pointbar and beach	0.2	Riverine pointbar and beach	0.0
Developed / Disturbed	0.0	Developed / Disturbed	1.4
Total:	**196.1**	**Total:**	**196.5**
		Reach 5C	
Moderately alkaline lake/pond	7.2	Moderately alkaline lake/pond	6.2
Low gradient stream	108.6	Low gradient stream	114.3
High gradient stream	0.0	High gradient stream	0.1
Wet meadow	0.0	Wet meadow	2.0
Shallow emergent marsh	15.5	Shallow emergent marsh	8.6
Deep emergent marsh	8.4	Deep emergent marsh	16.2
Shrub swamp	62.1	Shrub swamp	105.6
Red maple swamp	31.1	Red maple swamp	42.6
Black ash-red maple-tamarack calcareous seepage swamp	77.3	Black ash-red maple-tamarack calcareous seepage swamp	0.0
Red Maple, Black Ash, Bur Oak Swamp	0.0	Red Maple, Black Ash, Bur Oak Swamp	26.9
Transitional floodplain forest	43.7	Transitional floodplain forest	28.2
Northern hardwoods-hemlock-white pine forest	5.3	Northern hardwoods-hemlock-white pine forest	8.5
Red oak-sugar maple transition forest	5.9	Red oak-sugar maple transition forest	7.3
Rich Mesic Forest	4.5	Rich Mesic Forest	5.1
Cultural grasslands	0.0	Cultural grasslands	0.1
Developed / Disturbed	0.0	Developed / Disturbed	0.8
Total:	**369.7**	**Total:**	**372.6**
Grand Total:	**565.8**	**Grand Total:**	**569.1**

1. Natural community mapping based on Woodlot 2002 ecological characterization.
2. Natural community mapping based on AECOM 2023-2024 field surveys, and interpretation of available aerial photography and LiDAR data.

Table 6-4: Floodplain Wetland Habitat Characterization in Reaches 5B and 5C

Parameter	Description of Parameter	Inventory Approach*
Mapping and classification; watershed setting/factors	Mapping of physical location and limits; natural community cover type classification and delineation; wetland-watershed relationships (position in watershed; size of wetland relative to watershed; watershed factors)	Woodlot 2002 Ecological Characterization mapping and classification in Reaches 5B and 5C (updated during 2023-2024 natural community mapping and morphology surveys); aerial photograph interpretation and updated LiDAR mapping; 2023-2024 field surveys to confirm mapping and obtain data for Form FP-1
Hydrogeologic setting	Surficial geology	USGS surficial geology information; U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil survey mapping
Hydrology	Degree of surface flooding; connectivity to river or other surface water flow; water regime (mean water level, fluctuation/maximum water depth to lowest water level). Evidence of groundwater discharge (springs/seeps, etc.)	Consolidate existing information (from sources below); Federal Emergency Management Agency Flood (FEMA) Flood Insurance Study (FIS); 2023-2024 field surveys to obtain data for Form FP-1
Soil composition and characteristics	Soil profile description; soils series as mapped by the USDA NRCS	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Plant community	Plant species by community type	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Overall wildlife habitat/use	Wildlife use; habitat suitability; surrounding land uses; corridor connectivity	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Special habitat features	Wolf trees; standing dead timber; tree cavities; large woody debris; turtle hibernacula or nesting sites	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Rare species habitat	Priority Habitat/Core Area Habitat mapping; IPaC results from USFWS on-line data base	MNHESP investigations and designations (including updated outreach to MNHESP); IPaC results; 2023-2024 field surveys to confirm mapping and obtain data for Form FP-1
Invasive species	Invasive plant species as designated by ACOE New England District or MIPAG	Review of invasive plant species lists from USACE New England District and MIPAG; consolidate existing information (from sources below); 2023-2024 field surveys to map invasive species and obtain data for Form FP-1

* The existing information used for Reaches 5B and 5C floodplain wetland habitat characterization includes information from the following sources: the 2002 Woodlot Ecological Characterization reports, the 2003 RFI Report, the 2010 example area evaluations and RCMS Report, the MNHESP investigations of state-listed species through 2022, the Reaches 5B and 5C vernal pool investigations; all described and referenced in Section 2 of the Revised Reaches 5B-8 BRA Work Plan – as well as the USDA NRCS soil surveys, USGS surficial geology mapping, and FEMA FIS.

Table 6-5: Floodplain Wetland Plant Species Summary Data for Reaches 5B and 5C

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=159)	Status[1]
Bryophyte	Shagnum moss	*Sphagnum sp.*	1	Native
Herb, Forb and Grass Species	Sweetflag	*Acorus americanus*	2	Native
	White snakeroot	*Ageratina altissima*	1	Native
	Tall hairy agrimony	*Agrimonia gryposepala*	1	Native
	Bentgrass	*Agrostis sp.*	1	Native
	Southern water-plantain	*Alisma subcordatum*	5	Native
	Northern water-plantain	*Alisma trivale*	2	Native
	Garlic Mustard	*Alliaria petiolata*	8	Invasive[A,B]
	Ramps	*Allium tricoccum*	2	Native
	Purple-stemmed Angelica	*Angelica atropurpurea*	1	Native
	Sweet vernalgrass	*Anthoxanthum odoratum*	1	Non-native
	Common ground-nut	*Apios americana*	1	Native
	Spreading dogbane	*Apocynum androsaemifolium*	1	Native
	Swamp milkweed	*Asclepias incarnata*	4	Native
	Common milkweed	*Asclepias syriaca*	3	Native
	Aster	*Aster sp.*	1	Native
	Lady fern	*Athyrium angustum*	4	Native
	Nodding beggar-ticks	*Bidens cernua*	1	Native
	Devil's beggar-tick	*Bidens frondosa*	5	Native
	Three-lobed beggar-ticks	*Bidens tripartita*	1	Native
	Hairy wood-mint	*Blephilia hirsuta*	1	Native
	Small-spiked false nettle	*Boehmeria cylindrica*	23	Native
	Northern long-awned wood grass	*Brachyelytrum aristosum*	1	Native
	Black mustard	*Brassica nigra*	6	Non-native
	Bluejoint	*Calamagrostis canadensis*	5	Native
	Wild calla	*Calla palustris*	1	Native
	Vernal water-starwort	*Callitriche palustris*	5	Native
	Hedge false bindweed	*Calystegia sepium*	4	Native
	Brome-like sedge	*Carex bromoides*	2	Native
	Bearded sedge	*Carex comosa*	6	Native
	Fringed sedge	*Carex crinita*	4	Native
	Porcupine sedge	*Carex hystericina*	1	Native
	Greater bladder sedge	*Carex intumescens*	1	Native
	Lakeside sedge	*Carex lacustris*	9	Native
	Woolly-fruited sedge	*Carex lasiocarpa*	2	Native
	Hop sedge	*Carex lupulina*	7	Native
	Retrorse sedge	*Carex retrorsa*	3	Native
	Sedge	*Carex sp.*	7	Native
	Tussock sedge	*Carex stricta*	16	Native
	Lesser bladder sedge	*Carex vesicaria*	1	Native
	Northern catalpa	*Catalpa speciosa*	1	Non-native

Table 6-5: Floodplain Wetland Plant Species Summary Data for Reaches 5B and 5C (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=159)	Status[1]
	Coontail	*Ceratophyllum demersum*	5	Native
	White turtlehead	*Chelone glabra*	4	Native
	Sweet wood-reed	*Cinna arundinacea*	4	Native
	Broad-leaved enchanter's-nightshade	*Circaea canadensis*	1	Native
	Creeping thistle	*Cirsium arvense*	1	Non-native
	Common dodder	*Cuscuta gronovii*	6	Native
	Eastern hay-scented fern	*Dennstaedtia punctilobula*	1	Native
	Tall white-aster	*Doellingeria umbellata*	3	Native
	Evergreen wood fern	*Dryopteris intermedia*	1	Native
	Three-way sedge	*Dulichium arundinaceum*	3	Native
	Wild cucumber	*Echinocystis lobata*	12	Native
	Needle spikesedge	*Eleocharis acicularis*	6	Native
	Common spikesedge	*Eleocharis palustris*	3	Native
	Spikerush	*Eleocharis sp.*	5	Native
	Common waterweed	*Elodea canadensis*	5	Native
	Common eastern wild-rye	*Elymus virginicus*	3	Native
	Willow-herb	*Epilobium coloratum*	4	Native
	Hairy willow-herb	*Epilobium hirsutum*	1	Non-native
	Field horsetail	*Equisetum arvense*	2	Native
	River horsetail	*Equisetum fluviatile*	7	Native
	Tall scouring-rush	*Equisetum hyemale*	1	Native
	Marsh horsetail	*Equisetum palustre*	1	Native
	Horsetail	*Equisetum sp.*	1	Native
	Wood horsetail	*Equisetum sylvaticum*	2	Native
	American burnweed	*Erechtites hieraciifolius*	1	Native
	Boneset	*Eupatorium perfoliatum*	3	Native
	Grass-leaved-goldenrod	*Euthamia graminifolia*	1	Native
	Spotted Joe-Pye weed	*Eutrochium maculatum*	27	Native
	Japanese winged-knotweed	*Fallopia japonica*	1	Invasive[A,B,C]
	Red fescue	*Festuca rubra*	2	Non-native
	Woodland strawberry	*Fragaria vesca*	1	Native
	Common strawberry	*Fragaria virginiana*	1	Native
	Scratch bedstraw	*Galium aparine*	1	Native
	Rough bedstraw	*Galium asprellum*	44	Native
	Whorled bedstraw	*Galium mollugo*	1	Native
	Marsh bedstraw	*Galium palustre*	13	Native
	Bedstraw	*Galium sp.*	2	Native
	Stiff three-petaled bedstraw	*Galium tinctorium*	1	Native
	Yellow avens	*Geum aleppicum*	1	Native
	White avens	*Geum canadense*	4	Native
	Floodplain avens	*Geum laciniatum*	3	Native
	Avens	*Geum sp.*	1	Native

Table 6-5: Floodplain Wetland Plant Species Summary Data for Reaches 5B and 5C (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=159)	Status[1]
	Gill-over-the-ground	*Glechoma hederacea*	1	Non-native
	Rattlesnake manna grass	*Glyceria canadensis*	4	Native
	Northeastern manna grass	*Glyceria melicaria*	1	Native
	Dame's-rocket	*Hesperis matronalis*	3	Invasive[A,B]
	Dwarf St. John's-wort	*Hypericum mutilum*	1	Native
	Virginia marsh-St. John's-wort	*Hypericum virginicum*	3	Native
	Jewelweed	*Impatiens capensis*	39	Native
	Yellow iris	*Iris pseudacorus*	19	Invasive[A,B]
	Blue iris	*Iris versicolor*	1	Native
	Soft rush	*Juncus effusus*	5	Native
	Path rush	*Juncus tenuis*	1	Native
	Tall lettuce	*Lactuca canadensis*	3	Native
	Canada wood-nettle	*Laportea canadensis*	15	Native
	Rice cut grass	*Leersia oryzoides*	26	Native
	Common duckweed	*Lemna minor*	9	Native
	Canada lily	*Lilium canadense*	3	Native
	Cardinal-flower	*Lobelia cardinalis*	3	Native
	Common water-primrose	*Ludwigia palustris*	11	Native
	American water-horehound	*Lycopus americanus*	3	Native
	Northern water-horehound	*Lycopus uniflorus*	5	Native
	Virginia water-horehound	*Lycopus virginicus*	2	Native
	Fringed yellow-loosestrife	*Lysimachia ciliata*	13	Native
	Moneywort	*Lysimachia nummularia*	59	Invasive[A]
	Swamp yellow-loosestrife	*Lysimachia terrestris*	11	Native
	Purple loosestrife	*Lythrum salicaria*	93	Invasive[A,B,C]
	Ostrich fern	*Matteuccia struthiopteris*	13	Native
	Ginger mint	*Mentha arvensis*	3	Non-native
	American wild mint	*Mentha canadensis*	2	Native
	Monkey-flower	*Mimulus ringens*	1	Native
	Partridge-berry	*Mitchella repens*	1	Native
	Indian-pipe	*Monotropa uniflora*	1	Native
	Water forget-me-not	*Myosotis scorpioides*	27	Invasive[D]
	Eurasian water-milfoil	*Myriophyllum spicatum*	1	Invasive[A,B]
	Yellow pond-lily	*Nuphar variegata*	4	Native
	White water-lily	*Nymphaea odorata*	1	Native
	Sensitive fern	*Onoclea sensibilis*	72	Native
	Long-styled sweet-cicely	*Osmorhiza longistylis*	3	Native
	Cinnamon fern	*Osmunda cinnamomea*	7	Native
	Interrupted fern	*Osmunda claytoniana*	4	Native
	Royal fern	*Osmunda regalis*	23	Native
	Common yellow wood sorrel	*Oxalis stricta*	1	Native
	New York fern	*Parathelypteris noveboracensis*	4	Native

Table 6-5: Floodplain Wetland Plant Species Summary Data for Reaches 5B and 5C (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=159)	Status[1]
	Massachusetts fern	*Parathelypteris simulata*	2	Native
	Arrow-arum	*Peltandra virginica*	53	Native
	Ditch-stonecrop	*Penthorum sedoides*	12	Native
	halberd-leaved tearthumb	*Persicaria arifolia*	4	Native
	Water-pepper smartweed	*Persicaria hydropiper*	5	Native
	False water-pepper smartweed	*Persicaria hydropiperoides*	39	Native
	Dock-leaved smartweed	*Persicaria lapathifolia*	5	Native
	Lady's-thumb smartweed	*Persicaria maculosa*	3	Non-native
	Arrow-leaved tearthumb	*Persicaria sagittata*	35	Native
	Jumpseed	*Persicaria virginiana*	9	Native
	Reed canary grass	*Phalaris arundinacea*	35	Invasive[A,B,C]
	Phragmites	*Phragmites australis*	2	Invasive[A,B,C]
	Canada clearweed	*Pilea pumila*	17	Native
	Common plantain	*Plantago major*	1	Non-native
	King Solomon's-seal	*Polygonatum biflorum*	2	Native
	Pickerelweed	*Pontederia cordata*	18	Native
	Ribbon-leaved pondweed	*Potamogeton epihydrus*	2	Native
	Pondweed	*Potamogeton sp.*	1	Native
	Common cinquefoil	*Potentilla simplex*	1	Native
	Marsh mermaid-weed	*Proserpinaca palustris*	4	Native
	Swamp buttercup	*Ranunculus caricetorum*	2	Native
	Hispid crowfoot	*Ranunculus hispidus*	3	Native
	Hooked buttercup	*Ranunculus recurvatus*	1	Native
	Creeping crowfoot	*Ranunculus repens*	2	Non-native
	Buttercup	*Ranunculus sp.*	2	Native
	Green-headed coneflower	*Rudbeckia laciniata*	8	Native
	Curly dock	*Rumex crispus*	8	Non-native
	Bitter dock	*Rumex obtusifolius*	1	Non-native
	Swamp dock	*Rumex verticillatus*	7	Native
	Common arrowhead	*Sagittaria latifolia*	3	Native
	Arrowhead	*Sagittaria sp.*	2	Native
	Soft-stemmed club-bulrush	*Schoenoplectus tabernaemontani*	8	Native
	Woolgrass	*Scirpus cyperinus*	12	Native
	Barber-pole bulrush	*Scirpus microcarpus*	1	Native
	Hooded skullcap	*Scutellaria galericulata*	2	Native
	Mad dog skullcap	*Scutellaria lateriflora*	4	Native
	American burnweed	*Senecio hieraciifolius*	2	Native
	White campion	*Silene latifolia*	1	Non-native
	Cup-plant rosinweed	*Silphium perfoliatum*	1	Non-native
	Water-parsnip	*Sium suave*	7	Native
	Climbing nightshade	*Solanum dulcamara*	10	Non-native
	Tall goldenrod	*Solidago altissima*	3	Native

Table 6-5: Floodplain Wetland Plant Species Summary Data for Reaches 5B and 5C (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=159)	Status[1]
	Smooth goldenrod	*Solidago gigantea*	7	Native
	Rough-leaved goldenrod	*Solidago patula*	1	Native
	Common wrinkle-leaved goldenrod	*Solidago rugosa*	5	Native
	American bur-reed	*Sparganium americanum*	4	Native
	Great bur-reed	*Sparganium eurycarpum*	22	Native
	Bur-reed	*Sparganium sp.*	10	Native
	Calico American-aster	*Symphyotrichum lateriflorum*	6	Native
	New England American-aster	*Symphyotrichum novae-angliae*	3	Native
	Purple-stemmed American-aster	*Symphyotrichum puniceum*	2	Native
	Skunk-cabbage	*Symplocarpus foetidus*	3	Native
	Common tansy	*Tanacetum vulgare*	1	Non-native
	Dandelion	*Taraxacum sp.*	1	Non-native
	Tall meadow-rue	*Thalictrum pubescens*	3	Native
	Marsh fern	*Thelypteris palustris*	11	Native
	Virginia spiderwort	*Tradescantia virginiana*	1	Non-native
	Water chestnut	*Trapa natans*	1	Invasive[A,B]
	Narrow-leaved cattail	*Typha angustifolium*	2	Native
	Broad-leaved cattail	*Typha latifolia*	28	Native
	Stinging nettle	*Urtica dioica*	8	Native
	Common valerian	*Valeriana officinalis*	1	Non-native
	Narrow-leaved speedwell	*Veronica scutellata*	1	Native
	Cow vetch	*Vicia cracca*	3	Non-native
	Rough cocklebur	*Xanthium strumarium*	2	Native
Liana Species	Asian bittersweet	*Celastrus orbiculatus*	10	Invasive[A,B,C]
	Virgin's-bower	*Clematis virginiana*	4	Native
	Black bindweed	*Fallopia convolvulus*	2	Non-native
	Climbing bindweed	*Fallopia scandens*	4	Native
	Virginia-creeper	*Parthenocissus quinquefolia*	6	Native
	Poison ivy	*Toxicodendron radicans*	25	Native
	River grape	*Vitis riparia*	10	Native
Shrub Species	Speckled alder	*Alnus incana*	36	Native
	Japanese barberry	*Berberis thunbergii*	2	Invasive[A,B,C]
	Buttonbush	*Cephalanthus occidentalis*	33	Native
	Silky dogwood	*Cornus amomum*	85	Native
	Bunchberry	*Cornus canadensis*	2	Native
	Red-osier dogwood	*Cornus sericea*	19	Native
	American hazelnut	*Corylus americana*	1	Native
	Burningbush	*Euonymus alatus*	2	Invasive[A,B,C]
	European spindle-tree	*Euonymus europaeus*	2	Non-native
	Glossy false buckthorn	*Frangula alnus*	2	Invasive[A,B,C]
	Witchhazel	*Hamamelis virginiana*	3	Native

Table 6-5: Floodplain Wetland Plant Species Summary Data for Reaches 5B and 5C (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=159)	Status[1]
	Fall sneezeweed	*Helenium autumnale*	1	Native
	Winterberry	*Ilex verticillata*	24	Native
	European privet	*Ligustrum vulgare*	2	Invasive[D]
	Northern spicebush	*Lindera benzoin*	9	Native
	Morrow's honeysuckle	*Lonicera morrowii*	51	Invasive[A,B]
	Maleberry	*Lyonia ligustrina*	1	Native
	European buckthorn	*Rhamnus cathartica*	31	Invasive[A,B,C]
	Eastern black currant	*Ribes americanum*	3	Native
	Multiflora rose	*Rosa multiflora*	14	Invasive[A,B,C]
	Swamp rose	*Rosa palustris*	10	Native
	Swamp dewberry	*Rubus hispidus*	3	Native
	Pennsylvania blackberry	*Rubus pensilvanicus*	1	Native
	Dwarf raspberry	*Rubus pubescens*	3	Native
	White willow	*Salix alba*	20	Non-native
	Pussy willow	*Salix discolor*	2	Native
	Black willow	*Salix nigra*	6	Native
	Silky willow	*Salix sericea*	5	Native
	Willow	*Salix sp.*	9	Native
	Black elderberry	*Sambucus nigra*	10	Native
	Red elderberry	*Sambucus racemosa*	1	Native
	Elm-leaved goldenrod	*Solidago ulmifolia*	1	Native
	White meadowsweet	*Spiraea alba*	9	Native
	Smooth arrowwood	*Viburnum dentatum*	25	Native
	Withe-rod	*Viburnum nudum*	1	Native
	Highbush-cranberry	*Viburnum opulus*	1	Native
Tree Species	Boxelder maple	*Acer negundo*	13	Native
	Red Maple	*Acer rubrum*	51	Native
	Silver Maple	*Acer saccharinum*	34	Native
	Sugar Maple	*Acer saccharum*	1	Native
	Yellow birch	*Betula alleghaniensis*	4	Native
	Paper birch	*Betula papyrifera*	1	Native
	Gray birch	*Betula populifolia*	1	Native
	American hornbeam	*Carpinus caroliniana*	19	Native
	Bitternut hickory	*Carya cordiformis*	2	Native
	Cockspur hawthorn	*Crataegus crus-galli*	4	Native
	Fan-leaved hawthorn	*Crataegus flabellata*	1	Native
	Large-seeded hawthorn	*Crataegus macrosperma*	1	Native
	Hawthorn	*Crataegus sp.*	8	Native
	American beech	*Fagus grandifolia*	2	Native
	White ash	*Fraxinus americana*	5	Native
	Black ash	*Fraxinus nigra*	8	Native
	Green ash	*Fraxinus pennsylvanica*	8	Native

Table 6-5: Floodplain Wetland Plant Species Summary Data for Reaches 5B and 5C (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=159)	Status[1]
	Black-gum	*Nyssa sylvatica*	1	Native
	Hop-hornbeam	*Ostrya virginiana*	1	Native
	White pine	*Pinus strobus*	7	Native
	American sycamore	*Platanus occidentalis*	2	Native
	Eastern cottonwood	*Populus deltoides*	2	Native
	Quaking aspen	*Populus tremuloides*	1	Native
	Black cherry	*Prunus serotina*	1	Native
	Choke cherry	*Prunus virginiana*	2	Native
	Swamp white oak	*Quercus bicolor*	6	Native
	Bur oak	*Quercus macrocarpa*	11	Native
	Northern red oak	*Quercus rubra*	3	Native
	American linden	*Tilia americana*	5	Native
	Eastern hemlock	*Tsuga canadensis*	5	Native
	American elm	*Ulmus americana*	13	Native

[1] Invasive Ratings: A= MIPAG Invasive; B=IPANE Invasive; C=ACOE Invasive; D=MIPAG Likely Invasive

Table 6-6: Percent Cover of Trees, Shrubs, Woody Vines, Herbs, and Mosses Estimated within each Floodplain Natural Community Cover Type

		Reach 5B						Reach 5C						
		Deep emergent marsh	Shallow emergent marsh	Wet meadow	Shrub swamp	Red maple swamp	Transitional floodplain forest	Deep emergent marsh	Shallow emergent marsh	Wet meadow	Shrub swamp	Red maple swamp	Transitional floodplain forest	Red Maple, Black Ash, Bur Oak Swamp
	Count	2	9	13	18	6	14	8	5	3	39	17	11	12
Trees	**Min**	0.0	0.0	0.0	0.0	10.5	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
	Max	0.0	38.0	20.5	38.0	85.5	85.5	0.0	38.0	3.0	38.0	85.5	85.5	85.5
	Mean	0.0	9.9	4.5	7.3	57.6	44.9	0.0	8.2	1.0	4.1	45.2	52.7	64.8
	±SE	0.0	4.6	1.8	3.1	11.9	6.5	0.0	7.5	1.0	1.4	5.9	8.5	7.9
Shrubs	**Min**	0.0	0.0	0.0	20.5	20.5	10.5	0.0	0.0	0.0	20.5	38.0	38.0	3.0
	Max	0.0	85.5	63.0	98.0	85.5	85.5	38.0	38.0	3.0	98.0	85.5	85.5	63.0
	Mean	0.0	14.8	16.5	66.8	51.3	49.4	11.6	19.4	1.0	71.4	55.2	53.7	38.2
	±SE	0.0	9.1	5.8	6.1	9.6	7.3	5.9	7.8	1.0	3.2	4.5	4.9	6.2
Woody Vines	**Min**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Max	0.0	3.0	3.0	63.0	20.5	38.0	3.0	0.0	0.0	3.0	38.0	10.5	20.5
	Mean	0.0	0.3	0.2	3.5	4.4	9.9	0.4	0.0	0.0	0.4	3.8	2.6	2.8
	±SE	0.0	0.3	0.2	3.5	3.3	3.8	0.4	0.0	0.0	0.2	2.5	0.9	1.8
Herbs	**Min**	98.0	63.0	85.5	3.0	20.5	38.0	63.0	38.0	98.0	10.5	38.0	38.0	85.5
	Max	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0
	Mean	98.0	89.9	94.2	74.9	76.8	82.3	85.8	86.0	98.0	70.6	77.6	80.5	86.5
	±SE	0.0	3.9	1.7	6.5	11.4	4.0	3.8	12.0	0.0	4.1	3.8	5.6	1.0
Mosses	**Min**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Max	0.0	3.0	10.5	10.5	20.5	3.0	3.0	3.0	0.0	38.0	20.5	3.0	10.5
	Mean	0.0	0.3	1.0	0.8	12.0	0.2	0.4	1.2	0.0	1.9	4.5	0.5	1.8
	±SE	0.0	0.3	0.8	0.6	4.1	0.2	0.4	0.7	0.0	1.0	1.3	0.4	1.2

Table 6-7: NRCS Soil Series Mapping for Reaches 5B and 5C

Code[1]	Series[2]	Reach 5B Area (Acres)	Reach 5C Area (Acres)	Total
901E	Berkshire-Marlow association		1.9	1.9
267ABD	Copake fine sandy loam	6.7	1.8	8.6
34A	Fredon fine sandy loam	13.6	13.8	27.4
269B	Groton gravelly sandy loam	0.3		0.3
35A	Halsey fine sandy loam		46.4	46.4
270AB	Hero loam	0.2	6.2	6.3
271A	Hero variant gravelly loam	2.5		2.5
8A	Limerick silt loam	62.8	23.4	86.2
254AC	Merrimac fine sandy loam	6.8	1.9	8.7
58A	Natchaug and Catden mucks	2.6	96.3	98.9
273BD	Oakville loamy sand	0.2	3.0	3.3
905C	Peru-Marlow association		0.5	0.5
5A	Saco silt loam*	42.2	70.0	112.3
98A	Winooski silt loam*	23.8		23.8
NA	Udorthents, smoothed		1.5	1.5
NA	Open Water	34.7	106.0	140.7
	Total:	196.5	372.6	569.1

1. Letters refer to percent slope of the mapping unit; A=0-3%, B=3-8%, C=8-15%, D=15-25%
2. Floodplain soils are indicated by an asterisk (*)

Table 6-8: Floodplain Natural Communities –Biotic Habitat Features in Reaches 5B and 5C

	Wildlife Food[1]				Cover/Perches/Basking/Denning/Nesting Habitat[1]														
Plot_ID	Wetland and Aquatic Food	Upland Food	Shrub thickets with earthworm habitat	Live or Dead Trees >30" DBH	Standing Dead Trees with Cavities and Perches	Cavities in trunks or limbs of Live Trees	Small Mammal Burrows	Shrubs and/or Herbs for bird nesting	Sandy soils suitable for turtle nesting	Other Wildlife Dens/Nests	Dense Herb Cover	Large Woody Debris	Rocks, Crevices, Logs, Roots at Water Edge	Live or Dead Tall Veg. OH/Near Water	Persistent emergent wetland vegetation	Fine-leaved emergent vegetation	Depressions serving as vernal pools	Standing water Present at least part of the growing season	Four -toed salamander habitat
Reach 5B																			
1	*	NA	Ø	Ø	√	√	√	*	Ø	√	*	*	√	√	Ø	Ø	Ø	*	√
2	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	√	Ø	√	Ø	*	Ø
3	*	NA	Ø	Ø	Ø	Ø	√	*	Ø	NA	*	√	NA	NA	√	*	Ø	*	Ø
4	√	Ø	Ø	Ø	√	Ø	Ø	*	Ø	Ø	*	√	√	*	Ø	Ø	Ø	√	Ø
5	√	√	√	Ø	√	√	Ø	*	Ø	Ø	√	√	Ø	√	Ø	Ø	Ø	Ø	Ø
6	Ø	√	*	Ø	√	√	Ø	*	Ø	Ø	√	√	NA	NA	Ø	Ø	Ø	Ø	Ø
7	*	NA	Ø	Ø	Ø	Ø	Ø	*	NA	Ø	*	Ø	√	√	Ø	√	Ø	*	Ø
8	√	NA	Ø	Ø	Ø	Ø	Ø	√	Ø	Ø	√	Ø	NA	NA	Ø	Ø	Ø	Ø	Ø
9	*	Ø	Ø	Ø	√	√	Ø	*	Ø	√	*	√	Ø	√	Ø	*	Ø	*	Ø
10	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	√	Ø	*	*	√	Ø	*	Ø
12	*	√	Ø	√	√	√	√	*	Ø	√	*	*	√	√	Ø	Ø	Ø	*	√
14	Ø	*	√	√	Ø	√	Ø	*	Ø	Ø	√	*	Ø	*	Ø	Ø	Ø	Ø	Ø
15	*	NA	Ø	√	Ø	√	Ø	*	Ø	Ø	*	Ø	√	*	Ø	Ø	√	*	Ø
16	NA	√	√	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	Ø	Ø	Ø	Ø	Ø
17	√	√	√	Ø	Ø	√	√	*	Ø	Ø	*	Ø	Ø	Ø	Ø	Ø	Ø	√	Ø
18	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	√	Ø	√	*	Ø	Ø	√	*	Ø
19	Ø	√	*	*	√	*	√	√	Ø	Ø	*	√	NA	NA	Ø	Ø	Ø	Ø	Ø
21	√	√	√	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	Ø	Ø	Ø	Ø	√	Ø
22	√	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	Ø	Ø	Ø	Ø	Ø
23	√	√	√	√	Ø	√	Ø	*	Ø	Ø	√	*	√	*	Ø	Ø	Ø	√	Ø
24	√	√	√	Ø	Ø	Ø	Ø	*	Ø	Ø	*	√	Ø	Ø	NA	NA	Ø	√	Ø
25	*	Ø	Ø	√	Ø	√	Ø	√	Ø	Ø	*	√	Ø	√	Ø	Ø	√	√	Ø
26	Ø	√	√	Ø	Ø	Ø	√	*	Ø	Ø	*	√	NA	NA	NA	NA	Ø	√	Ø
27	*	NA	√	√	√	Ø	Ø	√	Ø	Ø	√	Ø	√	√	√	√	√	√	Ø
29	NA	√	*	Ø	Ø	Ø	√	*	Ø	Ø	√	√	√	√	NA	NA	Ø	Ø	Ø
30	*	NA	Ø	Ø	√	√	Ø	Ø	Ø	Ø	√	√	√	√	Ø	√	√	√	√
32	√	Ø	*	√	√	√	√	*	Ø	Ø	*	√	NA	NA	Ø	Ø	Ø	√	Ø
34	Ø	Ø	Ø	√	√	√	√	Ø	Ø	Ø	Ø	*	NA	NA	Ø	Ø	Ø	√	Ø
35	NA	√	*	√	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	√	NA	NA	Ø	√	Ø
36	*	NA	*	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	√	Ø	*	Ø	√	Ø
37	*	√	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	√	√	*	Ø	√	Ø
38	√	Ø	√	Ø	Ø	Ø	Ø	*	Ø	Ø	√	Ø	NA	NA	NA	NA	Ø	Ø	Ø
39	√	Ø	*	Ø	Ø	Ø	Ø	*	Ø	Ø	√	Ø	Ø	Ø	NA	NA	√	√	Ø
40	√	Ø	√	√	√	Ø	Ø	*	Ø	Ø	√	√	NA	NA	NA	NA	Ø	√	Ø
42	√	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	Ø	*	√	Ø	√	Ø

Table 6-8: Floodplain Natural Communities –Biotic Habitat Features in Reaches 5B and 5C (continued)

	Wildlife Food[1]					Cover/Perches/Basking/Denning/Nesting Habitat[1]													
Plot_ID	Wetland and Aquatic Food	Upland Food	Shrub thickets with earthworm habitat	Live or Dead Trees >30" DBH	Standing Dead Trees with Cavities and Perches	Cavities in trunks or limbs of Live Trees	Small Mammal Burrows	Shrubs and/or Herbs for bird nesting	Sandy soils suitable for turtle nesting	Other Wildlife Dens/Nests	Dense Herb Cover	Large Woody Debris	Rocks, Crevices, Logs, Roots at Water Edge	Live or Dead Tall Veg. OH/Near Water	Persistent emergent wetland vegetation	Fine-leaved emergent vegetation	Depressions serving as vernal pools	Standing water Present at least part of the growing season	Four -toed salamander habitat
45	*	Ø	*	Ø	Ø	Ø	Ø	*	Ø	Ø	√	Ø	NA	NA	NA	NA	Ø	√	Ø
47	√	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	√	Ø	Ø	Ø	Ø	Ø	√	Ø
48	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	Ø	*	Ø	*	Ø
49	*	√	√	√	Ø	√	√	√	Ø	√	*	Ø	√	*	Ø	Ø	Ø	Ø	Ø
50	*	Ø	√	Ø	Ø	Ø	Ø	*	Ø	Ø	Ø	Ø	√	*	Ø	Ø	Ø	Ø	Ø
51	√	Ø	√	Ø	Ø	Ø	√	*	Ø	Ø	√	Ø	NA	NA	√	Ø	Ø	√	Ø
52	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	√	Ø	Ø	Ø	Ø	Ø	Ø	√	Ø
53	√	*	√	Ø	Ø	Ø	Ø	*	Ø	Ø	√	Ø	Ø	Ø	√	Ø	Ø	√	Ø
54	*	NA	Ø	Ø	Ø	Ø	√	*	Ø	Ø	*	Ø	Ø	Ø	Ø	*	Ø	Ø	Ø
55	√	Ø	Ø	Ø	Ø	√	Ø	√	Ø	Ø	*	Ø	√	*	Ø	Ø	Ø	Ø	Ø
56	*	NA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	Ø	Ø	*	Ø
57	*	Ø	Ø	Ø	Ø	Ø	√	*	Ø	Ø	*	Ø	Ø	*	Ø	*	Ø	Ø	Ø
58	√	Ø	*	√	√	Ø	Ø	*	Ø	Ø	*	√	NA	NA	Ø	√	Ø	√	Ø
59	√	Ø	√	Ø	Ø	Ø	√	*	Ø	Ø	√	√	NA	NA	Ø	Ø	Ø	√	Ø
60	√	Ø	√	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	NA	NA	√	Ø	Ø	√	Ø
61	*	Ø	Ø	Ø	Ø	Ø	Ø	√	Ø	Ø	√	Ø	Ø	Ø	Ø	Ø	Ø	√	Ø
62	*	Ø	√	Ø	√	Ø	Ø	*	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	Ø	√	Ø
63	√	Ø	√	Ø	Ø	Ø	√	*	Ø	Ø	*	Ø	NA	NA	Ø	√	√	√	Ø
64	√	Ø	√	Ø	√	Ø	Ø	*	Ø	√	*	√	NA	NA	Ø	√	Ø	√	Ø
65	√	Ø	√	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	NA	NA	Ø	√	Ø	√	Ø
67	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	Ø	*	Ø	*	Ø
68	√	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	Ø	Ø	Ø	√	Ø
69	√	Ø	√	√	Ø	Ø	Ø	*	Ø	Ø	√	√	Ø	Ø	Ø	Ø	Ø	√	Ø
70	*	Ø	Ø	√	√	Ø	Ø	*	Ø	√	*	√	√	*	√	√	Ø	√	Ø
71	√	√	*	Ø	Ø	√	√	*	Ø	Ø	Ø	√	√	√	NA	NA	Ø	√	Ø
75	*	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	Ø	√	Ø
78	√	Ø	√	√	Ø	*	Ø	*	Ø	√	*	√	√	*	Ø	Ø	Ø	√	Ø
Reach 5C																			
82	*	√	*	Ø	√	√	√	*	Ø	Ø	√	√	Ø	Ø	Ø	Ø	Ø	√	Ø
85	Ø	√	√	Ø	Ø	√	√	*	Ø	Ø	*		*	*	Ø	Ø	Ø	Ø	Ø
86	√	√	Ø	Ø	√	Ø	√	√	Ø	Ø	*	*	Ø	Ø	Ø	Ø	Ø	Ø	Ø
88	*	Ø	Ø	√	√	√	Ø	*	Ø	Ø	√	√	√	*	Ø	Ø	Ø	√	Ø
90	*	Ø	Ø	Ø	*	√	Ø	*	Ø	√	*	*	*	*	Ø	√	√	√	Ø
92	*	Ø	Ø	√	√	*	√	*	Ø	√	√	*	*	*	Ø	Ø	Ø	√	Ø

Table 6-8: Floodplain Natural Communities –Biotic Habitat Features in Reaches 5B and 5C (continued)

	Wildlife Food[1]			Cover/Perches/Basking/Denning/Nesting Habitat[1]															
Plot_ID	Wetland and Aquatic Food	Upland Food	Shrub thickets with earthworm habitat	Live or Dead Trees >30" DBH	Standing Dead Trees with Cavities and Perches	Cavities in trunks or limbs of Live Trees	Small Mammal Burrows	Shrubs and/or Herbs for bird nesting	Sandy soils suitable for turtle nesting	Other Wildlife Dens/Nests	Dense Herb Cover	Large Woody Debris	Rocks, Crevices, Logs, Roots at Water Edge	Live or Dead Tall Veg. OH/Near Water	Persistent emergent wetland vegetation	Fine-leaved emergent vegetation	Depressions serving as vernal pools	Standing water Present at least part of the growing season	Four -toed salamander habitat
93	NA	*	*	√	√	√	Ø	√	Ø	Ø	*	√	NA	NA	NA	NA	Ø	Ø	Ø
94	*	√	√	√	√	√	Ø	√	Ø	Ø	√	√	√	√	*	√	√	√	√
95	*	Ø	Ø	Ø	√	√	Ø	*	Ø	Ø	Ø	√	Ø	*	Ø	Ø	Ø	√	Ø
96	Ø	√	√	√	√	*	√	*	Ø	√	√	*	√	√	Ø	Ø	Ø	Ø	Ø
97	Ø	√	√	√	√	√	Ø	*	Ø	Ø	√	*	Ø	Ø	Ø	Ø	√	√	Ø
98	NA	*	*	√	√	√	√	√	Ø	Ø	√	√	√	NA	NA	NA	Ø	Ø	Ø
100	*	√	√	√	√	√	Ø	√	Ø	Ø	√	√	√	√	*	√	√	√	√
101	*	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	√	Ø	Ø	Ø	*	Ø	Ø	Ø	√	Ø
102	*	Ø	Ø	√	Ø	*	Ø	*	Ø	Ø	*	√	√	*	Ø	Ø	Ø	√	Ø
103	√	√	√	√	√	√	√	√	Ø	Ø	*	√	√	√	√	√	√	√	Ø
107	*	Ø	Ø	√	Ø	√	Ø	√	Ø	Ø	*	√	√	*	Ø	Ø	Ø	Ø	Ø
108	NA	√	*	√	√	√	Ø	√	Ø	Ø	√	√	NA	√	Ø	Ø	√	√	Ø
110	Ø	√	√	√	*	√	√	*	Ø	Ø	√	√	√	√	Ø	Ø	Ø	Ø	Ø
111	√	Ø	Ø	Ø	√	√	√	*	Ø	Ø	*	√	NA	NA	Ø	Ø	√	√	Ø
112	√	Ø	√	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	Ø	Ø	Ø	Ø	√	Ø
113	√	NA	√	Ø	√	√	√	*	Ø	Ø	*	Ø	NA	√	Ø	Ø	Ø	√	Ø
115	√	Ø	√	Ø	√	Ø	Ø	*	Ø	Ø	√	√	Ø	√	Ø	Ø	Ø	√	Ø
117	√	√	Ø	Ø	Ø	Ø	Ø	√	Ø	Ø	√	√	√	*	√	√	√	√	√
118	√	NA	*	Ø	*	Ø	√	*	Ø	Ø	*	√	NA	NA	Ø	Ø	Ø	√	Ø
120	√	NA	Ø	√	√	√	√	√	Ø	Ø	*	√	NA	NA	Ø	Ø	Ø	√	Ø
121	√	NA	*	Ø	√	Ø	Ø	*	Ø	Ø	*	Ø	NA	NA	Ø	Ø	Ø	√	Ø
123	√	NA	NA	Ø	Ø	Ø	NA	Ø	Ø	Ø	√	√	√	√	Ø	√	NA	√	Ø
125	√	NA	Ø	Ø	√	Ø	Ø	*	Ø	Ø	Ø	√	NA	NA	Ø	Ø	Ø	*	Ø
126	√	Ø	Ø	Ø	√	√	Ø	√	Ø	Ø	*	Ø	Ø	√	√	*	Ø	√	Ø
129	√	Ø	√	Ø	√	√	√	*	Ø	Ø	√	*	Ø	NA	Ø	√	Ø	√	Ø
130	√	NA	Ø	Ø	√	Ø	Ø	√	Ø	Ø	*	Ø	Ø	√	√	√	Ø	√	Ø
132	√	NA	Ø	Ø	Ø	Ø	Ø	√	Ø	Ø	*	Ø	Ø	Ø	Ø	√	Ø	√	Ø
134	√	Ø	Ø	√	√	√	√	Ø	Ø	Ø	√	*	NA	NA	Ø	Ø	Ø	Ø	Ø
135	√	Ø	Ø	√	√	√	Ø	*	Ø	Ø	*	√	NA	NA	Ø	Ø	Ø	Ø	Ø
137	*	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	√	√	√	NA	NA	Ø	Ø	Ø	√	Ø
138	√	Ø	Ø	Ø	*	√	√	Ø	Ø	Ø	*	√	NA	NA	NA	√	Ø	√	Ø
139	√	Ø	Ø	√	√	√	√	√	Ø	Ø	*	*	Ø	Ø	Ø	√	Ø	√	Ø
140	*	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	√	√	NA	NA	Ø	Ø	Ø	Ø	Ø
142	√	Ø	Ø	Ø	√	√	Ø	*	Ø	Ø	*	√	Ø	Ø	Ø	√	Ø	√	Ø
143	√	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	√	*	Ø	Ø	Ø	Ø	Ø	√	Ø
145	*	NA	Ø	Ø	√	√	√	√	Ø	Ø	Ø	√	√	√	Ø	√	Ø	*	Ø

Table 6-8: Floodplain Natural Communities –Biotic Habitat Features in Reaches 5B and 5C (continued)

	Wildlife Food[1]				Cover/Perches/Basking/Denning/Nesting Habitat[1]														
Plot_ID	Wetland and Aquatic Food	Upland Food	Shrub thickets with earthworm habitat	Live or Dead Trees >30" DBH	Standing Dead Trees with Cavities and Perches	Cavities in trunks or limbs of Live Trees	Small Mammal Burrows	Shrubs and/or Herbs for bird nesting	Sandy soils suitable for turtle nesting	Other Wildlife Dens/Nests	Dense Herb Cover	Large Woody Debris	Rocks, Crevices, Logs, Roots at Water Edge	Live or Dead Tall Veg. OH/Near Water	Persistent emergent wetland vegetation	Fine-leaved emergent vegetation	Depressions serving as vernal pools	Standing water Present at least part of the growing season	Four -toed salamander habitat
146	*	Ø	Ø	Ø	√	Ø	Ø	*	√	Ø	*	√	*	*	*	Ø	Ø	√	Ø
147	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	√	√	Ø	*	Ø
148	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	*	√	Ø	*	Ø
149	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	NA	NA	*	Ø	Ø	*	Ø
150	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	*	*	Ø	*	Ø
151	*	NA	√	NA	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	√	Ø	Ø	√	Ø
152	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	*	*	Ø	*	Ø
154	*	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	√	*	*	*	Ø	Ø	√	Ø
155	*	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	*	*	*	√	Ø	Ø	√	Ø
156	*	NA	√	Ø	√	√	Ø	*	Ø	√	*	√	*	*	√	√	Ø	*	Ø
158	*	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	√	Ø	Ø	√	Ø
159	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	√	Ø	√	√	√	√	Ø	*	Ø
161	*	Ø	Ø	Ø	*	√	Ø	*	Ø	Ø	*	*	Ø	Ø	*	√	Ø	√	Ø
162	√		Ø	√	*	*	Ø	*	Ø	√	*		Ø	Ø	Ø	Ø	Ø	√	Ø
163	*	Ø	Ø		√	√	Ø	*	Ø	√	√	*	√	*	Ø	Ø	Ø	√	Ø
164	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	NA	NA	*	*	Ø	*	Ø
165	*	NA	*	Ø	*	*	√	√	Ø	√	√	*	√	√	Ø	√	Ø	*	Ø
167	*	NA	NA	Ø	Ø	Ø	Ø	√	Ø	Ø	*	Ø	*	*	*	√	Ø	*	Ø
168	*	NA	NA	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	*	*	√	*	Ø
169	*	NA	NA	Ø	√	Ø	Ø	*	Ø	√	*	√	*	*	*	*	Ø	*	Ø
170	*	NA	*	Ø	√	Ø	Ø	*	Ø	√	*	*	NA	NA	Ø	Ø	Ø	*	Ø
171	*	√	√	√	Ø	√	Ø	*	Ø	Ø	*	*	*	*	*	*	Ø	*	Ø
172	*	NA	*	Ø	Ø	Ø	Ø	*	Ø	√	√	Ø	√	√	√	√	Ø	*	Ø
173	*	NA	√	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	√	*	√	*	Ø	*	Ø
174	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	*	Ø	Ø	*	*	Ø	Ø	*	Ø
175	*	NA	√	Ø	Ø	Ø	Ø	*	Ø	√	√	Ø	*	*	√	Ø	Ø	*	Ø
176	*	NA	√	Ø	Ø	Ø	Ø	*	Ø	√	√	Ø	√	*	Ø	Ø	Ø	*	Ø
178	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	√	Ø	Ø	*	Ø
179	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	*	√	Ø	Ø	*	Ø
180	*	NA	*	Ø	Ø	Ø	Ø	*	Ø	√	√	Ø	NA	NA	Ø	Ø	Ø	√	Ø
181	*	NA	Ø	Ø	√	√	Ø	*	Ø	√	√	Ø	√	√	Ø	√	Ø	*	Ø
183	*	NA	NA	Ø	Ø	Ø	NA	*	Ø	*	*	Ø	√	*	*	*	Ø	*	Ø
184	*	NA	Ø	Ø	√	*	Ø	*	Ø	√	*	*	√	√	Ø	Ø	Ø	*	Ø
185	*	NA	NA	Ø	√	Ø	Ø	*	Ø	√	*	√	√	*	*	*	Ø	*	Ø
186	*	NA	*	Ø	√	√	Ø	*	Ø	√	√	√	NA	NA	Ø	Ø	Ø	*	Ø
187	*	NA	Ø	Ø	√	√	Ø	*	Ø	Ø	√	√	√	√	Ø	√	Ø	*	Ø

Table 6-8: Floodplain Natural Communities –Biotic Habitat Features in Reaches 5B and 5C (continued)

	Wildlife Food[1]				Cover/Perches/Basking/Denning/Nesting Habitat[1]														
Plot_ID	Wetland and Aquatic Food	Upland Food	Shrub thickets with earthworm habitat	Live or Dead Trees >30" DBH	Standing Dead Trees with Cavities and Perches	Cavities in trunks or limbs of Live Trees	Small Mammal Burrows	Shrubs and/or Herbs for bird nesting	Sandy soils suitable for turtle nesting	Other Wildlife Dens/Nests	Dense Herb Cover	Large Woody Debris	Rocks, Crevices, Logs, Roots at Water Edge	Live or Dead Tall Veg. OH/Near Water	Persistent emergent wetland vegetation	Fine-leaved emergent vegetation	Depressions serving as vernal pools	Standing water Present at least part of the growing season	Four -toed salamander habitat
188	*	NA	Ø	Ø	√	√	Ø	*	Ø	√	*	√	Ø	√	*	√	Ø	*	Ø
189	*	NA	√	Ø	Ø	√	Ø	*	Ø	√	*	√	√	√	√	√	Ø	*	Ø
191	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	√	*	*	√	Ø	√	Ø
192	√	Ø	Ø	√	Ø	Ø	Ø	*	Ø	Ø	√	√	NA	NA	Ø	Ø	Ø	√	Ø
195	*	NA	Ø	Ø	√	√	Ø	*	Ø	√	*	√	*	√	*	Ø	Ø	*	Ø
196	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	*	Ø	*	Ø	*	√	Ø	*	Ø
197	√	NA	NA	Ø	Ø	Ø	Ø	*	Ø	√	*	√	Ø	*	Ø	Ø	Ø	*	Ø
198	*	NA	Ø	Ø	√	Ø	Ø	√	Ø	Ø	*	√	NA	Ø	Ø	Ø	Ø	√	Ø
199	*	NA	Ø	Ø	√	Ø	Ø	√	Ø	Ø	*	√	NA	NA	Ø	Ø	Ø	√	Ø
202	*	NA	Ø	Ø	√	√	Ø	*	Ø	√	√	*	NA	NA	Ø	Ø	Ø	*	Ø
203	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	√	√	√	√	√	√	√	Ø	*	Ø
204	*	NA	√	Ø	√	√	Ø	*	Ø	√	*	√	√	√	√	Ø	Ø	√	Ø
206	√	NA	Ø	Ø	Ø	√	√	√	Ø	Ø	Ø	√	Ø	Ø	Ø	Ø	Ø	√	Ø
209	*	NA	Ø	Ø	√	√	Ø	*	Ø	Ø	√	Ø	NA	NA	Ø	Ø	Ø	*	Ø
210	*	NA	Ø	Ø	√	√	Ø	*	Ø	√	√	√	*	√	Ø	Ø	Ø	*	Ø
211	*	NA	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	Ø	Ø	√	Ø	Ø	Ø	Ø	Ø	Ø
241	*	NA	√	Ø	√	√	Ø	*	Ø	√	*	√	√	*	*	*	Ø	√	Ø

[1] See Table 6-9 for wildlife associations with listed habitat features

* =Abundant; √=Present; Ø=Absent

Table 6-9: Floodplain Natural Communities: Summary of Biotic Habitat Features in Reaches 5B and 5C

		Reach 5B			Reach 5C		
Habitat Feature	Wildlife Use	% of Stations Abundant	% of Stations Present	% of Stations Absent	% of Stations Abundant	% of Stations Present	% of Stations Absent
Wetland and Aquatic Food	Overall food	44	43	8	65	28	4
Upland Food	Overall food	3	25	43	2	13	29
Shrub thickets with earthworm habitat	Game foraging habitat (e.g., American woodcock)	17	37	46	11	21	61
Live or Dead Trees >30” DBH	Cover/perching/nesting	2	24	75	0	22	77
Standing Dead Trees with Cavities and Perches	Cavities/perching/breeding/nesting/feeding	0	27	73	11	48	41
Cavities in trunks or limbs of Live Trees	Cavities/perching/breeding/nesting	3	27	70	6	43	51
Small Mammal Burrows	Hibernation/breeding/nesting/escape/cover	0	27	73	0	19	79
Shrub and/or herbaceous vegetation	Suitable for birds such as veery nesting	83	11	6	76	21	3
Open sandy to gravelly soils with sparse vegetation	Turtle nesting habitat	0	0	98	0	1	99
Other Wildlife Dens/Nests	Hibernation/breeding/nesting/escape/cover	0	13	86	1	44	55
Dense Herb Cover	Voles, small mammals, amphibians, reptiles	60	32	8	60	34	6
Large Woody Debris on the ground	Small mammals, amphibians, reptiles, invertebrate emergence	8	37	56	18	48	34
Rocks, Crevices, Logs, Roots at Water Edge	Turtles, snakes, frogs, invertebrate emergence	0	27	46	23	31	21
Live or dead vegetation overhanging and/or near water	Habitat offering good visibility of open water for, e.g., osprey, kingfisher, flycatchers, cedar waxwings. Vegetation closer to ground for turtles, snakes, frogs, wading birds, wood duck, mink, raccoon	32	22	19	37	26	14
Persistent emergent wetland vegetation at least seasonally flooded during the growing season	Habitat for American bittern, wood duck, green heron, black-crowned night heron, rails (sora, king, Virginia), moorhen, coot, pie-billed grebe, etc.	3	11	71	23	19	54
Fine-leaved emergent vegetation (Grasses and sedges) at least seasonally flooded during the growing season	Habitat for common snipe, spotted sandpiper, sedge wren, least bittern, common moorhen	13	17	56	12	30	56
Depressions serving as vernal pools	Turtles, snakes, frogs, invertebrate emergence	0	11	89	0	10	89
Standing water present at least part of the growing season	Amphibians, turtles, foraging waterfowl, non-breeding amphibians and reptiles (foraging, re-hydration)	19	59	22	40	48	12
Sphagnum hummocks or mats, moss-covered logs or saturated logs, overhanging or directly adjacent to pools of standing water in spring	Habitat for four-toed salamander	0	5	95	0	3	97

Table 6-10. Wildlife Observations Made During the 2023-2024 Floodplain Surveys in Reaches 5B and 5C

Common Name	Scientific Name	Common Name	Scientific Name
Amphibians and Reptiles		**Mammals (cont.)**	
Spotted salamander	*Ambystoma maculatum*	Grey Squirrel	*Sciurus carolinensis*
American toad	*Anaxyrus americanus*	Chipmunk	*Tamias striatus*
Snapping turtle	*Chelydra serpentina*	Black bear	*Ursus americanus*
Painted turtle	*Chrysemys picta*	**Birds**	
Wood turtle	*Glyptemys insculpta*	Spotted sandpiper	*Actitis macularius*
Bullfrog	*Lithobates catesbeiana*	Red-winged blackbird	*Agelaius phoeniceus*
Green frog	*Lithobates clamitans*	Mallard	*Anas platyrhynchos*
Pickerel frog	*Lithobates palustris*	Ruby-throated hummingbird	*Archilochus colubris*
Northern leopard frog	*Lithobates pipiens*	Great egret	*Ardea alba*
Wood frog	*Lithobates sylvaticus*	Great blue heron	*Ardea herodias*
Red-spotted newt	*Notophthalmus viridescens*	Coopers hawk	*Astur cooperii*
Spring peeper	*Pseudacris crucifer*	Tufted titmouse	*Baeolophus bicolor*
Fish		Red-tailed hawk	*Beteo jamaicensis*
Largemouth bass	*Micropterus salmoides*	Cedar waxwing	*Bombycilla cedrorum*
Brook trout	*Salvelinus fontinalis*	American bittern	*Botaurus lentiginosus*
Invertebrates		Canada goose	Branta canadensis
Dragonfly	*Anisoptera sp.*	Red-shouldered hawk	*Buteo lineatus*
Bumblebee	*Bombas sp.*	Broad-winged hawk	*Buteo platypterus*
Monarch butterfly	*Danaus plexippus*	Green heron	*Butorides virescens*
Spicebush swallowtail	*Papilio troilus*	Semi-palmated sandpiper	*Calidris pusilla*
Mammals		Northern cardinal	*Cardinalis cardinalis*
Coyote	*Canis latrans*	Turkey vulture	*Cathartes aura*
Beaver	*Castor canadensis*	Yellow shafted flicker	*Colaptes auratus*
Porcupine	*Erethizon dorsatum*	Eastern wood-pewee	*Contopus virens*
White-tailed deer	*Odocoileus virginianus*	American crow	*Corvus brachyrhynchos*
Muskrat	*Ondatra zibethicus*	Common raven	*Corvus corax*

Table 6-10. Wildlife Observations Made During the 2023-2024 Floodplain Surveys in Reaches 5B and 5C (continued)

Common Name	Scientific Name	Common Name	Scientific Name
Birds (cont.)		**Birds (cont.)**	
Blue Jay	*Cyanocitta cristata*	White-breasted nuthatch	*Sitta carolinensis*
Downy woodpecker	*Dryobates pubescens*	Osprey	*Pandion haliaetus*
Pileated woodpecker	*Dryocopus pileatus*	Indigo bunting	*Passerina cyanea*
Gray catbird	*Dumetella carolinensis*	Black capped chickadee	*Poecile atricapillus*
Willow flycatcher	*Empidonax traillii*	Common grackle	*Quiscalus quiscula*
American kestrel	*Falco sparverius*	Eastern phoebe	*Sayornis phoebe*
Common yellow throat	*Geothypis trichas*	American Woodcock	*Scolopax minor*
Bald eagle	*Haliaeetus leucocephalus*	Yellow throated warbler	*Setophaga dominica*
Wood thrush	*Hylocichla mustelina*	Yellow warbler	*Setophaga petechia*
Hairy woodpecker	*Leuconotopicus villosus*	American redstart	*Setophaga ruticilla*
Belted kingfisher	*Megaceryle alcyon*	Eastern bluebird	*Sialia sialis*
Red-bellied woodpecker	*Melanerpes carolinus*	American goldfinch	*Spinus tristis*
Swamp sparrow	*Melospiza georgiana*	Barred owl	*Strix varia*
Song sparrow	*Melospiza melodia*	Carolina wren	*Thryothorus ludovicianus*
Black-and-white warbler	*Mniotilta varia*	American robin	*Turdus migratorius*
Great crested flycatcher	*Myiarchus crinitus*	Eastern kingbird	*Tyrannus tyrannus*
Double-crested cormorant	*Nannopterum auritum*	Red-eyed vireo	*Vireo olivaceus*

Table 6-11: Bird Observations in Reaches 5B and 5C (from Cornell ebird.org)

In accordance with the Revised Reaches 5B-8 BRA Work Plan, collection of data from Cornell's ebird website (https:/ebird.org) was conducted to include observations from the birding public of bird usage in Reaches 5B and 5C.[1] These data were derived from hot spots located within each of two locations in these reaches. which combined had over 1,650 site visits (642 visits to Reach 5B and 1,035 visits to Reach 5C). More than 170 species of birds were recorded at sites within Reaches 5B and 5C. Note that these observations encompass all habitats in Reaches 5B and 5C, not just the floodplain wetlands.

Scientific Name	Common Name	Reach 5B	Reach 5C
Empidonax alnorum	Alder flycatcher	√	√
Botaurus lentiginosus	American bittern	√	√
Anas rubripes	American black duck	√	√
Fulica americana	American coot	√	
Corvus brachyrhynchos	American crow	√	√
Spinus tristis	American goldfinch	√	√
Larus smithsonianus	American herring gull		√
Falco sparverius	American kestrel	√	√
Anthus rubescens	American pipit		√
Setophaga ruticilla	American redstart	√	√
Turdus migratorius	American robin	√	√
Spizelloides arborea	American tree sparrow	√	√
Mareca americana	American wigeon	√	√
Scolopax minor	American woodcock	√	√
Haliaeetus leucocephalus	Bald eagle	√	√
Icterus galbula	Baltimore oriole	√	√
Riparia riparia	Bank swallow	√	√
Hirundo rustica	Barn swallow	√	√
Strix varia	Barred owl	√	√
Setophaga castanea	Bay-breasted warbler	√	√
Megaceryle alcyon	Belted kingfisher	√	√
Mniotilta varia	Black-and-white warbler	√	√
Coccyzus erythropthalmus	Black-billed cuckoo	√	√
Setophaga fusca	Blackburnian warbler	√	√
Poecile atricapillus	Black-capped chickadee	√	√
Nycticorax nycticorax	Black-crowned night heron	√	
Setophaga striata	Blackpoll warbler	√	√
Setophaga caerulescens	Black-throated blue warbler	√	√
Setophaga virens	Black-throated green warbler	√	√
Coragyps atratus	Black vulture	√	√

[1] eBird is a citizen science site, so identification is not verified. However, eBird does vet observations to make sure the occurrence is reasonable for the time and location.

Table 6-11: Bird Observations in Reaches 5B and 5C (from Cornell ebird.org) (continued)

Cyanocitta cristata	Blue jay	√	√
Polioptila caerulea	Blue-gray gnatcatcher	√	√
Vireo solitarius	Blue-headed vireo	√	√
Spatula discors	Blue-winged teal	√	√
Vermivora cyanoptera	Blue-winged warbler	√	√
Dolichonyx oryzivorus	Bobolink	√	√
Buteo platypterus	Broad-winged hawk	√	√
Certhia americana	Brown creeper	√	√
Toxostoma rufum	Brown thrasher	√	√
Molothrus ater	Brown-headed cowbird	√	√
Bucephala albeola	Bufflehead	√	√
Branta canadensis	Canada goose	√	√
Cardellina canadensis	Canada warbler	√	√
Setophaga tigrina	Cape May warbler	√	√
Thryothorus ludovicianus	Carolina wren	√	√
Bombycilla cedrorum	Cedar waxwing	√	√
Setophaga cerulea	Cerulean warbler		
Setophaga pensylvanica	Chestnut-sided warbler	√	√
Chaetura pelagica	Chimney swift	√	√
Spizella passerina	Chipping sparrow	√	√
Petrochelidon pyrrhonota	Cliff swallow	√	√
Tyto alba	Common barn owl		
Gallinula galeata	Common gallinule	√	√
Bucephala clangula	Common goldeneye		√
Quiscalus quiscula	Common grackle	√	√
Gavia immer	Common loon	√	√
Mergus merganser	Common merganser	√	√
Gallinula chloropus	Common moorhen		
Chordeiles minor	Common nighthawk	√	√
Corvus corax	Common raven	√	√
Acanthis flammea	Common redpoll	√	√
Gallinago gallinago	Common snipe		
Geothlypis trichas	Common yellowthroat	√	√
Accipiter cooperii	Cooper's hawk	√	√
Junco hyemalis	Dark-eyed junco	√	√
Phalacrocorax auritus	Double-crested cormorant	√	√
Dryobates pubescens	Downy woodpecker	√	√

Table 6-11: Bird Observations in Reaches 5B and 5C (from Cornell ebird.org) (continued)

Sialia sialis	Eastern bluebird	√	√
Tyrannus tyrannus	Eastern kingbird	√	√
Sturnella magna	Eastern meadowlark	√	√
Sayornis phoebe	Eastern phoebe	√	√
Megascops asio	Eastern screech owl		√
Pipilo erythrophthalmus	Eastern towhee	√	√
Contopus virens	Eastern wood-pewee	√	√
Sturnus vulgaris	European starling	√	√
Hesperiphona vespertinus	Evening grosbeak	√	√
Spizella pusilla	Field sparrow	√	√
Corvus ossifragus	Fish crow	√	√
Passerella iliaca	Fox sparrow	√	√
Mareca strepera	Gadwell	√	√
Regulus satrapa	Golden-crowned kinglet	√	√
Vermivora chrysoptera	Golden-winged warbler		
Dumetella carolinensis	Gray catbird	√	√
Catharus minimus	Gray-cheeked thrush		√
Ardea herodias	Great blue heron	√	√
Myiarchus crinitus	Great crested flycatcher	√	√
Ardea alba	Great egret	√	√
Bubo virginianus	Great horned owl	√	√
Tringa melanoleuca	Greater yellowlegs	√	√
Butorides virescens	Green heron	√	√
Anas carolinensis	Green-winged teal	√	√
Leuconotopicus villosus	Hairy woodpecker	√	√
Ammodramus henslowii	Henslow's sparrow		
Catharus guttatus	Hermit thrush	√	√
Larus argentatus	Herring gull		
Lophodytes cucullatus	Hooded merganser	√	√
Eremophila alpestris	Horned lark		√
Haemorhous mexicanus	House finch	√	√
Passer domesticus	House sparrow	√	√
Passerina cyanea	Indigo bunting	√	√
Charadrius vociferus	Killdeer	√	√
Rallus elegans	King rail		
Calcarius lapponicus	Lapland longspur		
Ixobrychus exilis	Least bittern		√
Empidonax minimus	Least flycatcher	√	√

Table 6-11: Bird Observations in Reaches 5B and 5C (from Cornell ebird.org) (continued)

Calidris minutilla	Least sandpiper	√	√
Tringa flavipes	Lesser yellowlegs	√	√
Melospiza lincolnii	Lincoln's sparrow	√	√
Asio otus	Long-eared owl		
Parkesia motacilla	Louisiana waterthrush	√	√
Setophaga magnolia	Magnolia warbler	√	√
Anas platyrhynchos	Mallard	√	√
Cistothorus palustris	Marsh wren	√	√
Falco columbarius	Merlin	√	√
Zenaida macroura	Mourning dove	√	√
Geothlypis philadelphia	Mourning warbler	√	
Cygnus olor	Mute swan	√	
Leiothlypis ruficapilla	Nashville warbler	√	√
Colinus virginianus	Northern bobwhite		
Cardinalis cardinalis	Northern cardinal	√	√
Colaptes auratus	Northern flicker	√	√
Accipiter gentilis	Northern goshawk		
Circus hudsonius	Northern harrier	√	√
Troglodytes aedon	Northern house wren	√	√
Mimus polyglottos	Northern mockingbird	√	√
Setophaga americana	Northern parula	√	√
Anas acuta	Northern pintail		√
Stelgidopteryx serripennis	Northern rough-winged swallow	√	
Aegolius acadicus	Northern saw-whet owl	√	√
Lanius borealis	Northern shrike	√	√
Parkesia noveboracensis	Northern waterthrush	√	√
Contopus cooperi	Olive-sided flycatcher	√	√
Leiothlypis celata	Orange-crowned warbler		√
Icterus spurius	Orchard oriole	√	√
Pandion haliaetus	Osprey	√	√
Seiurus aurocapillus	Ovenbird	√	√
Setophaga palmarum	Palm warbler	√	√
Falco peregrinus	Peregrine falcon	√	√
Vireo philadelphicus	Philadelphia vireo	√	√
Podilymbus podiceps	Pied-billed grebe		√
Dryocopus pileatus	Pileated woodpecker	√	√
Pinicola enucleator	Pine grosbeak		
Spinus pinus	Pine siskin	√	√

Table 6-11: Bird Observations in Reaches 5B and 5C (from Cornell ebird.org) (continued)

Setophaga pinus	Pine warbler	√	√
Setophaga discolor	Prairie warbler	√	√
Haemorhous purpureus	Purple finch	√	√
Progne subis	Purple martin		
Melanerpes carolinus	Red-bellied woodpecker	√	√
Sitta canadensis	Red-breasted nuthatch	√	√
Loxia curvirostra	Red crossbill	√	
Vireo olivaceus	Red-eyed vireo	√	√
Melanerpes erythrocephalus	Red-headed woodpecker		
Buteo lineatus	Red-shouldered hawk	√	√
Buteo jamaicensis	Red-tailed hawk	√	√
Gavia stellata	Red-throated loon		√
Agelaius phoeniceus	Red-winged blackbird	√	√
Larus delawarensis	Ring-billed gull	√	√
Aythya collaris	Ring-necked duck	√	√
Phasianus colchicus	Ring-necked pheasant	√	√
Columba livia	Rock dove		
Columba livia	Rock pigeon	√	√
Pheucticus ludovicianus	Rose-breasted grosbeak	√	√
Buteo lagopus	Rough-legged hawk		
Regulus calendula	Ruby-crowned kinglet	√	√
Archilochus colubris	Ruby-throated hummingbird	√	√
Bonasa umbellus	Ruffed grouse	√	√
Euphagus carolinus	Rusty blackbird	√	√
Antigone canadensis	Sandhill crane		√
Passerculus sandwichensis	Savannah sparrow	√	√
Piranga olivacea	Scarlet tanager	√	√
Cistothorus stellaris	Sedge wren		
Calidris pusilla	Semipalmated sandpiper	√	
Accipiter striatus	Sharp-shinned hawk	√	√
Plectrophenax nivalis	Snow bunting		
Anser caerulescens	Snow goose		
Tringa solitaria	Solitary sandpiper	√	√
Melospiza melodia	Song sparrow	√	√
Porzana carolina	Sora	√	√
Actitis macularia	Spotted sandpiper	√	√
Catharus ustulatus	Swainson’s thrush	√	√
Melospiza georgiana	Swamp sparrow	√	√

Table 6-11: Bird Observations in Reaches 5B and 5C (from Cornell ebird.org) (continued)

Leiothlypis peregrina	Tennessee warbler	√	√
Tachycineta bicolor	Tree swallow	√	√
Baeolophus bicolor	Tufted titmouse	√	√
Cathartes aura	Turkey vulture	√	√
Catharus fuscescens	Veery	√	√
Pooecetes gramineus	Vesper sparrow		√
Rallus limicola	Virginia rail	√	√
Vireo gilvus	Warbling vireo	√	√
Antrostomus vociferus	Whip-poor-will		
Sitta carolinensis	White-breasted nuthatch	√	√
Zonotrichia albicollis	White-throated sparrow	√	√
Meleagris gallopavo	Wild turkey	√	√
Empidonax traillii	Willow flycatcher	√	√
Gallinago delicata	Wilson's snipe	√	√
Cardellina pusilla	Wilson's warbler	√	√
Troglodytes hiemalis	Winter wren	√	√
Zonotrichia leucophrys	White-crowned sparrow	√	√
Verio griseus	White-eyed vireo		√
Aix sponsa	Wood duck	√	√
Hylocichla mustelina	Wood thrush	√	√
Helmitheros vermivorum	Worm-eating warbler	√	
Setophaga coronata	Yellow warbler	√	√
Sphyrapicus varius	Yellow-bellied sapsucker	√	√
Coccyzus americanus	Yellow-billed cuckoo	√	√
Icteria virens	Yellow-breasted chat		
Setophaga coronata	Yellow-rumped warbler	√	√
Vireo flavifrons	Yellow-throated vireo	√	√

Table 6-12: State-Listed Rare Species Potentially Associated with Floodplain Wetland Habitats in Reaches 5B and 5C[1]

Scientific Name	Common Name	State Status
	Reach 5B	
Ambystoma jeffersonianum	Jefferson Salamander (complex)	Special Concern
Botaurus lentiginosus	American Bittern	Endangered
Carex alopecoidea	Foxtail Sedge	Threatened
Claytonia virginica	Narrow-leaved Spring-beauty	Endangered
Eleocharis intermedia	Matted Spike-sedge	Threatened
Eragrostis frankii	Frank's Lovegrass	Special Concern
Glyptemys insculpta	Wood Turtle	Special Concern
Hylogomphus abbreviatus	Spine-crowned Clubtail	Endangered
Phanogomphus quadricolor	Rapids Clubtail	Endangered
Pieris oleracea	Mustard White	Threatened
Quercus macrocarpa	Bur Oak	Special Concern
Ranunculus pensylvanicus	Bristly Buttercup	Special Concern
Sagittaria cuneata	Wapato	Threatened
	Reach 5C	
Ambystoma jeffersonianum	Jefferson Salamander (complex)	Special Concern
Botaurus lentiginosus	American Bittern	Endangered
Carex alopecoidea	Foxtail Sedge	Threatened
Carex grayi	Gray's Sedge	Threatened
Claytonia virginica	Narrow-leaved Spring-beauty	Endangered
Eleocharis intermedia	Matted Spike-sedge	Threatened
Gallinula galeata	Common Gallinule	Special Concern
Glyptemys insculpta	Wood Turtle	Special Concern
Haliaeetus leucocephalus	Bald Eagle	Special Concern
Phanogomphus quadricolor	Rapids Clubtail	Endangered
Pieris oleracea	Mustard White	Threatened
Quercus macrocarpa	Bur Oak	Special Concern
Ranunculus pensylvanicus	Bristly Buttercup	Special Concern
Sagittaria cuneata	Wapato	Threatened
Sorex palustris	Water Shrew	Special Concern

[1] This list includes only species for which MNHESP provided Species Habitat mapping. In addition, review of the U.S. Fish and Wildlife Service (USFWS) on-line Information, Planning, and Consultation System (IPaC) for identification of federally listed rare species (USFWS 2024) resulted in the identification of habitat for one such listed species – the northern long-eared bat (*Myotis septentrionalis*) – and two species proposed for listing – the tricolored bat (*Perimyotis subflavus*) and the monarch butterfly (*Danaus plexippus*) – within Reaches 5B and 5C. Habitat for these species is mapped within the entirety of Reaches 5B and 5C, and potential habitat for these species occurs within floodplain wetland habitats of those reaches.

Table 6-13: Reaches 5B and 5C Floodplain Wetland Function Assessment Factors* (Functional Assessment Documented on Form FP-2)

Function	Description of Function	Parameters Considered in Assessing Function
Groundwater recharge/discharge	This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. Recharge relates to the potential for the wetland to contribute water to an aquifer. Discharge relates to the potential for the wetland to serve as an area where groundwater can be discharged to the surface.	Hydrogeologic setting; soil composition and characteristics
Floodflow alteration (storage & desynchronization)	This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
Sediment, toxicant, and 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.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
Nutrient removal, retention, and 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.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
Production export (nutrient)	This function relates to the effectiveness of the wetland to produce food or usable products for humans or other living organisms.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community; overall wildlife habitat/use
Sediment/shoreline stabilization	This function relates to the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
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. Species lists of observed and potential animals should be included in the wetland assessment report.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community; special habitat features; overall wildlife habitat/use; rare species habitat; invasive species; incidental wildlife observations
Fish and shellfish habitat	This function considers the effectiveness of seasonal or permanent waterbodies associated with the wetland in question for fish and shellfish habitat.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community; special habitat features; overall wildlife habitat; rare species habitat; invasive species
Rare species habitat	This value relates to the effectiveness of the wetland or associated waterbodies to support threatened, endangered, or other rare species.	Rare species habitat (mapped Priority Habitat and Core Area habitat and IPaC results)

* Generally adapted from USACE New England District, 1995: *The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach*, NEDEP-360-1-30a

Table 6-14: Reaches 5B and 5C Floodplain Upland Habitat Characterization

Parameter	Description of Parameter	Reaches 5B and 5C Inventory Approach*
Mapping and classification	Mapping of physical location and limits; natural community cover type classification and delineation	Woodlot 2002 Ecological Characterization mapping and classification in Reaches 5B and 5C; aerial photograph interpretation and updated LiDAR mapping; 2023-2024 field surveys to confirm mapping and obtain data for Form FP-1
Hydrogeologic setting	Surficial geology	USGS surficial geology information; U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil survey mapping
Hydrology/drainage characteristics	Degree of surface flooding; connectivity to adjacent wetlands, river or other surface water flow	Consolidate existing information (from sources below); Federal Emergency Management Agency Flood (FEMA) Flood Insurance Study (FIS); 2023-2024 field surveys to obtain data for Form FP-1
Soil composition and characteristics	Soil profile description; soils series as mapped by the USDA NRCS.	USDA NRCS soil survey mapping; consolidate other existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Plant community	Plant species by community type; density/diversity and interspersion of plant community cover types	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Overall wildlife habitat/use	Wildlife use; habitat suitability	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1; incidental wildlife observations
Special habitat features	Wolf trees; standing dead timber; tree cavities; large woody debris; turtle hibernacula or nesting sites	Consolidate existing information (from sources below); 2022 field surveys to obtain data for Form FP-1
Rare species habitat	Priority Habitat/Core Area Habitat mapping; IPaC results from USFWS on-line data base	MNHESP investigations and designations (including updated outreach to MNHESP; IPaC results; 2023-2024 field surveys to obtain data for Form FP-1
Invasive species	Invasive plant species as designated by ACOE New England District or MIPAG	Review of invasive plant species lists from USACE New England District and MIPAG; consolidate existing information (from sources below); 2023-2024 field surveys to map invasive species and obtain data for Form FP-1

* The existing information used for the Reach 5B and 5C floodplain upland habitat characterization includes information from the following sources: the 2002 Woodlot Ecological Characterization reports, the 2003 RFI Report, the 2010 example area evaluations and RCMS Report, and the MNHESP investigations of state-listed species through 2012; all described and referenced in Section 2 of the Revised Reaches 5B-8 BRA Work Plan – as well as the USDA NRCS soil surveys, USGS surficial geology mapping, and; FEMA FIS.

Table 6-15: Reaches 5B and 5C Plant Species in Upland Natural Communities Summary Data

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=26)	Status[1]
Bryophyte	Haircap moss	*Polytrichum commune*	2	Native
Herb, Forb and Grass Species	White baneberry	*Actaea pachypoda*	1	Native
	Red baneberry	*Actaea rubra*	1	Native
	Garlic Mustard	*Alliaria petiolata*	2	Invasive[A,B]
	Wild sarsaparilla	*Aralia nudicaulis*	3	Native
	Jack-in-the-pulpit	*Arisaema triphyllum*	4	Native
	Lady fern	*Athyrium angustum*	3	Native
	Northern long-awned wood grass	*Brachyelytrum aristosum*	1	Native
	Greater bladder sedge	*Carex intumescens*	1	Native
	Pennsylvania sedge	*Carex pensylvanica*	2	Native
	Blue cohosh	*Caulophyllum thalictroides*	1	Native
	Flat-branched tree-clubmoss	*Dendrolycopodium obscurum*	3	Native
	Eastern hay-scented fern	*Dennstaedtia punctilobula*	4	Native
	Silvery false spleenwort	*Deparia acrostichoides*	1	Native
	Evergreen wood fern	*Dryopteris intermedia*	5	Native
	Wood fern	*Dryopteris sp.*	2	Native
	Wild cucumber	*Echinocystis lobata*	1	Native
	Beech-drops	*Epifagus virginiana*	1	Native
	White wood-aster	*Eurybia divaricata*	5	Native
	Japanese winged-knotweed	*Fallopia japonica*	1	Invasive[A,B,C]
	Rough bedstraw	*Galium asprellum*	1	Native
	Wintergreen	*Gaultheria procumbens*	1	Native
	Northeastern manna grass	*Glyceria melicaria*	1	Native
	Jewelweed	*Impatiens capensis*	2	Native
	Common nipplewort	*Lapsana communis*	1	Non-native
	Starflower	*Lysimachia borealis*	6	Native
	Canada-mayflower	*Maianthemum canadense*	10	Native
	Ostrich fern	*Matteuccia struthiopteris*	1	Native
	American wild mint	*Mentha canadensis*	1	Native
	Partridge-berry	*Mitchella repens*	1	Native
	Indian-pipe	*Monotropa uniflora*	1	Native
	Three-leaved rattlesnake-root	*Nabalus trifoliolatus*	2	Native
	Sensitive fern	*Onoclea sensibilis*	8	Native
	Cinnamon fern	*Osmunda cinnamomea*	6	Native
	Interrupted fern	*Osmunda claytoniana*	5	Native
	Royal fern	*Osmunda regalis*	3	Native
	Common yellow wood sorrel	*Oxalis stricta*	1	Native
	New York fern	*Parathelypteris noveboracensis*	7	Native
	King Solomon's-seal	*Polygonatum biflorum*	2	Native
	Hairy Solomon's-seal	*Polygonatum pubescens*	1	Native

Table 6-15: Reaches 5B and 5C Plant Species in Upland Natural Communities Summary Data (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=26)	Status[1]
	Christmas fern	*Polystichum acrostichoides*	7	Native
	Bracken fern	*Pteridium aquilinum*	1	Native
	Elliptic-leaved shinleaf	*Pyrola elliptica*	1	Native
	Blue-stem goldenrod	*Solidago caesia*	1	Native
	Zig-zag goldenrod	*Solidago flexicaulis*	1	Native
	Smooth goldenrod	*Solidago gigantea*	1	Native
	Common wrinkle-leaved goldenrod	*Solidago rugosa*	1	Native
	Tall meadow-rue	*Thalictrum pubescens*	3	Native
	Foam-flower	*Tiarella cordifolia*	1	Native
Liana Species	Asian bittersweet	*Celastrus orbiculatus*	3	Invasive[A,B,C]
	Virginia-creeper	*Parthenocissus quinquefolia*	1	Native
	Poison ivy	*Toxicodendron radicans*	4	Native
	River grape	*Vitis riparia*	1	Native
Shrub Species	Speckled alder	*Alnus incana*	1	Native
	Japanese barberry	*Berberis thunbergii*	2	Invasive[A,B,C]
	Bush-honeysuckle	*Diervilla lonicera*	1	Native
	Burningbush	*Euonymus alatus*	2	Invasive[A,B,C]
	Witchhazel	*Hamamelis virginiana*	3	Native
	Mountain laurel	*Kalmia latifolia*	1	Native
	Northern spicebush	*Lindera benzoin*	1	Native
	Morrow's honeysuckle	*Lonicera morrowii*	10	Invasive[A,B]
	Maleberry	*Lyonia ligustrina*	1	Native
	Eastern black currant	*Ribes americanum*	1	Native
	Swamp dewberry	*Rubus hispidus*	2	Native
	Dwarf raspberry	*Rubus pubescens*	3	Native
	Highbush blueberry	*Vaccinium corymbosum*	3	Native
	Hillside blueberry	*Vaccinium pallidum*	1	Native
	Smooth arrowwood	*Viburnum dentatum*	1	Native
	Hobblebush	*Viburnum lantanoides*	1	Native
	Nannyberry	*Viburnum lentago*	1	Native
Tree Species	Striped maple	*Acer pensylvanicum*	4	Native
	Red Maple	*Acer rubrum*	15	Native
	Sugar Maple	*Acer saccharum*	12	Native
	Yellow birch	*Betula alleghaniensis*	2	Native
	Sweet birch	*Betula lenta*	4	Native
	Paper birch	*Betula papyrifera*	1	Native
	Gray birch	*Betula populifolia*	3	Native
	American hornbeam	*Carpinus caroliniana*	12	Native
	Bitternut hickory	*Carya cordiformis*	3	Native

Table 6-15: Reaches 5B and 5C Plant Species in Upland Natural Communities Summary Data (continued)

Layer	Common Name	Scientific Name	Occurrence (Number of Plots N=26)	Status[1]
	Cockspur hawthorn	*Crataegus crus-galli*	1	Native
	Large-seeded hawthorn	*Crataegus macrosperma*	1	Native
	American beech	*Fagus grandifolia*	12	Native
	White ash	*Fraxinus americana*	12	Native
	European larch	*Larix decidua*	1	Non-native
	White pine	*Pinus strobus*	10	Native
	Eastern cottonwood	*Populus deltoides*	1	Native
	Bigtooth aspen	*Populus grandidentata*	1	Native
	Quaking aspen	*Populus tremuloides*	3	Native
	Black cherry	*Prunus serotina*	11	Native
	Choke cherry	*Prunus virginiana*	1	Native
	Bur oak	*Quercus macrocarpa*	1	Native
	Northern red oak	*Quercus rubra*	13	Native
	Black oak	*Quercus velutina*	1	Native
	American yew	*Taxus canadensis*	1	Native
	American linden	*Tilia americana*	1	Native
	Eastern hemlock	*Tsuga canadensis*	14	Native
	American elm	*Ulmus americana*	2	Native
	Slippery elm	*Ulmus rubra*	1	Native

[1] Invasive Ratings: A= MIPAG Invasive; B=IPANE Invasive; C=ACOE Invasive; D=MIPAG Likely Invasive

Table 6-16: Percent Cover of Trees, Shrubs, Woody Vines, Herbs, and Mosses Estimated within Upland Natural Community Cover Types in Reaches 5Band 5C

		Reach 5B	Reach 5C	
		Northern hardwoods-hemlock-white pine forest	Northern hardwoods-hemlock-white pine forest	Red oak-sugar maple transition forest
	Count	14	2	11
Trees	**Min**	63.0	85.5	63.0
	Max	98.0	85.5	98.0
	Mean	88.4	85.5	82.5
	±SE	2.5	0	3.1
Shrubs	**Min**	0.0	10.5	0.0
	Max	63.0	10.5	63.0
	Mean	14.5	10.5	26.1
	±SE	4.4	0	7.0
Woody Vines	**Min**	0.0	0	0.0
	Max	3.0	0	10.5
	Mean	0.4	0	1.5
	±SE	0.3	0	1.0
Herbs	**Min**	3.0	10.5	0.0
	Max	85.5	63	63.0
	Mean	29.3	36.75	41.8
	±SE	7.7	26.25	7.9
Mosses	**Min**	0.0	0	0.0
	Max	38.0	10.5	63.0
	Mean	8.4	5.25	6.8
	±SE	3.7	5.25	5.6

Table 6-17: Upland Natural Communities –Biotic Habitat Features in Reaches 5B and 5C

	Wildlife Food[1]		Cover/Perches/Basking/Denning/Nesting Habitat[1]															
Plot_ID	Wetland and Aquatic Food	Upland Food	Shrub thickets with earthworm habitat	Live or Dead Trees >30" DBH	Standing Dead Trees with Cavities and Perches	Cavities in trunks or limbs of Live Trees	Small Mammal Burrows	Shrubs and/or Herbs for bird nesting	Sandy soils suitable for turtle nesting	Other Wildlife Dens/Nests	Dense Herb Cover	Large Woody Debris	Rocks, Crevices, Logs, Roots at Water Edge	Live or Dead Tall Veg. OH/Near Water	Persistent emergent wetland vegetation	Fine-leaved emergent vegetation	Depressions serving as vernal pools	Standing water Present at least part of the growing season	Four -toed salamander habitat
Reach 5B																		
13	NA	√	Ø	Ø	√	√	√	Ø	Ø	Ø	Ø	√	NA	NA	NA	NA	Ø	Ø	Ø
20	NA	√	Ø	√	Ø	√	√	Ø	Ø	Ø	Ø	*	NA	NA	NA	NA	Ø	Ø	Ø
28	NA	√	Ø	√	√	√	√	Ø	Ø	Ø	Ø	*	NA	NA	NA	NA	Ø	Ø	Ø
31	NA	√	Ø	√	√	*	√	Ø	Ø	Ø	Ø	√	NA	NA	NA	NA	Ø	NA	NA
43	NA	√	Ø	Ø	Ø	Ø	√	Ø	Ø	Ø	Ø	Ø	NA	NA	NA	NA	Ø	NA	Ø
66	Ø	√	Ø	√	√	√	√	√	Ø	Ø	√	*	NA	NA	NA	NA	Ø	√	Ø
72	Ø	Ø	Ø	√	√	Ø	Ø	√	Ø	√	Ø	√	*	*	NA	NA	Ø	Ø	Ø
73	Ø	√	√	Ø	√	√	√	√	Ø	Ø	√	√	Ø	Ø	Ø	Ø	Ø	Ø	Ø
77	Ø	*	*	√	√	*	√	√	Ø	Ø	Ø	√	Ø	Ø	Ø	Ø	Ø	Ø	Ø
79	Ø	√	Ø	Ø	Ø	Ø	√	√	Ø	Ø	Ø	√	NA	NA	NA	NA	Ø	Ø	Ø
240	NA	√	Ø	√	√	√	√	√	Ø	Ø	Ø	√	NA	NA	NA	NA	Ø	NA	NA
Reach 5C																		
83	√	√	√	Ø	√	√	√	*	Ø	Ø	√	*	Ø	Ø	Ø	Ø	Ø	√	Ø
84	√	√	√	Ø	√	√	√	*	Ø	Ø	*	*	Ø	Ø	Ø	Ø	Ø	Ø	Ø
87	Ø	√	Ø	Ø	√	√	√	√	Ø	Ø	*	*	Ø	Ø	Ø	Ø	Ø	Ø	Ø
89	NA	√	√	Ø	*	Ø	√	√	Ø	Ø	√	√	√	√	NA	NA	Ø	Ø	Ø
91	Ø	√	Ø	Ø	Ø	√	√	Ø	Ø	Ø	Ø	*	NA	NA	NA	NA	Ø	Ø	Ø
109	NA	√	√	√	√	Ø	√	√	Ø	Ø	√	√	NA	NA	NA	NA	NA	NA	NA
114	NA	√	Ø	Ø	Ø	Ø	√	Ø	Ø	Ø	Ø	√	NA	NA	NA	NA	NA	NA	NA
127	NA	√	√	√	√	√	√	√	Ø	Ø	√	*	Ø	Ø	Ø	Ø	Ø	Ø	Ø
133	Ø	√	Ø	Ø	√	√	√	√	Ø	Ø	Ø	*	NA	NA	NA	NA	Ø	Ø	Ø
177	Ø	*	√	√	√	√	NA	*	Ø	√	√	√	*	*	NA	NA	Ø	Ø	Ø
190	NA	*	Ø	√	√	Ø	Ø	Ø	Ø	Ø	Ø	*	Ø	Ø	NA	NA	Ø	Ø	NA
193	Ø	√	Ø	Ø	Ø	Ø	√	√	Ø	Ø	Ø	*	NA	NA	NA	NA	Ø	Ø	Ø
201	NA	*	Ø	√	√	√	√	√	Ø	Ø	√	*	NA	NA	Ø	Ø	Ø	Ø	Ø
205	Ø	√	Ø	√	√	√	√	Ø	Ø	Ø	Ø	√	NA	NA	NA	NA	Ø	NA	NA
208	NA	*	Ø	√	√	√	√	√	Ø	√	√	*	NA	NA	Ø	Ø	Ø	Ø	Ø

[1]See Table 6-17 for wildlife associations with listed habitat features

*=Abundant; √=Present; Ø=Absent

Table 6-18: Upland Natural Communities: Summary of Biotic Habitat Features in Reaches 5B and 5C

		Reach 5B			Reach 5C		
Habitat Feature	Wildlife Use	% of Stations Abundant	% of Stations Present	% of Stations Absent	% of Stations Abundant	% of Stations Present	% of Stations Absent
Wetland and Aquatic Food	Overall food	0	8	42	0	7	43
Upland Food	Overall food	8	83	8	29	71	0
Shrub thickets with earthworm habitat	Game foraging habitat (e.g., American woodcock)	8	17	75	0	36	64
Live or Dead Trees >30” DBH	Cover/perching/nesting	0	58	42	0	50	50
Standing Dead Trees with Cavities and Perches	Cavities/perching/breeding/nesting/feeding	0	75	25	7	71	21
Cavities in trunks or limbs of Live Trees	Cavities/perching/breeding/nesting	17	58	25	0	64	36
Small Mammal Burrows	Hibernation/breeding/nesting/escape/cover	0	92	8	0	86	7
Shrub and/or herbaceous vegetation	Suitable for birds such as veery nesting	8	50	42	14	57	29
Open sandy to gravelly soils with sparse vegetation	Turtle nesting habitat	0	0	100	0	0	100
Other Wildlife Dens/Nests	Hibernation/breeding/nesting/escape/cover	0	8	92	0	14	86
Dense Herb Cover	Voles, small mammals, amphibians, reptiles	0	25	75	14	43	43
Large Woody Debris on the ground	Small mammals, amphibians, reptiles, invertebrate emergence	33	58	8	64	36	0
Rocks, Crevices, Logs, Roots at Water Edge	Turtles, snakes, frogs, invertebrate emergence	8	0	25	7	7	29
Live or dead vegetation overhanging and/or near water	Habitat offering good visibility of open water for, e.g., osprey, kingfisher, flycatchers, cedar waxwings. Vegetation closer to ground for turtles, snakes, frogs, wading birds, wood duck, mink, raccoon	8	0	25	7	7	29
Persistent emergent wetland vegetation at least seasonally flooded during the growing season	Habitat for American bittern, wood duck, green heron, black-crowned night heron, rails (sora, king, Virginia), moorhen, coot, pie-billed grebe, etc.	0	0	25	0	0	36
Fine-leaved emergent vegetation (Grasses and sedges) at least seasonally flooded during the growing season	Habitat for common snipe, spotted sandpiper, sedge wren, least bittern, common moorhen	0	0	25	0	0	36
Depressions serving as vernal pools	Turtles, snakes, frogs, invertebrate emergence	0	0	100	0	0	86
Standing water present at least part of the growing season	Amphibians, turtles, foraging waterfowl, non-breeding amphibians and reptiles (foraging, re-hydration)	0	17	58	0	0	79
Sphagnum hummocks or mats, moss-covered logs or saturated logs, overhanging or directly adjacent to pools of standing water in spring	Habitat for four-toed salamander	0	0	83	0	0	71

Table 6-19: State-Listed Rare Species Potentially Associated with Floodplain Upland Habitats in Reaches 5B and 5C[2]

Scientific Name	Common Name	State Status
	Reach 5B	
Ambystoma jeffersonianum	Jefferson Salamander (complex)	Special Concern
Carex alopecoidea	Foxtail Sedge	Threatened
Claytonia virginica	Narrow-leaved Spring-beauty	Endangered
Eragrostis frankii	Frank's Lovegrass	Special Concern
Glyptemys insculpta	Wood Turtle	Special Concern
Pieris oleracea	Mustard White	Threatened
Quercus macrocarpa	Bur Oak	Special Concern
Ranunculus pensylvanicus	Bristly Buttercup	Special Concern
	Reach 5C	
Ambystoma jeffersonianum	Jefferson Salamander (complex)	Special Concern
Carex alopecoidea	Foxtail Sedge	Threatened
Carex grayi	Gray's Sedge	Threatened
Claytonia virginica	Narrow-leaved Spring-beauty	Endangered
Glyptemys insculpta	Wood Turtle	Special Concern
Pieris oleracea	Mustard White	Threatened
Quercus macrocarpa	Bur Oak	Special Concern
Ranunculus pensylvanicus	Bristly Buttercup	Special Concern

[2] This list includes only species for which MNHESP provided Species Habitat mapping. In addition, review of the U.S. Fish and Wildlife Service (USFWS) on-line Information, Planning, and Consultation System (IPaC) for identification of federally listed rare species (USFWS 2024) resulted in the identification of habitat for one such listed species – the northern long-eared bat (*Myotis septentrionalis*) – and two species proposed for listing – the tricolored bat (*Perimyotis subflavus*) and the monarch butterfly (*Danaus plexippus*) – in Reaches 5B and 5C. Habitat for these species is mapped within the entirety of Reaches 5B and 5C, and potential habitat for these species occurs within floodplain upland habitats of these reaches.

Table 6-20: Reaches 5B and 5C Floodplain Upland Function Assessment Factors

Function	Description of Function	Parameters Considered in Assessing Function
Groundwater recharge	Infiltration/recharge of surface water to groundwater, especially during flood or high runoff events	Hydrogeologic setting; soil composition and characteristics; hydrology/drainage characteristics; plant community
Flood storage and desynchronization	Floodwater dynamics (flood flow amelioration, flood storage and desynchronization, peak rate control)	Hydrology/drainage characteristics; plant community
Corridor ecological connectivity	Capacity to contribute to ecological corridor connectivity along the riparian zone	Mapping and classification; plant community; overall wildlife habitat/use; rare species habitat
Buffer capacity	Capacity to buffer adjacent wetland and water habitats from nearby development	Soil composition and characteristics; plant community
Overall wildlife habitat	Habitat suitability for diverse wildlife at various trophic levels and all life stages	Plant community; presence of special habitat features; overall wildlife habitat/use; rare species habitat; invasive species; incidental wildlife observations
Rare species habitat	Designated rare species habitat per MNHESP and USFWS	Rare species habitat (mapped Priority Habitat and Core Area habitat and IPaC results)

Table 7-1: Data Collected in 2023-2024 on Vernal Pool inspections in Reaches 5B and 5C

	Historical Data			2023 Biological Data				2024 Biological Data				Physical Data (2023-2024)	
Pool_ID	Obligate Species[1,3]	Facultative Species[1]	Other Species[1]	Obligate Species (egg mass counts)[1,3]	Facultative Species[1]	Other Species[1]	Fish Presence	Obligate Species (egg mass counts)[1,3]	Facultative Species[1]	Other Species[1]	Fish Presence	Permanency[2]	Perm Flowing Outlet?
5B-VP-1				WF Larvae (30-50)				WF (2), SS (3), WF (Larvae)				T[a]	Y
5B-VP-5				SS (3)		ST, GF (larvae)		SS (7)				P	N
5B-VP-6				WF (40-50), SS (2)				NA	NA			T[a]	N
5B-VP-7								WF (100's larvae)				T[a]	N
5B-VP-8	SS		PT, RSN, GF	WF Larvae (30-50)			Y	NA	NA			T[a]	N
5B-VP-10						NLF		WF (larvae), WF (2), SS (3)				P	Y
5B-VP-11	SS, WF, FS	SP	ST, RSN, NLF, GF	SS(6), WF(11)				NA	NA			T[b]	N
5B-VP-12	SS, WF		PT, RSN, NLF	WF (25), SS (2),WF (Larvae), FS				NA	NA			T[a]	N
5B-VP-13	SS, WF, FS			WF (Larvae)		ST	Y	NA	NA			P	Y
5B-VP-15	SS, WF, FS					GF (Larvae)		WF (100's larvae)		GF (Larvae)		T[b]	N
5B-VP-17	SS, WF, FS	SP	ST, PT, RSN, NLF, GF	WF (<100), SS(6)		PT		NA	NA			T[b]	N
5B-VP-18				SS (3), FS				NA	NA			T[b]	N
5B-VP-18A				SS (14)				NA	NA			P	Y
5B-VP-18B								WF (6)				T[a]	N
5B-VP-19	None	None	None	WF (40), SS (6)		Carp, PT	Y	NA	NA			T[b]	N
5B-VP-22					AT Larvae			NA - pool is already MA CVP				P	N
5B-VP-24				WF (6)-5 on dry land unhatched				NA	NA			T[b]	N
5B-VP-25				WF (1), WF (Larvae)				NA	NA			T[a]	N
5B-VP-26	WF	SP	NLF, GF	WF (2), (WF Larvae)				NA	NA			T[b]	N
5B-VP-27				WF (9), WF Larvae		RSN, NLF		NA	NA			P	N
5B-VP-28				WF Larvae (8-10)				NA	NA			T[a]	N
5B-VP-29				WF (>100 Larvae)				WF (119)				T[a]	N
5B-VP-30	WF	SP	NLF, GF	WF (>100 Larvae)				NA	NA			T[a]	N
5B-VP-32				WF (60)				WF (25)				P	Y
5B-VP-33A	WF	None	None	WF Larvae (25-50), SS(1)				NA	NA			P	Y
5B-VP-35				WF (1), WF (Larvae)(20)	SP	ST		WF (53)				T[a]	N
5B-VP-38				WF (8)				WF (28)				T[a]	N
5B-VP-46				SS (38)		RSN, GF (adult)		NA	NA			P	Y
5B-VP-47				WF (5), SS (3)				WF (33)				T[b]	N

Table 7-1: Data Collected in 2023-2024 on Vernal Pool inspections in Reaches 5B and 5C (continued)

	Historical Data			2023 Biological Data				2024 Biological Data				Physical Data (2023-2024)	
Pool_ID	Obligate Species[1,3]	Facultative Species[1]	Other Species[1]	Obligate Species (egg mass counts)[1,3]	Facultative Species[1]	Other Species[1]	Fish Presence	Obligate Species (egg mass counts)[1,3]	Facultative Species[1]	Other Species[1]	Fish Presence	Permanency[2]	Perm Flowing Outlet?
5C-VP-2				WF (28)				NA	NA			P	N
5C-VP-3				WF (13), FS				NA	NA			T[a]	N
5C-VP-4				SS (7)		RSN, GF	Y	NA	NA			P	N
5C-VP-5				WF (60), SS (3)		GF (Adult)		WF(160), SS(11)				T[b]	N
5C-VP-6				SS (11)		GF (larvae), RSN		NA	NA			P	N
5C-VP-7				WF (Larvae)		GF, RSN		NA	NA			P	N
5C-VP-8	SS	None	None	WF (Larvae), SS (1), WF (3)			Y	NA	NA			T[a]	N
5C-VP-11	SS, WF	SP	ST, RSN, NLF, PF, GF	WF (Larvae)		RSN		NA	NA			T[a]	Y
5C-VP-14A				SS (11)				NA	NA			T[b]	N

1. Species abbreviations:

Code	Meaning	Code	Meaning
	Obligate Species		***Other Species***
WF	Wood Frog	BF	Bull Frog
SS	Spotted Salamander	GF	Green Frog
JS	Jefferson Salamander	NLF	Northern Leopard Frog
FS	Fairy Shrimp	PF	Pickerel Frog
	Facultative Species	PT	Painted Turtle
AT	American Toad	RSN	Red Spotted Newt
GTF	Gray Tree Frog	ST	Snapping Turtle
SP	Spring Peeper	WT	Wood Turtle
NA	Not applicable because pool has already been determined to meet vernal pool criteria under obligate species method based on 2023 data		

2. Hydrologic Code:

Code	Meaning
T[a]	Temporary pool, observed with no surface water
T[b]	Temporary pool, observed nearly dry in late spring, expected to dry out entirely during summer of a normal hydrological year
P	Expected to be permanently flooded

3. Obligate species listed consist of egg masses for amphibians except where adults and/or larvae are noted, or fairy shrimp.

Table 7-2: Habitat Characteristics within Reaches 5B and 5C Vernal Pools and the Adjacent Landscape

		General Vernal Pool Characteristics										Vegetation Cover (%)[4]					In-Pool Physical Habitat Structure				Surrounding Land Use (Percent of total area from edge of pool)[5]							
																					All Forest		Developed		Open Space		Scrub/Shrub	
Pool_ID	Date	Discrete Depression in floodplain	Pool part of larger wetland	Number of Pools within 1000 feet	Cover Types[1]	Substrate Type[2]	Area (Acres)	Max Depth (inches)	Average Depth (inches)	Pool Hydrology[3]	Inlet/Outlet	Tree Canopy Cover	Shrubs	Herbs	Mosses	Woody Vines	FWD	CWD	Windthrown Trees / Root Wads	Hummocks (Sedge/Grass/shrub)	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750
5B-VP-1	7/23/2024	Y	N	4	SEM	Mineral/FSL	0.21	16	10	Seasonally Flooded	N	20.5	3.0	98.0	0	0	10.5	3	0	0	29.1	35.3	0.0	9.7	52.8	32.4	1.9	7.6
5B-VP-5	10/15/2024	Y	Y	7	DEM, PSS	Deep Organic Muck	0.92	27	13	Permanently Flooded	N	10.0	80.2	60.4	0	0	30	10	5	0	88.0	46.1	0.0	5.6	0.0	29.4	9.3	7.2
5B-VP-6	10/15/2024	N	Y	10	PSS, SEM	Mineral/ SL	0.05	16	10	Seasonally Flooded	Temporary	0.3	76.8	55.2	0	0	5	0	0	0	9.2	49.4	0.0	4.3	39.1	27.4	51.7	6.8
5B-VP-7	11/6/2024	Y	N	7	SEM	Mucky Mineral/FSL	0.05	20	9	Seasonally Flooded	N	22.4	47.0	96.7	0	0	5	1	0	0	6.8	25.2	43.2	36.9	48.8	23.8	1.2	5.3
5B-VP-8	11/6/2024	Y	N	10	SEM	Mucky Mineral/FSL	0.06	26	15	Seasonally Flooded	N	0.0	0.0	35.0	0	0	0	0	0	0	6.4	37.5	0.0	20.7	82.7	24.2	9.4	7.5
5B-VP-10	10/18/2024	Y	N	11	SEM	Mineral/VFSL	0.08	24	18	Seasonally Flooded/Saturated	Temporary	13.0	0.0	95.6	0	0	15	5	0	0	67.6	42.5	0.0	6.7	14.7	32.5	0.0	7.9
5B-VP-11	10/18/2024	Y	N	11	SEM	Mineral/VFSL	0.11	18	9	Seasonally Flooded	N	14.0	0.0	70.9	0	0	5	10	0	0	70.6	47.5	0.0	1.1	6.2	31.8	0.0	7.9
5B-VP-12	10/18/2024	Y	N	12	SEM	Mineral/VFSL	0.44	22	14	Seasonally Flooded	N	69.0	7.4	35.4	0	0	5	10	0	0	89.8	55.0	0.0	0.7	1.8	26.2	0.0	7.5
5B-VP-13	11/6/2024	N	Y	11	SEM, MALP, PSS	Deep Organic Muck	2.44	54	24	Permanently Flooded	Y	7.7	5.5	81.3	0	0	25	10	2	0	73.1	41.9	0.0	17.8	12.0	20.5	8.1	11.6
5B-VP-15	10/18/2024	Y	N	9	SEM	Mineral/Silt Loam	0.13	18	12	Seasonally Flooded	N	25.0	0.0	97.5	0	0	5	0	0	0	61.0	70.0	0.0	6.1	27.0	12.0	0.1	4.0
5B-VP-17	10/18/2024	Y	N	11	SEM, PSS	Mineral/Silt Loam	0.55	28	13	Seasonally Flooded	N	64.1	8.4	69.3	0	0	30	15	0	0	93.9	68.3	0.0	0.4	4.6	17.9	0.0	4.2
5B-VP-18	10/18/2024	Y	N	11	SEM	Mineral/VFSL	0.18	20	10	Seasonally Flooded	N	0.0	1.1	69.5	0	0	30	15	0	0	81.3	64.8	0.0	0.2	14.0	17.7	2.1	6.6
5B-VP-18A	10/31/2024	N	Y	10	SEM	Deep Organic Muck	0.22	24	10	Semipermanently Flooded	Temporary	67.6	0.0	100.0	0	0	10	12	7	3	93.5	63.3	0.0	4.6	6.5	16.0	0.0	6.3
5B-VP-18B	10/31/2024	Y	N	9	SEM	Mineral/ VFSL	0.09	14	8	Seasonally Flooded	N	100.0	4.2	100.0	0	0	7	7	0	0	99.9	59.8	0.0	4.1	0.1	16.0	0.0	10.3
5B-VP-19	10/15/2024	N	Y	8	PSS, WMD	Mineral/Silt Loam	0.05	10	5	Seasonally Flooded	N	0.0	39.8	63.8	0	0	15	0	0	0	47.9	65.9	2.4	0.5	5.5	16.3	44.3	10.6
5B-VP-22	5/9/2023	N	Y	11	DEM	Mineral/ VFSL	0.39	28	14	Seasonally Flooded/Saturated	Temporary	10.0	20.0	30.0	0	0	10	0	0	0	45.2	23.3	7.1	5.6	12.6	30.5	35.1	29.9
5B-VP-24	10/30/2024	Y	N	10	SEM	Mineral/ VFSL	0.11	14	9	Seasonally Flooded	N	31.7	0.0	100.0	0	0	2	0	0	0	78.2	24.4	6.5	9.9	0.0	26.8	0.1	31.6
5B-VP-25	10/14/2024	N	Y	11	SEM, PSS	Mineral/FSL	0.03	10	6	Seasonally Flooded/Saturated	N	0.0	100.0	100.0	0	0	0	0	0	0	0.3	15.5	12.2	3.1	23.5	37.0	63.9	32.2
5B-VP-26	10/14/2024	N	Y	10	SEM, PSS	Mineral/Silt Loam	0.16	11	6	Seasonally Flooded/Saturated	N	12.0	6.6	50.5	0	0	0	0	0	0	0.0	13.6	16.9	2.6	23.1	38.1	53.2	32.6
5B-VP-27	10/29/2024	Y	Y	10	DEM, PSS	Mineral/FSL	0.55	23	14	Seasonally Flooded	N	0.0	12.0	53.0	0	0	0	0	0	2	0.0	5.0	0.0	3.4	36.4	45.4	44.1	34.8
5B-VP-28	10/30/2024	Y	N	9	WMD, SEM	Mineral/ VFSL	0.04	7	4	Seasonally Flooded	N	0.0	0.0	100.0	0	0	0	0	0	0	0.0	11.9	0.0	5.5	38.7	35.8	61.3	33.3
5B-VP-29	10/30/2024	Y	Y	10	SEM	Mineral/ VFSL	0.08	15	7	Seasonally Flooded	N	0.0	0.0	100.0	0	0	0	0	0	20	0.0	9.5	0.0	3.4	35.8	39.8	64.2	32.8
5B-VP-30	10/30/2024	Y	Y	10	SEM	Mineral/ VFSL	0.02	5	3	Seasonally Flooded	N	0.0	2.8	100.0	0	0	0	0	0	0	0.0	5.9	0.0	1.8	15.4	44.9	62.0	31.8
5B-VP-32	10/29/2024	N	Y	9	PSS	Mineral/FSL	0.17	18	14	Seasonally Flooded	Y	0.0	20.3	59.2	0	0	5	0	0	2	0.0	4.5	0.0	4.0	24.2	45.5	67.9	33.8
5B-VP-33A	10/29/2024	N	Y	7	PSS	Mineral/FSL	0.90	29	19	Permanently Flooded	Y	0.0	69.2	99.2	0	0	4	3	0	30	0.0	13.6	0.0	3.4	21.4	42.4	78.6	29.3
5B-VP-35	10/31/2024	Y	N	7	DEM, PSS, WMD	Deep Organic Muck	0.84	27	15	Seasonally Flooded/Saturated	N	10.5	10.0	94.0	0	0	2	0	0	5	0.0	5.7	0.0	0.8	85.1	39.4	0.0	40.1
5B-VP-38	11/6/2024	Y	N	2	SEM	Mineral/ VFSL	0.04	10	7	Seasonally Flooded	N	100.0	0.0	61.2	0	0	25	25	0	0	0.0	7.9	0.0	0.0	35.6	47.0	0.0	31.7
5B-VP-46	11/5/2024	N	Y	2	PSS, LGS	Deep Organic Muck	0.20	35	17	Seasonally Flooded/Saturated	Y	0.0	10.0	20.0	0	0	30	0	0	0	7.0	49.2	0.0	2.8	6.2	19.4	75.1	19.4
5B-VP-47	10/30/2024	Y	Y	2	SEM	Mineral/ VFSL	0.07	14	8	Seasonally Flooded	N	77.9	7.9	97.6	0	0	30	10	0	1	87.5	43.3	0.0	0.2	0.0	19.5	12.5	20.7
5C-VP-2	10/30/2024	Y	N	8	PSS	Organic/VFSL	0.74	41	12	Seasonally Flooded/Saturated	N	64.4	65.3	38.4	0	0	10	7	0	80	100.0	64.2	0.0	2.1	0.0	9.5	0.0	15.8

Table 7-2: Habitat Characteristics within Reaches 5B and 5C Vernal Pools and the Adjacent Landscape (continued)

		General Vernal Pool Characteristics										Vegetation Cover (%)[4]					In-Pool Physical Habitat Structure				Surrounding Land Use (Percent of total area from edge of pool)[5]							
																					All Forest		Developed		Open Space		Scrub/Shrub	
Pool_ID	Date	Discrete Depression in floodplain	Pool part of larger wetland	Number of Pools within 1000 feet	Cover Types[1]	Substrate Type[2]	Area (Acres)	Max Depth (inches)	Average Depth (inches)	Pool Hydrology[3]	Inlet/Outlet	Tree Canopy Cover	Shrubs	Herbs	Mosses	Woody Vines	FWD	CWD	Windthrown Trees / Root Wads	Hummocks (Sedge/Grass/shrub)	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750
5C-VP-3	10/30/2024	Y	N	7	PSS	Mineral/ VFSL	0.07	11	4	Seasonally Flooded	N	65.7	0.7	13.4	0	0	10	17	3	0	81.8	62.8	0.0	1.8	0.0	8.8	18.2	19.0
5C-VP-4	10/30/2024	N	Y	7	PSS, MALP	Deep Organic Muck	2.52	39	14	Permanently Flooded	N	11.8	38.5	58.6	0	0	15	12	5	10	76.4	66.8	2.9	1.6	1.4	10.9	14.9	13.8
5C-VP-5	10/30/2024	Y	N	9	PSS	Mineral/Loamy sand	0.07	15	10	Seasonally Flooded/Saturated	N	50.5	19.0	25.2	0	0	7	7	2	3	72.3	75.6	13.9	2.2	0.0	7.5	13.8	10.8
5C-VP-6	11/5/2024	Y	N	5	PSS, MALP	Mineral/Silt Loam	0.70	12	9	Semipermanently Flooded	N	56.0	48.0	48.0	0	0	20	1	0	0	66.1	67.9	0.0	1.1	0.0	7.0	24.2	13.9
5C-VP-7	11/5/2024	Y	N	5	PSS, MALP, DEM	Deep Organic Muck	0.92	6	5	Seasonally Flooded/Saturated	N	11.3	37.2	62.8	0	0	10	1	0	0	84.2	60.2	0.0	1.0	2.1	8.8	0.3	17.3
5C-VP-8	10/31/2024	Y	N	5	SEM	Mineral/Silt Loam	0.26	20	8	Seasonally Flooded	N	9.6	9.3	100.0	0	0	15	5	0	0	63.8	50.4	0.0	1.6	9.0	14.8	1.9	19.8
5C-VP-11	10/31/2024	Y	N	0	SEM	Mineral/VFSL	0.08	25	14	Seasonally Flooded/Saturated	Temporary	0.0	26.0	79.2	0	0	7	7	2	0	50.1	59.7	0.0	0.0	5.2	7.0	15.7	15.5
5C-VP-14A	11/1/2024	Y	Y	0	SEM	Mineral/Silt Loam	0.06	24	18	Seasonally Flooded	N	10.0	2.0	90.0	1	0	1	2	0	0	36.5	49.8	0.0	0.0	4.0	9.4	28.7	16.1
5C-VP-16	10/31/2024	N	Y	0	RMS	Mineral/VFSL	0.06	13	9	Seasonally Flooded	Temporary	0.0	78.6	91.4	0	0	7	7	5	5	71.3	49.9	0.0	0.0	0.0	2.1	26.1	20.1
5C-VP-17	5/4/2023	N	Y	0	PSS/SEM	Mineral/Silt Loam	0.08	32	18	Seasonally Flooded/Saturated	Temporary	0.0	23.1	65.7	0	0	10.5	10.5	0	63	21.9	43.4	0.0	0.0	2.0	2.5	76.1	12.5

Table 7-3. Summary Statistics of Vernal Pool Vegetation Cover, In-pool Physical Structure, and the Adjacent Landscape

	Vegetation Cover (%)					In-Pool Physical Habitat Structure				Surrounding Land Use (Percent of total area from edge of pool)[1]								
										All Forest		Developed		Open Space		Scrub/Shrub		
	Tree Canopy Cover	Shrubs	Herbs	Mosses	Woody Vines	FWD	CWD	Windthrown Trees / Root Wads	Hummocks (Sedge/Grass/shrub)	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750	VPE 0-100	CTH 100-750	Number of Pools within 1000 feet
Min	0.0	0.0	13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	2.1	0.0	4.0	0.0
Max	100.0	100.0	100.0	1.0	0.0	30.0	25.0	7.0	80.0	100.0	75.6	43.2	36.9	85.1	47.0	78.6	40.1	12.0
Mean	23.4	22.0	71.6	0.03	0.0	10.5	5.3	0.8	5.6	46.5	41.4	2.6	4.4	17.4	23.6	24.2	18.0	7.4
Count	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
SE	4.8	4.4	4.2	0.03	0.0	1.6	1.0	0.3	2.6	5.9	3.6	1.2	1.1	3.4	2.1	4.3	1.7	0.6

1. VPE = Vernal Pool Envelope, landscape within 0-100 feet from pool edge
   CTH = Critical Terrestrial Habitat, landscape within 100-750 feet from pool edge

Table 7-4. Reaches 5B and 5C Plant Species Summary Data for Certified Vernal Pools

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=40)
Herb, Forb and Grass Species	Sweet flag	*Acorus calamus*	Native	4
	Water plantain	*Alisma subcordatum*	Native	4
	Northern water-plantain	*Alisma triviale*	Native	1
	Nodding beggar-ticks	*Bidens cernua*	Native	2
	Purple-stem beggar-ticks	*Bidens connata*	Native	1
	Devil's beggar-tick	*Bidens frondosa*	Native	6
	Tall beggar-tick	*Bidens vulgata*	Native	2
	Small-spiked false nettle	*Boehmeria cylindrica*	Native	4
	Greater water-starwort	*Callitriche heterophylla*	Native	1
	Pond water-starwort	*Callitriche stagnalis*	Non-native	1
	Hedge bindweed	*Calystegia sepium*	Native	2
	Fringed sedge	*Carex crinita*	Native	1
	Lake sedge	*Carex lacustris*	Native	3
	Hop sedge	*Carex lupulina*	Native	6
	Retrorse sedge	*Carex retrorsa*	Native	3
	Sedge	*Carex spp.*	Native	1
	Tussock sedge	*Carex stricta*	Native	1
	Buttonbush	*Cephalanthus occidentalis*	Native	2
	Coontail	*Ceratophyllum demersum*	Native	1
	Rough bedstraw	*Cgalium asprellum*	Native	2
	Bulblet-bearing water hemlock	*Cicuta bulbifera*	Native	1
	Prickly tree-clubmoss	*Dendrolycopodium dendroideum*	Native	1
	Flat branched tree-clubmoss	*Dendrolycopodium obscurum*	Native	1
	Flat-topped white aster	*Doellingeria umbellata*	Native	1
	Spinulose wood fern	*Dryopteris carthusiana*	Native	1
	Intermediate wood fern	*Dryopteris intermedia*	Native	1
	Three-way sedge	*Dulichium arundinaceum*	Native	3
	Wild cucumber	*Echinocystis lobata*	Native	2
	Needle spikerush	*Eleocharis acicularis*	Native	10
	Common spikerush	*Eleocharis palustris*	Native	1
	Eastern willow-herb	*Epilobium coloratum*	Native	1
	River horsetail	*Equisetum fluviatile*	Native	3
	Spotted joe-pye weed	*Eutrochium maculatum*	Native	2
	Climbing bindweed	*Fallopia scandens*	Native	2
	Rough bedstraw	*Galium asprellum*	Native	13
	Rattlesnake manna grass	*Glyceria canadensis*	Native	1
	American manna grass	*Glyceria grandis*	Native	2
	Floating manna grass	*Glyceria septentrionalis*	Native	1
	Fowl manna grass	*Glyceria striata*	Native	1

Table 7-4. Reaches 5B and 5C Plant Species Summary Data for Certified Vernal Pools (continued)

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=40)
	St. John's-wort	*Hypericum virginicum*	Native	4
	Jewelweed	*Impatiens capensis*	Native	10
	Yellow iris	*Iris pseudacorus*	Invasive[A,B]	11
	Blue iris	*Iris versicolor*	Native	1
	Soft rush	*Juncus effusus*	Native	3
	Rice cut grass	*Leersia oryzoides*	Native	8
	White cut grass	*Leersia virginica*	Native	1
	Common duckweed	*Lemna minor*	Native	7
	Common water-primrose	*Ludwigia palustris*	Native	11
	Northern water-horehound	*Lycopus uniflorus*	Native	5
	Moneywort	*Lysimachia nummularia*	Invasive[A,C]	22
	Swamp yellow-loosestrife	*Lysimachia terrestris*	Native	2
	Purple loosestrife	*Lythrum salicaria*	Invasive[A,B,C]	28
	Water forget-me-not	*Myosotis scorpioides*	Invasive[D]	13
	Yellow pond-lily	*Nuphar variegata*	Native	4
	Sensitive fern	*Onoclea sensibilis*	Native	23
	Royal fern	*Osmunda spectabilis*	Native	5
	Cinnamon fern	*Osmundastrum cinnamomeum*	Native	1
	Arrow-arum	*Peltandra virginica*	Native	9
	Ditch-stonecrop	*Penthorum sedoides*	Native	17
	Arrow-leaved tearthumb	*Peresicaria sagittata*	Native	1
	Water-pepper smartweed	*Persicaria hydropiper*	Native	3
	False water-pepper smartweed	*Persicaria hydropiperoides*	Native	28
	Dock-leaved smartweed	*Persicaria lapathifolia*	Native	1
	Pennsylvania smartweed	*Persicaria pensylvanica*	Native	4
	Arrow-leaved tearthumb	*Persicaria sagittaria*	Native	1
	Arrow-leaved tearthumb	*Persicaria sagittata*	Native	17
	Reed canary grass	*Phalaris arundinacea*	Invasive[A,B,C]	12
	Phragmites	*Phragmites australis*	Invasive[A,B,C]	1
	Canada clearweed	*Pilea pumila*	Native	13
	White pine	*Pinus strobus*	Native	1
	Juniper haircap moss	*Polytrichum juniperinum*	Native	1
	Pickerelweed	*Pontederia cordata*	Native	5
	Pondweed	*Potamogeton sp.*	Native	1
	Swamp buttercup	*Ranunculus caricetorum*	Native	2
	Swamp dewberry	*Rubus hispidus*	Native	1
	Greater water dock	*Rumex britannica*	Native	4

Table 7-4. Reaches 5B and 5C Plant Species Summary Data for Certified Vernal Pools (continued)

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=40)
	Woolgrass	*Scirpus cyperinus*	Native	9
	Leafy bulrush	*Scirpus polyphyllus*	Native	1
	Mad dog skullcap	*Scutellaria lateriflora*	Native	1
	American burnweed	*Senecio hieraciifolius*	Native	1
	Water-parsnip	*Sium suave*	Native	2
	Carrion-flower	*Smilax herbacea*	Native	1
	Climbing nightshade	*Solanum dulcamara*	Non-native	1
	American bur-reed	*Sparganium americanum*	Native	3
	Great bur-reed	*Sparganium eurycarpum*	Native	14
	Greater duckweed	*Spirodela polyrhiza*	Native	3
	Tall meadow-rue	*Thalictrum pubescens*	Native	1
	Marsh fern	*Thelypteris palustris*	Native	8
	Broad-leaved cattail	*Typha latifolia*	Native	2
	Narrow-leaved speedwell	*Veronica scutellata*	Native	1
	Columbian water-meal	*Wolffia columbiana*	Native	1
	Rough cocklebur	*Xanthium strumarium*	Native	5
Shrub Species	Speckled alder	*Alnus incana*	Native	2
	Buttonbush	*Cephalanthus occidentalis*	Native	11
	White dogwood	*Cornus alba*	Native	1
	Silky dogwood	*Cornus amomum*	Native	18
	Common winterberry	*Ilex verticillata*	Native	4
	Morrow's honeysuckle	*Lonicera morrowii*	Invasive[A,B]	3
	Pussy willow	*Salix discolor*	Native	2
	Black willow	*Salix nigra*	Native	9
	Silky willow	*Salix sericea*	Native	4
	Willow	*Salix sp.*	Native	2
	White meadowsweet	*Spiraea alba*	Native	4
	Highbush blueberry	*Vaccinium corymbosum*	Native	1
	Smooth arrowwood	*Viburnum dentatum*	Native	2
Tree Species	Red Maple	*Acer rubrum*	Native	7
	Silver maple	*Acer saccharinum*	Native	15
	American hornbeam	*Carpinus caroliniana*	Native	3
	Cockspur hawthorn	*Crataegus crus-galli*	Native	1
	Large-seeded hawthorn	*Crataegus macrocarpa*	Native	4
	Bur oak	*Quercus macrocarpa*	Native	1
	Northern red oak	*Quercus rubra*	Native	1

[1] Invasive Ratings: A= MIPAG Invasive; B=IPANE Invasive; C=ACOE Invasive; D=MIPAG Likely Invasive

Table 7-5: State-Listed Rare Species Potentially Associated with Vernal Pool Habitats in Reaches 5B and 5C[1]

Scientific Name	Common Name	State Status
	Reach 5B	
Ambystoma jeffersonianum	Jefferson Salamander (complex)	Special Concern
Botaurus lentiginosus	American Bittern	Endangered
Carex alopecoidea	Foxtail Sedge	Threatened
Eleocharis intermedia	Matted Spike-sedge	Threatened
Glyptemys insculpta	Wood Turtle	Special Concern
Pieris oleracea	Mustard White	Threatened
Quercus macrocarpa	Bur Oak	Special Concern
Ranunculus pensylvanicus	Bristly Buttercup	Special Concern
Sagittaria cuneata	Wapato	Threatened
	Reach 5C	
Ambystoma jeffersonianum	Jefferson Salamander (complex)	Special Concern
Botaurus lentiginosus	American Bittern	Endangered
Carex alopecoidea	Foxtail Sedge	Threatened
Carex grayi	Gray's Sedge	Threatened
Eleocharis intermedia	Matted Spike-sedge	Threatened
Gallinula galeata	Common Gallinule	Special Concern
Glyptemys insculpta	Wood Turtle	Special Concern
Pieris oleracea	Mustard White	Threatened
Quercus macrocarpa	Bur Oak	Special Concern
Ranunculus pensylvanicus	Bristly Buttercup	Special Concern
Sagittaria cuneata	Wapato	Threatened

[1] This list includes only species for which MNHESP provided Species Habitat mapping. In addition, review of the U.S. Fish and Wildlife Service (USFWS) on-line Information, Planning, and Consultation System (IPaC) for identification of federally listed rare species (USFWS 2023) resulted in the identification of habitat for one such listed species – the northern long-eared bat (*Myotis septentrionalis*) – and two species proposed for listing – the tricolored bat (*Perimyotis subflavus*) and the monarch butterfly (*Danaus plexippus*) – in Reaches 5B and 5C. Habitat for these species is mapped within the entirety of Reaches 5B and 5C, and potential habitat for these species occurs within vernal pool habitats of these reaches.

Table 7-6: Vernal Pool Tier Ratings for Reaches 5B and 5C*

	Category A				Category B			
Pool_ID	State-listed Species Present or Breeding in CVP	2 or more VP Indicator Species	> 25 Egg Masses Counted	Score	>75% VPE Undvlp	>50% CTH Undvlp	Score	Tier Rating
5B-VP-1		Yes		1	Yes	Yes	2	Tier I
5B-VP-5				0	Yes	Yes	2	Tier III
5B-VP-6		Yes	Yes	2	Yes	Yes	2	Tier I
5B-VP-7				0		Yes	1	Tier III
5B-VP-8				0	Yes	Yes	2	Tier III
5B-VP-10		Yes		1	Yes	Yes	2	Tier I
5B-VP-11		Yes		1	Yes	Yes	2	Tier I
5B-VP-12		Yes	Yes	2	Yes	Yes	2	Tier I
5B-VP-13				0	Yes	Yes	2	Tier III
5B-VP-15				0	Yes	Yes	2	Tier III
5B-VP-17		Yes	Yes	2	Yes	Yes	2	Tier I
5B-VP-18		Yes		1	Yes	Yes	2	Tier I
5B-VP-18A				0	Yes	Yes	2	Tier III
5B-VP-18B				0	Yes	Yes	2	Tier III
5B-VP-19		Yes	Yes	2	Yes	Yes	2	Tier I
5B-VP-22				0	Yes	Yes	2	Tier III
5B-VP-24				0	Yes	Yes	2	Tier III
5B-VP-25				0	Yes	Yes	2	Tier III
5B-VP-26				0	Yes	Yes	2	Tier III
5B-VP-27				0	Yes	Yes	2	Tier III
5B-VP-28				0	Yes	Yes	2	Tier III
5B-VP-29			Yes	1	Yes	Yes	2	Tier I
5B-VP-30				0	Yes	Yes	2	Tier III
5B-VP-32			Yes	1	Yes	Yes	2	Tier I
5B-VP-33A		Yes	Yes	2	Yes	Yes	2	Tier I

Table 7-6: Vernal Pool Tier Ratings for Reaches 5B and 5C* (continued)

	Category A				Category B			
Pool_ID	State-listed Species Present or Breeding in CVP	2 or more VP Indicator Species	> 25 Egg Masses Counted	Score	>75% VPE Undvlp	>50% CTH Undvlp	Score	Tier Rating
5B-VP-35			Yes	1	Yes	Yes	2	Tier I
5B-VP-38			Yes	1	Yes	Yes	2	Tier I
5B-VP-46			Yes	1	Yes	Yes	2	Tier I
5B-VP-47	Yes	Yes	Yes	3	Yes	Yes	2	Tier I
5C-VP-2	Yes		Yes	2	Yes	Yes	2	Tier I
5C-VP-3	Yes	Yes		2	Yes	Yes	2	Tier I
5C-VP-4	Yes			1	Yes	Yes	2	Tier I
5C-VP-5	Yes		Yes	2	Yes	Yes	2	Tier I
5C-VP-6				0	Yes	Yes	2	Tier III
5C-VP-7				0	Yes	Yes	2	Tier III
5C-VP-8		Yes		1	Yes	Yes	2	Tier I
5C-VP-11				0		Yes	1	Tier III
5C-VP-14A				0		Yes	1	Tier III
5C-VP-16		Yes		1	Yes	Yes	2	Tier I
5C-VP-17		Yes		1	Yes	Yes	2	Tier I

* Based upon the Tier Rating System of Calhoun and Klemens (2002)

Table 8-1: State-Listed Species with Species Habitat Mapping Overlapping Reaches 5B and 5C as shown on MNHESP Data Provided in October 2022

Scientific Name	Common Name	MA Protection Status[1]	Mapped Acreage in Reach 5B	Mapped Acreage in Reach 5C
Mammals				
Sorex palustris	Water Shrew	SC	0.0	90.7
Birds				
Botaurus lentiginosus	American Bittern	E	65.3	27.0
Gallinula galeata	Common Gallinule	SC	0.0	241.5
Haliaeetus leucocephalus	Bald Eagle	SC	0.0	135.6
Reptiles				
Glyptemys insculpta	Wood Turtle	SC	193.6	173.3
Amphibians				
Ambystoma jeffersonianum	Jefferson Salamander (complex)	SC	12.6	39.7
Insects				
Hylogomphus abbreviatus	Spine-crowned Clubtail	SC	109.9	0.0
Phanogomphus quadricolor	Rapids Clubtail	E	169.9	81.6
Pieris oleracea	Mustard White	E	192.7	355.2
Plants				
Carex alopecoidea	Foxtail Sedge	T	65.8	0.3
Carex grayi	Gray's Sedge	T	0.0	61.4
Claytonia virginica	Narrow-leaved Spring-beauty	E	16.1	1.7
Eleocharis intermedia	Matted Spike-sedge	T	84.4	71.2
Ergrostis frankii	Frank's Lovegrass	SC	38.8	0.0
Quercus macrocarpa	Bur Oak	SC	15.3	227.5
Ranunculus pensylvanicus	Bristly Buttercup	SC	2.4	0.8
Sagittaria cuneata	Wapato	T	98.8	203.6

1. MNHESP (Massachusetts Natural Heritage and Endangered Species Program)

- E (State Endangered) - Any species of plant or animal in danger of extinction throughout all or a significant portion of its range and species of plants or animals in danger of extirpation as documented by biological research and inventory.
- T (State Threatened) - Any species of plant or animal likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and any species declining or rare as determined by biological research and inventory and likely to become endangered in the foreseeable future.
- SC (State Special Concern) - Any species of plant or animal which has been documented by biological research and inventory to have suffered a decline that could threaten the species if allowed to continue unchecked or that occurs in such small numbers or with such a restricted distribution or specialized habitat requirements that it could easily become threatened within Massachusetts.

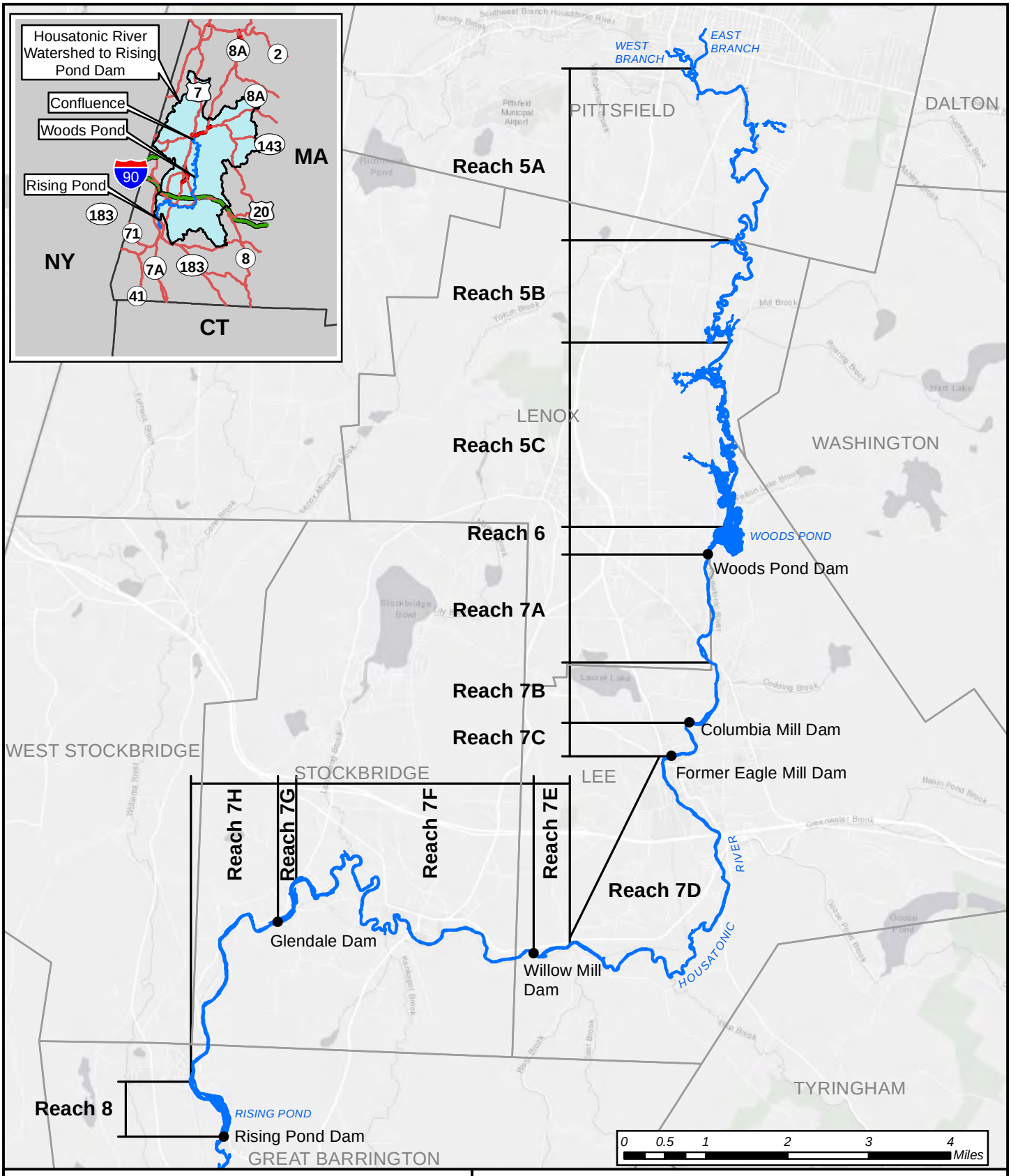
Table 9-1: Invasive and Other Unacceptable Plant Species Summary Data for Reaches 5B and 5C

Layer	Common Name	*Scientific Name*	Status[1]	Occurrence*
Tree Species	Black locust	*Robinia pseudocacia*	AC	B
Shrub Species	Japanese barberry	*Berberis thunbergii*	ABC	FP, B
	Burningbush	*Euonymus alatus*	ABC	FP
	Glossy false buckthorn	*Frangula alnus*	ABC	FP
	European privet	*Ligustrum vulgare*	D	FP
	Morrow's honeysuckle	*Lonicera morrowii*	AB	FP, BW, VP, B
	European buckthorn	*Rhamnus cathartica*	ABC	FP, BW, B
	Multiflora rose	*Rosa multiflora*	ABC	FP, BW, B
Woody Vine Species	Asian bittersweet	*Celastrus orbiculatus*	ABC	FP, B
Herb, Forb and Grass Species	Garlic Mustard	*Alliaria petiolata*	AB	FP
	Japanese winged-knotweed	*Fallopia japonica*	ABC	FP, B
	Dame's-rocket	*Hesperis matronalis*	AB	FP
	Yellow iris	*Iris pseudacorus*	AB	FP, BW, VP, B
	Moneywort	*Lysimachia nummularia*	A	FP, VP, B
	Purple loosestrife	*Lythrum salicaria*	ABC	FP, BW, VP, B
	Water forget-me-not	*Myosotis scorpioides*	D	FP, BW, VP, B
	Eurasian water-milfoil	*Myriophyllum spicatum*	AB	FP, BW, R, B
	Reed canary grass	*Phalaris arundinacea*	ABC	FP, BW, VP, B
	Phragmites	*Phragmites australis*	ABC	FP, BW, VP, R
	Curly pondweed	*Potamogeton crispus*	ABC	BW, R
	Bittersweet nightshade	*Solanum dulcamara*	B	B
	Water-chestnut	*Trapa natans*	AB	FP, BW
	Coltsfoot	*Tussilago farfara*	BCD	B

[1]Invasive Ratings: A= MIPAG Invasive; B=IPANE Invasive; C=ACOE Invasive; D=MIPAG Likely Invasive

*Occurrence Codes: FP=Floodplain; B=Bank; BW=Backwater; R=River; VP=Vernal Pool

Figures



Legend

- Dams
- Watershed to Rising Pond Dam
- Housatonic River

NOTE:
Basemap "Light Gray Canvas" from ESRI

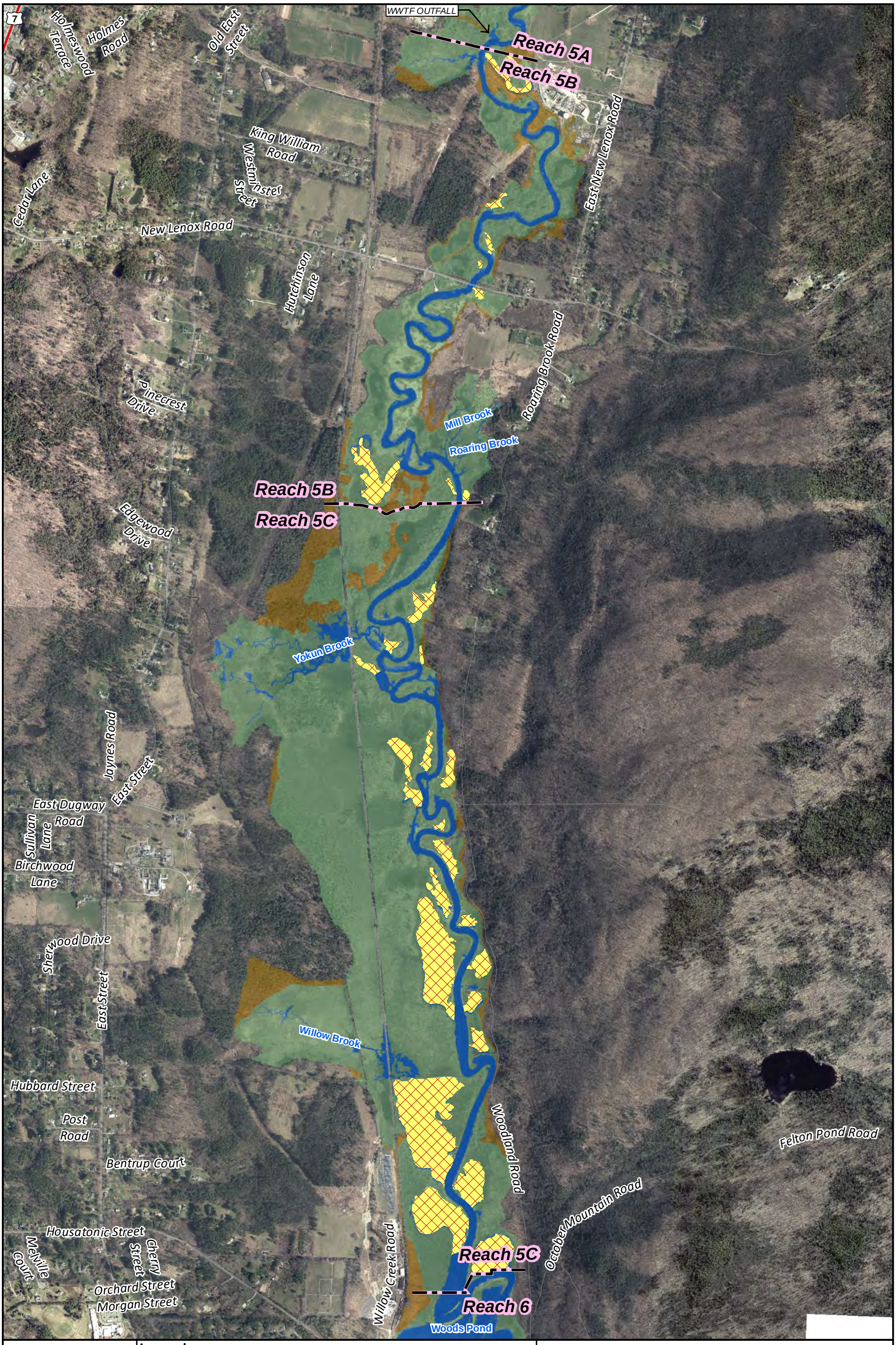
Rest of River Area Subject to Revised Permit

Reaches 5B and 5C Baseline Restoration Assessment Report

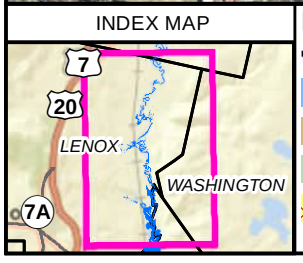
SCALE	DATE	PROJECT NO.
1:104,000	2/12/2025	60736371

AECOM

Figure 1-1



INDEX MAP



Legend

- Reach Boundaries
- Housatonic River
- Upland
- Wetland
- Backwaters

0 325 650 1,300 Feet

Reach 5B and 5C
Reaches 5B and 5C
Baseline Restoration Assessment Report
Housatonic River

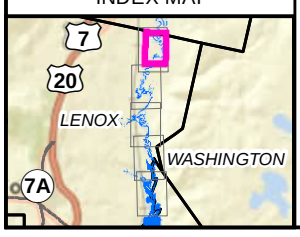
SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

AECOM

Figure 1-2
Map Sheet 1 of 1



INDEX MAP



Legend

- Minnow Trap Location
- Reach Boundaries
- RBP Area Boundary
- Water Flow Direction

RBP-#: In-river assessment reach

0 100 200 400 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Sampling Stations
Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60688342

AECOM

Figure 3-1a

Map Sheet 1 of 6

New Lenox Road

5B-C-1 Start

5B RBP 2

5B Minnow Traps 2&3

5B-C-1 End

5B RBP 3

Example Area #5

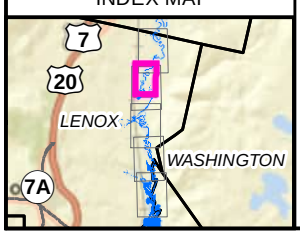
5B-C-2 end

5B-C-2 Start

Mill Brook

Roaring Brook

INDEX MAP



Legend

- Minnow Trap Location
- Macroinvertebrate Sampling Station
- Example Area
- RBP Area Boundary
- RBP-#: In-river assessment reach
- Water Flow Direction

0 100 200 400 Feet

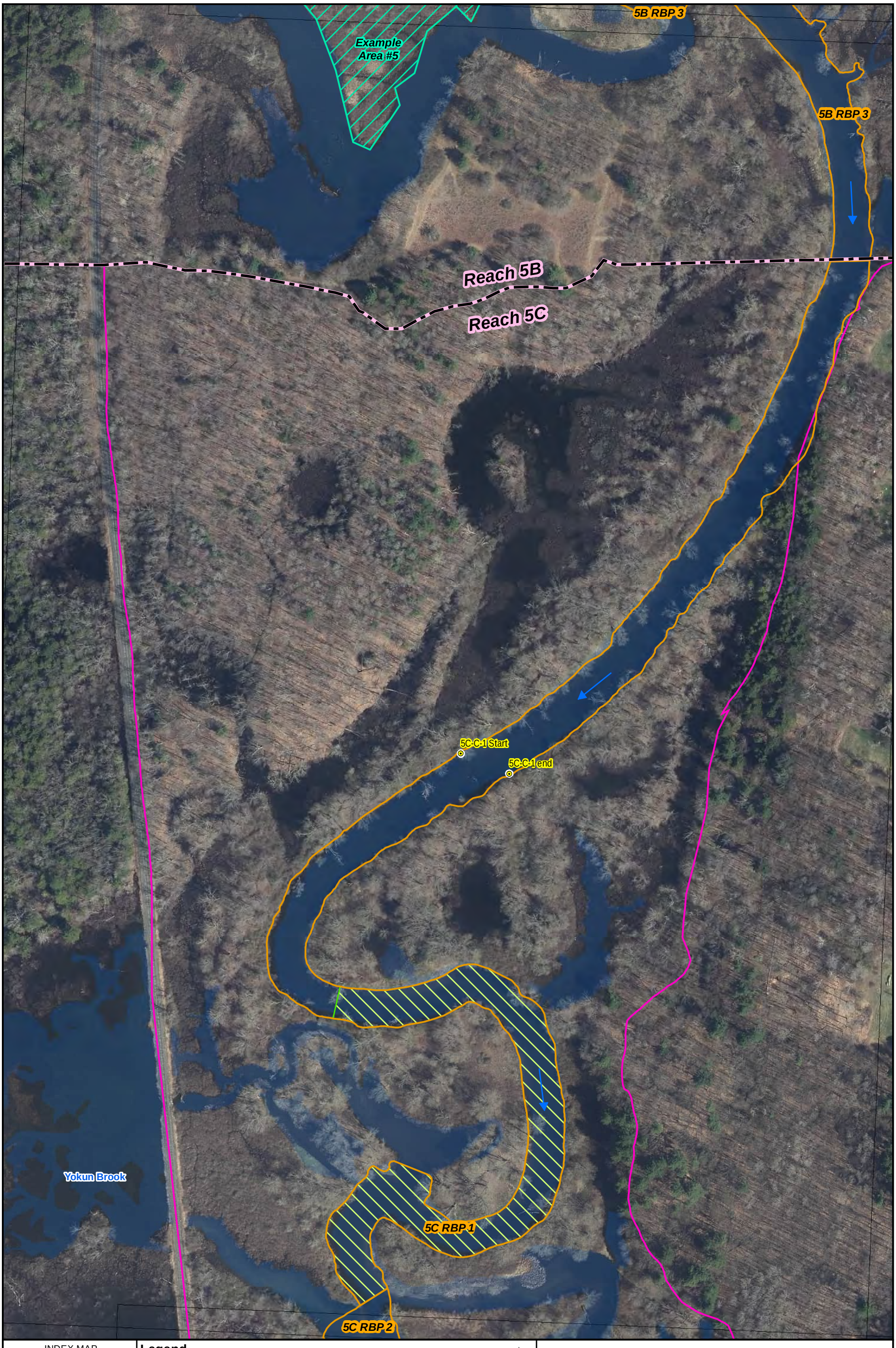
Reach 5B and 5C
Riverine Habitat Investigations
Sampling Stations
Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
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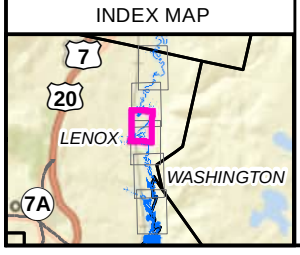
AECOM

Figure 3-1b

Map Sheet 2 of 6



INDEX MAP



Legend

- Macroinvertebrate Sampling Station
- PCB Isopleth
- Reach Boundaries
- Example Area
- RBP Area Boundary
- Community Fish Sampling
- Water Flow Direction

RBP-#: In-river assessment reach

0 100 200 400 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Sampling Stations
Housatonic River - Lenox, MA

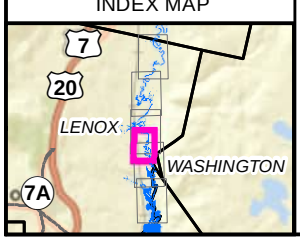
SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60688342

AECOM

Figure 3-1c
Map Sheet 3 of 6

5C Minnow Traps 1&2
5C-C-2 end
5C-C-2 start
5C RBP 2
5C-C-3 start
5C-C-3 Stop
5C RBP 3
Roaring Brook Road

INDEX MAP



Legend

- Minnow Trap Location
- Macroinvertebrate Sampling Station
- PCB Isopleth
- RBP Area Boundary
- RBP-#: In-river assessment reach
- Water Flow Direction

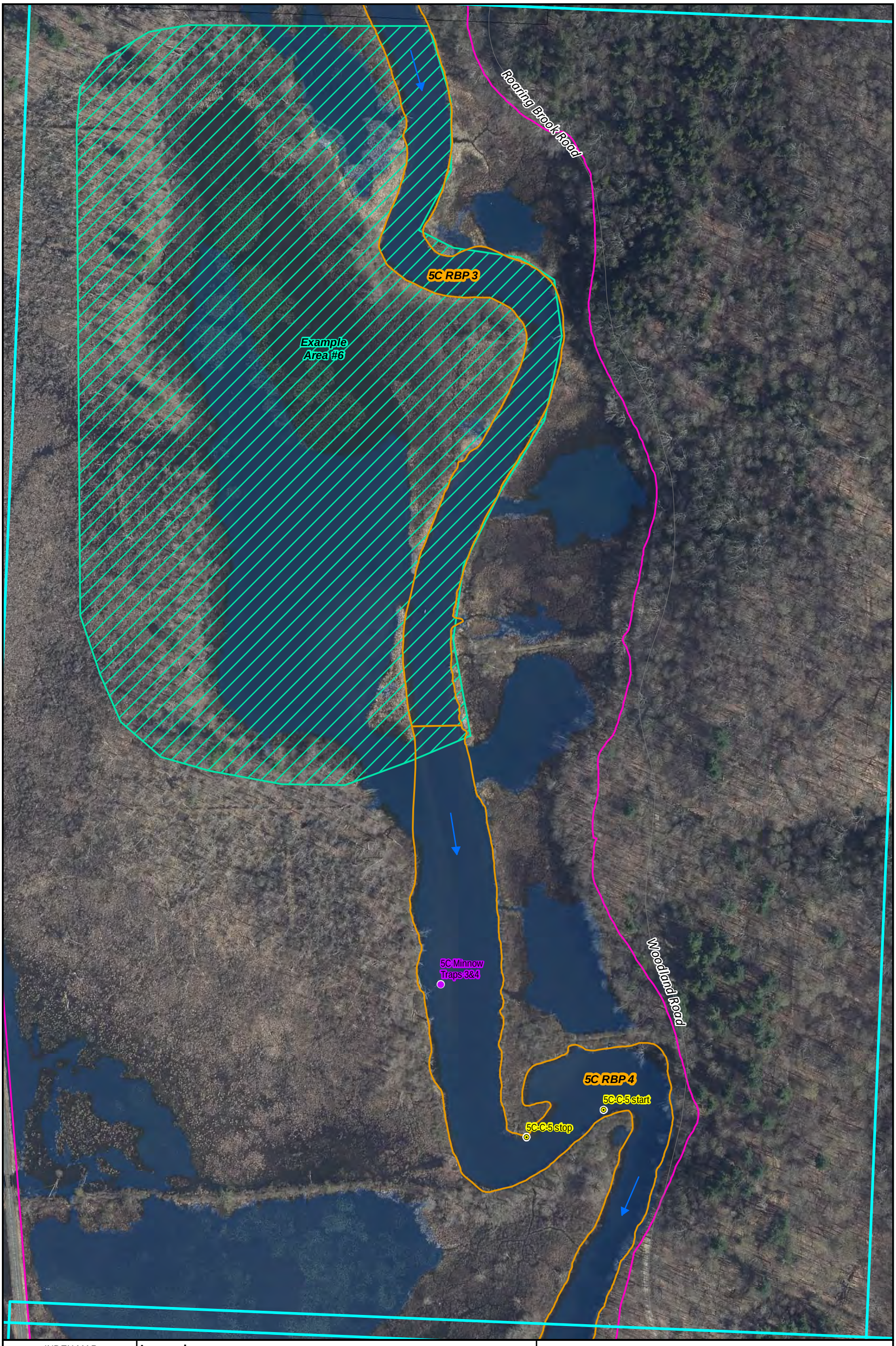
0 100 200 400 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Sampling Stations
Housatonic River - Lenox, MA

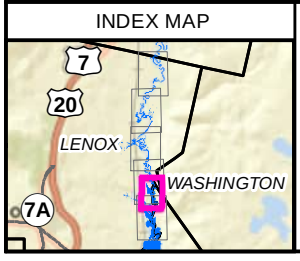
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1:2,500	2/12/2025	60688342

AECOM

Figure 3-1d
Map Sheet 4 of 6



INDEX MAP



Legend

- Minnow Trap Location
- Macroinvertebrate Sampling Station
- PCB Isopleth
- Example Area
- RBP Area Boundary
- Water Flow Direction

RBP-#: In-river assessment reach

0 100 200 400 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Sampling Stations
Housatonic River - Lenox and Lee, MA

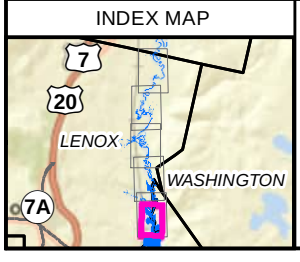
SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60688342

AECOM

Figure 3-1e
Map Sheet 5 of 6



INDEX MAP



Legend

- Macroinvertebrate Sampling Station
- Water Flow Direction
- PCB Isopleth
- Reach Boundaries
- RBP Area Boundary

RBP-#: In-river assessment reach

0 100 200 400 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Sampling Stations
Housatonic River - Lenox and Lee, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60688342

AECOM

Figure 3-1f
Map Sheet 6 of 6

Reach 5A

Reach 5B

Sandy silt with algae & sparse gravel

Large Woody Debris

Sandy silt with algae & sparse gravel

Large Woody Debris

Large Woody Debris

Large Woody Debris

5B RBP 1

Cobble

Sandy silt with algae & sparse gravel

Sandy silt with algae & sparse gravel

Large Woody Debris

Sandy silt with algae & sparse gravel

Sandy silt with algae

5B RBP 2

Sandy silt

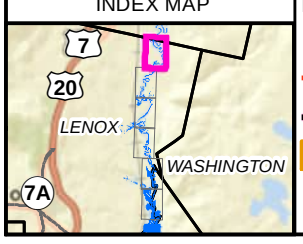
Pocket of mixed gravel

Large Woody Debris

Sandy silt with algae

Pocket of mixed gravel

INDEX MAP



Legend

- Ground Truth Location
- RBP Limits
- Reach Boundaries
- RBP Area Boundary

Substrate Type

- Boulder
- Cobble
- Cobble & Gravel
- Gravel
- Rip-rap
- Woody Debris
- Sand/Silt/Clay

0 75 150 300 Feet

N

Reach 5B and 5C
Riverine Habitat Investigations
Habitat Conditions
Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

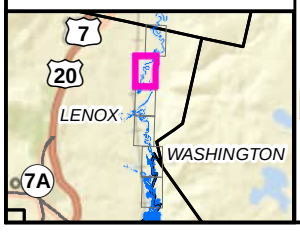
AECOM

Figure 3-2a

Map Sheet 1 of 6



INDEX MAP



Legend

- Ground Truth Location
- RBP Limits
- RBP Area Boundary

Substrate Type

- Boulder
- Cobble
- Cobble & Gravel
- Gravel
- Rip-rap
- Woody Debris
- Sand/Silt/Clay

0 75 150 300 Feet

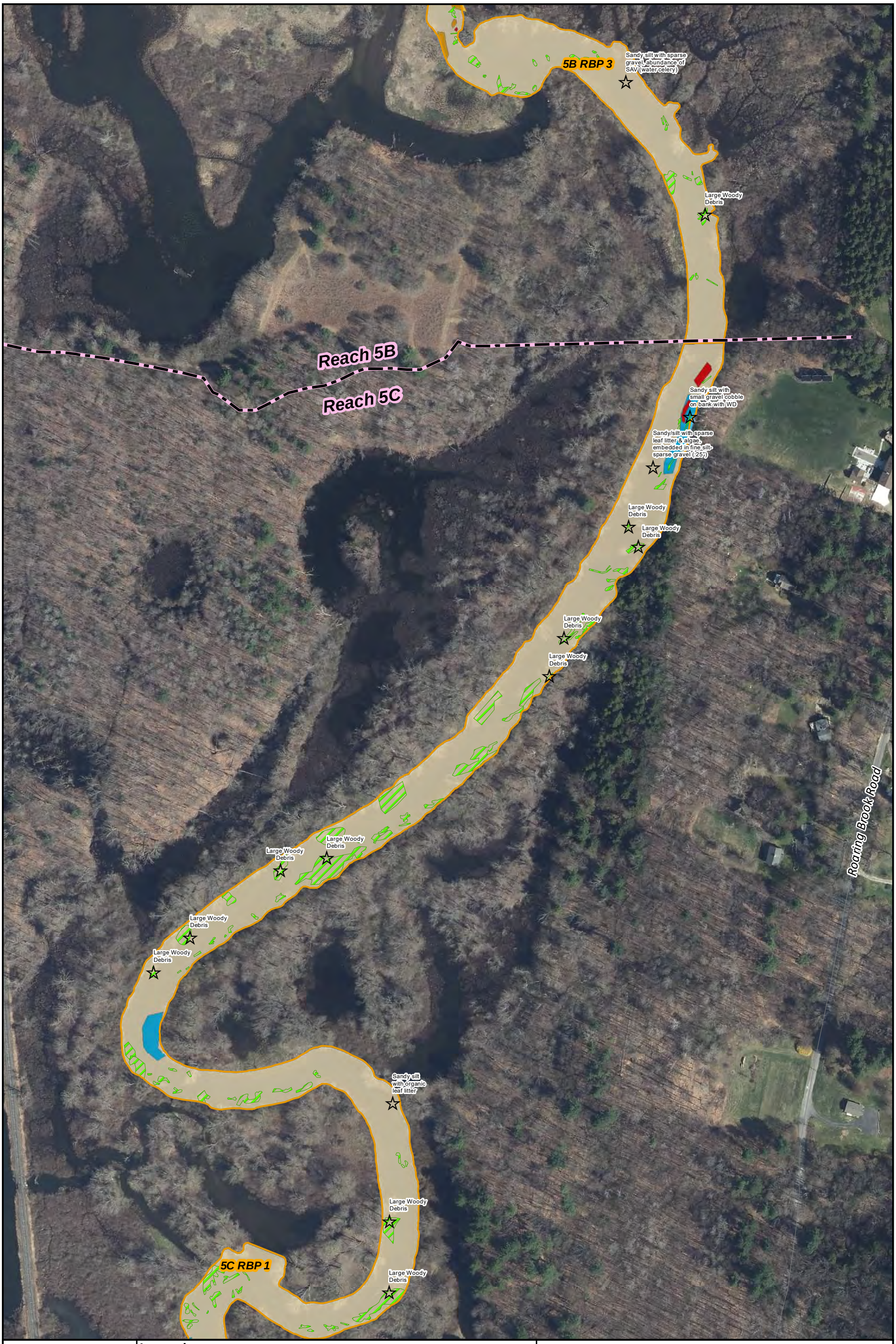
Reach 5B and 5C
Riverine Habitat Investigations
Habitat Conditions
Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

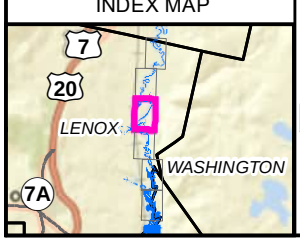
AECOM

Figure 3-2b

Map Sheet 2 of 6



INDEX MAP



Legend

- Ground Truth Location
- Reach Boundaries
- RBP Area Boundary

Substrate Type

- Boulder
- Cobble
- Cobble & Gravel
- Woody Debris
- Sand/Silt/Clay

0 75 150 300 Feet

N

Reach 5B and 5C
Riverine Habitat Investigations
Habitat Conditions
Housatonic River - Lenox, MA

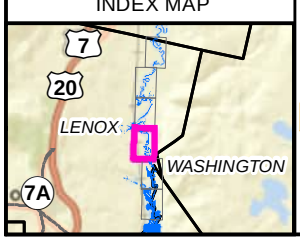
SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

AECOM

Figure 3-2c
Map Sheet 3 of 6



INDEX MAP



Legend

- Ground Truth Location
- RBP Limits
- RBP Area Boundary

Substrate Type

- Boulder
- Cobble
- Cobble & Gravel
- Gravel
- Woody Debris
- Sand/Silt/Clay

0 75 150 300 Feet

N

Reach 5B and 5C
Riverine Habitat Investigations
Habitat Conditions
Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

AECOM

Figure 3-2d
Map Sheet 4 of 6

Roaring Brook Road

5C RBP 3

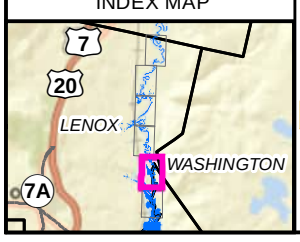
Sandy silt

Woodland Road

5C RBP 4

Sandy silt with LWD and boulders with some cobble

INDEX MAP



Legend

- Ground Truth Location
- RBP Limits
- RBP Area Boundary

Substrate Type

- Boulder
- Cobble
- Cobble & Gravel
- Woody Debris
- Sand/Silt/Clay

0 75 150 300 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Habitat Conditions
Housatonic River - Lenox and Lee, MA

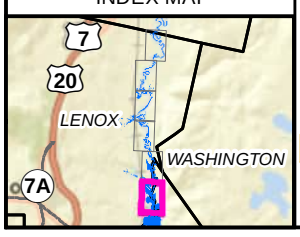
SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

AECOM

Figure 3-2e
Map Sheet 5 of 6



INDEX MAP



Legend

- Ground Truth Location
- RBP Limits
- Reach Boundaries
- RBP Area Boundary

Substrate Type

- Boulder
- Woody Debris
- Sand/Silt/Clay

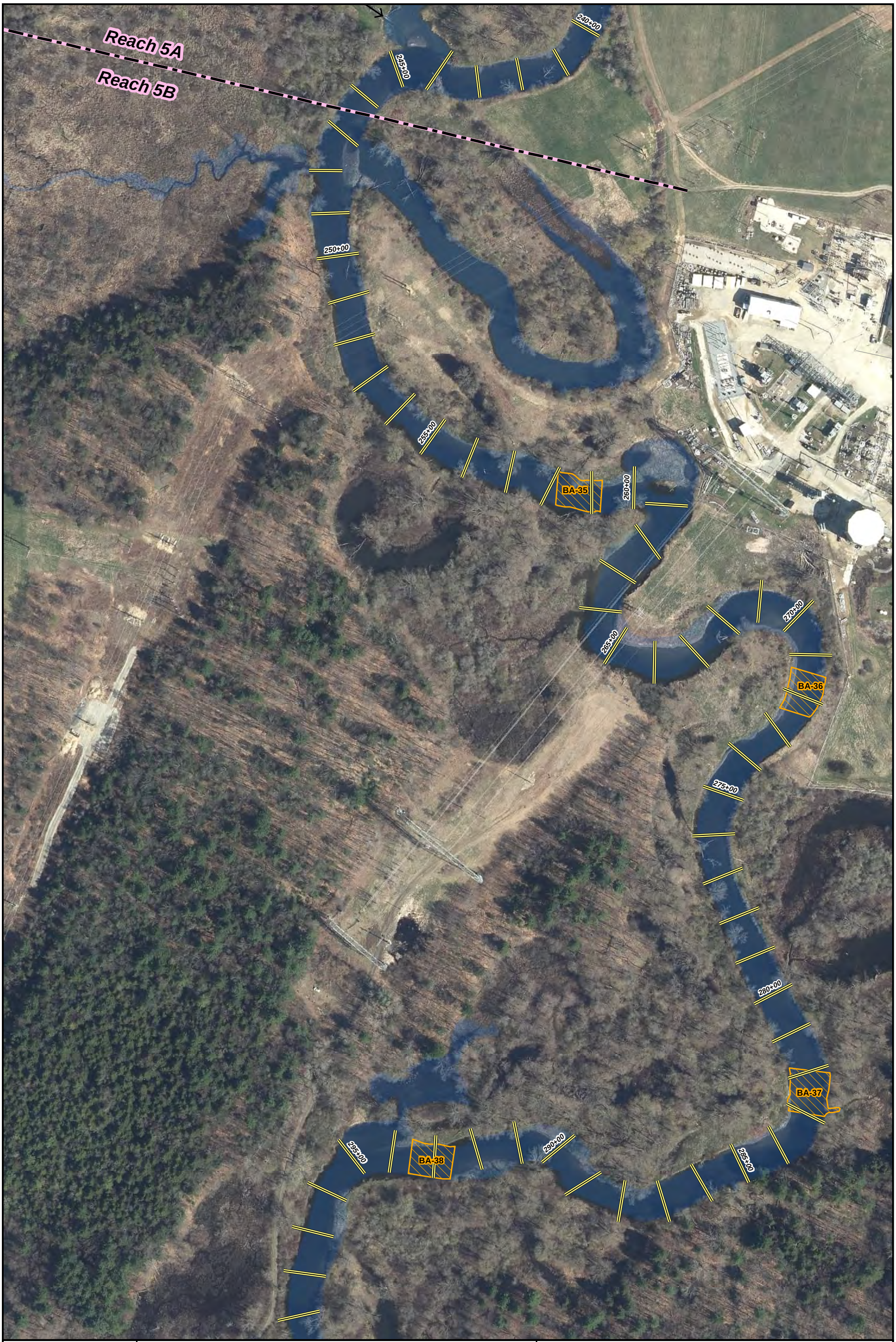
0 75 150 300 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Habitat Conditions
Housatonic River - Lenox and Lee, MA

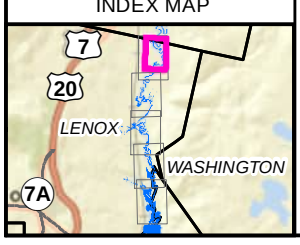
SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

AECOM

Figure 3-2f
Map Sheet 6 of 6



INDEX MAP



Legend

- Housatonic River
- River Stations
- Bank Area
- Reach Boundaries

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations

Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
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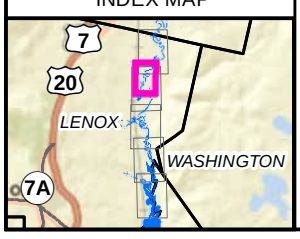
AECOM

Figure 4-1a

Map Sheet 1 of 6



INDEX MAP



Legend

- Housatonic River
- River Stations
- Bank Area

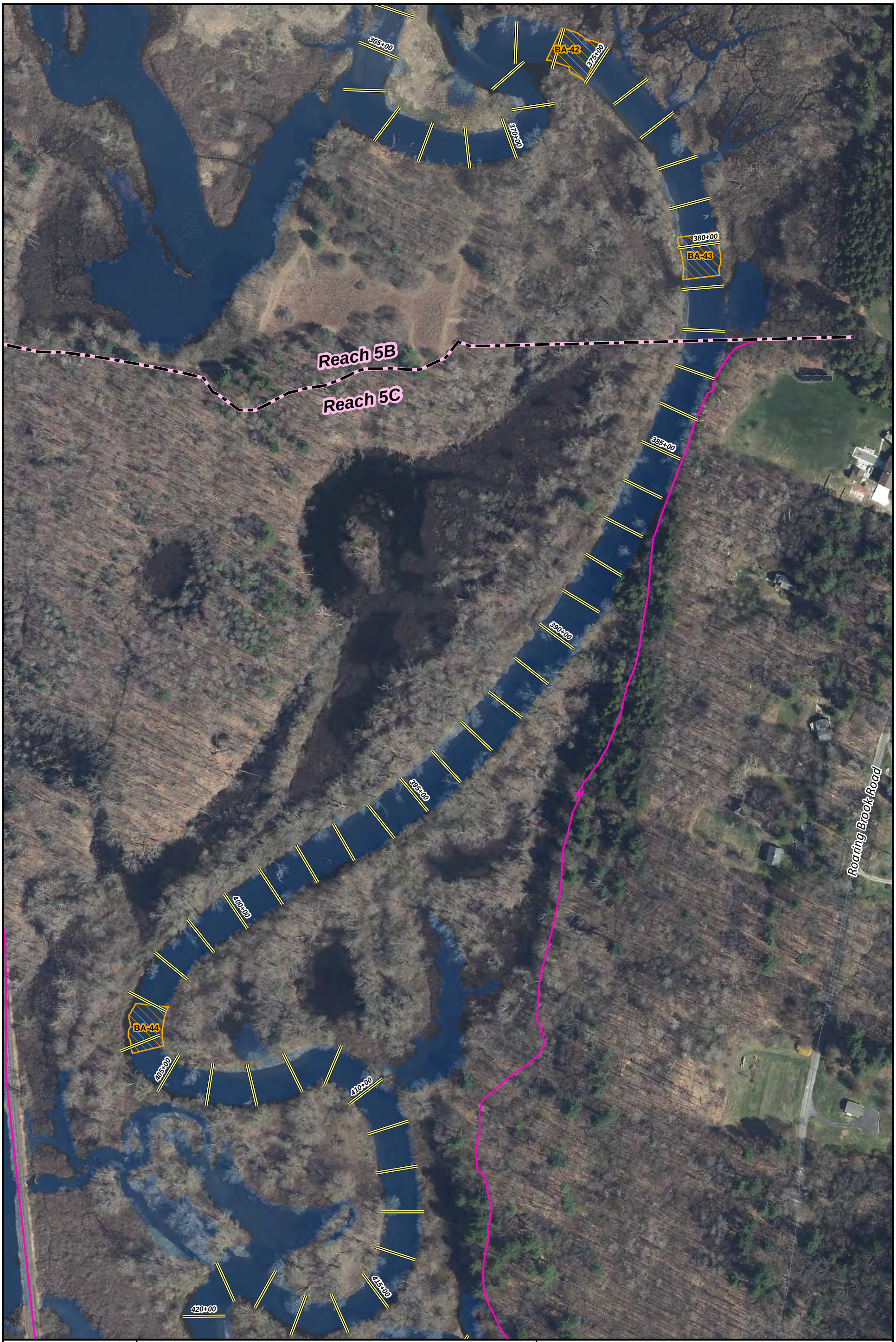
0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox, MA

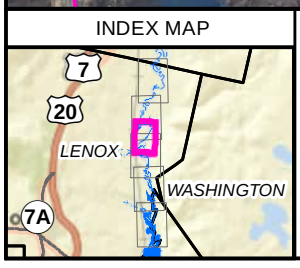
SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1b
Map Sheet 2 of 6



INDEX MAP



Legend

- Housatonic River
- PCB Isopleth
- River Stations
- Bank Area
- Reach Boundaries

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox, MA

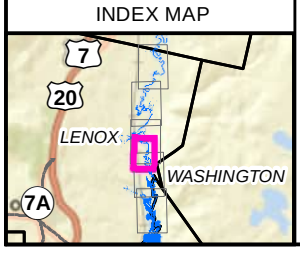
SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1c
Map Sheet 3 of 6



INDEX MAP



Legend

- Housatonic River
- PCB Isopleth
- River Stations
- Bank Area

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox, MA

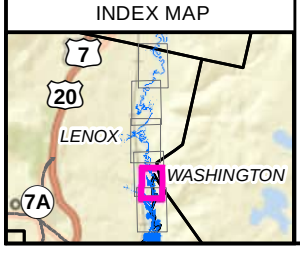
SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1d
Map Sheet 4 of 6



INDEX MAP



Legend

- Housatonic River
- PCB Isopleth
- River Stations
- Bank Area

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations

Housatonic River - Lenox and Lee, MA

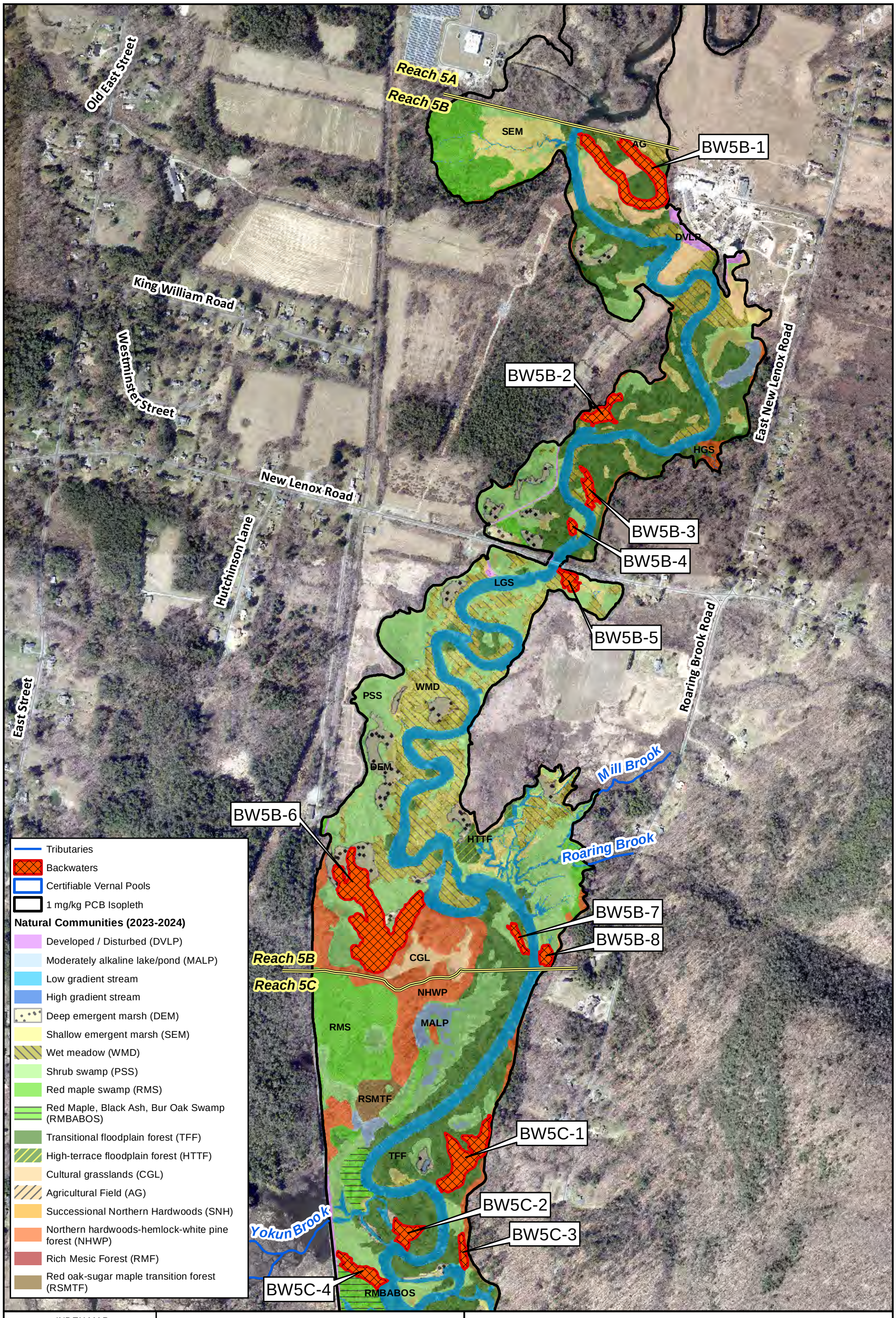
SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1e

Map Sheet 5 of 6


525+00
530+00
535+00
BA-51
540+00
BA-52
545+00
550+00
555+00
Woodland Road
Willow Creek Road
Reach 5C
Reach 6
INDEX MAP
7
20
LENOX
WASHINGTON
7A
Legend
Housatonic River
PCB Isopleth
River Stations
Bank Area
Reach Boundaries
0
100
200
400
Feet
Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox and Lee, MA
SCALE
1:2,500
DATE
2/10/2025
PROJECT NO.
60688342
AECOM
Figure 4-1f
Map Sheet 6 of 6


Old East Street
Reach 5A
Reach 5B
SEM
AG
BW5B-1
DVLP
King William Road
Westminster Street
East New Lenox Road
BW5B-2
HGS
New Lenox Road
Hutchinson Lane
BW5B-3
BW5B-4
LGS
BW5B-5
Roaring Brook Road
East Street
PSS
WMD
DEM
Mill Brook
BW5B-6
HTTF
Roaring Brook
BW5B-7
BW5B-8
Reach 5B
Reach 5C
CGL
NHWP
RMS
MALP
RSMTF
TFF
BW5C-1
BW5C-2
BW5C-3
Yokun Brook
BW5C-4
RMBABOS
Tributaries
Backwaters
Certifiable Vernal Pools
1 mg/kg PCB Isopleth
Natural Communities (2023-2024)
Developed / Disturbed (DVLP)
Moderately alkaline lake/pond (MALP)
Low gradient stream
High gradient stream
Deep emergent marsh (DEM)
Shallow emergent marsh (SEM)
Wet meadow (WMD)
Shrub swamp (PSS)
Red maple swamp (RMS)
Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
Transitional floodplain forest (TFF)
High-terrace floodplain forest (HTTF)
Cultural grasslands (CGL)
Agricultural Field (AG)
Successional Northern Hardwoods (SNH)
Northern hardwoods-hemlock-white pine forest (NHWP)
Rich Mesic Forest (RMF)
Red oak-sugar maple transition forest (RSMTF)
INDEX MAP
PITTSFIELD
LENOX
WASHINGTON
Lenox Pittsfield State Road
1
2
7
N
1 inch = 700 feet
0 350 700 1,400
Feet
Reach 5B and 5C
Backwater Habitats and
Floodplain Natural Communities
Housatonic River
SCALE 1:8,400
DATE 2/24/2025
PROJECT NO. 60736371
AECOM
Figure 5-1a
Map Sheet 1 of 2

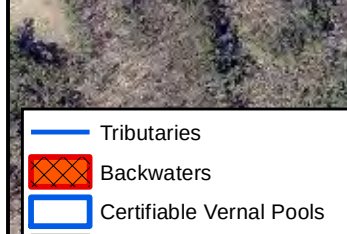
BW5C-4
DVLP
TFF
Roaring Brook Road
BW5C-6
BW5C-5
BW5C-7
BW5C-8
BW5C-9
RMBABOS
BW5C-10
BW5C-11
BW5C-12
WMD
NHWP
BW5C-14
PSS
BW5C-13
BW5C-15
BW5C-16
Willow Creek
SEM
MALP
DEM
LGS
BW5C-17
RMF
RMS
Woodland Road
BW5C-18
HGS
October Mountain Road
Willow Creek Road
RSMTF
Reach 5C
Reach 6
WOODS POND

Tributaries
Backwaters
Certifiable Vernal Pools
1 mg/kg PCB Isopleth

Natural Communities (2023-2024)

- Developed / Disturbed (DVLP)
- Moderately alkaline lake/pond (MALP)
- Low gradient stream
- High gradient stream
- Deep emergent marsh (DEM)
- Shallow emergent marsh (SEM)
- Wet meadow (WMD)
- Shrub swamp (PSS)
- Red maple swamp (RMS)
- Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
- Transitional floodplain forest (TFF)
- High-terrace floodplain forest (HTTF)
- Cultural grasslands (CGL)
- Agricultural Field (AG)
- Successional Northern Hardwoods (SNH)
- Northern hardwoods-hemlock-white pine forest (NHWP)
- Rich Mesic Forest (RMF)
- Red oak-sugar maple transition forest (RSMTF)

INDEX MAP



N

1 inch = 700 feet

0 350 700 1,400

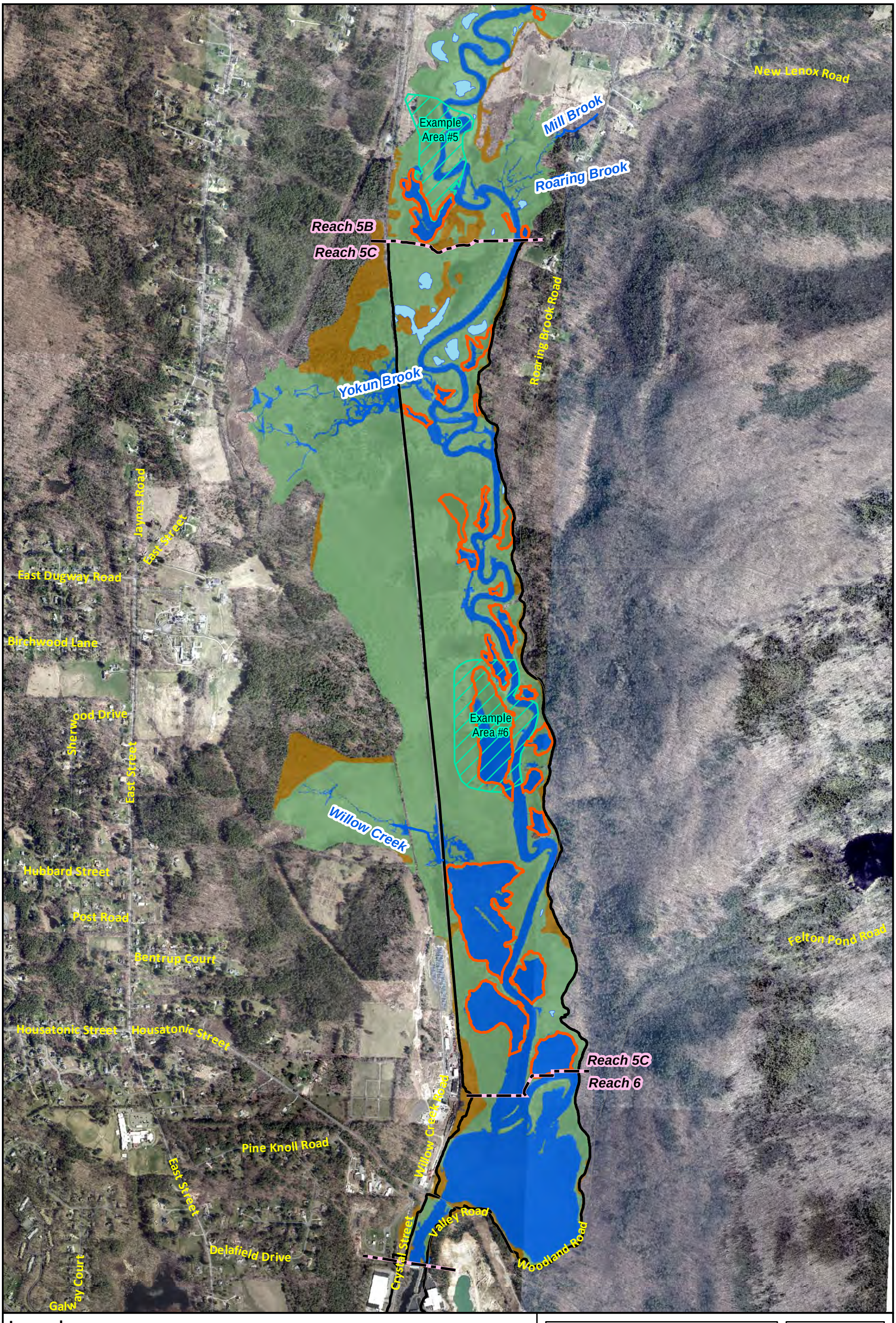
Feet

Reach 5B and 5C
Backwater Habitats and
Floodplain Natural Communities
Housatonic River

SCALE	DATE	PROJECT NO.
1:8,400	2/24/2025	60736371

AECOM

Figure 5-1b
Map Sheet 2 of 2



Legend

- Reach Boundaries
- Backwaters
- Certifiable Vernal Pools
- 1 mg/kg PCB Isopleth

Cover Types

- Stream
- Upland
- Wetland

1 inch = 1,200 feet

0 600 1,200 2,400 Feet

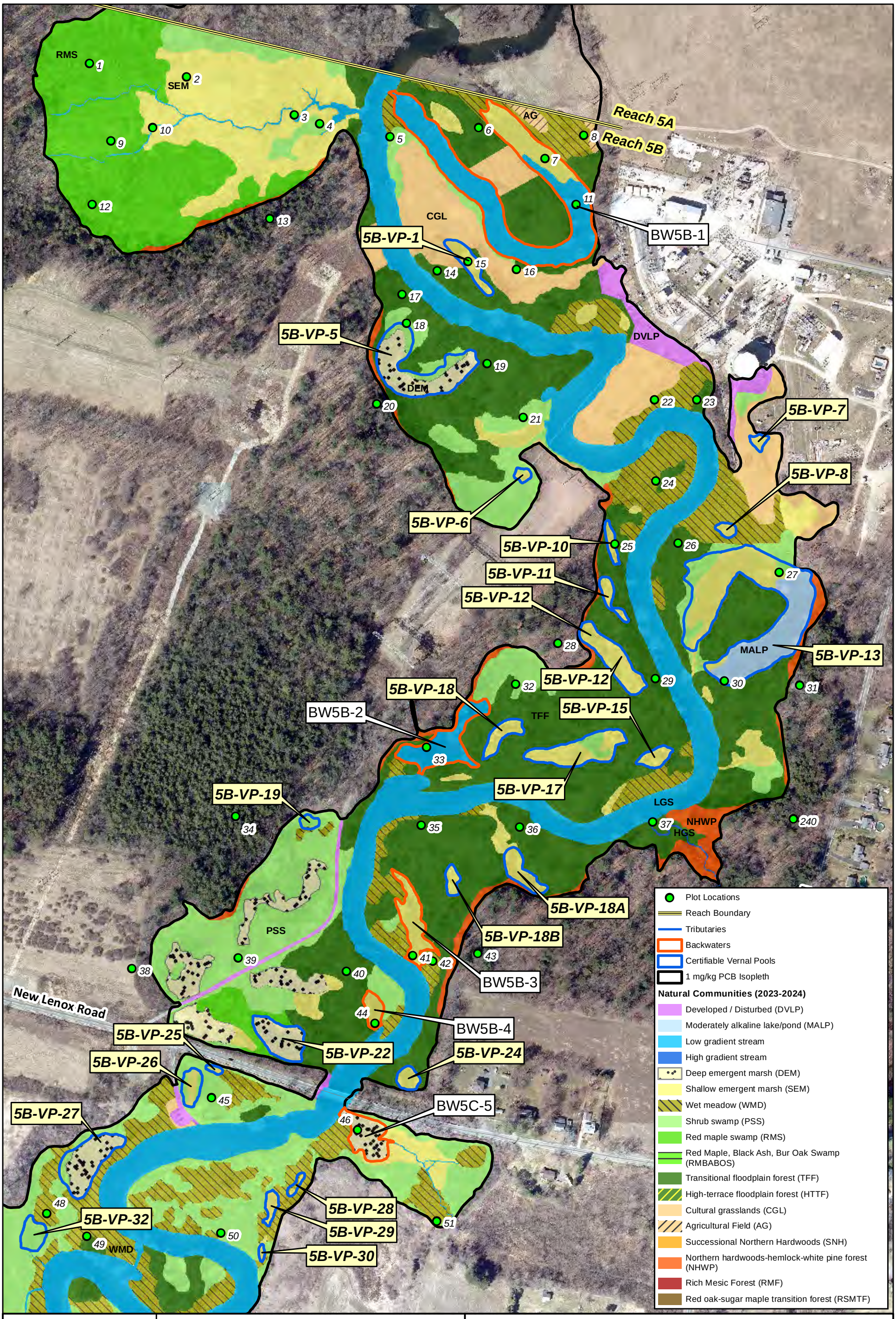
Reaches 5B and 5C Example Areas Within Floodplain Habitats

Housatonic River

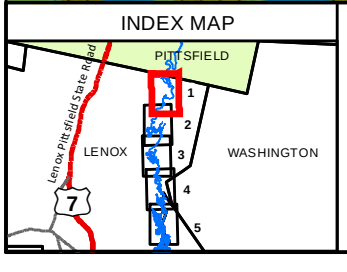
SCALE	DATE	PROJECT NO.
1:8,400	2/12/2025	60670015

AECOM

Figure 6-1



INDEX MAP



N

1 inch = 300 feet

0 150 300 600 Feet

Reach 5B and 5C Floodplain Natural Communities

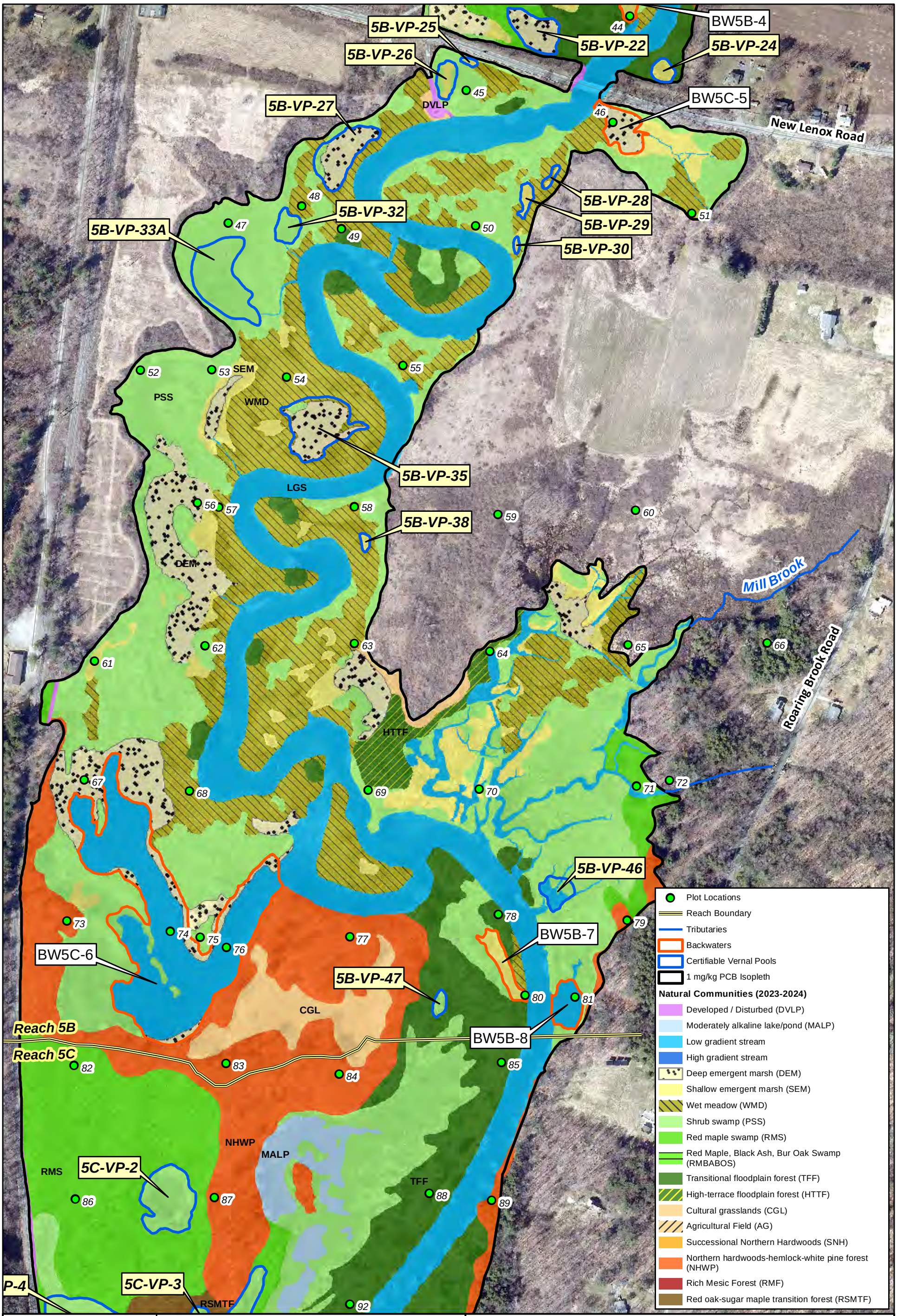
Reach 5B and 5C Baseline Restoration Assessment Report

SCALE	DATE	PROJECT NO.
1:3,600	2/24/2025	60736371

AECOM

Figure 6-2a

Map Sheet 1 of 5



Reach 5B and 5C Floodplain Natural Communities

Reach 5B and 5C Baseline Restoration Assessment Report

SCALE	DATE	PROJECT NO.
1:3,600	2/24/2025	60736371

AECOM

Figure 6-2b

Map Sheet 2 of 5

Reach 5B
Reach 5C
CGL
BW5B-8
82
83
84
85
NHWP
MALP
RMS
5C-VP-2
86
87
88
89
5C-VP-4
5C-VP-3
92
5C-VP-5
RSMTF
90
91
93
94
5C-VP-6
TFF
BW5C-1
5C-VP-7
95
96
97
98
99
100
Roaring Brook Road
5C-VP-8
WMD
BW5C-1
102
BW5C-2
101
103
Yokun Brook
104
BW5C-3
DVLP
105
108
109
106
107
BW5C-4
110
DEM
LGS
111
112
113
114
5C-VP-11
PSS
117
116
BW5C-5
115
118
119
BW5C-7
BW5C-6
120
121
122
123
RMBABOS
124
RMF
BW5C-8
SEM
125
126
127

Plot Locations
Reach Boundary
Tributaries
Backwaters
Certifiable Vernal Pools
1 mg/kg PCB Isopleth
Natural Communities (2023-2024)
Developed / Disturbed (DVLP)
Moderately alkaline lake/pond (MALP)
Low gradient stream
High gradient stream
Deep emergent marsh (DEM)
Shallow emergent marsh (SEM)
Wet meadow (WMD)
Shrub swamp (PSS)
Red maple swamp (RMS)
Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
Transitional floodplain forest (TFF)
High-terrace floodplain forest (HTTF)
Cultural grasslands (CGL)
Agricultural Field (AG)
Successional Northern Hardwoods (SNH)
Northern hardwoods-hemlock-white pine forest (NHWP)
Rich Mesic Forest (RMF)
Red oak-sugar maple transition forest (RSMTF)

INDEX MAP
PITTSFIELD
Lenox Pittsfield State Road
LENOX
WASHINGTON
1
2
3
4
5
7

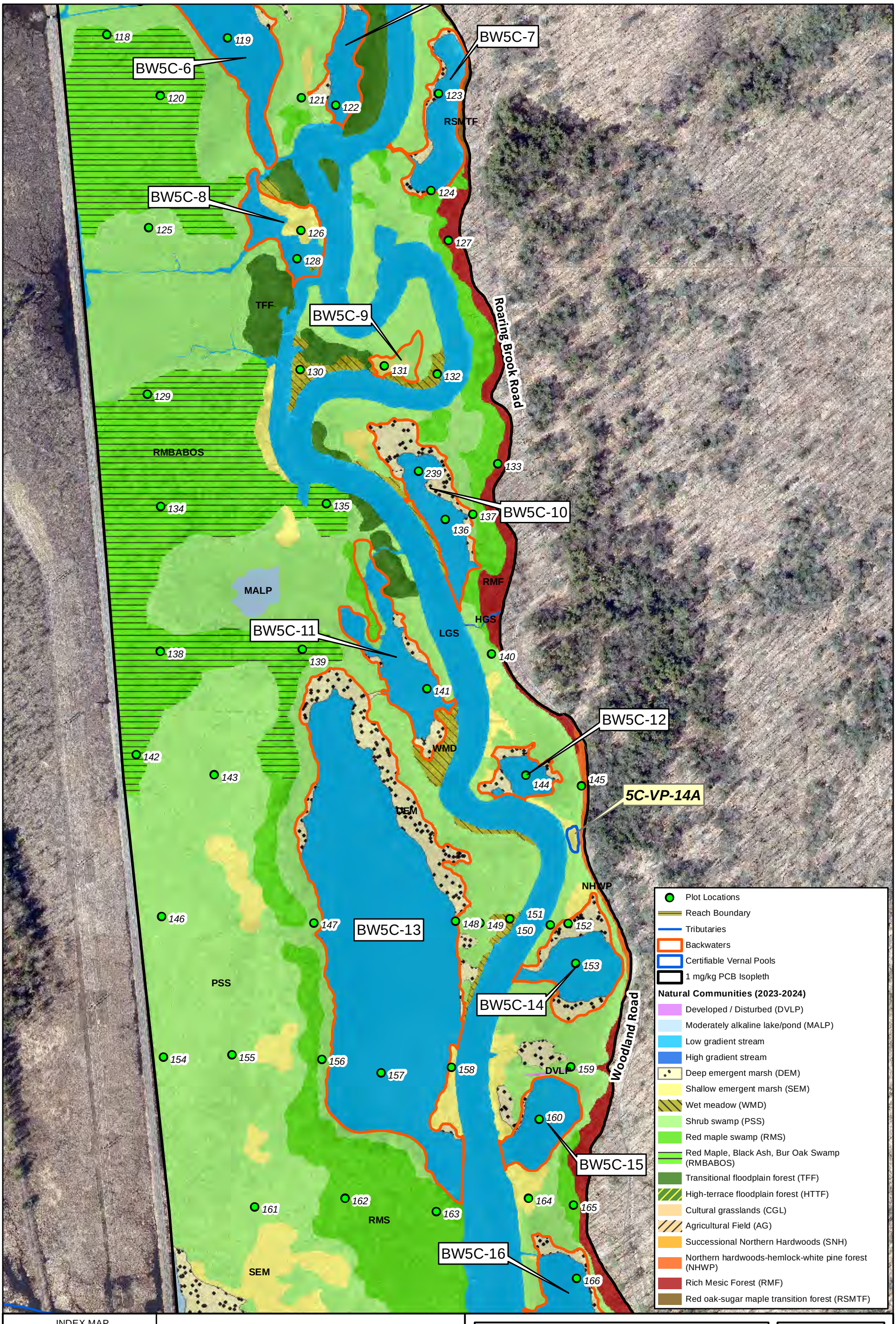
N
1 inch = 300 feet
0 150 300 600
Feet

Reach 5B and 5C Floodplain Natural Communities
Reach 5B and 5C Baseline Restoration Assessment Report

SCALE	DATE	PROJECT NO.
1:3,600	2/24/2025	60736371

AECOM

Figure 6-2c
Map Sheet 3 of 5



Reach 5B and 5C Floodplain Natural Communities

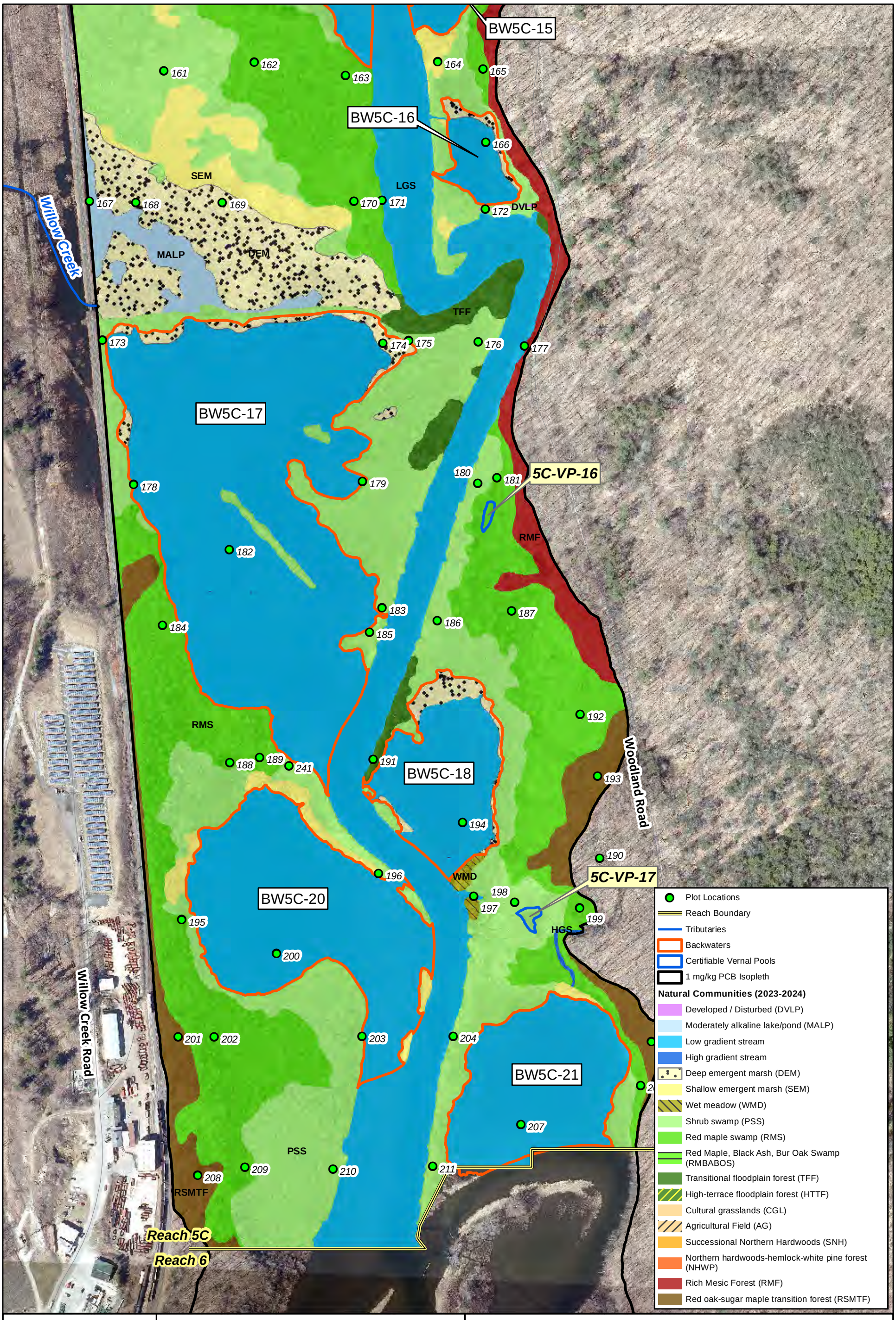
Reach 5B and 5C Baseline Restoration Assessment Report

SCALE	DATE	PROJECT NO.
1:3,600	2/24/2025	60736371

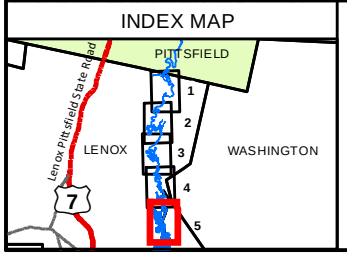
AECOM

Figure 6-2d

Map Sheet 4 of 5



INDEX MAP



N

1 inch = 300 feet

0 150 300 600 Feet

Reach 5B and 5C Floodplain Natural Communities

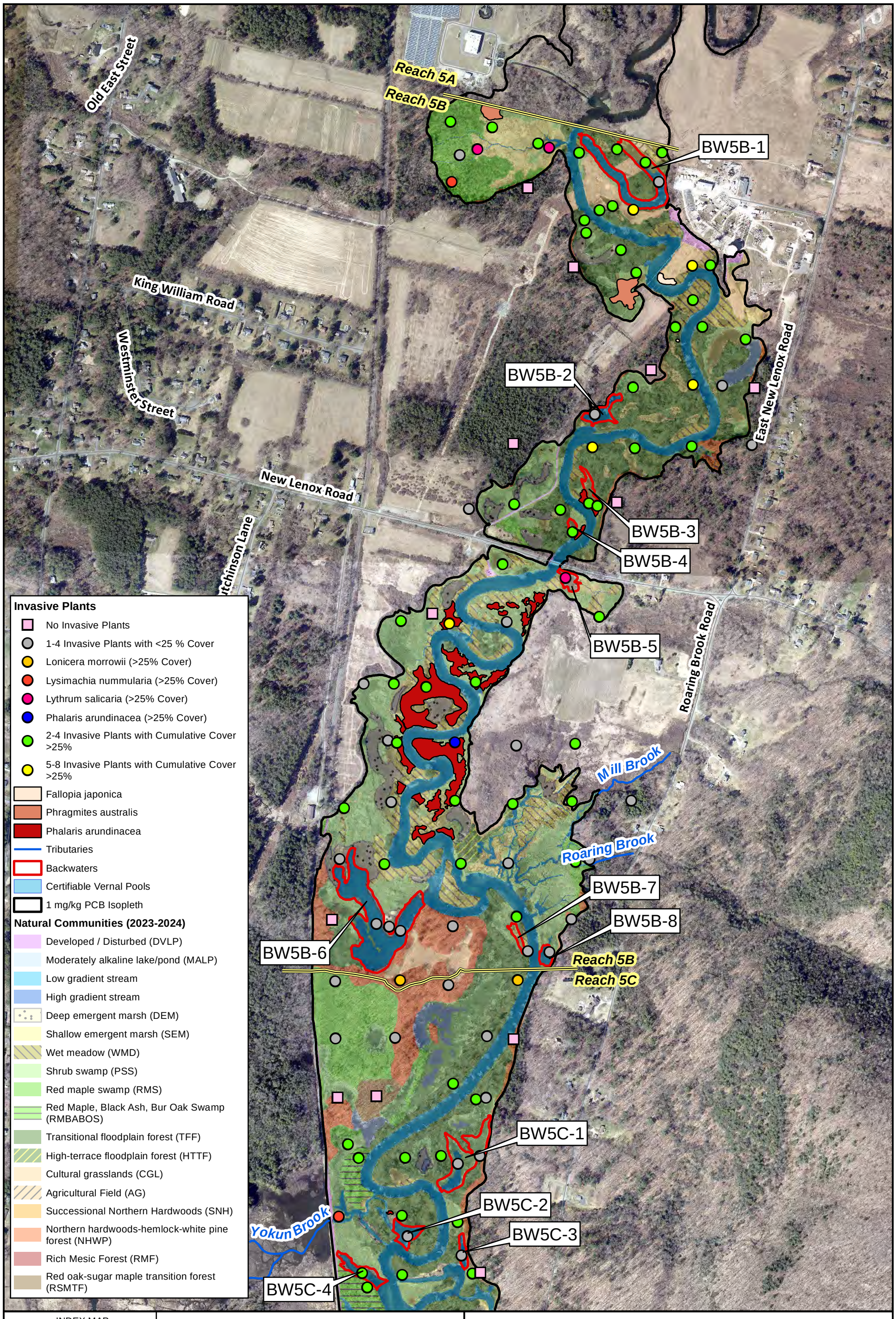
Reach 5B and 5C Baseline Restoration Assessment Report

SCALE	DATE	PROJECT NO.
1:3,600	2/24/2025	60736371

AECOM

Figure 6-2e

Map Sheet 5 of 5


Old East Street
King William Road
Westminster Street
New Lenox Road
Hutchinson Lane
East New Lenox Road
Roaring Brook Road
Mill Brook
Roaring Brook
Yokun Brook
Reach 5A
Reach 5B
Reach 5B
Reach 5C
BW5B-1
BW5B-2
BW5B-3
BW5B-4
BW5B-5
BW5B-6
BW5B-7
BW5B-8
BW5C-1
BW5C-2
BW5C-3
BW5C-4
Invasive Plants
No Invasive Plants
1-4 Invasive Plants with <25 % Cover
Lonicera morrowii (>25% Cover)
Lysimachia nummularia (>25% Cover)
Lythrum salicaria (>25% Cover)
Phalaris arundinacea (>25% Cover)
2-4 Invasive Plants with Cumulative Cover >25%
5-8 Invasive Plants with Cumulative Cover >25%
Fallopia japonica
Phragmites australis
Phalaris arundinacea
Tributaries
Backwaters
Certifiable Vernal Pools
1 mg/kg PCB Isopleth
Natural Communities (2023-2024)
Developed / Disturbed (DVLP)
Moderately alkaline lake/pond (MALP)
Low gradient stream
High gradient stream
Deep emergent marsh (DEM)
Shallow emergent marsh (SEM)
Wet meadow (WMD)
Shrub swamp (PSS)
Red maple swamp (RMS)
Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
Transitional floodplain forest (TFF)
High-terrace floodplain forest (HTTF)
Cultural grasslands (CGL)
Agricultural Field (AG)
Successional Northern Hardwoods (SNH)
Northern hardwoods-hemlock-white pine forest (NHWP)
Rich Mesic Forest (RMF)
Red oak-sugar maple transition forest (RSMTF)
INDEX MAP
PITTSFIELD
LENOX
WASHINGTON
Lenox Pittsfield State Road
1
2
7
N
1 inch = 700 feet
0
350
700
1,400
Feet
Reach 5B and 5C Invasive Species Observations
Reach 5B and 5C Baseline Restoration Assessment Report
SCALE
1:8,400
DATE
2/18/2025
PROJECT NO.
60736371
AECOM
Figure 6-3a
Map Sheet 1 of 2

BW5C-4
BW5C-6
BW5C-8
BW5C-5
BW5C-7
BW5C-9
BW5C-10
BW5C-11
BW5C-12
BW5C-14
BW5C-13
BW5C-15
BW5C-16
BW5C-17
BW5C-18
Roaring Brook Road
Willow Creek
Willow Creek Road
Woodland Road
October Mountain Road
Reach 5C
Reach 6
WOODS POND

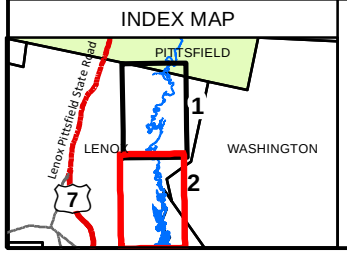
Invasive Plants

- No Invasive Plants
- 1-4 Invasive Plants with <25 % Cover
- Lonicera morrowii (>25% Cover)
- Lysimachia nummularia (>25% Cover)
- Lythrum salicaria (>25% Cover)
- Phalaris arundinacea (>25% Cover)
- 2-4 Invasive Plants with Cumulative Cover >25%
- 5-8 Invasive Plants with Cumulative Cover >25%
- Fallopia japonica
- Phragmites australis
- Phalaris arundinacea
- Tributaries
- Backwaters
- Certifiable Vernal Pools
- 1 mg/kg PCB Isopleth

Natural Communities (2023-2024)

- Developed / Disturbed (DVLP)
- Moderately alkaline lake/pond (MALP)
- Low gradient stream
- High gradient stream
- Deep emergent marsh (DEM)
- Shallow emergent marsh (SEM)
- Wet meadow (WMD)
- Shrub swamp (PSS)
- Red maple swamp (RMS)
- Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
- Transitional floodplain forest (TFF)
- High-terrace floodplain forest (HTTF)
- Cultural grasslands (CGL)
- Agricultural Field (AG)
- Successional Northern Hardwoods (SNH)
- Northern hardwoods-hemlock-white pine forest (NHWP)
- Rich Mesic Forest (RMF)
- Red oak-sugar maple transition forest (RSMTF)

INDEX MAP



N

1 inch = 700 feet

0 350 700 1,400 Feet

Reach 5B and 5C Invasive Species Observations

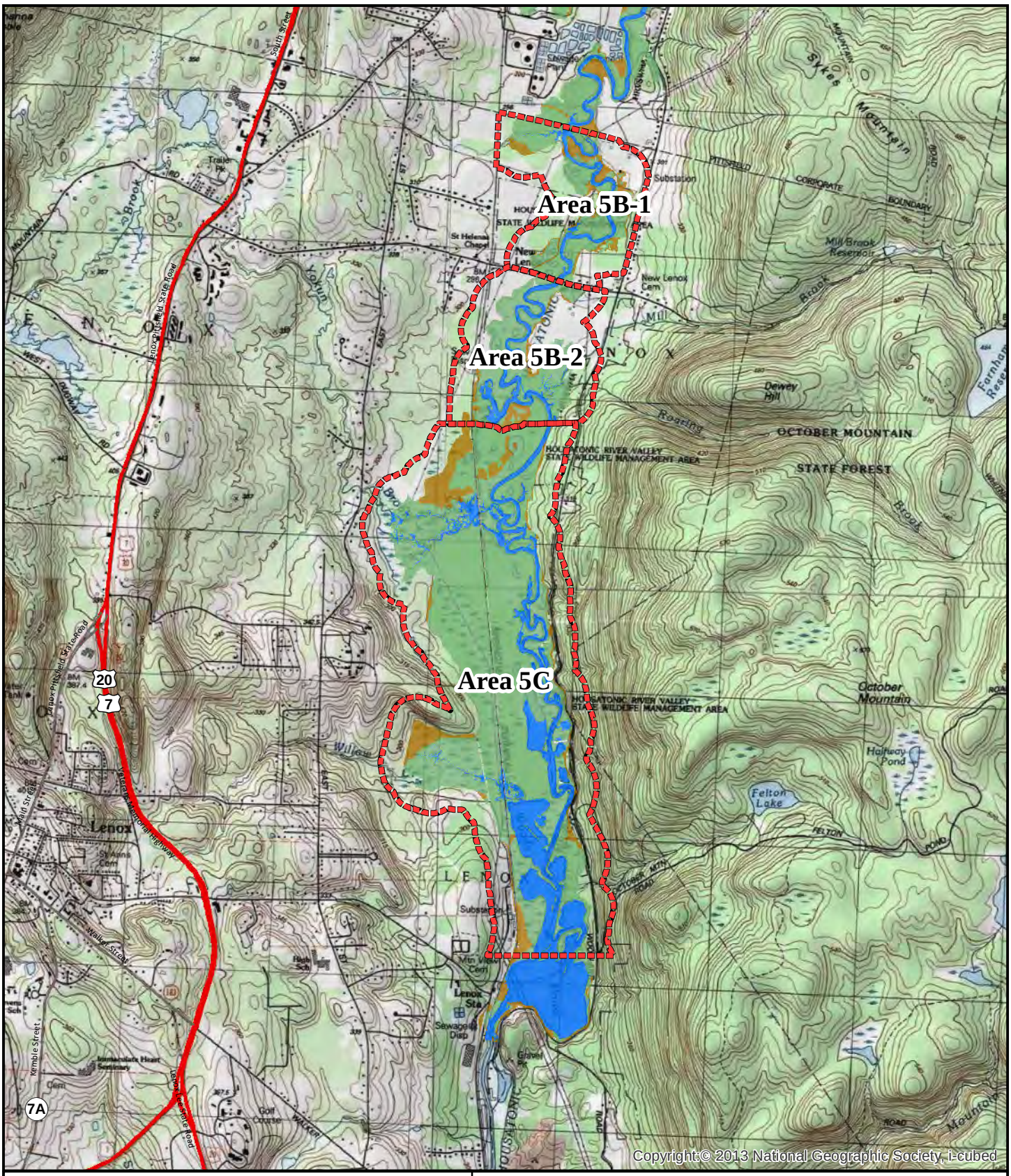
Reach 5B and 5C Baseline Restoration Assessment Report

SCALE	DATE	PROJECT NO.
1:8,400	2/18/2025	60736371

AECOM

Figure 6-3b

Map Sheet 2 of 2



Legend

Cover Types

- Wetland Functional Units
- Stream
- Upland
- Wetland

1 inch = 3,000 feet

0 1,500 3,000 6,000 *Feet*

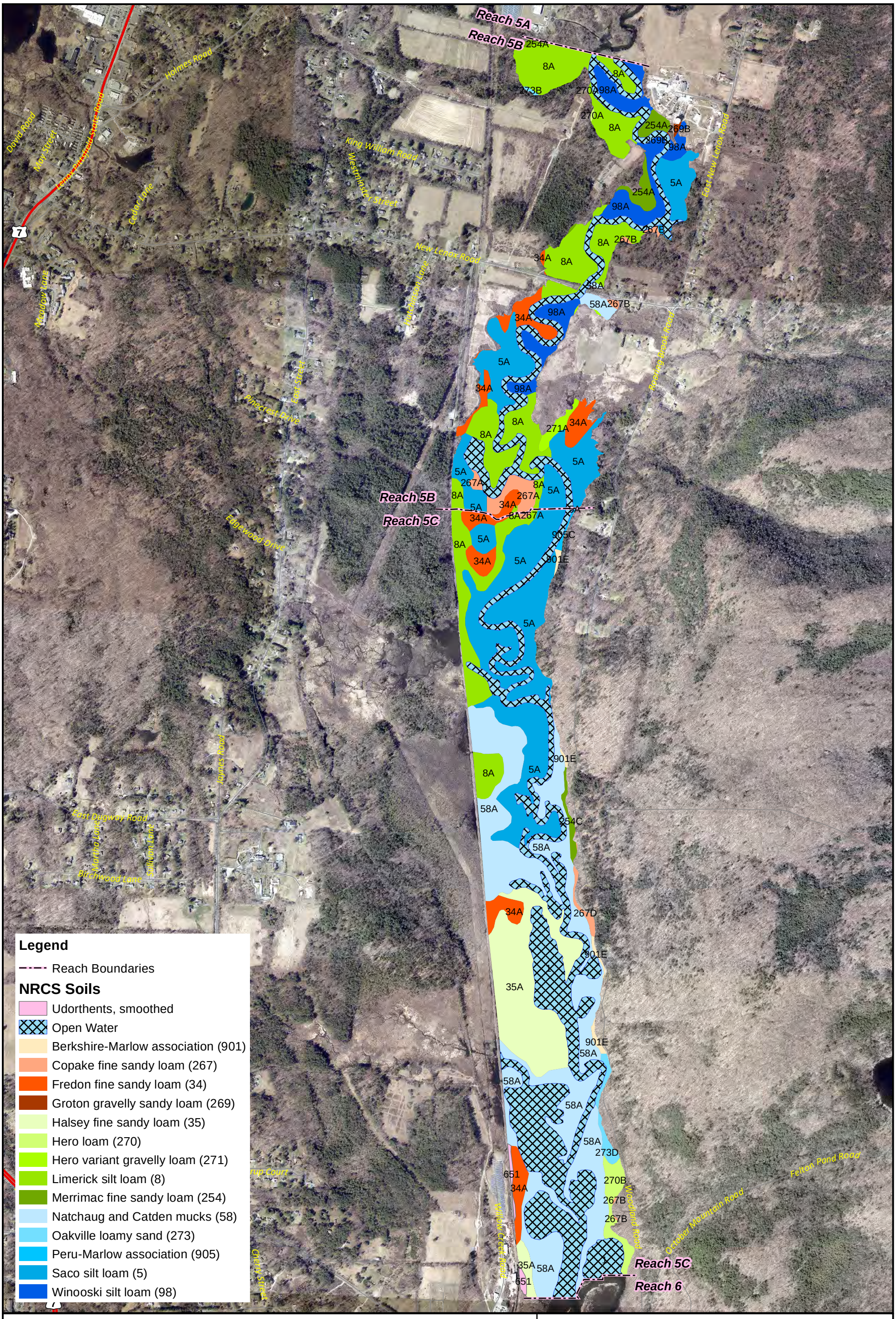
Reaches 5B and 5C Wetland Functional Units

Housatonic River - Massachusetts

SCALE	DATE	PROJECT NO.
1:8,400	2/12/2025	60670015

AECOM

Figure 6-4



Reaches 5B and 5C
NRCS Soils Mapping
Housatonic River - Massachusetts

SCALE	DATE	PROJECT NO.
1:15,600	2/12/2025	60670015

AECOM

Figure 6-5

East Street
King William Road
Westminster Street
New Lenox Road
Hutchinson Lane
East New Lenox Road
Roaring Brook Road
Mill Brook
Roaring Brook
Yokun Brook
Woodland Road

Reach 5A
Reach 5B
Reach 5C
Reach 6

5B-VP-1
5B-VP-5
5B-VP-6
5B-VP-10
5B-VP-11
5B-VP-12
5B-VP-18
5B-VP-19
5B-VP-22
5B-VP-25
5B-VP-26
5B-VP-27
5B-VP-32
5B-VP-33A
5B-VP-35
5B-VP-38
5B-VP-46
5B-VP-47
5B-VP-7
5B-VP-8
5B-VP-13
5B-VP-15
5B-VP-17
5B-VP-18A
5B-VP-18B
5B-VP-24
5B-VP-28
5B-VP-29
5B-VP-30
BW5B-8

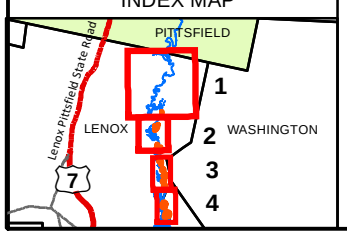
5C-VP-2
5C-VP-3
5C-VP-4
5C-VP-5
5C-VP-8
5C-VP-6
5C-VP-7
5C-VP-11
BW5C-1
BW5C-5
BW5C-7
BW5C-10
5C-VP-14A
BW5C-12
BW5C-14
BW5C-15
BW5C-16
BW5C-18
5C-VP-16
5C-VP-17
BW5C-21

1 mg/kg PCB Isopleth
Tributaries
Certifiable Vernal Pools
Backwaters with Spotted Salamander Eggs

Natural Communities (2023-2024)

- Developed / Disturbed (DVLP)
- Moderately alkaline lake/pond (MALP)
- Low gradient stream
- High gradient stream
- Deep emergent marsh (DEM)
- Shallow emergent marsh (SEM)
- Wet meadow (WMD)
- Shrub swamp (PSS)
- Red maple swamp (RMS)
- Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
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- Agricultural Field (AG)
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- Northern hardwoods-hemlock-white pine forest (NHWP)
- Rich Mesic Forest (RMF)
- Red oak-sugar maple transition forest (RSMTF)

INDEX MAP



N

1 inch = 750 feet

0 350 700 1,400

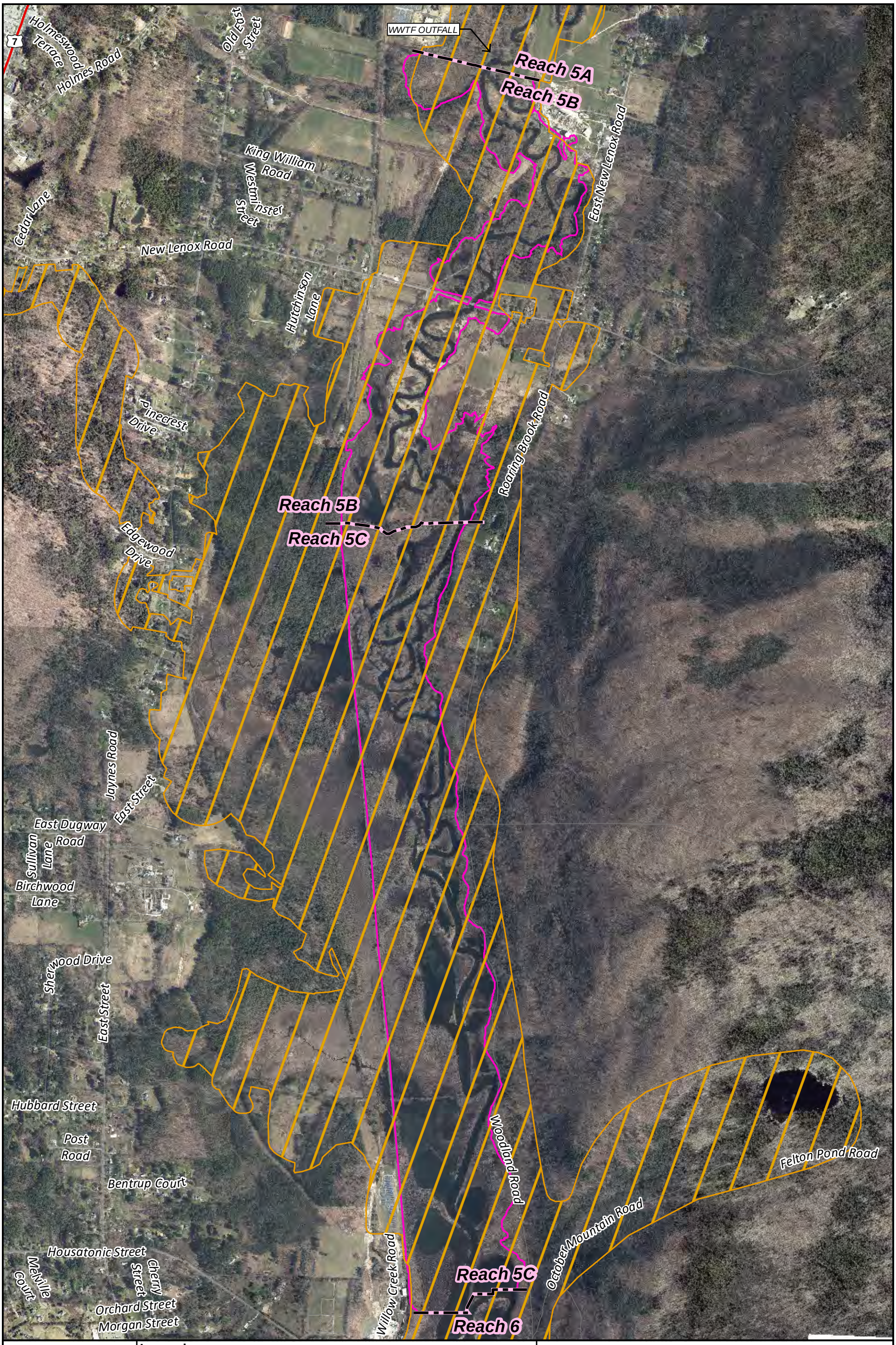
Feet

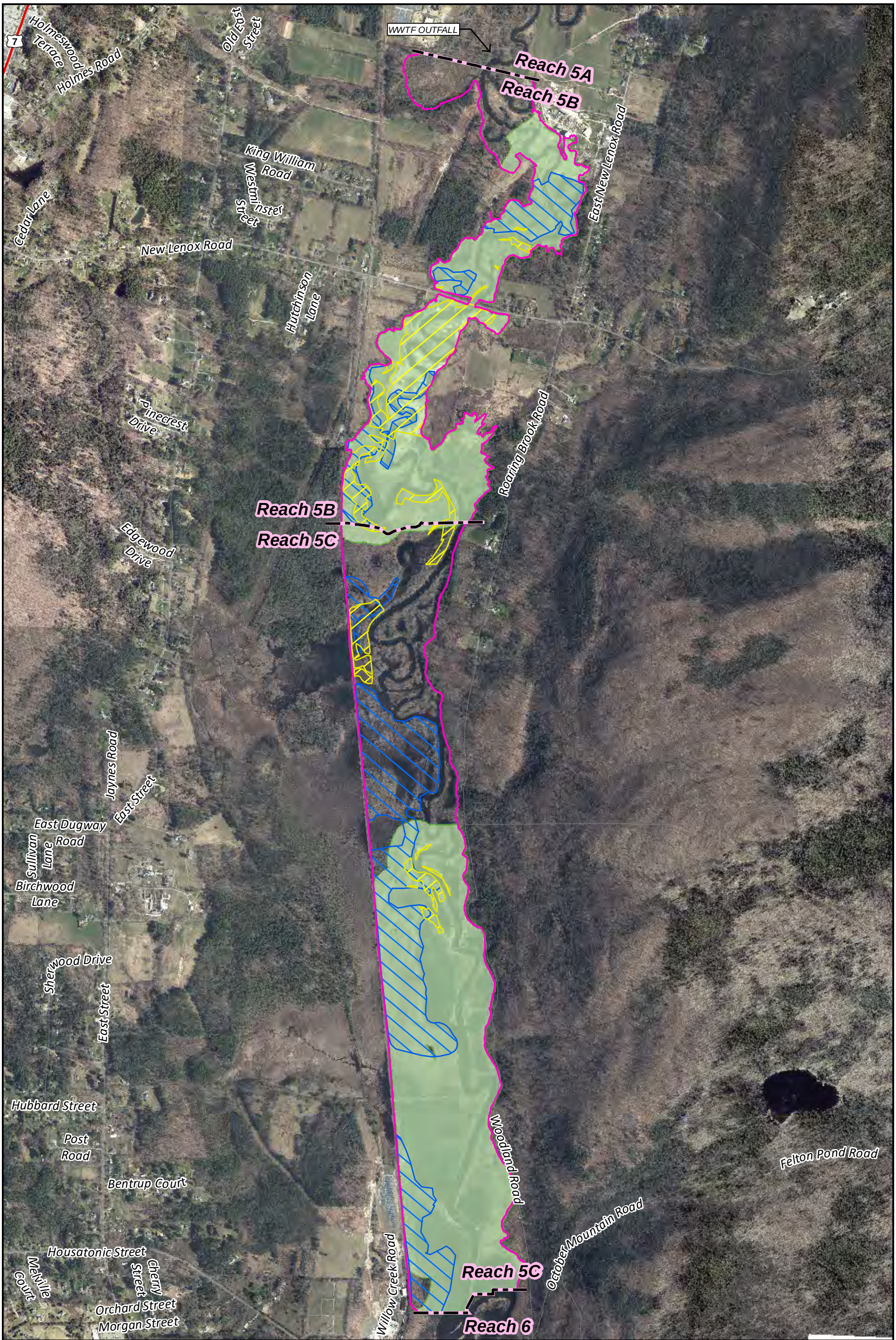
Reach 5B and 5C
Certifiable Vernal Pools and
Floodplain Natural Communities
Housatonic River

SCALE	DATE	PROJECT NO.
1:9,000	2/16/2025	60736371

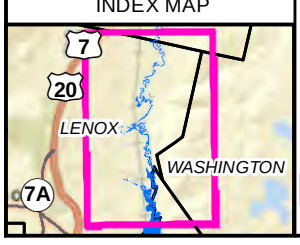
AECOM

Figure 7-1


WWTF OUTFALL
Reach 5A
Reach 5B
Reach 5B
Reach 5C
Reach 5C
Reach 6
Holmeswood Terrace
Holmes Road
Old East Street
King William Road
Westminster Street
Cedar Lane
New Lenox Road
East New Lenox Road
Hutchinson Lane
Pinecrest Drive
Edgewood Drive
Roaring Brook Road
Jaynes Road
East Street
East Dugway Road
Sullivan Lane
Birchwood Lane
Sherwood Drive
Hubbard Street
Post Road
Bentrup Court
Housatonic Street
Melville Court
Cherry Street
Orchard Street
Morgan Street
Willow Creek Road
Woodland Road
October Mountain Road
Felton Pond Road
INDEX MAP
LENOX
WASHINGTON
Legend
Reach Boundaries
NHESP Priority Habitats of Rare Species
PCB Isopleth
0 325 650 1,300
Feet
Reach 5B and 5C
MNHESP Priority Habitats of Rare Species
Housatonic River
SCALE
1:2,500
DATE
2/12/2025
PROJECT NO.
60719336
AECOM
Figure 8-1
Map Sheet 1 of 1



INDEX MAP



Legend

- Reach Boundaries
- Core Area 1
- Core Area 2
- Core Area 3
- PCB Isopleth

0 325 650 1,300 Feet

Reach 5B and 5C
MNHESP Core Areas

Housatonic River

SCALE	DATE	PROJECT NO.
1:2,500	2/12/2025	60719336

AECOM

Figure 8-2

Map Sheet 1 of 1

Old East Street
Reach 5A
Reach 5B
BW5B-1
Utility Line
King William Road
Westminster Street
East New Lenox Road
BW5B-2
New Lenox Road
BW5B-3
BW5B-4
Utility Line
Hutchinson Lane
BW5B-5
Previously Disturbed Open Space
Previously Disturbed Open Space
Mill Brook
Roaring Brook
BW5B-6
BW5B-7
BW5B-8
Reach 5B
Reach 5C
BW5C-1
Yokun Brook
BW5C-2
BW5C-3
BW5C-4
Roaring Brook Road

Disturbed Areas
- Active Railroad Line
- Dirt Road
- Historic Fill / Access
- Other Disturbed Open Space
- Monoculture Stands of Invasive Plants
- Reach Boundary
- Tributaries
- Backwaters
- Certifiable Vernal Pools

Natural Communities (2023-2024)
- Developed / Disturbed (DVLP)
- Moderately alkaline lake/pond (MALP)
- Low gradient stream
- High gradient stream
- Deep emergent marsh (DEM)
- Shallow emergent marsh (SEM)
- Wet meadow (WMD)
- Shrub swamp (PSS)
- Red maple swamp (RMS)
- Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
- Transitional floodplain forest (TFF)
- High-terrace floodplain forest (HTTF)
- Cultural grasslands (CGL)
- Agricultural Field (AG)
- Successional Northern Hardwoods (SNH)
- Northern hardwoods-hemlock-white pine forest (NHWP)
- Rich Mesic Forest (RMF)
- Red oak-sugar maple transition forest (RSMTF)

INDEX MAP



N

1 inch = 700 feet

0 300 600 1,200

Feet

Reach 5B and 5C
Riverine Habitat Investigations
Disturbed Areas
Housatonic River

SCALE	DATE	PROJECT NO.
1:8,400	2/18/2025	60736371

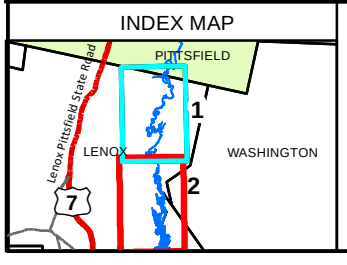
AECOM

Figure 10-1a
Map Sheet 1 of 2

BW5C-3
BW5C-4
BW5C-6
BW5C-5
BW5C-7
BW5C-8
Roaring Brook Road
BW5C-9
BW5C-10
BW5C-11
Utility Line
BW5C-12
BW5C-13
BW5C-14
BW5C-15
BW5C-16
Willow Creek
BW5C-17
BW5C-18
Woodland Road
BW5C-20
BW5C-21
October Mountain Road
Willow Creek Road
Reach 5C
Reach 6
WOODS POND

Disturbed Areas
- Active Railroad Line
- Dirt Road
- Historic Fill / Access
- Other Disturbed Open Space
- Monoculture Stands of Invasive Plants
- Reach Boundary
- Tributaries
- Backwaters
- Certifiable Vernal Pools

Natural Communities (2023-2024)
- Developed / Disturbed (DVLP)
- Moderately alkaline lake/pond (MALP)
- Low gradient stream
- High gradient stream
- Deep emergent marsh (DEM)
- Shallow emergent marsh (SEM)
- Wet meadow (WMD)
- Shrub swamp (PSS)
- Red maple swamp (RMS)
- Red Maple, Black Ash, Bur Oak Swamp (RMBABOS)
- Transitional floodplain forest (TFF)
- High-terrace floodplain forest (HTTF)
- Cultural grasslands (CGL)
- Agricultural Field (AG)
- Successional Northern Hardwoods (SNH)
- Northern hardwoods-hemlock-white pine forest (NHWP)
- Rich Mesic Forest (RMF)
- Red oak-sugar maple transition forest (RSMTF)

INDEX MAP


N

1 inch = 700 feet

0 300 600 1,200 Feet

Reach 5B and 5C
Riverine Habitat Investigations
Disturbed Areas
Housatonic River

SCALE	DATE	PROJECT NO.
1:8,400	2/18/2025	60736371

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Figure 10-1b
Map Sheet 2 of 2

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Appendices to:

Baseline Restoration Assessment Report for Housatonic River Reaches 5B and 5C

Appendix A: Riverine Habitat Information

Appendix B: Riverbank Habitat Inventory Forms

Appendix C: Backwater Habitat Information

Appendix D: Floodplain Habitat Information

Appendix E: Wetland Function and Value Assessment

Appendix F: Vernal Pool Information

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Appendix A

Riverine Habitat Information

A.1 RBP Physical Data Sheets

A.2 Benthic Macroinvertebrate Results, Field Data Sheets and Notes

A.3 Ground Truth Photo Log

Appendix A.1

RBP Physical Data Sheets

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5B: RBP 1	
STATION # 1 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.40256 LONG -73.24014	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/18/24 TIME 1600	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
50 % ☑	%cloud cover	☐ ____%
☐	clear/sunny	☐

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 50 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem ☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type ☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☑ Industrial
☑ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☑ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Silver maple, buckthorn

INSTREAM FEATURES

Estimated Reach Length 775 m

Estimated Stream Width 30 m

Sampling Reach Area 20,192 m²

Area in km² (m²x1000) 0.020 km²

Estimated Stream Depth 1 m

Surface Velocity (at thalweg) 0.5 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded

High Water Mark 2 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ____ % ☑ Run 9 %
☑ Pool 91 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 3,647 m²

Density of LWD 180,600 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☑ Attached Algae

dominant species present Elodea canadensis

Portion of the reach with aquatic vegetation 5 %

WATER QUALITY

Temperature 7.2 ⁰ C

Specific Conductance 381.7 uS/cm

Dissolved Oxygen 11.15%

pH 8.12

Turbidity 0.76 NTU

WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other Treated sewage from WWTF

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	18.06
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	2	Muck-Mud	black, very fine organic (FPOM)	5
Gravel	2-64 mm (0.1"-2.5")	5			
Sand	0.06-2mm (gritty)	18	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	70			
Clay	< 0.004 mm (slick)	5			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5B: RBP 1	
STATION # 1 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.40256 LONG -73.24014	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/18/24 TIME 1600	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 **18** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 **11**	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	**5** 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 **6**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	**8** 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	**8** 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 **7** 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 **7** 6	5 4 3	2 1 0

Total Score 149

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/18/2024

Weather: Sunny

Team member(s): TW, SM, AL, JP

Team activity: Reach 5B and C BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name: GE	Site Location: Reach 5B Housatonic River	Project No. 60689453

Photo No.	Date:
1	11/18/24

Direction Photo Taken:
West

Description:
Reach 5B: RBP 1 looking upstream. This section of the river contains a short run. The shoreline consists of grasses along with a few shrubs and trees. The banks show erosion on the left side (downstream right) of the river.

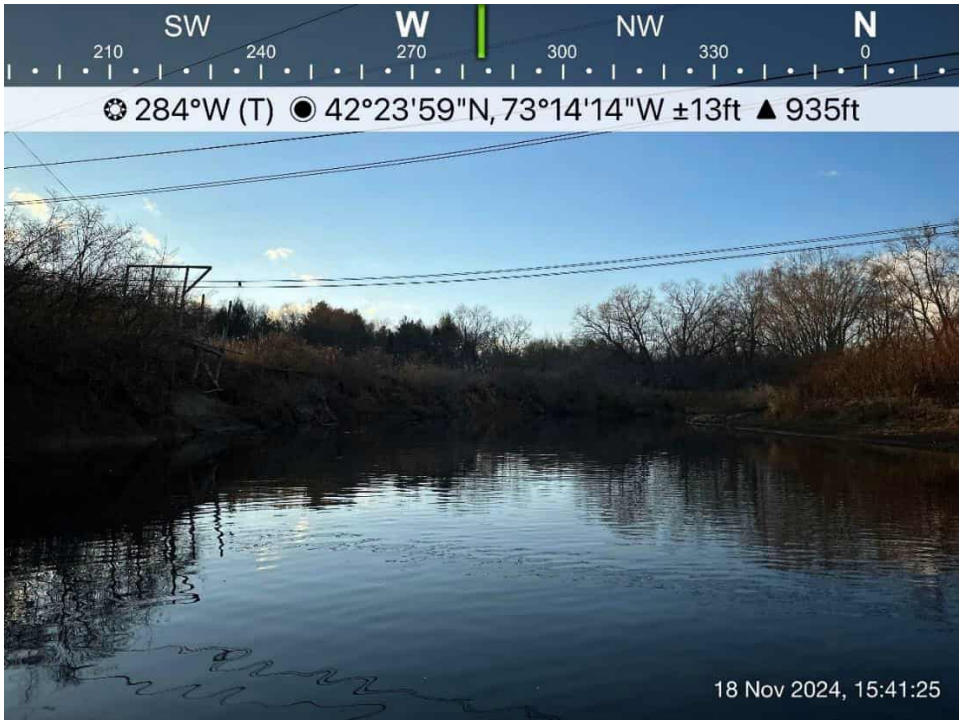


Photo No.	Date:
2	11/18/24

Direction Photo Taken:
Northwest

Description:
Reach 5B: RBP 1 looking upstream. This section of the river Shows a run with large cluster of large woody debris in the middle of the river and smaller aggregations closer to the shoreline. The shoreline consisted of many trees and shrubs.

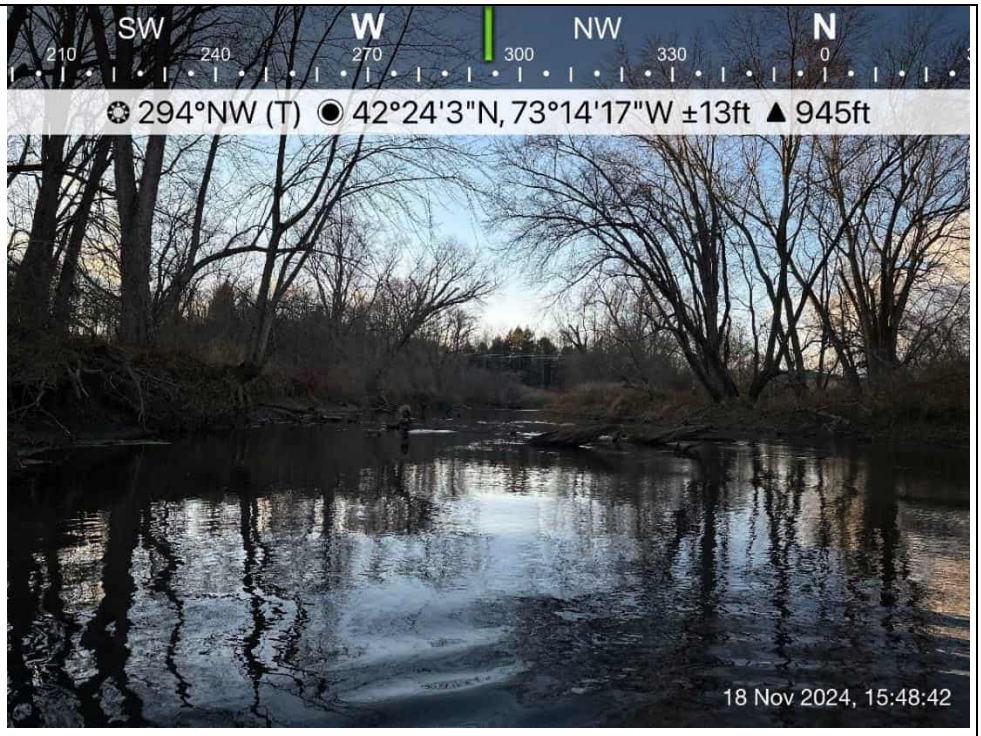
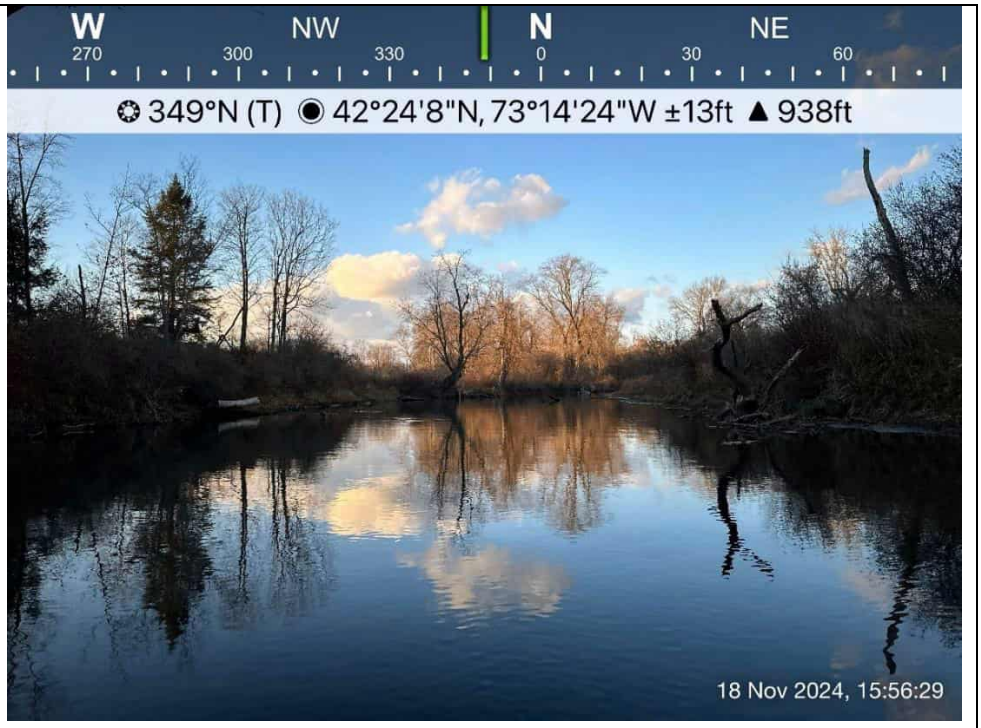


Photo No. 3	Date: 11/18/24	
Direction Photo Taken: North		
Description: Reach 5B: RBP 1 looking upstream. This section of the river shows a larger run with woody debris along the edges of the river. The shoreline consists of many trees and shrubs.		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5B: RBP 2	
STATION # 2 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.4002474 LONG -73.2362778	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/18/24 TIME 1530	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
10 % ☑	%cloud cover	☐ ____%
☐	clear/sunny	☐

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 51 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem ☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type ☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☑ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☑ Shrubs ☐ Grasses ☑ Herbaceous

dominant species present cornus amomum, reynoutria japonica, phalaris

INSTREAM FEATURES

Estimated Reach Length 1,368 m
Estimated Stream Width 30 m
Sampling Reach Area 34,977 m²
Area in km² (m²x1000) 0.035 km²
Estimated Stream Depth 1.5 m
Surface Velocity (at thalweg) 0.5 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded

High Water Mark 2 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ____ % ☑ Run 10 %
☑ Pool 90 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 1,947 m²
Density of LWD 55,669 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☑ Attached Algae

dominant species present curly leaf pondweed, water milfoil

Portion of the reach with aquatic vegetation 10 %

WATER QUALITY

Temperature 7.3 ⁰ C
Specific Conductance 384 uS/cm
Dissolved Oxygen 11.21%
pH 8.12
Turbidity 0.67 NTU
WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_____

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other_____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other_____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other_____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	5.57
Boulder	> 256 mm (10")	1			
Cobble	64-256 mm (2.5"-10")	6	Muck-Mud	black, very fine organic (FPOM)	5
Gravel	2-64 mm (0.1"-2.5")	6			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	66			
Clay	< 0.004 mm (slick)	6			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5B: RBP 2	
STATION # 2 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.4002474 LONG -73.2362778	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/18/24 TIME 1530	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 **16**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 **16**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 **12** 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 **7** 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 **7** 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	**8** 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	**8** 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	**5** 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	**5** 4 3	2 1 0

Total Score 148

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/18/2024

Weather: Sunny

Team member(s): TW, SM, AL, JP

Team activity: Reach 5B and C BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5B Housatonic River	60689453

Photo No.	Date:
1	11/18/24

Direction Photo Taken:
Northwest

Description:
Reach 5B: RBP 2 looking upstream. This section of the river contains a moderate number of woody debris including fallen logs. The shoreline consists of a few trees, shrubs, and grasses.

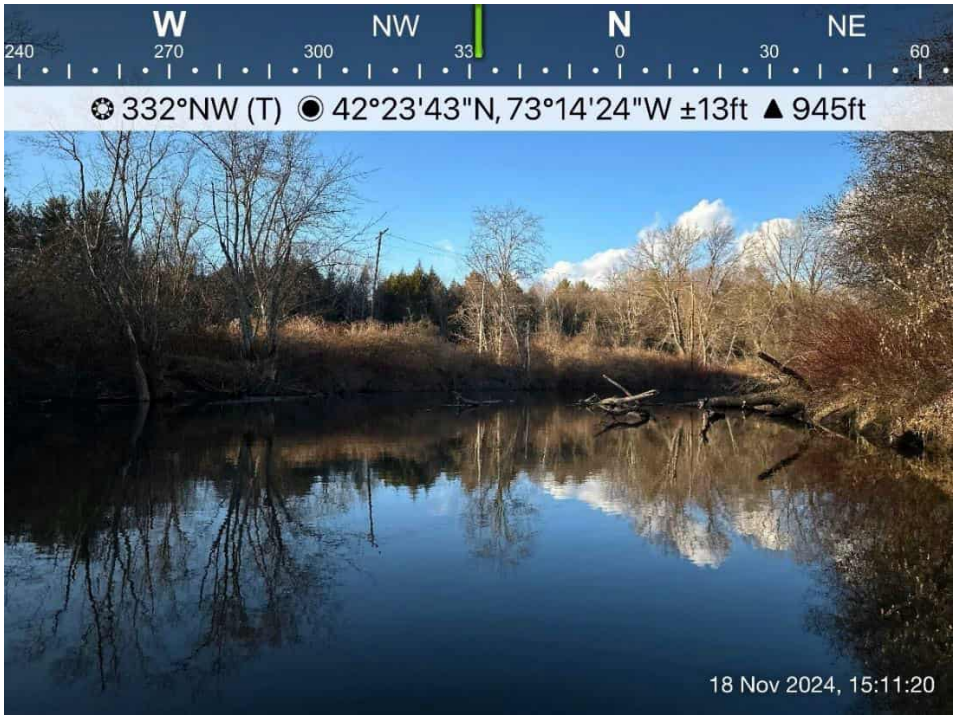


Photo No.	Date:
2	11/18/24

Direction Photo Taken:
North

Description:
Reach 5B: RBP 2 looking upstream. This section of the river consists of a short run with a shoreline that contains mostly trees and shrubs.

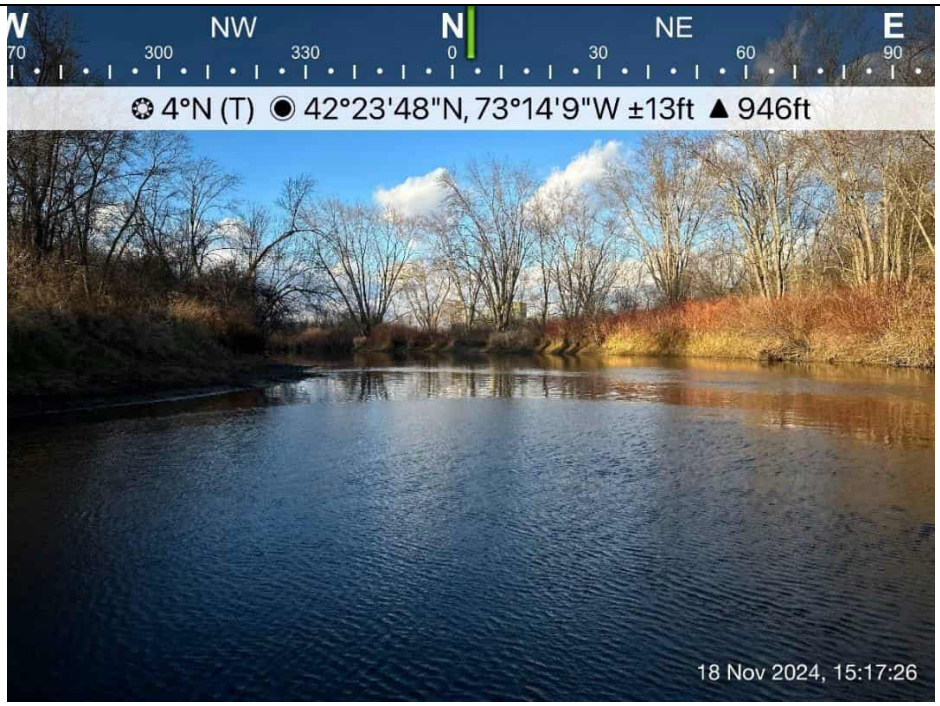
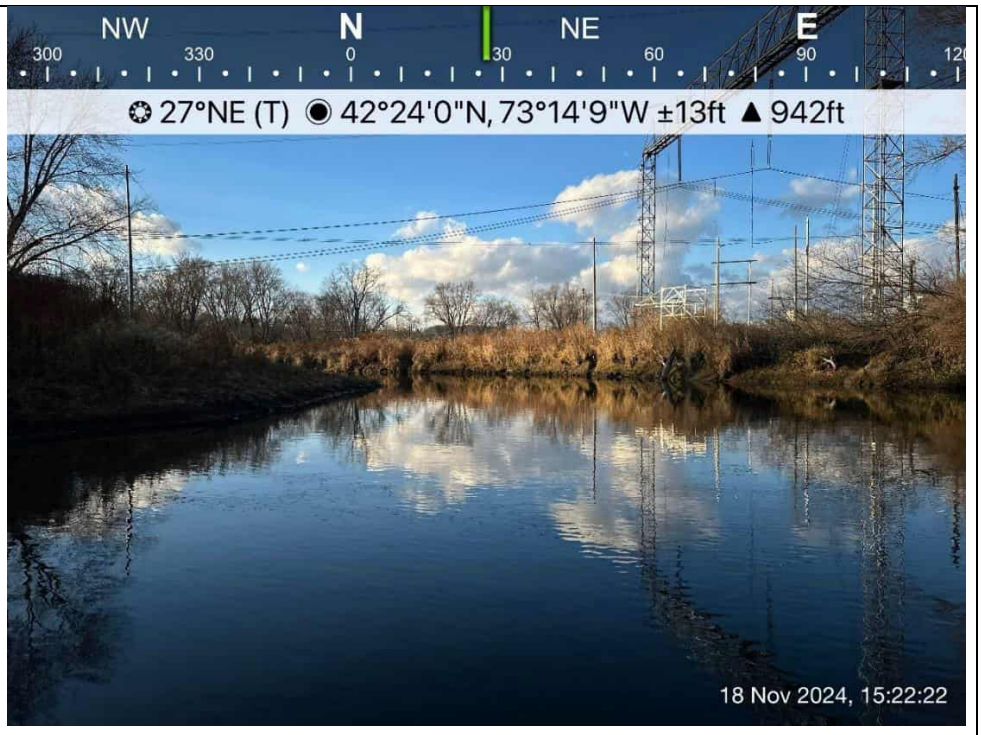


Photo No. 3	Date: 11/18/24	
Direction Photo Taken: Northeast		
Description: Reach 5B: RBP 2 looking upstream. This section of the river shows a short run with a shoreline that contains grasses and shrubs with few trees. The bank of the river shows signs of slight erosion on the right-side (downstream left).		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5B: RBP 3	
STATION # 3 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.2312 LONG -73.1429	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/18/24 TIME 1330	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
40 % ☑	%cloud cover	☐ ____%
☐	clear/sunny	☐

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 52 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☑ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☑ Grasses ☑ Herbaceous
dominant species present lythrum salarica, phalaris

INSTREAM FEATURES

Estimated Reach Length 1,970 m
Estimated Stream Width 30 m
Sampling Reach Area 51,909 m²
Area in km² (m²x1000) 0.052 km²
Estimated Stream Depth 2 m
Surface Velocity (at thalweg) 0.5 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded
High Water Mark 2 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☐ Run _____ %
☑ Pool 100 %

Channelized ☐ Yes ☑ No
Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 3,669 m²
Density of LWD 70,685 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae
dominant species present Elodea canadensis
Portion of the reach with aquatic vegetation 20 %

WATER QUALITY

Temperature 6.1 ⁰ C
Specific Conductance 383.7 uS/cm
Dissolved Oxygen 11.07%
pH 8.09
Turbidity 0.75 NTU
WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	7.07
Boulder	> 256 mm (10")	1			
Cobble	64-256 mm (2.5"-10")	4.5	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	1.5			
Sand	0.06-2mm (gritty)	18	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	68			
Clay	< 0.004 mm (slick)	7			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5B: RBP 3	
STATION # 3 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.2312 LONG -73.1429	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/18/24 TIME 1330	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 **12** 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 **16**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 **16**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	**10** 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0

Total Score 150

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/18/2024

Weather: Sunny

Team member(s): TW, SM, AL, JP

Team activity: Reach 5B and C BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]
1445	RBP 39-41	Mammal	Beaver	Sign	N/A	No
1445	RBP 39-41	Bird	Black-capped chickadee	Animal	Feeding	No

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name: GE	Site Location: Reach 5B Housatonic River	Project No. 60689453

Photo No.	Date:
1	11/18/24

Direction Photo Taken:
North

Description:
Reach 5B: RBP 3 looking upstream. This section of the river contains a short run. The shoreline consists of grasses along with a few large shrubs and trees. The banks have slight signs of erosion and bits of woody debris.

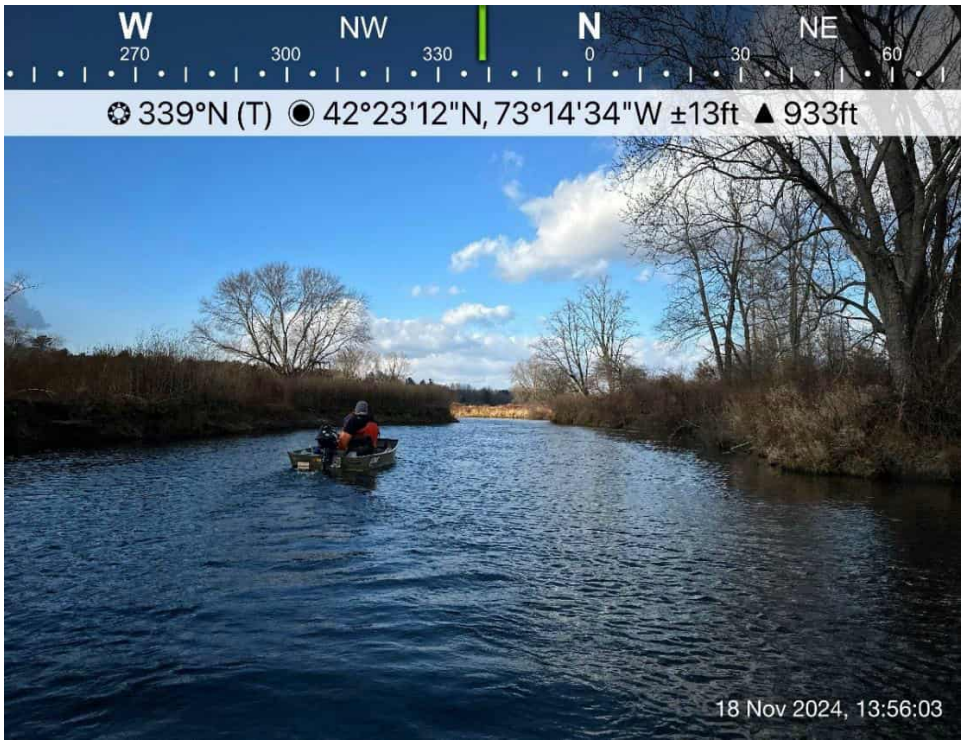


Photo No.	Date:
2	11/18/24

Direction Photo Taken:
East

Description:
Reach 5B: RBP 3 Looking upstream. This section of the river consisted of a short run with a relatively high density of silky dogwood to the right and grasses on the left. The banks had slight erosion on the right (downstream left) as it bended.

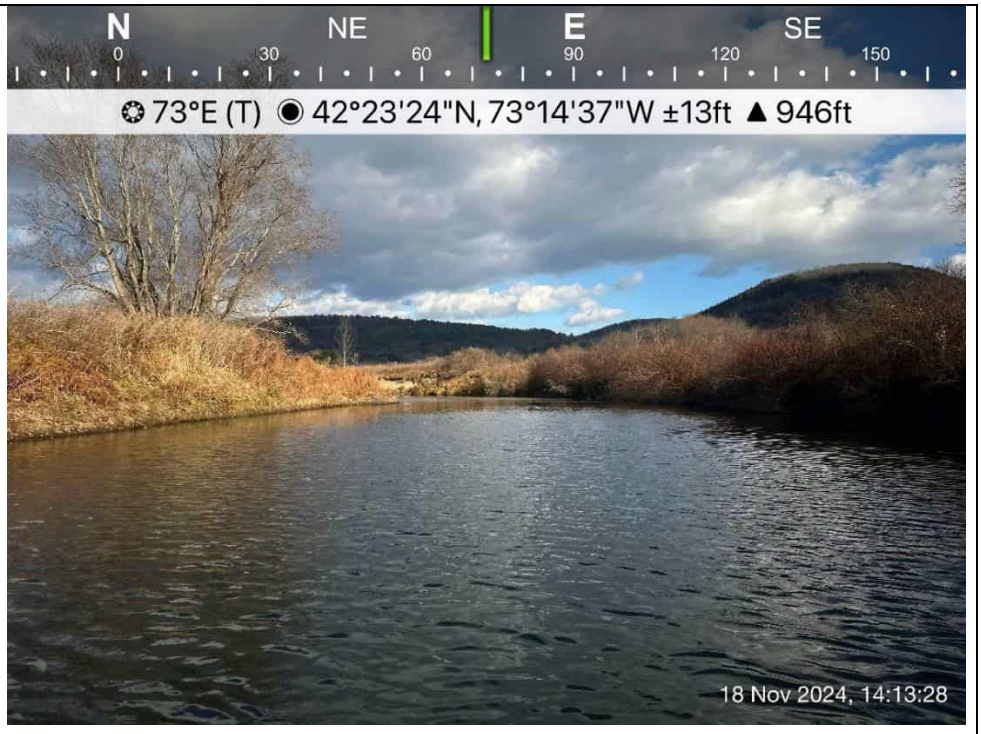
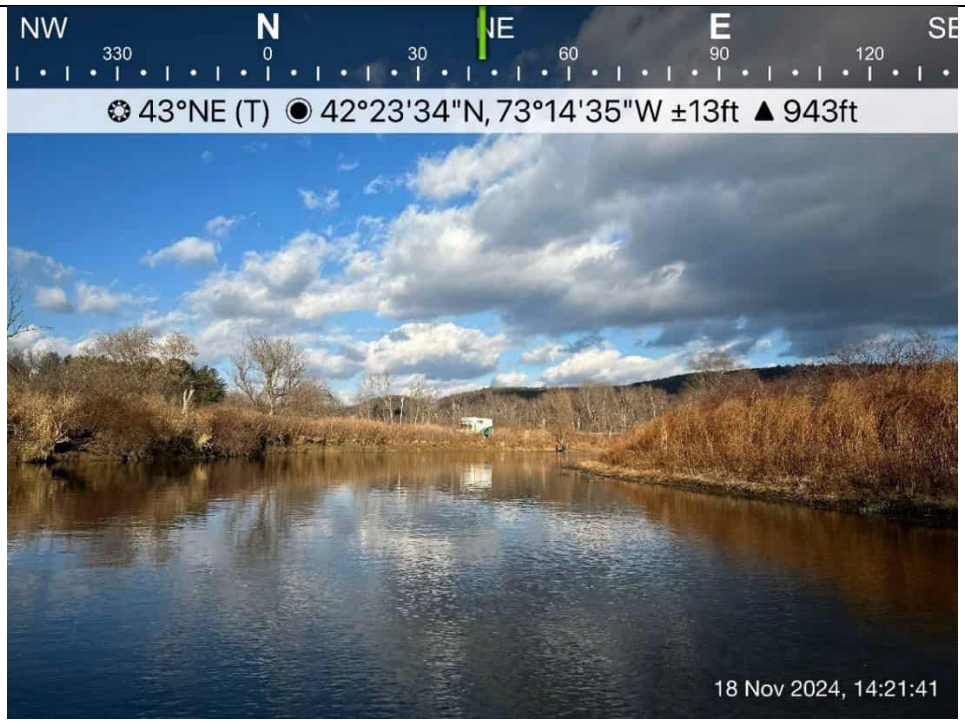


Photo No. 3	Date: 11/18/24	
Direction Photo Taken: Northeast		
Description: Reach 5B: RBP 3 looking upstream. This section of the river by Decker boat launch with a shoreline that consisted of grasses and scattered large shrubs. The banks had slight erosion on the left side (downstream right).		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 1	
STATION # 1 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.382254 LONG -73.243171	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1115	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
5 % ☑	%cloud cover	☐ %
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 47 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem ☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type ☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☑ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☑ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present cornus amomum, celastrus orb, lonicera morrowii

INSTREAM FEATURES

Estimated Reach Length 1,235 m
Estimated Stream Width 35 m
Sampling Reach Area 34,474 m²
Area in km² (m²x1000) 0.034 km²
Estimated Stream Depth 2 m
Surface Velocity (at thalweg) 0.3 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded

High Water Mark 0.5 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☐ Run _____ %
☑ Pool 100 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 3,314 m²
Density of LWD 96,121 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☑ Attached Algae

dominant species present algae, water milfoil, pondweed

Portion of the reach with aquatic vegetation 5 %

WATER QUALITY

Temperature 6.8 ⁰ C
Specific Conductance 363.1 uS/cm
Dissolved Oxygen 10.89%
pH 8.13
Turbidity 1.29 NTU
WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☑ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	9.61
Boulder	> 256 mm (10")	1			
Cobble	64-256 mm (2.5"-10")	2	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	4			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	70			
Clay	< 0.004 mm (slick)	8			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 1	
STATION # 1 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.382254 LONG -73.243171	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1115	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 148

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/19/2024

Weather: Sunny

Team member(s): TW, JP, SM, AL

Team activity: Reach 5B/C BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]
1100	RBP43A-44A	Small mammal	Black squirrel	Animal	Walking	No
1105	RBP43A-44A	Small mammal	Grey squirrel	Animal	Walking	No

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5C Housatonic River	60689453

Photo No.	Date:
1	11/19/24

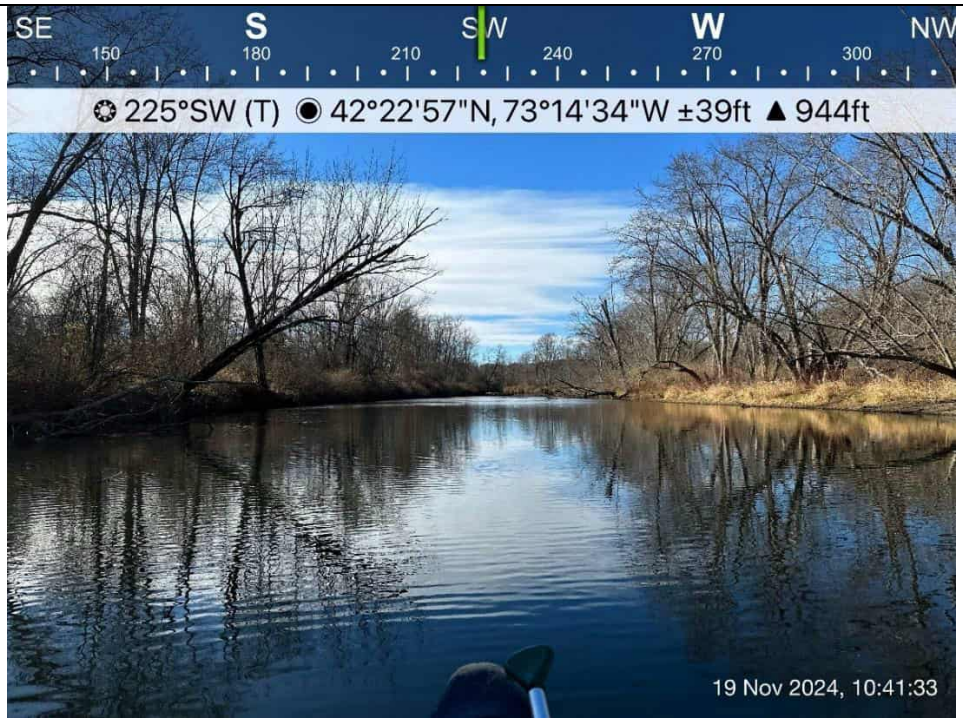
Direction Photo Taken:
South



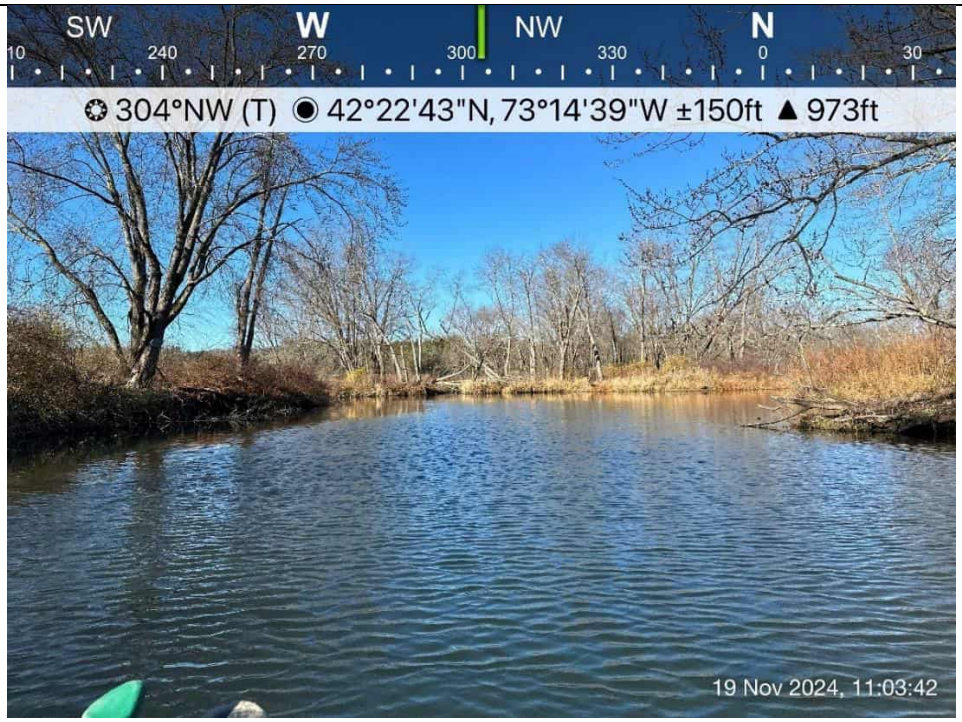
Description:
Reach 5C: RBP 1 looking downstream. This section of the river contains a long pool. The shoreline consists of an abundance of tree and shrubs with minimal grasses.

Photo No.	Date:
2	11/19/24

Direction Photo Taken:
Southwest



Description:
Reach 5C: RBP 1 looking downstream. This section of the river Contains a big pool with lots of trees and shrubs with moderate grass seen on the right. A few fallen trees draped across the water from the banks on both sides.

Photo No. 3	Date: 11/19/24	
Direction Photo Taken: Northwest		
Description: Reach 5C: RBP 1 looking downstream. This section of the river consists of a large pool on the right-hand side. The shoreline consisted of an abundance of trees and shrubs with little grasses.		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 2	
STATION # 2 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.37189 LONG -73.24144	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1215	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
<5 % ☑	%cloud cover	☐ ____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 50 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☑ Herbaceous

dominant species present Cornus amomum, phalaris, phragmites

INSTREAM FEATURES

Estimated Reach Length 1,531 m
Estimated Stream Width 35 m
Sampling Reach Area 44,862 m²
Area in km² (m²x1000) 0.045 km²
Estimated Stream Depth 3.5 m
Surface Velocity (at thalweg) 0.3 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded

High Water Mark 0.5 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle_____% ☐ Run_____%
☑ Pool 100 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 2,660 m²
Density of LWD 59,288 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☑ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present phragmites, cattail, elodea

Portion of the reach with aquatic vegetation 10 %

WATER QUALITY

Temperature 6.2 ⁰ C
Specific Conductance 383 uS/cm
Dissolved Oxygen 10.88%
pH 8.11
Turbidity 1.06 NTU
WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_____

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other_____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other_____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other_____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	5.93
Boulder	> 256 mm (10")	1			
Cobble	64-256 mm (2.5"-10")	3	Muck-Mud	black, very fine organic (FPOM)	10
Gravel	2-64 mm (0.1"-2.5")	5			
Sand	0.06-2mm (gritty)	14	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	69			
Clay	< 0.004 mm (slick)	8			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 2	
STATION # 2 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.37189 LONG -73.24144	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1215	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 172

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/19/2024

Weather: Sunny

Team member(s): TW, JP, SM, AL

Team activity: Reach 5B/C BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5C Housatonic River	60689453

Photo No.	Date:
1	11/19/24

Direction Photo Taken:
Southeast

Description:
Reach 5C: RBP 2 looking downstream. This section of pool/run contains a small island in the middle with sparse woody debris such as a fallen log. The shoreline contained many trees and shrubs.

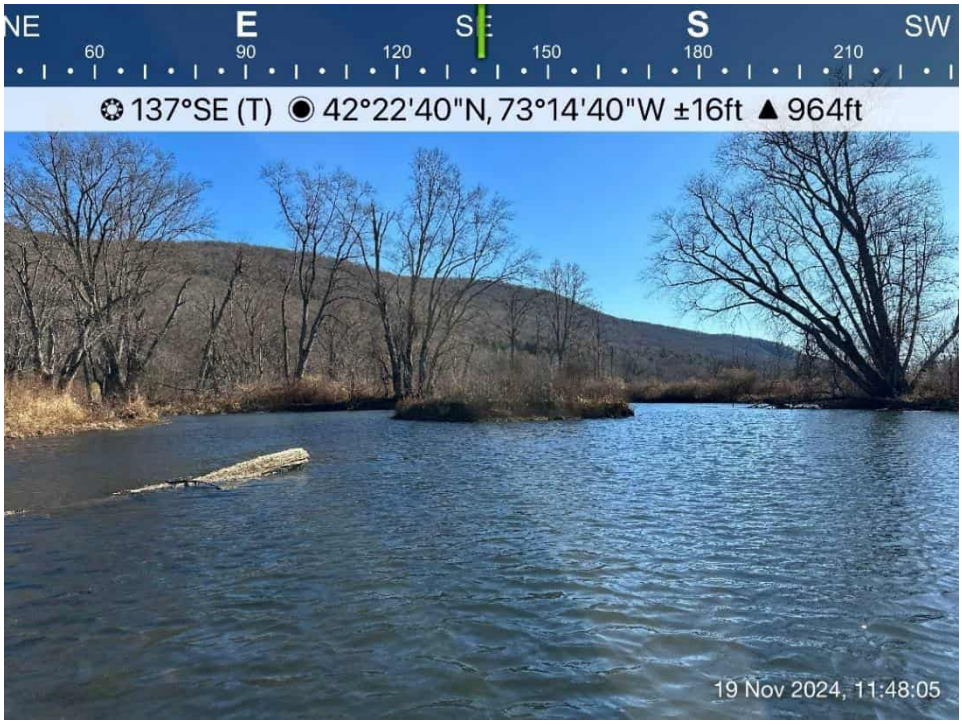


Photo No.	Date:
2	11/19/24

Direction Photo Taken:
Southeast

Description:
Reach 5C: RBP 2 looking downstream This section of the river shows a run with large cluster of cattails growing out of the water along the shoreline.

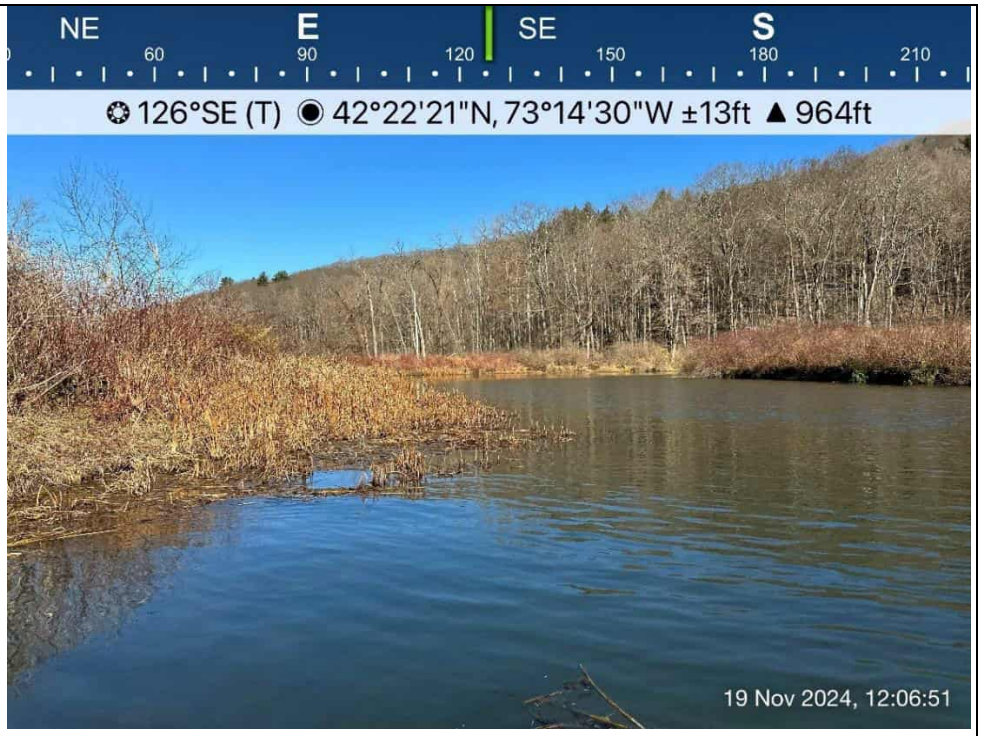


Photo No. 3	Date: 11/19/24	
Direction Photo Taken: South		
Description: Reach 5C: RBP 2 looking downstream. This section of the river shows a bend that has a shoreline that consists of shrubs, trees and a moderate number of grasses.		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 3	
STATION # 3 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.367624 LONG -73.239542	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1330	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
<5 % ☑	%cloud cover	☐ ____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 52 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☑ Shrubs ☐ Grasses ☑ Herbaceous

dominant species present Cattail,red osier dogwood, phragmites

INSTREAM FEATURES

Estimated Reach Length 838 m
Estimated Stream Width 35 m
Sampling Reach Area 26,244 m²
Area in km² (m²x1000) 0.026 km²
Estimated Stream Depth 3 m
Surface Velocity (at thalweg) 0.1 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded

High Water Mark 0.25 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle_____% ☐ Run_____%
☑ Pool 100 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 410 m²
Density of LWD 15,632 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☑ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present cattail, waterthyme

Portion of the reach with aquatic vegetation 10 %

WATER QUALITY

Temperature 8.01 ⁰ C
Specific Conductance 308.8 uS/cm
Dissolved Oxygen 11.50%
pH 8.21
Turbidity 1.96 NTU
WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_____

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other_____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other_____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other_____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	1.56
Boulder	> 256 mm (10")	1			
Cobble	64-256 mm (2.5"-10")	1	Muck-Mud	black, very fine organic (FPOM)	5
Gravel	2-64 mm (0.1"-2.5")	1			
Sand	0.06-2mm (gritty)	17	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	70			
Clay	< 0.004 mm (slick)	10			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 3	
STATION # 3 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.367624 LONG -73.239542	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1330	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 156

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/19/24

Weather: Sunny

Team member(s): TW, JP

Team activity: Reach 5BC BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]
1300	RBP47A-RBP48	Mammal	Beaver	Sign	Lodge & scent mounds	No

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5C Housatonic River	60689453

Photo No.	Date:
1	11/19/24

Direction Photo Taken:
Southeast

Description:
Reach 5C: RBP 3 looking downstream This section of the river contains a large pool. The shoreline consists of an abundance of grasses with trees behind it.



Photo No.	Date:
2	11/19/24

Direction Photo Taken:
Southeast

Description:
Reach 5C: RBP 3 looking downstream. This section of the river consists of a large pool along a bend. The shoreline is dominated by shrubs and trees.

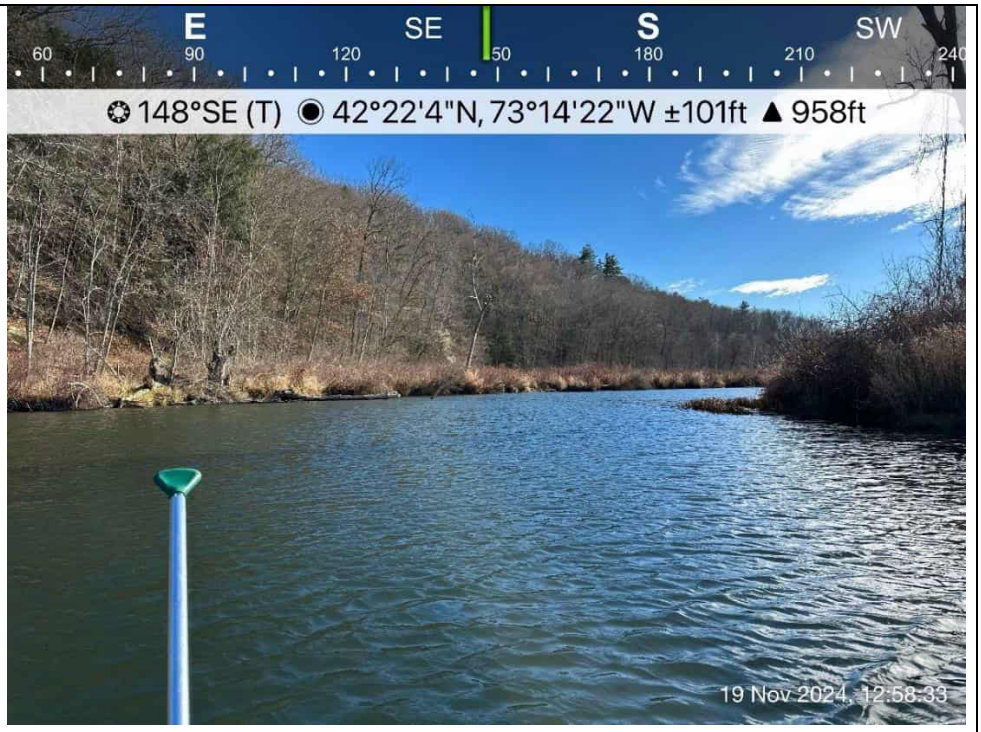
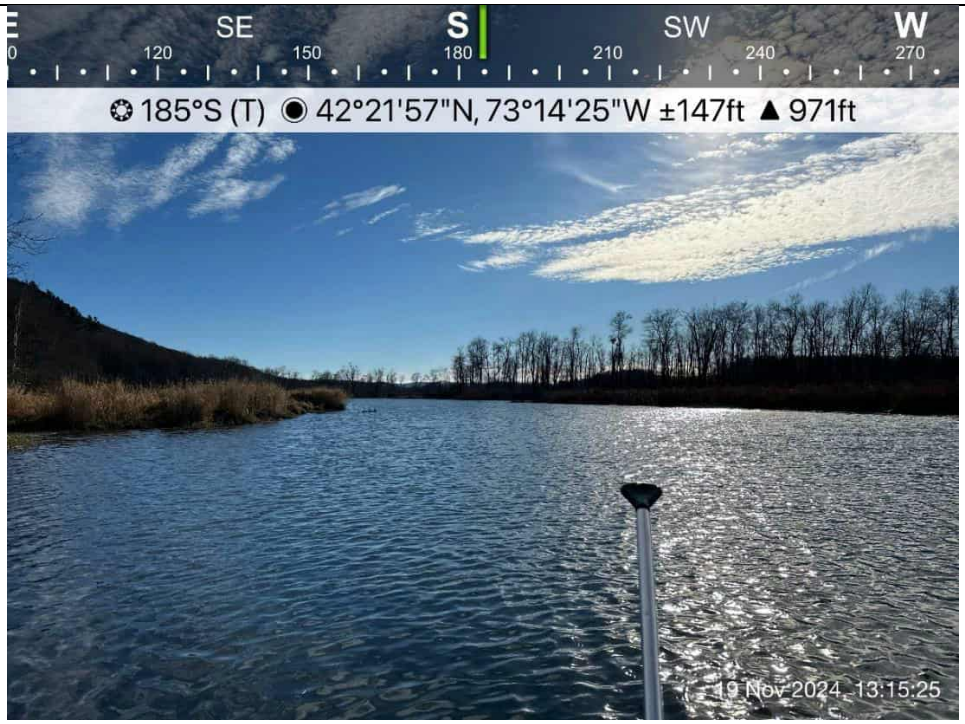


Photo No. 3	Date: 11/19/24
Direction Photo Taken: South	
Description: Reach 5C: RBP 3 looking downstream. This section of the river consists of a large Pool that has a shoreline with an abundance of grasses on both banks.	



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 4	
STATION # 4 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.358934 LONG -73.240157	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1430	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
<5 % ☑	%cloud cover	☐ ____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 52 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem ☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type ☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☑ Shrubs ☐ Grasses ☑ Herbaceous

dominant species present red osier dogwood, phalaris, phragmites

INSTREAM FEATURES

Estimated Reach Length 1,109 m
Estimated Stream Width 35 m
Sampling Reach Area 42,196 m²
Area in km² (m²x1000) 0.042 km²
Estimated Stream Depth 3.5 m
Surface Velocity (at thalweg) 0.1 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded

High Water Mark 0.5 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle_____% ☐ Run_____%
☑ Pool 100 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 864 m²
Density of LWD 20,486 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☑ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present Cattail

Portion of the reach with aquatic vegetation 15 %

WATER QUALITY

Temperature 6.2 ⁰ C
Specific Conductance 380.5 uS/cm
Dissolved Oxygen 11.03%
pH 8.12
Turbidity 1.45 NTU
WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_____

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other_____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other_____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other_____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	2.05
Boulder	> 256 mm (10")	1			
Cobble	64-256 mm (2.5"-10")	4	Muck-Mud	black, very fine organic (FPOM)	15
Gravel	2-64 mm (0.1"-2.5")	2			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	68			
Clay	< 0.004 mm (slick)	10			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 4	
STATION # 4 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.358934 LONG -73.240157	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1430	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 153

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/19/24

Weather: Sunny

Team member(s): TW, JP

Team activity: Reach 5BC BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]
1400	RBP49-RBP50B	Mammal	Beaver	Sign	Lodge & scent mounds	No

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5C Housatonic River	60689453

Photo No.	Date:
1	11/19/24

Direction Photo Taken:
South

Description:
Reach 5C: RBP 4 looking downstream along a bend that has a shoreline dominated by shrubs with overhanging trees on the left side.

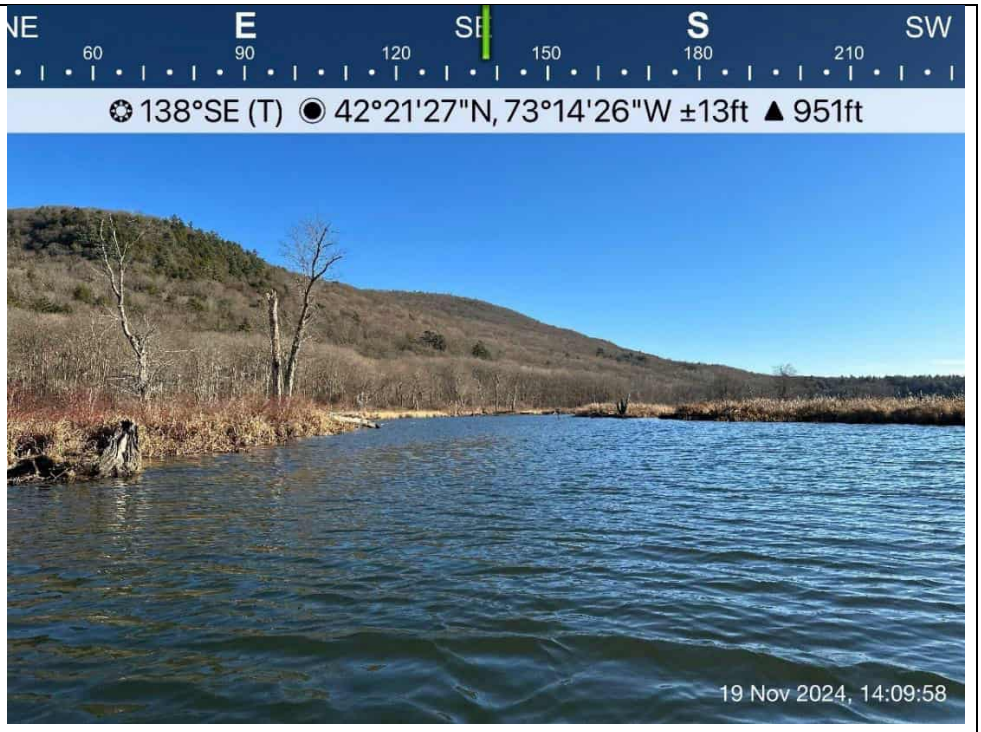


Photo No.	Date:
2	11/19/24

Direction Photo Taken:
South

Description:
Reach 5C: RBP 4 looking downstream. This section of the river contains a long run with little to no woody debris. The shoreline contains grasses, small shrubs, and a sparse tree.



Photo No. 3	Date: 11/19/24	
Direction Photo Taken: Southeast		
Description: Reach 5C: RBP 4 looking downstream shows a long run that has a shoreline of grasses and Shrubs with slight woody debris.		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 5	
STATION # 5 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.353304 LONG -73.240015	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1500	REASON FOR SURVEY Reach 5B/C BRA

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
<5 % ☑	%cloud cover	☐ ____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 52 ^{0} F

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☑ Shrubs ☐ Grasses ☑ Herbaceous
dominant species present Silky dogwood, phalaris, phragmites

INSTREAM FEATURES

Estimated Reach Length 626 m
Estimated Stream Width 35 m
Sampling Reach Area 27,669 m²
Area in km² (m²x1000) 0.028 km²
Estimated Stream Depth 4 m
Surface Velocity (at thalweg) 0.1 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ❑ Shaded
High Water Mark 0.5 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☐ Run _____ %
☑ Pool 100 %

Channelized ☐ Yes ☑ No
Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 483 m²
Density of LWD 17,458 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☑ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae
dominant species present Waterthyme, Cattail
Portion of the reach with aquatic vegetation 20 %

WATER QUALITY

Temperature 6.7 ⁰ C
Specific Conductance 387.1 uS/cm
Dissolved Oxygen 11.27%
pH 8.17
Turbidity 1.78 NTU
WQ Instrument Used YSI Pro D SS

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ❑ Globs ❑ Flecks
☑ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other Sand/Mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	1.75
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	0	Muck-Mud	black, very fine organic (FPOM)	20
Gravel	2-64 mm (0.1"-2.5")	0			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	70			
Clay	< 0.004 mm (slick)	10			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Housatonic River	LOCATION Reach 5C: RBP 5	
STATION # 5 RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.353304 LONG -73.240015	RIVER BASIN Housatonic	
STORET # N/A	AGENCY N/A	
INVESTIGATORS TW, SM, AL, JP		
FORM COMPLETED BY TW	DATE 11/19/24 TIME 1500	REASON FOR SURVEY Reach 5B/C BRA

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 157

Appendix A-1 (continued). Incidental Direct Wildlife Observations During In-River Habitat Surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 11/19/24

Weather: Sunny

Team member(s): TW, JP

Team activity: Reach 5BC BRA in-river surveys

Observations:

Time	Location & Habitat Type[1]	Faunal Type[2]	Species[3]	Observation Type[4]	Behavior/Description/Condition[5]	Documentation: Photo/Sketch[6]
1500	RBP51-WP	Bird	Seagull	Animal	Flying	No
1500	RBP51-WP	Mammal	Beaver	Sign	4 beaver lodges	No

[1] Station #, GPS coordinates, description plus habitat type

[2] Bird, large mammal, small mammal, reptile, amphibian, or fish

[3] Species: Common name/family/genus/species. If uncertain or unknown, state that.

[4] Observation Type: Animal, scat, track, rub, call or other sound, eggs, nest, den, bed, molt, other

[5] If animal, then record:

Behavior (e.g., resting, roosting, feeding, watering, courtship, reproduction, territorial, trapped, nesting, predation, flying, swimming running, walking, standing, grooming, other)

Life stage (adult, subadult, juvenile, unknown)

Sex (female, male, unknown)

Condition (alive, diseased, injured, dead)

Number observed (individual, pair, family, multiple) (# or range)

[6] Documentation: Photos/video: Yes (number)/No
Sketch: Yes (attach)/No

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5C Housatonic River	60689453

Photo No.	Date:
1	11/19/24

Direction Photo Taken:
South

Description:
Reach 5C: RBP 5 looking downstream. This section of the river shows the transitional area to Woods Pond. river consists of a small island located in the middle of the river with a mixed shoreline of grasses and shrubs on both banks.

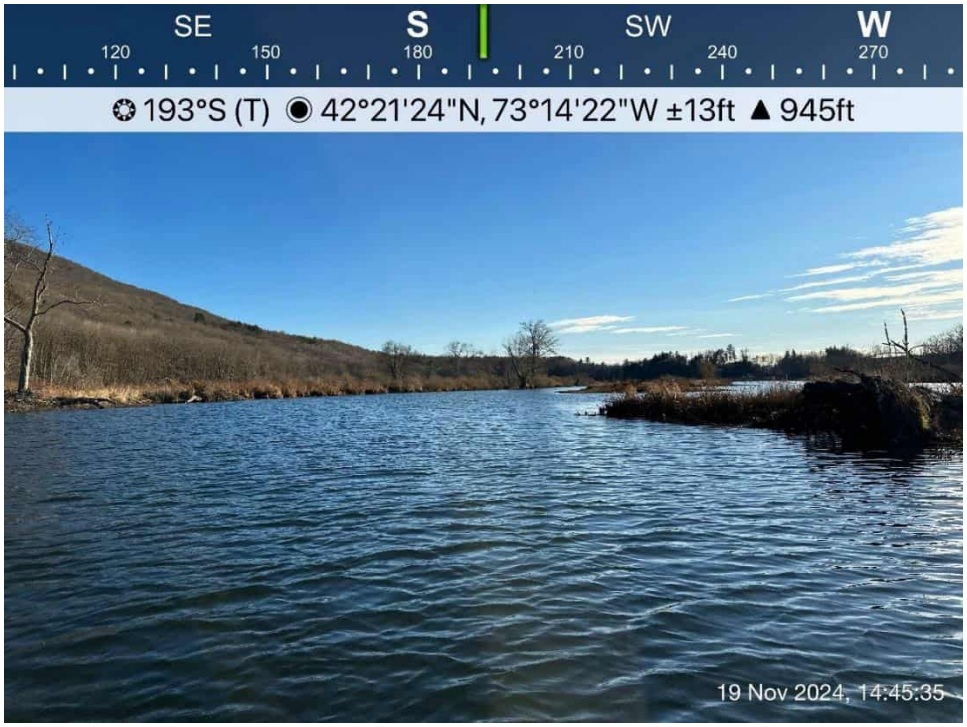


Photo No.	Date:
2	11/19/24

Direction Photo Taken:
Southwest

Description:
Reach 5C: RBP 5 transitional area to Woods Pond. Looking downstream. This section of the river has a large pool on the right with a shoreline dominated by shrubs on the left bank.

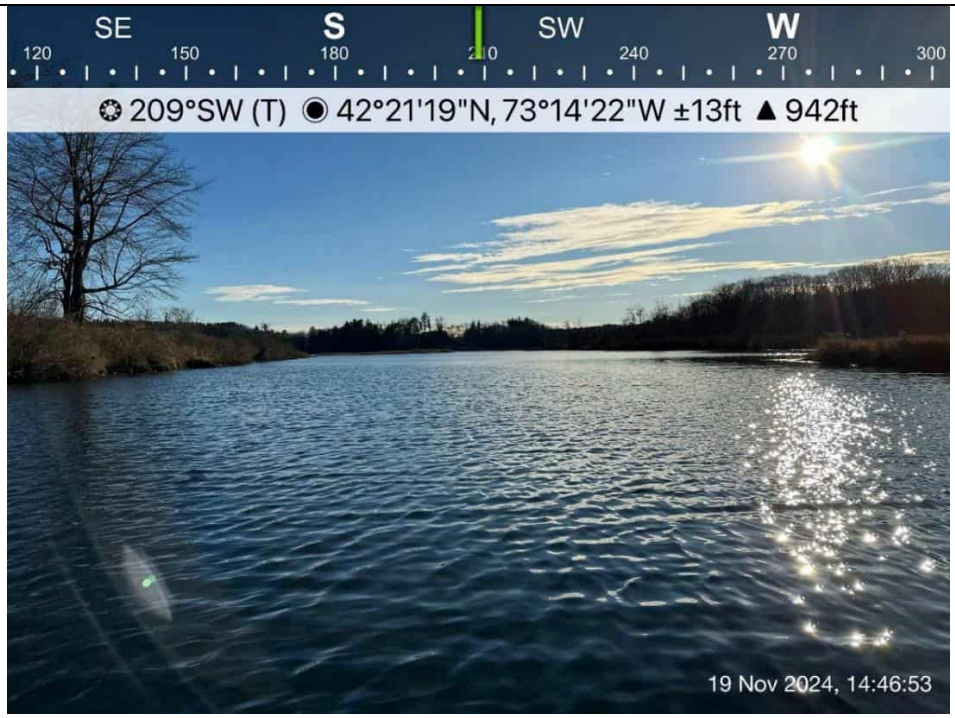
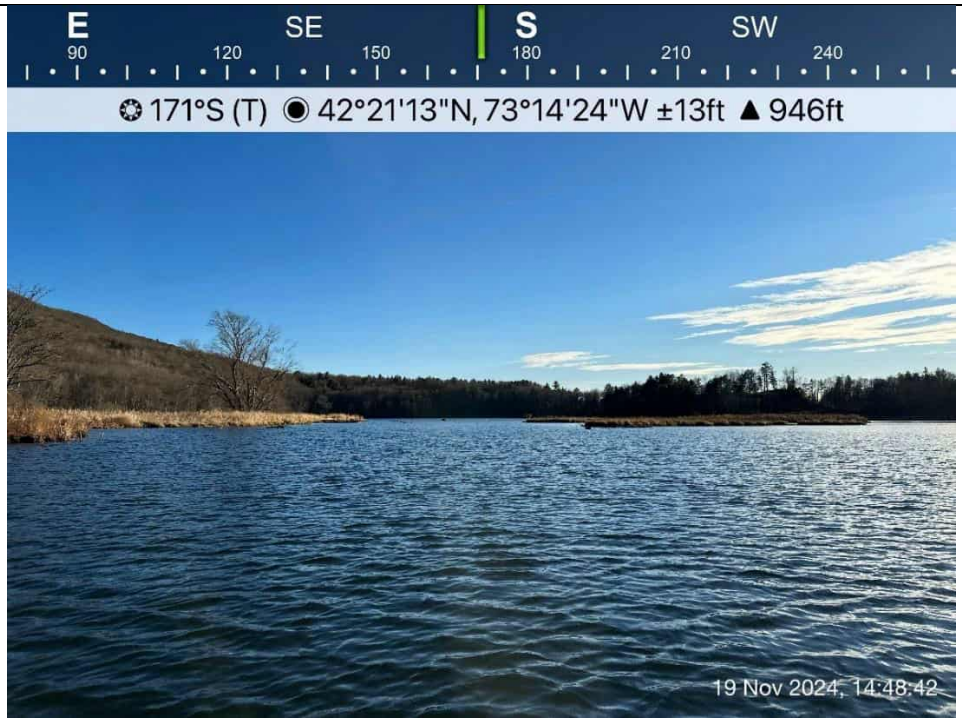


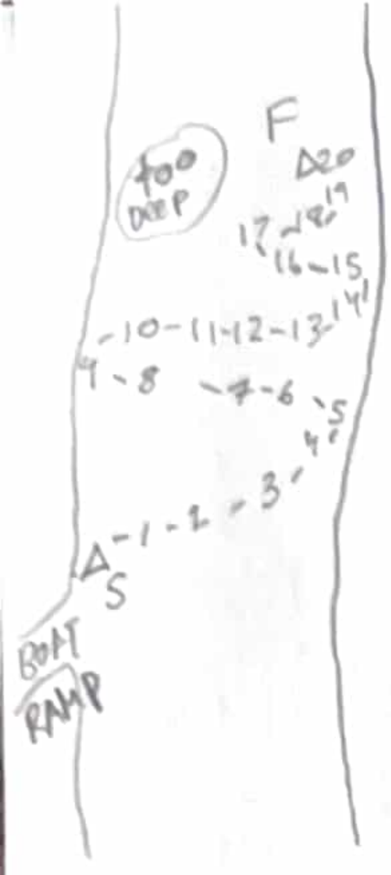
Photo No. 3	Date: 11/19/24	
Direction Photo Taken: South		
Description: Reach 5C: RBP 5 The transitional area to Woods Pond. Looking downstream. The shoreline consists of an abundance of grasses on both banks.		

Appendix A.2

Benthic Macroinvertebrate Results, Field Data Sheets and Notes

Phylum	Class	Order	Family	Common Name	Final ID	5B-C-1	5B-C-2	5B-C-2 DUP	5C-C-1	5C-C-1 DUP	5C-C-2	5C-C-3	5C-C-4	5C-C-5	7D-C-1	7D-C-1 DUP	Total	Tolerance Value
Annelida	Clitellata	Tubificida	Naididae	Segmented Worms	*Aulodrilus sp.*	10				2		7					19	8
					Dero digitata										3	1	4	10
					Limnodrilus sp.	5	8	2	1	1	9	2	3	1	4	11	47	10
					Limnodrilus hoffmeisteri				7		2		1	2		5	17	10
					Nais sp.	2		3				1	1				7	9
Arthropoda	Arachnida	Trombidiformes	Arrenuridae	Mites	*Arrenurus sp.*										1	4	5	8
		Trombidiformes	Hygrobatidae		*Hygrobates sp.*		1										1	8
	Insecta	Coleoptera	Dytiscidae	Beetles	*Agabus sp.*	2		2			2		1	1	3		11	5
					Coptotomus sp.										1		1	9
			Elmidae		*Dubiraphia sp.*		1	6	2	3	4	1					17	6
					Macronychus glabratus	1		3	5		7	9	2	1			28	4
					Optioservus sp.					2							2	4
					Promoresia sp.	2			1			3		2	1	6	15	2
					Stenelmis sp.	1							1	2		1	5	5
			Gyrinidae		*Dineutus sp.*										2		2	4
			Psephenidae		*Psephenus herricki*			2				5	1				8	6
		Diptera	Ceratopogonidae	True Flies	*Bezzia/Palpomyia sp.*	2	2					2	3		6	4	19	6
					Stilobezzia sp.	1		1		1				4	1	8	16	6
			Chironomidae		*Ablabesmyia mallochi*				1			1			10	7	19	6
					Chironomus sp.	1	2	9	1			2	3	4	10	14	46	8
					Cladotanytarsus sp.	3	2	8	6	9	4	1		2	8	11	54	7
					Cricotopus bicinctus	29	32	18	25	31	32	46	38	11	4	3	269	6
					Cricotopus sylvestris group	33	18	21	13	10	2		14	27	6	19	163	10
					Cryptochironomus sp.	2	9		7	10		1	2		1	5	37	8
					Dicrotendipes sp.		1							1	5	4	11	8
					Eukiefferiella claripennis group	1			2	6		5					14	8
					Microtendipes pedellus group		6	9	5	1	14	5		1		3	44	5
					Microtendipes rydalensis group				1		10			2	2		15	2
					Nanocladius sp.		1	3			3	2	12				21	3
					Orthocladius annectens			3									3	6
					Parametriocnemus sp.		11	1	9	7		8	10	5	1		52	5
					Paratendipes sp.										1	5	6	8
					Polypedilum flavum				1								1	4
					Polypedilum halterale group			6	2	3	3	2	1		1		18	7
					Polypedilum illinoense group		1		1	1		5		2			10	7
					Polypedilum scalaenum group			2		1							3	7
					Psectrocladius sp.	16	12	22	19	24	7	10	25	1	2	1	139	8
					Procladius bellus					1			2		8	4	15	9
					Rheocricotopus robacki		1	3		1							5	6
					Rheotanytarsus exiguus group	2	6	16	12	9	5	14	20	2	7	1	94	6
					Tanytarsus sp.				7	3	4		3	16	2	9	44	6
					Thienemanniella sp.	8	2	3	2	2	1	1		1			20	6
					Thienemannimyia group						9			6	7	13	35	6
					Tvetenia paucunca				1	5							6	5
					Tvetenia vitracies	1		2	2		1		5				11	5
					Chironomidae (pupae)	9	1	2	8	9	10	2	3	4	7	2	57	6
			Empididae		*Hemerodromia sp.*		2	1			1						4	6
					Neoplasta sp.		1			3	1		1				6	6
			Tipulidae		*Antocha sp.*			1									1	3
					Dicranota sp.	1			1								2	3
					Tipula sp.	1											1	4
		Ephemeroptera	Baetidae	Mayflies	*Baetis flavistriga*	13	8	14	10	9	8	10	1	9	1	14	97	5
					Baetis intercalaris		1	6	6		1	7	10	3		2	36	6
					Iswaeon anoka	18	10	4	7	6	5		5	1	9		65	4
					Labiobaetis sp.				1	2				2	7	5	17	6
					Plauditus sp.	1	2	7	9	7		4		1	4	10	45	5
			Baetiscidae		*Baetisca sp.*	1	1		2	1							5	4
			Ephemerellidae		*Ephemerella*			1		3	6	1	7	1	5	3	27	3
			Heptageniidae		*Maccaffertium modestum*	6	14	24	19	9	19	14	9		5	2	121	5
					Maccaffertium sp.		5	7	14	17	11		8		4	10	76	5

					Stenacron sp.						1	1		4	16	10	32	4
			Isonychiidae		*Isonychia sp.*							1	5	2		1	9	3
			Leptophlebiidae		*Paraleptophlebia sp.*	7	11	9	11	6		1	5	14	11	7	82	4
		Megaloptera	Corydalidae		*Nigronia sp.*								2		1		3	5
			Sialidae		*Sialis sp.*		1		2								3	4
		Odonata	Aeschnidae	Dragonflies/Damselflies	*Basiaeschna janata*	1		1					1	2		2	7	6
					Boyeria grafiana		1		2		1	5	1				10	6
					Boyeria vinosa				1			1			1		3	6
			Coenagrionidae		*Ischnura sp.*	4	7	6	12	9		13	8	1	4	7	71	9
			Gomphidae		*Ophiogomphus sp.*						2		1				3	6
					Stylurus sp.				1				2				3	5
		Plecoptera	Perlidae	Stoneflies	*Acroneuria abnormis*		1		2	3			1				7	2
					Paragnetina media					1				1			2	2
			Taeniopterygidae		*Taeniopteryx sp.*	2			1								3	2
		Trichoptera	Hydropsychidae	Caddisflies	*Cheumatopsyche sp.*	44	19	38	15	26	39	42	10	49	17	1	300	6
					Hydropsyche betteni	2	6	14	17	8	6	10	7	8	1	16	95	5
					Hydropsyche bronta				4	1					2		7	5
					Hydropsyche morosa				2				4	1		8	15	5
					Hydropsyche sparna	3	11	9	19	22	14	12	7	8	39	8	152	5
					Hydropsychidae	25	31	16	7	4	2	14	12	9	7	2	129	5
			Hydroptilidae		*Hydroptila sp.*	3	1	5	4			4	2	5	5		29	6
			Lepidostomatidae		*Lepidostoma sp.*				1	6	3						10	1
			Limnephilidae		*Limnephilus sp.*						3		2			2	7	5
					Pycnopsyche sp.										7	3	10	4
			Philopotamidae		*Chimarra aterrima*	3	6	1	12	9	2	4	14	7	7	3	68	4
					Chimarra obscura		2	5	12	2	2		1	22	5		51	4
					Dolophilodes sp.				1						2	2	5	4
			Polycentropodidae		*Neureclipsis sp.*				1	6				4			11	4
					Polycentropus sp.	9	14	10	13	15	9	13	9		5	1	98	5
			Psychomyiidae		*Lype diversa*					1		3		6	5	5	20	3
Crustacea	Malacostraca	Amphipoda	Gammaridae		*Gammarus sp.*			1				2	2	12			17	5
			Hyalellidae		*Hyalella sp.*	2	9	8	17	4		9		10	38	41	138	8
		Decapoda	Cambaridae		*Faxonius sp.*			1				2		1			4	6
		Isopoda	Asellidae		*Caecidotea sp.*						2		1		6	2	11	6
Mollusca	Bivalvia	Sphaeriida	Sphaeriidae	Clams/Mussels	*Sphaerium sp.*	1		9	2	7	4	5	4	2		3	37	6
		Unionoida	Unionidae		*Elliptio complanata*				1				2		1	2	6	5
	Gastropoda	Basommatophora	Physidae	Snails	*Physella sp.*	6		8	4	3	1	5	2	2			31	8
			Planorbidae		*Helisoma sp.*									1			1	6
					Ferrissia sp.	2	1	2	2	3	1	4	4	1	7	1	28	6
					Total Abundance	**286**	**282**	**355**	**376**	**335**	**273**	**322**	**301**	**287**	**326**	**314**	**3457**	
					Total Richness	**42**	**43**	**49**	**60**	**51**	**43**	**48**	**53**	**51**	**54**	**51**		
					EPT Richness	**14**	**17**	**16**	**24**	**22**	**16**	**16**	**19**	**20**	**22**	**21**		
					Dominant Taxa	*Cheumatopsyche sp. 15.4%*	*C. bicinctus 11.3%*	*Cheumatopsyche sp. 10.7%*	*C. bicinctus 6.6%*	*C. bicinctus 9.3%*	*Cheumatopsyche 14.3%*	*C. bicinctus 14.3%*	*C. bicinctus 12.6%*	*Cheumatopsyche sp. 17.1%*	*H. sparna 11.9%*	*Hyalella sp. 13.1%*		
					Water Class Estimate	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**		



BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Housatonic River	LOCATION Lenox, MA	
STATION # SB-C-1 RIVERMILE	STREAM CLASS	
LAT 42.393570 LONG -73.242112	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Taylor White		LOT NUMBER
FORM COMPLETED BY Taylor White	DATE 10/07/24 TIME 1300 AM (PM)	REASON FOR SURVEY Community & Tissue Sample

Temp 16.6°C
DO 8.18 mg/l
544 SPC
7.79 pH
104.5 ORP mV
0.44 NTU

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 0 % ☐ Snags 0 % ☐ Vegetated Banks 0 % ☐ Sand 0 % ☑ Submerged Macrophytes 60 % ☑ Other (silty sand) 40 %
SAMPLE COLLECTION	**Gear used** ☑ D-frame ☐ kick-net ☐ Other _____ **How were the samples collected?** ☑ wading ☐ from bank ☑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble____ ☐ Snags____ ☐ Vegetated Banks____ ☐ Sand____ ☐ Submerged Macrophytes 12 ☑ Other (silty sand) 8
GENERAL COMMENTS	subset of sample (~5 jabs) taken from boat near center of channel- Tissue sample taken concurrently

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

See Notes on back →

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Housatonic	LOCATION 5B-C-2	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT 42.387783 LONG -73.243621	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE 10/7/24 TIME 1520 AM (PM)	REASON FOR SURVEY Community sample

HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Cobble____% ❑ Snags____% ❑ Vegetated Banks____% ❑ Sand____% ☑ Submerged Macrophytes 80 % ❑ Other (Silt/Sand) 20%
SAMPLE COLLECTION	**Gear used** ☑ D-frame ❑ kick-net ❑ Other _____ **How were the samples collected?** ☑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble____ ❑ Snags____ ❑ Vegetated Banks____ ❑ Sand____ ❑ Submerged Macrophytes 16 ❑ Other (Silt/Sand) 4
GENERAL COMMENTS	Duplicate Benthic community sample collected here (1620) "5B-C-2-DUP

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

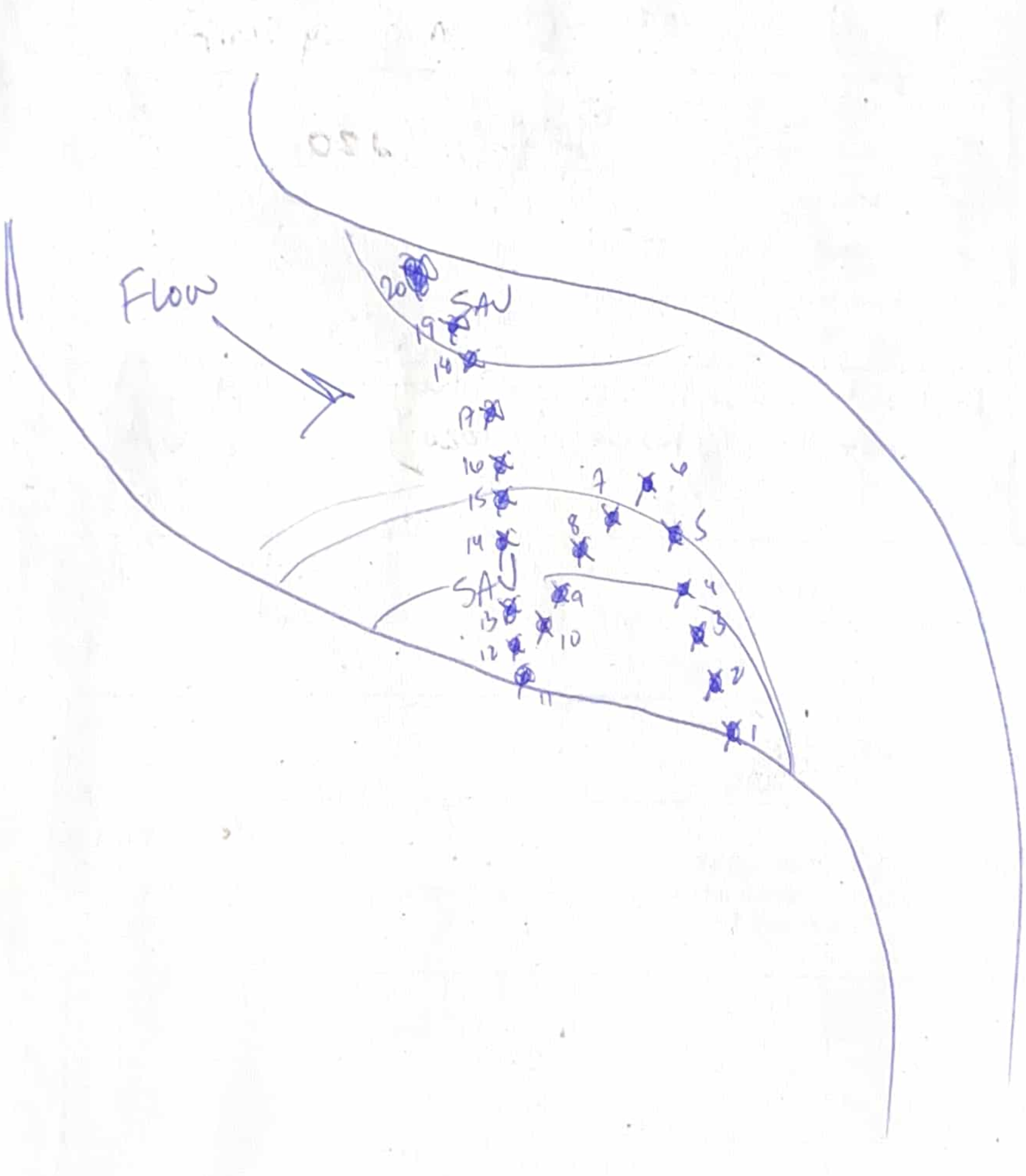
1 blunthose minnow

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

Temp 17.2C
DO 9.51 mg/L
DO 98.9 %
Cons. 539 µS/cm
pH 8.04
ORP 46.3
Turbidity 11.03


N
FLOW
20
SAN
19
18
17
16
15
14
SAN
13
12
11
10
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6
5
4
3
2
1

sketch on back →

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Housatonic	LOCATION SC-C-1	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS TW		LOT NUMBER
FORM COMPLETED BY Taylor White	DATE 10/09/24 TIME 0850 (AM) PM	REASON FOR SURVEY Benthic Community

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble____% ☑ Snags 15 % ☑ Vegetated Banks 20 % ☑ Sand 10 % ☑ Submerged Macrophytes 55% TW 45% ☑ Other (root wads) 10%
SAMPLE COLLECTION	**Gear used** ☑ D-frame ☐ kick-net ☐ Other _____ **How were the samples collected?** ☑ wading ☐ from bank ☑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble____ ☑ Snags 3 ☑ Vegetated Banks 4 ☑ Sand 2 ☑ Submerged Macrophytes 9 ☑ Other (root wads) 2
GENERAL COMMENTS	community survey only dup collected - LWD jabs were taken from boat with D frame

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

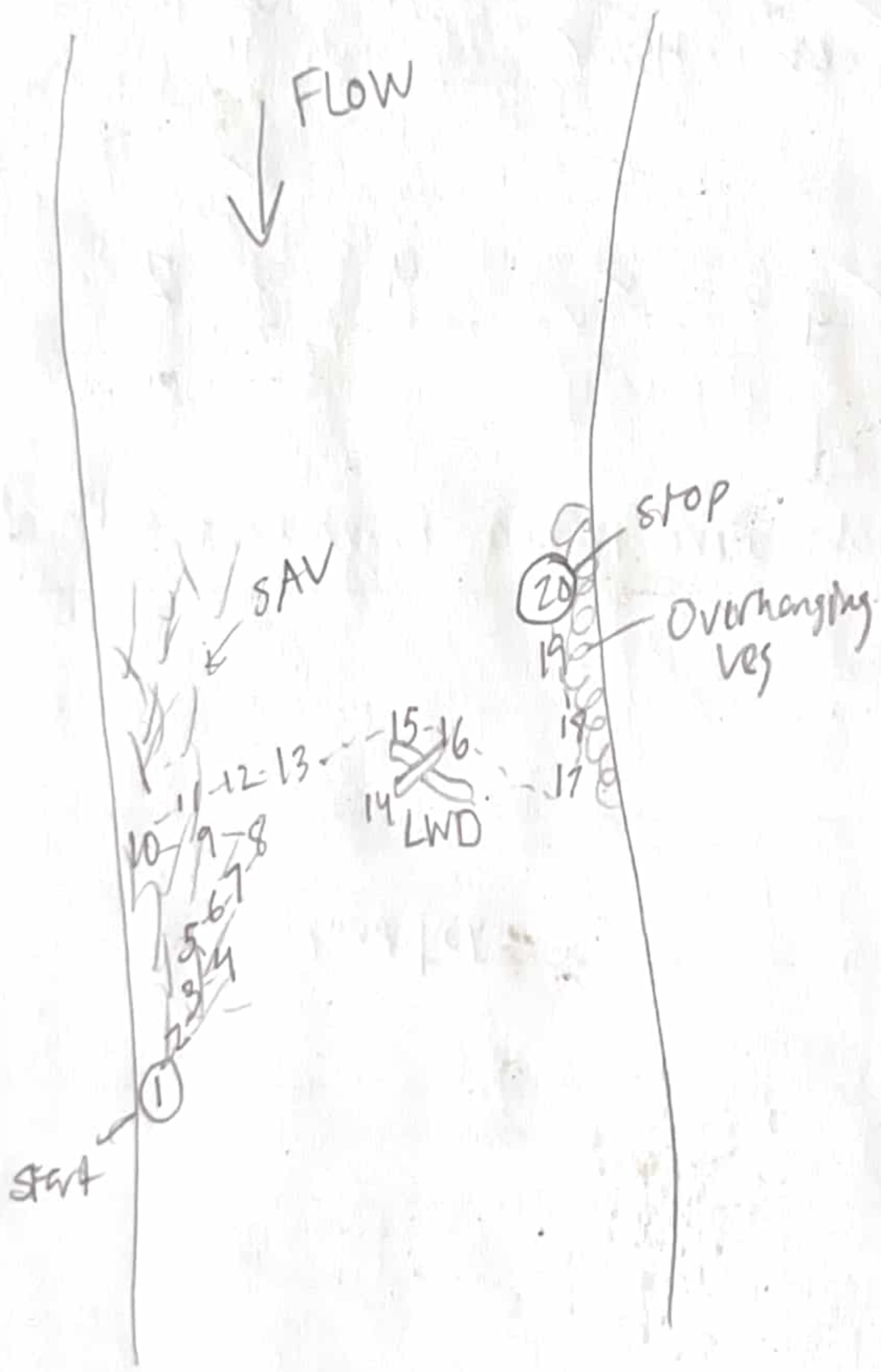
Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish - YOY pumpkinseed	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

Temp 14.1
DO 8.53 mg/L
SPC 530
pH 7.83
ORP 72.9
NTU 1.11

5C-C-1 & 5C-C-1-DUP



sketch on back →

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Housatonic	LOCATION 5C-C-2 & 5C-T-1	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS TW, MF		LOT NUMBER
FORM COMPLETED BY Taylor White	DATE 10/8/24 TIME 1140 AM PM	REASON FOR SURVEY Tissue & Community Survey

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble ____ % ☑ Snags 10 % ☐ Vegetated Banks ____ % ☑ Sand 10 % (Sand/silt) ☑ Submerged Macrophytes 80 % ☐ Other ( ) ____ %
SAMPLE COLLECTION	**Gear used** ☑ D-frame ☐ kick-net ☐ Other _____ **How were the samples collected?** ☐ wading ☐ from bank ☑ from boat (TW) **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☑ Snags 2 ☐ Vegetated Banks ____ ☑ Sand 2 ☑ Submerged Macrophytes 16 ☐ Other ( ) ____
GENERAL COMMENTS	Tissue sample collected (5C-T-1)

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

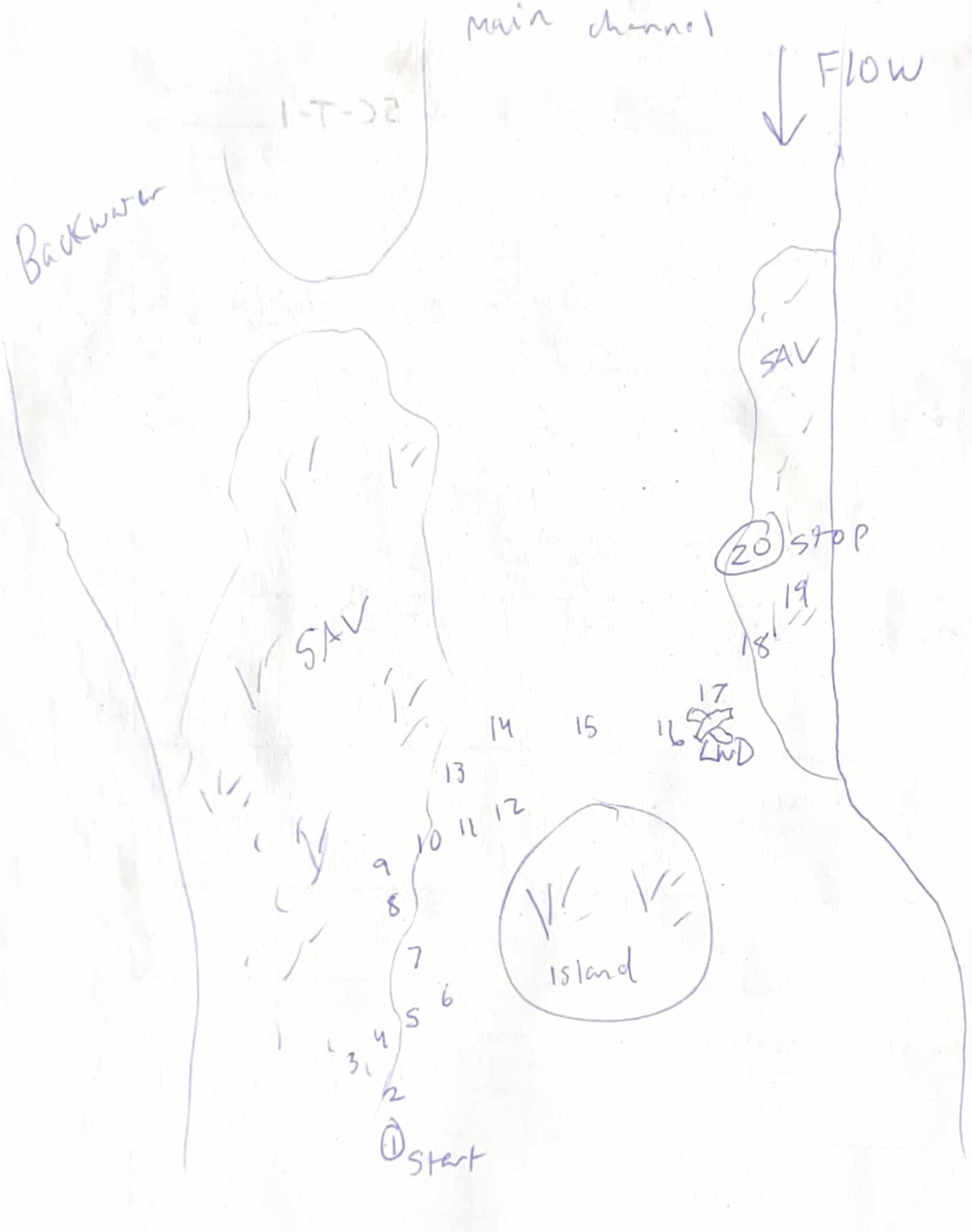
Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4								
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4								
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4								

yoy rock bass, LMB, bluegill, pumpkinseed, bluntnose minnow

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4		
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4		
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4		
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4		
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	Temp	15.0 C						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4	DO	8.42						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4	SPC	532						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4	pH	7.86						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4	ORP	76.7						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4								
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4								
						Culcidae	0	1	2	3	4	NTU	2.08						


main channel
FLOW
1-T-22
Backwater
SAV
SAV
20 STOP
19
18
17
16 END
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1 Start
Island

sketch on back →

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Horsepond ic	LOCATION SC-C-3	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS TW, MF		LOT NUMBER
FORM COMPLETED BY Taylor White	DATE 10/08/24 TIME 1300 AM (PM)	REASON FOR SURVEY Community Sample

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble____% ☑ Snags____% ☐ Vegetated Banks____% ☑ Sand silt____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
SAMPLE COLLECTION	**Gear used** ☑ D-frame ☐ kick-net ☐ Other _____ **How were the samples collected?** ☑ wading ☐ from bank ☑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble____ ☑ Snags 4 ☐ Vegetated Banks____ ☑ Sand 2 ☑ Submerged Macrophytes 14 ☐ Other ( )____
GENERAL COMMENTS	middle of channel jabs taken by boat on LWD

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

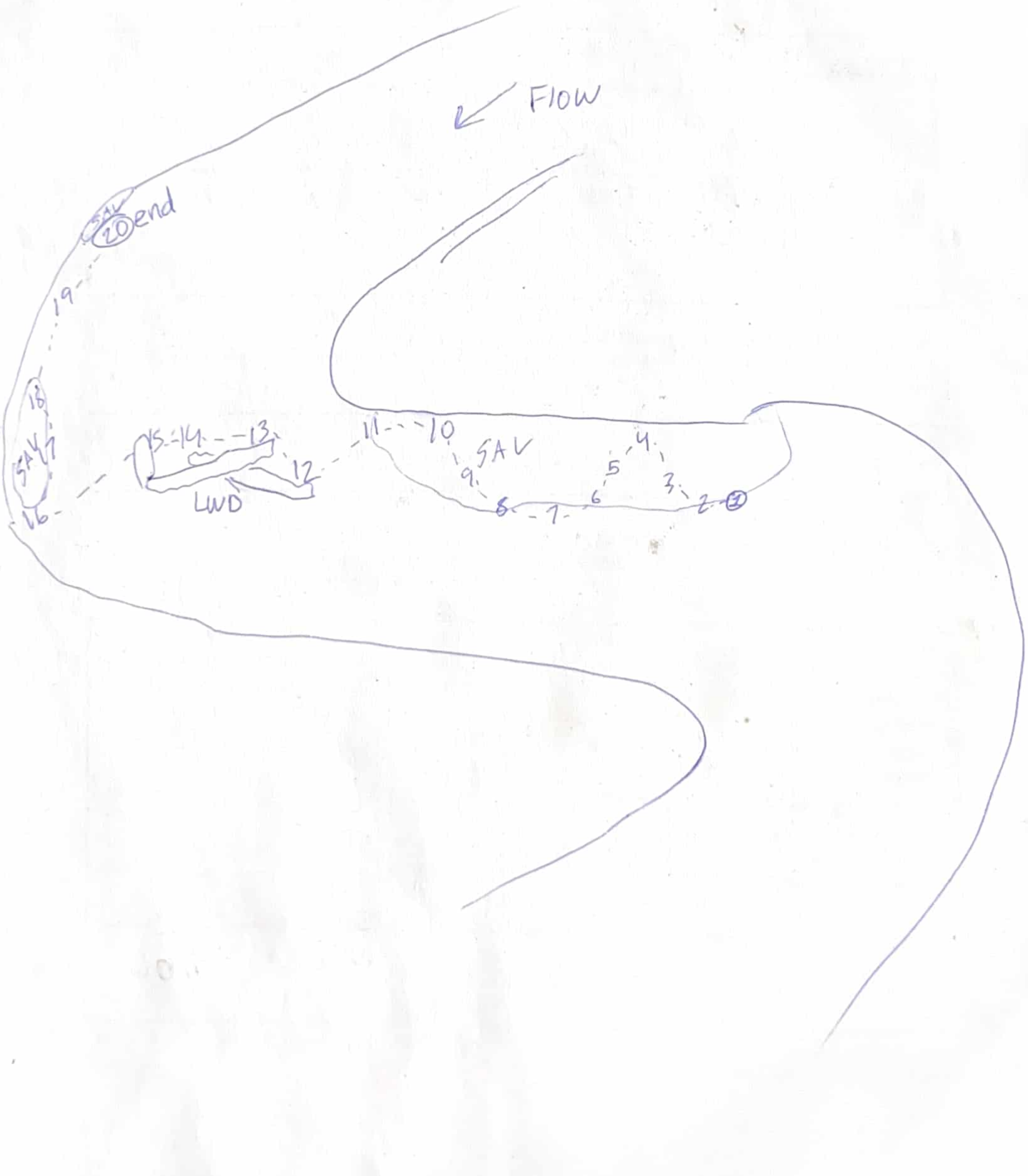
Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

Temp 15.2
DO 8.15 mg/L
SPC 531
pH 7.81
ORP — 70.5 mV
NTU 3.06

5C-C-3


FLOW
SAV
20 end
19
18
SAV
17
16
15
14
13
12
LWD
11
10
SAV
9
8
7
6
5
4
3
2
1

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Housatonic	LOCATION Housatonic - SC-C-4	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS TW, MF		LOT NUMBER
FORM COMPLETED BY Taylor White	DATE 10/8/24 TIME 1440 AM (PM)	REASON FOR SURVEY community survey

HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Cobble ____ % ☑ Snags 10 % ❑ Vegetated Banks ____ % ☑ Sand 15 % ☑ Submerged Macrophytes 65 % ☑ Other (Silt/Sand) 10 %
SAMPLE COLLECTION	**Gear used** ❑ D-frame ❑ kick-net ❑ Other _____ **How were the samples collected?** ❑ wading ❑ from bank ☑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble ____ ☑ Snags 2 ❑ Vegetated Banks ____ ☑ Sand 3 ☑ Submerged Macrophytes 13 ☑ Other (Sand/Silt) 2
GENERAL COMMENTS	jabs taken by boat Community sample only

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	Temp	15.7				
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4	DO	8.72				
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4	SPC	524				
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4	pH	7.88				
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4	ORP	70.4				
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4	NTU	2.75				

5C-C-4

FOW
20
STOP
19
18-17
16
15-14
13
12-11
10-9
8-7
SAV
5-6
4
too deep
Samples
to secure
overhanging veg
3
2
1
start
BOAT LAUNCH

sketch on Back →

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Housatonic	LOCATION SC-C-5	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS TW, MF		LOT NUMBER
FORM COMPLETED BY Taylor White	DATE 10/08/24 TIME 1400 AM (PM)	REASON FOR SURVEY community survey

HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Cobble____% ❑ Snags____% ❑ Vegetated Banks____% ☑ Sand/Silt 75% ☑ Submerged Macrophytes 25 % ❑ Other ( )____%
SAMPLE COLLECTION	**Gear used** ☑ D-frame ❑ kick-net ❑ Other _____ **How were the samples collected?** ❑ wading ❑ from bank ☑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble____ ❑ Snags____ ❑ Vegetated Banks____ ☑ Sand 15 ☑ Submerged Macrophytes 5 ❑ Other ( )____
GENERAL COMMENTS	Sandy silt bottom with sparse vegetation and small patches of SAV - Only community sample

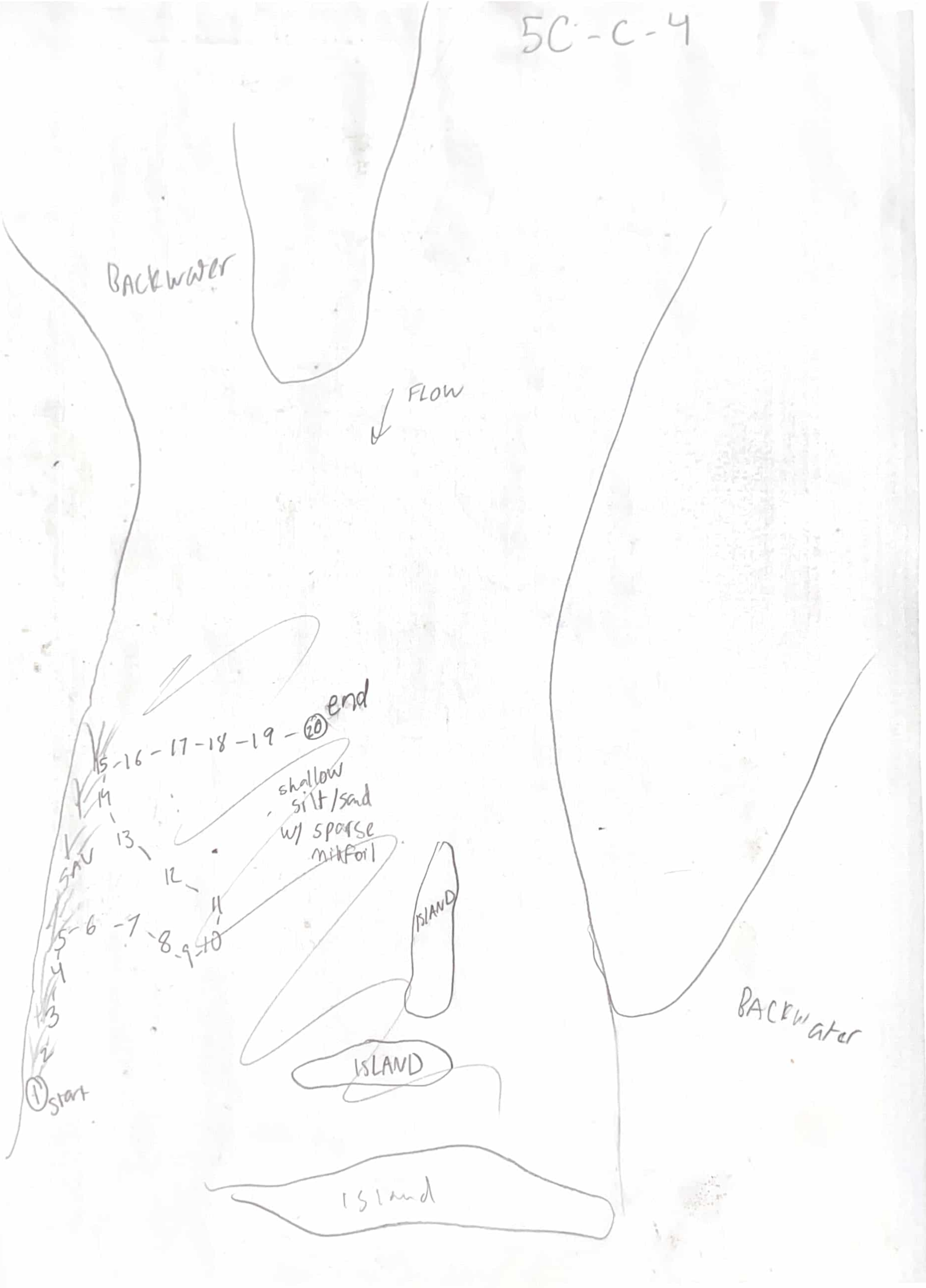
QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4	Temp 16.9					
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4	DO 8.56 mg/L					
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4	SPC 530					
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4	pH 7.89					
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4	ORP 88.2					
						Culcidae	0	1	2	3	4						
												NTU 2.24					

5C-C-4


BACKWATER
FLOW
1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20 end
shallow silt/sand w/ sparse milfoil
SAV
start
ISLAND
ISLAND
BACKWATER
island

118

Location Housatonic River Date 10/07/24

Project / Client GE

weather: Sunny, 60s

0700 TW, BR, Arcadis meet at hotel, tailgate & gameplan

~0900 Launch at decker boat ramp

1000 ride north to beggining of 5B identify sampling locations

1050 drop minnow trap 1&2 (5B)

1130 John Cassel EPA Oversight arrives

1130 WQ @ 5B-C-1

Temp 16.6°C Do 8.18 mg/l 544 SPC

7.79 pH 104.5 ORP mV 0.44 NTU

1145 Began CS → 5B-C-1

1210 deploy minnow trap 3&4 (5B)

1255 finish 5B-C-1 CS

1300 BR dropped 5B minnow trap 1&2

1315 started tissue collection

1445 finished tissue collection 5B-T-1 sample 5B-T1 consists of aprox 60% odonates by mass, smaller # of mayflies & caddisfly

1500 mob to CS location 2 in 5B

1600 Finish 5B-CS-2 & 5B-CS-2 DUP

1500 OFF water

Location Housatonic River Date 10/08/24

Project / Client GE

Weather: Sunny, 50s

0700 tailgate @ hotel, mob to decker boat ramp

0850 arrive @ 5C-C-1 start

0920 Finish 5C-C-1 & DUP

0945 arrive @ 5C-C-2 - Matt F running upstream to boat launch to pick up John Cassels - TW starting tissue collection 1150 Tissue end

1110 - Matt F &

1115 - TW pull minnow trapset 5C-M-1 (2 traps 10-12 cord)

PS	2 1/16"	6 YOY	Pumpkinseed
BG	2 6/16"	7 YOY	Bluegill
PS	2 1/2"		
PS	2 1/4"	1140	CS - 5C-C-2
PS	2 1/4"	1150	5C-T-1
PS	2"		
BG	2 1/16"		
PS	2 1/16"		
BG	2 14/16"		
BG	1 10/16"		
BG	2 11/16"		
BG	1 11/16"		
BG	1 14/16"		

Rite in the Rain

120

Location Housatonic R Date 10/8/24

Project / Client

1300	5C-C-3	completed
~~1345~~	~~5C-C-4~~	~~start~~
TW 1400	5C-C-5	completed
1430	5C - minnow trapset #2 dropped	
~~1500~~ TW	5C-C-4	~~start~~ TW completed
1440		
1600	off water	

10/9/24

0700 Tailgate @ hotel, mob to Nobles Farm - TW (AECOM) - MF, AS (Arcadis)
0800 Arrive @ Nobles for 5A-T-1
0830 Begin 5A-T-1
Jar 11.7.9
1030 FINISH 5A-T-1
1200 FINISH 7D-C-1 & DUP
Start 7D-T-1
1400 FINISH 7D-T-1 ← time on Smpk.
MOB TO 7H
1520 7H-T-1 Complete
Mob to Woods pond. For Minnow trap retrieval
1620 retrieve Minnow set #2 in 5C-EMPTY
1630 - OFFSITE

Location Housatonic River Date 10/10/24

Project / Client GE

0830 arrive @ Reach 11
TW (AECOM) AS, MF (Arcadis)
John Cassels EPA oversight

- Plan to collect Biota tissue sample for caddisfly, hellgrammite, & stonefly (20g each)
SAMPLE IDS
11-T-1 (caddisfly)
11-T-2 (hellgrammite) } switch
11-T-3 (stonefly)
0900 start sampling
11-I-1 (hellgramite) completed 0938
11-I-2 (caddisfly) completed 1030
11-T-3 (stonefly) completed 1130
MF, AS to take all tissue samples
TW to return to bldg 59 to collect community samples
1200 offsite

Appendix A.3

Ground Truth Photo Log

Ground truth Photos

AECOM Imagine it. Delivered.		PHOTOGRAPHIC LOG
Client Name: GE	Site Location: Reach 5C Housatonic River	Project No. 60689453
Photo No. 1	Date: 11/19/24	
Description: Ground truth snapshot that consists of fa sandy silt substrate with an abundance of woody debris adjacent to beaver lodge in 5C RBP 4.		

AECOM Imagine it. Delivered.		PHOTOGRAPHIC LOG
Client Name: GE	Site Location: Reach 5C Housatonic River	Project No. 60689453
Photo No. 2	Date: 11/19/24	
Description: Ground truth snapshot that consists of sandy silt substrate with sparsely scattered gravel in 5C RBP 1.		

AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5B Housatonic River	60689453

Photo No.	Date:
3	11/19/24

Description:
Ground truth snapshot that consists of a sandy silt substrate with randomly scattered holes due to potential carp rooting.





AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5C Housatonic River	60689453

Photo No.	Date:
4	11/19/24

Description:
Ground truth snapshot that consists of a sandy silt substrate with large, scattered boulders.





AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name: GE	Site Location: Reach 5C Housatonic River	Project No. 60689453

Photo No.	Date:
5	11/19/24

Description:
Ground truth snapshot that consists of a sandy silt substrate covered in an abundance of organic leaf litter and woody debris.



AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name: GE	Site Location: Reach 5C Housatonic River	Project No. 60689453

Photo No.	Date:
6	11/19/24

Description:
Ground truth snapshot that consists of a sandy silt substrate with an abundance of submersed aquatic vegetation.





AECOM Imagine it. Delivered.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
GE	Reach 5C Housatonic River	60689453

Photo No.	Date:
7	11/19/24

Description:
Ground truth snapshot that consists of a sandy silt substrate with a sparse cobble sizzed rocks and woody debris.

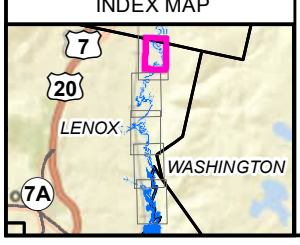


Appendix B

Riverbank Habitat Inventory Forms



INDEX MAP



Legend

- Housatonic River
- River Stations
- Bank Area
- Reach Boundaries

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations

Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

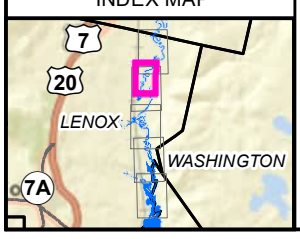
AECOM

Figure 4-1a

Map Sheet 1 of 6



INDEX MAP



Legend

- Housatonic River
- River Stations
- Bank Area

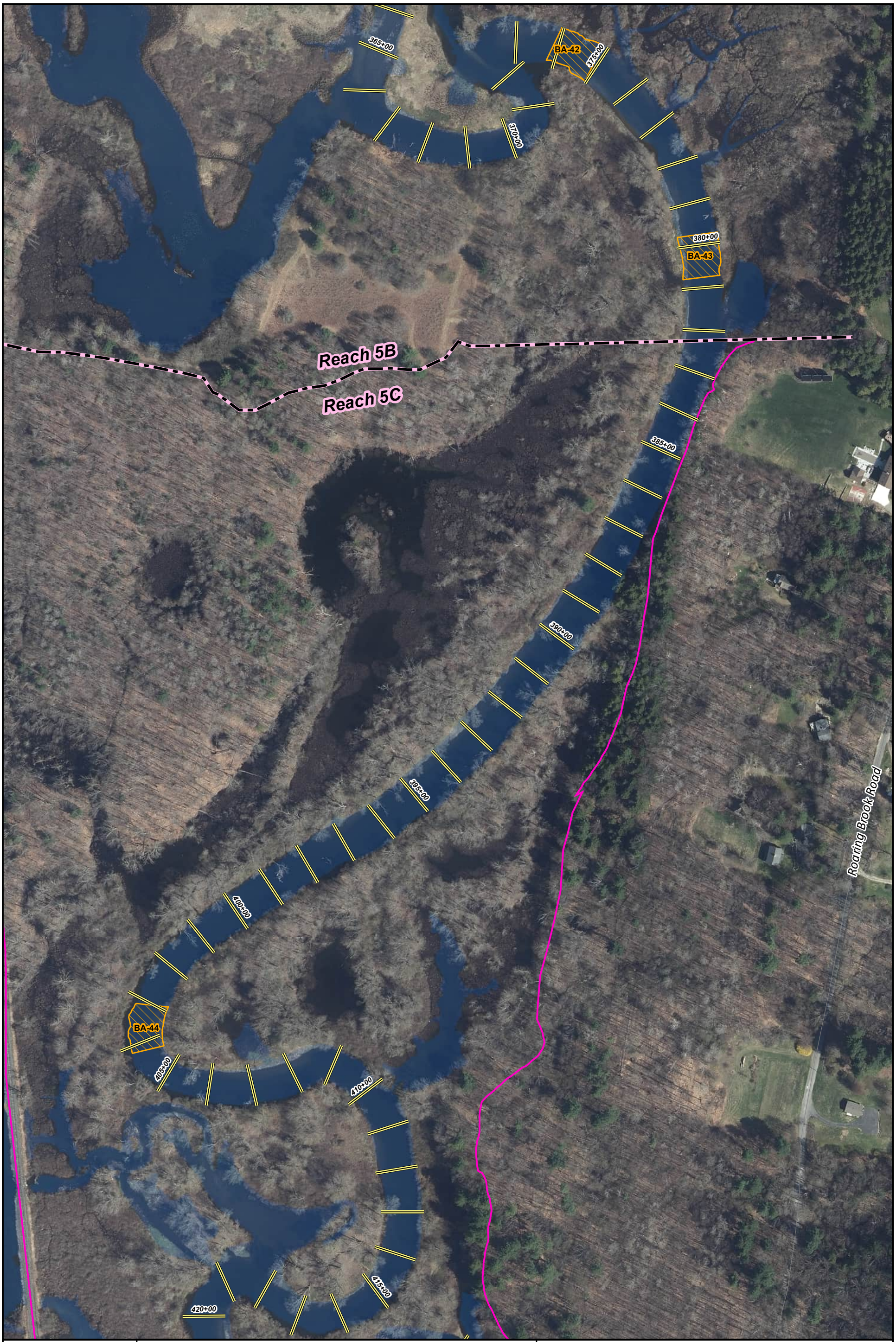
0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox, MA

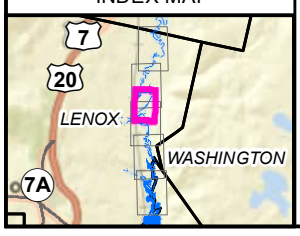
SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1b
Map Sheet 2 of 6



INDEX MAP



Legend

- Housatonic River
- PCB Isopleth
- River Stations
- Bank Area
- Reach Boundaries

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1c
Map Sheet 3 of 6

Roaring Brook Road

425+00
430+00
435+00
440+00
BA-45
445+00
450+00
BA-46
455+00
460+00
465+00
470+00
475+00
BA-47
480+00

INDEX MAP



Legend

- Housatonic River
- PCB Isopleth
- River Stations
- Bank Area

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox, MA

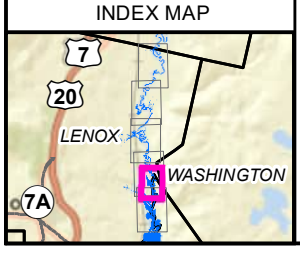
SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1d
Map Sheet 4 of 6



INDEX MAP



Legend

- Housatonic River
- PCB Isopleth
- River Stations
- Bank Area

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox and Lee, MA

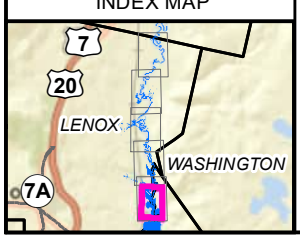
SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1e
Map Sheet 5 of 6

525+00
530+00
535+00
540+00
545+00
550+00
555+00
BA-51
BA-52
Woodland Road
Willow Creek Road
Reach 5C
Reach 6

INDEX MAP



Legend

- Housatonic River
- PCB Isopleth
- River Stations
- Bank Area
- Reach Boundaries

0 100 200 400 Feet

Reach 5B and 5C
Riverbank Habitat Investigations
Housatonic River - Lenox and Lee, MA

SCALE	DATE	PROJECT NO.
1:2,500	2/10/2025	60688342

AECOM

Figure 4-1f
Map Sheet 6 of 6

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 35
Site Name and Evaluation Segment

Bank 35: Just downstream of R5A/5B border
Location/Physical Description

7/26/24
Date(s) of Site Visit(s) and Data Collection

Sunny, low 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 100' Bank Height R: 7' L: 6' Slope: R: 90 L: 60

Sediment / Substrate composition:

% Sand 30 % Silt 65 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 5

Bank stability / Observed erosional conditions: Right bank has some vertical bank slumping, strong root cover; Left bank very stable, no active erosion; Minor Thalweg along both Right and Left banks, some mid-channel bar

B. Bordering Habitat Types

Wetland

- ☒ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☐ Shallow emergent marsh
- ☒ Shrub swamp
- ☒ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☒ Agricultural fields
- ☒ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☒ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☒ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: __4_ft Top of bank slope: _6__ft Floodplain surface: _8__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank ☒ Changes in character of soil

☒ Bed and banks ☒ Water staining

☒ Shelving ☐ Vegetation matted down, bent or absent

☒ Wrack lines (litter and debris) ☒ Change in plant community

☒ Scour and/or Deposition ☐ Destruction of terrestrial vegetation

☒ Line of mud or silt on tree trunks/vegetation ☒ Debris stuck on overhanging tree limbs

☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line ☐ Recent changes to river bends/meanders

☒ Depositional bench (active channel) ☒ Undercuts

☐ Depositional point bar ☒ Staining of rocks

☐ Depositional island ☐ Top of point bars

☐ Middle bench for braided rivers ☒ Lower limits in perennial vegetation

☒ Break in slope of banks (floodplain break)

☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 80 Bank Vegetation; 80 Overhanging Vegetation; 100 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

60	50	30	0	80
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 95 (Bank Vegetation) 70 (Overhanging Vegetation) 100 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
70	10	5	0	80

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
40	60	10	0	80

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

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Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Osprey	Wood duck
Great blue heron	Painted turtle
Green heron	Red-tail hawk
Muskrat/beaver slides	Spotted sandpiper

Cardinals Song sparrows Fish – large carp, minnows

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Bittersweet, Buckthorn, Eurasian water-milfoil, Japanese knotweed, Morrow's honeysuckle, Purple loosestrife, Reed canary grass, Water forget-me-not, Yellow iris_

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: __Large woody debris; root wad material

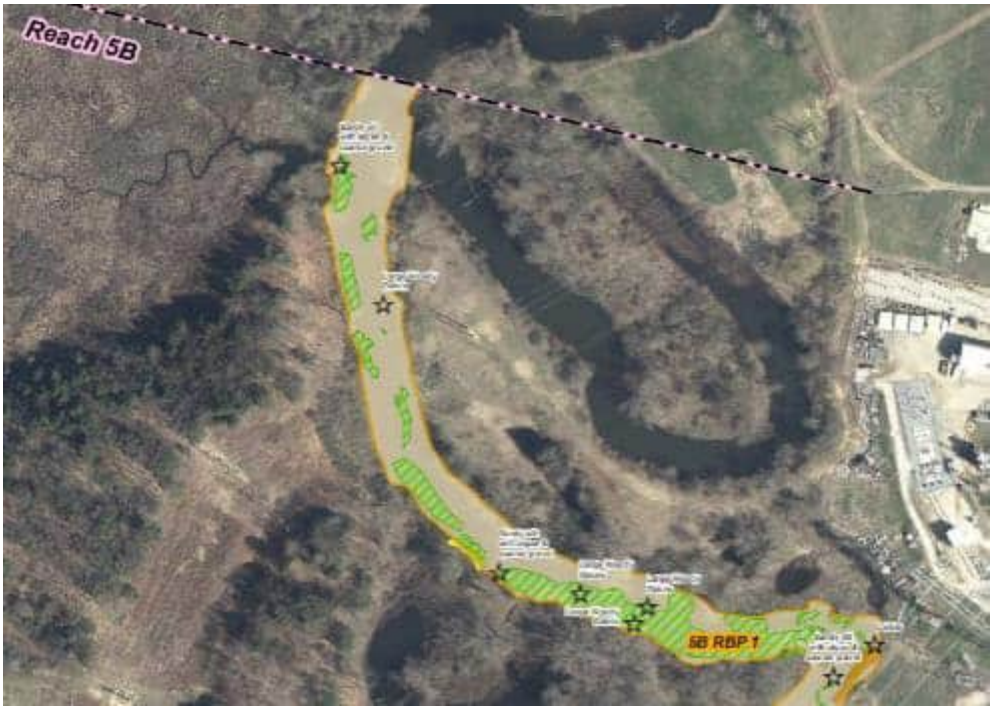
☒ Other restoration opportunities: brush mattress

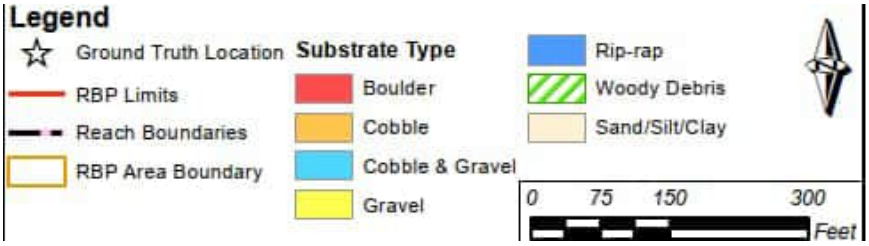
Bank 35 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	Allegheny monkeyflower/*Mimulus ringens*/herb
Asian bittersweet/*Celastrus orbiculatus*/vine*	American bur-reed/*Sparganium americanum*/herb
Canada clearweed/*Pilea pumila*/herb	American speedwell/*Veronica americana*/herb
common buckthorn/*Rhamnus cathartica*/shrub*	bitter dock/*Rumex obtusifolius*/herb
green-headed coneflower/*Rudbeckia laciniata*/herb	black mustard/*Brassica nigra*/herb
jewelweed/*Impatiens capensis*/herb	blue vervain/*Verbena hastata*/herb
Morrow's honeysuckle/*Lonicera morrowii*/herb*	boxelder/*Acer negundo*/tree
ostrich fern/*Matteuccia struthiopteris*/herb	Canada wood nettle/*Laportea canadensis*/herb
red-osier dogwood/*Cornus sericea*/shrub	common arrowhead/*Sagittaria latifolia*/herb
red raspberry/*Rubus idaeus*/herb	common buckthorn/*Rhamnus cathartica*/shrub*
silver maple/*Acer saccharinum*/tree	common water-purslane/*Ludwigia palustris*/herb
spotted Joe-Pye weed/*Eupatorium maculatum*/herb	ditch-stonecrop/*Penthorum sedoides*/herb
	Eurasian water-milfoil/*Myriophyllum spicatum*/herb*
	false water-pepper smartweed/*Persicaria hydropiperoides*/herb
	giant chickweed/*Myosoton aquaticum*/herb
	green-headed coneflower/ *Rudbeckia laciniata*/herb
	Japanese knotweed/*Fallopia japonica*/herb*
	jewelweed/*Impatiens capensis*/herb
	lady's-thumb smartweed/*Persicaria maculosa*/herb
	ostrich fern/*Matteuccia struthiopteris*/herb
	pale smartweed/*Persicaria lapathifolia*/herb
	purple loosestrife/*Lythrum salicaria*/herb*
	red-osier dogwood/*Cornus sericea*/shrub
	reed canary grass/*Phalaris arundinacea*/herb*
	rough cocklebur/*Xanthium strumarian*/herb
	silver maple/*Acer saccharinum*/tree
	spotted Joe-Pye weed/*Eupatorium maculatum*/herb
	stinging nettle/*Urtica dioica*/herb
	sweet flag/*Acorus americanus*/herb
	tapegrass/*Vallisneria americana*/herb
	water forget-me-not/*Myosotis scorpiodes*/herb*
	wild cucumber/*Echinocystis lobata*/vine
	yellow iris/*Iris pseudacorus*/herb*

*Invasive

Bank 35 Aerial Views









Left bank looking downstream



Right bank looking downstream



Left bank looking downstream



Left bank silver maple



Right bank looking downstream



View of right bank from left bank

Photographs of Bank 35, July 26, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 36
Site Name and Evaluation Segment

Bank 36: upstream of New Lenox Road
Location/Physical Description

7/26/24
Date(s) of Site Visit(s) and Data Collection

Sunny, low 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 90' Bank Height R: 5' L:9' Slope: R: 30% L 80%

Sediment / Substrate composition:

% Sand 40 % Silt 55 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 5

Bank stability / Observed erosional conditions: Right bank is very stable, point bar development, vegetated with annual plants to mean low water; Left bank is unstable, sandy areas that are unvegetated, likely high BEHI; Thalweg along Left bank with high NBS (near bank stress) along sandy banks.

B. Bordering Habitat Types

Wetland

- ☒ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☐ Shallow emergent marsh
- ☒ Shrub swamp
- ☒ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☒ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☒ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☐ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☒ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: __4_ft Top of bank slope: __6_ft Floodplain surface: _8__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank
☒ Bed and banks
☒ Shelving
☒ Wrack lines (litter and debris)
☒ Scour and/or Deposition
☒ Line of mud or silt on tree trunks/vegetation
☒ Changes in character of soil
☒ Water staining
☐ Vegetation matted down, bent or absent
☒ Change in plant community
☒ Destruction of terrestrial vegetation
☒ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☒ Depositional bench (active channel)
☒ Depositional point bar
☐ Depositional island
☐ Middle bench for braided rivers
☒ Break in slope of banks (floodplain break)
☐ Recent changes to river bends/meanders
☒ Undercuts
☐ Staining of rocks
☒ Top of point bars
☒ Lower limits in perennial vegetation
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 90 Bank Vegetation; 0 Overhanging Vegetation; 100 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	10	0	0	90
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 70 (Bank Vegetation) 70 (Overhanging Vegetation) 100 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

40	70	20	0	20
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Percent Cover of Riparian Vegetation by Strata

20	60	10	0	80
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Frank's Lovegrass, Matted Spike-grass, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Robin	
Mourning dove	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Asian bittersweet, Common buckthorn, Morrow's honeysuckle, Purple loosestrife, Reed canary grass, Water forget-me-not

☒ Evidence of other human disturbance; describe: _EPRI facility

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: Large woody debris

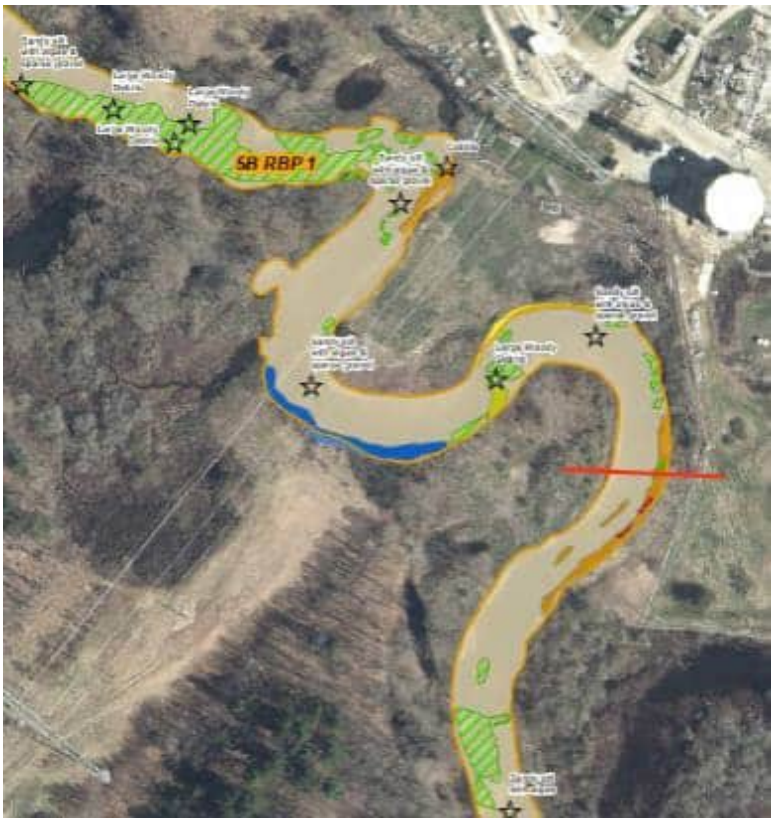
☒ Other restoration opportunities: Reshape point bar on right; log vane and root wad material on left

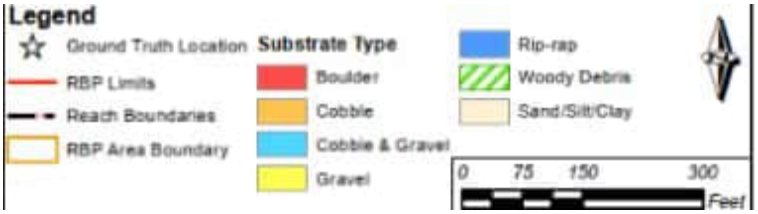
Bank 36 Plant Species	
Right Bank	**Left Bank**
Asian bittersweet/*Celastrus orbiculatus*/vine*	Allegheny monkeyflower/*Mimulus ringens*/herb
blue vervain/*Verbena hastata*/herb	black mustard/*Brassica nigra*/herb
boxelder/*Acer negundo*/tree	blue vervain/*Verbena hastata*/herb
common buckthorn/*Rhamnus cathartica*/shrub*	common soft rush/*Juncus effusus*/herb
curly dock/*Rumex crispus*/herb	common water-purslane/*Ludwigia palustris*/herb
green-headed coneflower/ *Rudbeckia laciniata*/herb	compact dodder/*Cuscuta compacta*/herb
Morrow's honeysuckle/*Lonicera morrowii*/herb*	curly dock/*Rumex crispus*/herb
ostrich fern/*Matteuccia struthiopteris*/herb	false water-pepper smartweed/*Persicaria hydropiperoides*/herb
reed canary grass/*Phalaris arundinacea*/herb*	hop sedge/*Carex lupulina*/herb
river grape/*Vitis riparia*/vine	lady's-thumb smartweed/*Persicaria maculosa*/herb
sensitive fern/*Onoclea sensibilis/herb*	pale smartweed/*Persicaria lapathifolia*/herb
silver maple/*Acer saccharinum*/tree	purple loosestrife/*Lythrum salicaria*/herb*
staghorn sumac/*Rhus hirta*/shrub	red-osier dogwood/*Cornus sericea*/shrub
white meadowsweet/*Spiraea alba*/shrub	reed canary grass/*Phalaris arundinacea*/herb*
	rough cocklebur/*Xanthium strumarian*/herb
	water forget-me-not/*Myosotis scorpiodes*/herb*
	woolgrass/*Scirpus cyperinus/herb*

*Invasive

Bank 36 Aerial Views









Right bank looking downstream



Left bank looking from right bank



Right bank looking upstream across to left



Left bank from right bank



Left bank undercut and burrows



Left bank looking upstream

Bank 36 photographs , July 26, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 37
Site Name and Evaluation Segment

Bank 37: upstream of New Lenox Rd
Location/Physical Description

7/26/24
Date(s) of Site Visit(s) and Data Collection

Sunny, 75
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 100' Bank Height R: 5' L: 6' Slope: R: 30% L: 50%

Sediment / Substrate composition:

% Sand 35 % Silt 60 % Clay 0 % Gravel/cobble 0

% Boulder/Bedrock 0 % Organic matter 5

Bank stability / Observed erosional conditions: Right bank is very stable, well vegetated, no erosion; Left bank is very stable, well vegetated, no erosion; Thalweg on Left bank

B. Bordering Habitat Types

Wetland

- ☒ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☐ Deep emergent marsh
- ☐ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☒ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☒ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: __3_ft Top of bank slope: __5_ft Floodplain surface: _5__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank
☒ Bed and banks
☒ Shelving
☒ Wrack lines (litter and debris)
☒ Scour and/or Deposition
☒ Line of mud or silt on tree trunks/vegetation
☒ Changes in character of soil
☒ Water staining
☐ Vegetation matted down, bent or absent
☒ Change in plant community
☐ Destruction of terrestrial vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☒ Depositional bench (active channel)
☒ Depositional point bar
☐ Depositional island
☐ Middle bench for braided rivers
☒ Break in slope of banks (floodplain break)
☐ Recent changes to river bends/meanders
☒ Undercuts
☐ Staining of rocks
☒ Top of point bars
☐ Lower limits in perennial vegetation
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 100 Bank Vegetation; 20 Overhanging Vegetation; 100 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	10	10	0	100
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 95 (Bank Vegetation) 95 (Overhanging Vegetation) 100 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50	70	10	0	40
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Percent Cover of Riparian Vegetation by Strata

30	65	0	0	70
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Frank's Lovegrass, Matted Spike-grass, Mustard White, Narrow-leaved Spring-beauty Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Raccoon tracks	
Slides (Beaver, Muskrat)	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Common buckthorn, Morrow's honeysuckle, Purple loosestrife, Reed canary grass, Water forget-me-not, Yellow iris

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: _large trees

☒ Other restoration opportunities: log vanes on left; reshape point bar on right

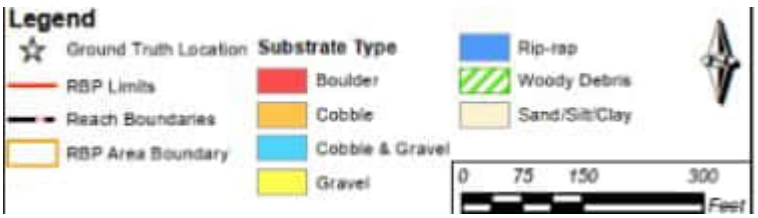
Bank 37 Plant Species	
Right Bank	**Left Bank**
Allegheny monkeyflower/*Mimulus ringens*/herb	American bur-reed/*Sparganium americanum*/herb
American bur-reed/*Sparganium americanum*/herb	American elm/*Ulmus americana*/tree
blue vervain/*Verbena hastata*/herb	American speedwell/*Veronica americana*/herb
common water-purslane/*Ludwigia palustris*/herb	boxelder/*Acer negundo*/tree
dark-green bulrush/*Scirpus atrovirens*/herb	common buckthorn/*Rhamnus cathartica*/shrub*
ditch stone-crop/*Penthorum sedoides*/herb	common water-purslane/*Ludwigia palustris*/herb
eastern willow-herb/*Epilobium coloratum*/herb	curly dock/*Rumex crispus*/herb
false water-pepper smartweed/*Persicaria hydropiperoides*/herb	ditch stone-crop/*Penthorum sedoides*/herb
green-headed coneflower/ *Rudbeckia laciniata*/herb	Morrow's honeysuckle/*Lonicera m*orrowii/shrub*
pale smartweed/*Persicaria lapathifolia*/herb	ostrich fern/*Matteuccia struthiopteris*/herb
purple loosestrife/*Lythrum salicaria*/herb*	purple loosestrife/*Lythrum salicaria*/herb*
red-osier dogwood/*Cornus sericea*/shrub	red-osier dogwood/*Cornus sericea*/shrub
reed canary grass/*Phalaris arundinacea*/herb*	reed canary grass/*Phalaris arundinacea*/herb*
river grape/*Vitis riparia*/vine	sensitive fern/*Onoclea sensibilis*/herb
silky dogwood/*Cornus amomum*/shrub	silky dogwood/*Cornus amomum*/shrub
water forget-me-not/*Myosotis scorpiodes*/herb*	silver maple/*Acer saccharinum*/tree
water-pepper smartweed/*Persicaria hydropiper*/herb	spotted Joe-Pye weed/*Eupatorium maculatum*/herb
wild cucumber/*Echinocystis lobata*/vine	yellow iris/*Iris pseudacorus*/herb*

*Invasive

Bank 37 Aerial Views









Right bank looking downstream



Left bank; swale thru bank into marsh



Right bank looking upstream



Left bank looking upstream from right bank



Right bank looking upstream from left bank



View upstream; right bank on left side

Photographs of Bank 37; July 26, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 38
Site Name and Evaluation Segment

Bank 38: upstream of New Lenox Road
Location/Physical Description

7/26/24
Date(s) of Site Visit(s) and Data Collection

Sunny 75
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 110'' Bank Height R: 3' L: 6' Slope: R: 80% L: 80%

Sediment / Substrate composition:

% Sand 30 % Silt 60 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank is very stable, fully vegetated, no erosion despite being steep; Left bank appears stable despite lack of vegetation cover under shrub growth; Thalweg unclear due to deep channel

B. Bordering Habitat Types

Wetland

- ☒ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☒ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☐ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☒ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: __3_ft Top of bank slope: _4__ft Floodplain surface: __5_ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank
☒ Bed and banks
☒ Shelving
☒ Wrack lines (litter and debris)
☒ Scour and/or Deposition
☐ Line of mud or silt on tree trunks/vegetation
☒ Changes in character of soil
☒ Water staining
☐ Vegetation matted down, bent or absent
☒ Change in plant community
☐ Destruction of terrestrial vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☒ Depositional bench (active channel)
☒ Depositional point bar
☐ Depositional island
☐ Middle bench for braided rivers
☒ Break in slope of banks (floodplain break)
☐ Recent changes to river bends/meanders
☒ Undercuts
☐ Staining of rocks
☒ Top of point bars
☐ Lower limits in perennial vegetation
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 100 Bank Vegetation; 80 Overhanging Vegetation; 90 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

5	10	0	0	90
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 60 (Bank Vegetation) 60 (Overhanging Vegetation) 90 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

5	60	10	0	40
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Percent Cover of Riparian Vegetation by Strata

30	50	10	0	80
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	see attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☒ Core Area 2 ☒ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Foxtail Sedge, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Narrow-leaved Spring-beauty, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Great blue heron	
Spotted sandpiper	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Purple loosestrife, Reed canary grass, Water forget-me-not_

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: _large trees

☒ Other restoration opportunities: coir matting on right; brush mattress on left

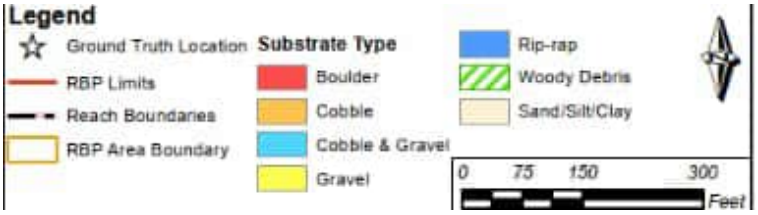
Bank 38 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American bur-reed/*Sparganium americanum*/herb
arrow-leaved tearthumb/*Persicaria sagittata*/herb	American speedwell/*Veronica americana*/herb
Canada clearweed/*Pilea pumila*/herb	boxelder/*Acer negundo*/tree
common water-purslane/*Ludwigia palustris*/herb	common water-purslane/*Ludwigia palustris*/herb
curly dock/*Rumex crispus*/herb	green-headed coneflower/ *Rudbeckia laciniata*/herb
ditch stone-crop/*Penthorum sedoides*/herb	lady's-thumb smartweed/*Persicaria maculosa*/herb
giant chickweed/*Myosoton aquaticum*/herb	ostrich fern/*Matteuccia struthiopteris*/herb
green-headed coneflower/ *Rudbeckia laciniata*/herb	purple loosestrife/*Lythrum salicaria*/herb*
lady's-thumb smartweed/*Persicaria maculosa*/herb	red-osier dogwood/*Cornus sericea*/shrub
purple loosestrife/*Lythrum salicaria*/herb*	red raspberry/*Rubus idaeus*/herb
reed canary grass/*Phalaris arundinacea*/herb*	silky dogwood/*Cornus amomum*/shrub
silky dogwood/*Cornus amomum*/shrub	water forget-me-not/*Myosotis scorpiodes*/herb*
silver maple/*Acer saccharinum*/tree	
water forget-me-not/*Myosotis scorpiodes*/herb*	

*Invasive

Bank 38 Aerial Views









Right bank looking downstream



Left bank looking downstream



Left bank from right bank



Right bank



Right bank looking upstream



Right bank looking upstream

Photographs of Bank 38, July 26, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 39
Site Name and Evaluation Segment

Babk 39: downstream of New Lenox Raod
Location/Physical Description

9/20/24
Date(s) of Site Visit(s) and Data Collection

cloudy, 70
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 100' Width 100' Bank Height R: 7' L: 5' Slope: R: 75% L: 50%

Sediment / Substrate composition:

% Sand 40 % Silt 50 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank has good-exellent stability; Left bank has good-excellent stability; Thalweg on Right

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☐ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☒ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☒ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☐ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☒ Moderately incised ☐ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _4__ft Top of bank slope: _6__ft Floodplain surface: _7__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank
☒ Bed and banks
☒ Shelving
☒ Wrack lines (litter and debris)
☒ Scour and/or Deposition
☒ Line of mud or silt on tree trunks/vegetation
☐ Other_____
☒ Changes in character of soil
☒ Water staining
☐ Vegetation matted down, bent or absent
☒ Change in plant community
☐ Destruction of terrestrial vegetation
☐ Debris stuck on overhanging tree limbs

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☒ Depositional bench (active channel)
☐ Depositional point bar
☐ Depositional island
☐ Middle bench for braided rivers
☒ Break in slope of banks (floodplain break)
☐ Other_____
☐ Recent changes to river bends/meanders
☐ Undercuts
☐ Staining of rocks
☐ Top of point bars
☒ Lower limits in perennial vegetation

D. Inventory (Plant Community)

Right Bank

Total % Cover: 95 Bank Vegetation; 50 Overhanging Vegetation; 90 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	50	10	0	60
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 100 (Bank Vegetation) 0 (Overhanging Vegetation) 100 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	5	0	0	100

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
5	50	10	0	80

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☒ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

American Bittern, Foxtail Sedge, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Green frogs	
Green heron	
Sharp-shinned hawk	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Eurasian water-milfoil, Multiflora rose, Purple loosestrife, Reed canary grass, Water forget-me-not_

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: _large woody debris

☒ Other restoration opportunities: compartmentalized fill on the right; coir matting and reshape point bar on left

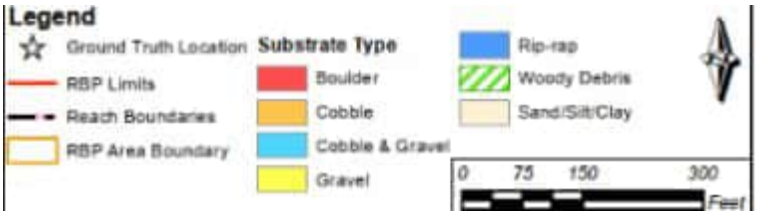
Bank 39 Plant Species	
Right Bank	**Left Bank**
black willow/*Salix nigra*/tree	American bur-reed/*Sparganium americanum*/herb
boxelder/*Acer negundo*/tree	arrow-leaved tearthumb/*Persicaria sagittata*/herb
common evening primrose/*Oenothera biennis*/herb	black willow/*Salix nigra*/tree
Canada goldenrod/*Solidago canadensis*/herb	blue vervain/*Verbena hastata*/herb
common water-purslane/*Ludwigia palustris*/herb	common barnyard grass/*Echinochloa crus-galli*/herb
dotted smartweed/*Persicaria punctata*/herb	common water-purslane/*Ludwigia palustris*/herb
eastern willow-herb/*Epilobium coloratum*/herb	curly dock/*Rumex crispus*/herb
lance-leaved American aster/*Symphyotrichum lanceolata/*herb	ditch stone-crop/*Penthorum sedoides*/herb
multiflora rose/*Rosa multiflora*/shrub*	eastern willow-herb/*Epilobium coloratum*/herb
nodding beggar-ticks/*Bidens cernua*/herb	Eurasian water-milfoil/*Myriophyllum spicatum*/herb*
purple loosestrife/*Lythrum salicaria*/herb*	lady's-thumb smartweed/*Persicaria maculosa*/herb
reed canary grass/*Phalaris arundinacea*/herb*	nodding beggar-ticks/*Bidens cernua*/herb
river grape/*Vitis riparia*/vine	pale smartweed/*Persica lapathifolia*/herb
silky dogwood/*Cornus amomum*/shrub	pickerelweed/*Pontederia cordata*/herb
wild cucumber/*Echinocystis* lobata/vine	purple loosestrife/*Lythrum salicaria*/herb*
	rough cocklebur/*Xanthium strumarium*/herb
	silky dogwood/*Cornus amomum*/shrub
	spike rush/*Eleocharis sp*/herb
	sweet flag/*Acorus americanus*/herb
	umbrella sedge/*Cyperus strigosus*/herb
	water forget-me-not/*Myosotis scorpiodes*/herb*

*Invasive

Bank 39 Aerial Views











On Left: Left bank looking upstream across at right bank.

Above: View of right bank from left bank.



View of right bank from left bank

Photographs of Bank 39; September 29, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 40
Site Name and Evaluation Segment

Bank 40: downstream of New Lenox Road
Location/Physical Description

9/20/24
Date(s) of Site Visit(s) and Data Collection

Cloudy, 70
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 100' Bank Height R: 6' L: 5' Slope: R: 80 L: 30

Sediment / Substrate composition:

% Sand 40 % Silt 50 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank has some undercutting and slumping; Left bank has excellent stablility, no erosion; Thalweg on Right

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☐ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☒ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☒ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: __3_ft Top of bank slope: _6__ft Floodplain surface: _7__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank
☒ Bed and banks
☒ Shelving
☒ Wrack lines (litter and debris)
☒ Scour and/or Deposition
☒ Line of mud or silt on tree trunks/vegetation
☐ Other_____
☒ Changes in character of soil
☒ Water staining
☐ Vegetation matted down, bent or absent
☒ Change in plant community
☐ Destruction of terrestrial vegetation
☐ Debris stuck on overhanging tree limbs

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☒ Depositional bench (active channel)
☐ Depositional point bar
☐ Depositional island
☐ Middle bench for braided rivers
☒ Break in slope of banks (floodplain break)
☐ Other_____
☐ Recent changes to river bends/meanders
☒ Undercuts
☐ Staining of rocks
☐ Top of point bars
☒ Lower limits in perennial vegetation

D. Inventory (Plant Community)

Right Bank

Total % Cover: 95 Bank Vegetation; 80 Overhanging Vegetation; 95 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

25	25	10	0	70
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 100 (Bank Vegetation) 60 (Overhanging Vegetation) 95 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	60	0	0	100

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
20	70	10	0	70

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☒ Core Area 2 ☒ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

American Bittern, Foxtail Sedge, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Blue Jay	Pickerel or Leopard frogs
Cabbage white butterfly	
Catbird	
Green frogs	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: Asian bittersweet, Climbing nightshade, Purple loosestrife, Reed canary grass, Water forget-me-not

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

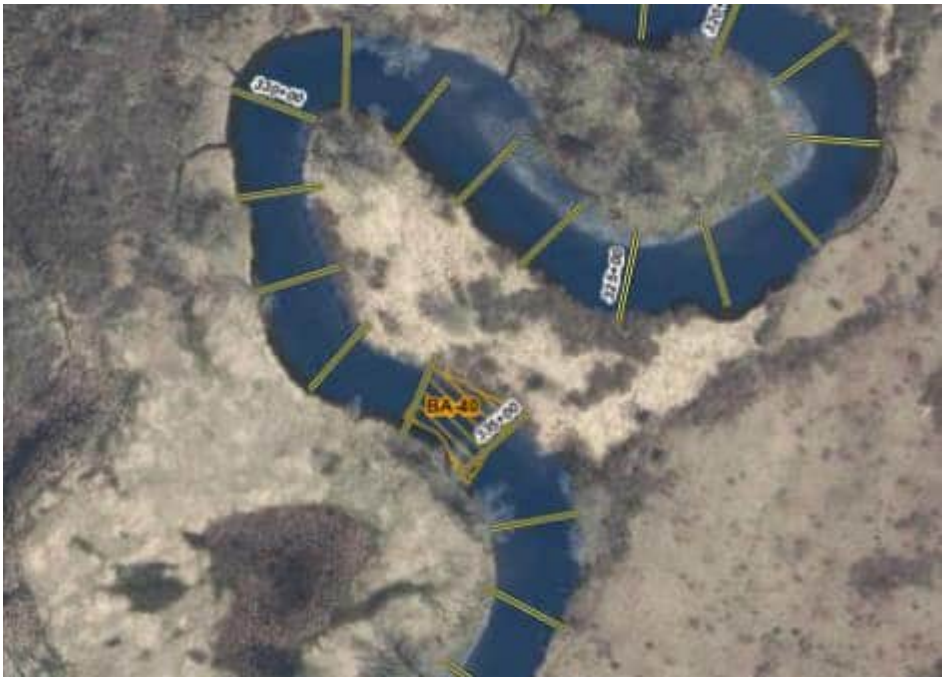
☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large woody debris; boulder; large trees

☒ Other restoration opportunities: reshape point bar on right; coir matting on left

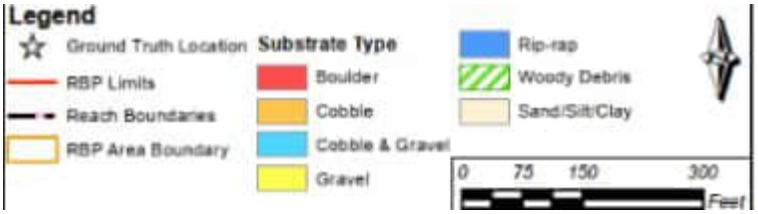
Bank 40 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American bur-reed/*Sparganium americanum*/herb
Asian bittersweet/*Celastrus orbiculatus*/vine*	black mustard/*Brassica nigra*/herb
black mustard/*Brassica nigra*/herb	blue vervain/*Verbena hastata*/herb
Canada clearweed/*Pilea pumilla*/herb	common barnyard grass/*Echinochloa crus-galli*/herb
Canada goldenrod/*Solidago canadensis*/herb	common soft rush/*Juncus effusus*/herb
climbing nightshade/*Solanum dulcamara*/herb*	common water-purslane/*Ludwigia palustris*/herb
common water-purslane/*Ludwigia palustris*/herb	creeping yellow cress/*Rorippa sylvestris*/herb
creeping yellow cress/*Rorippa sylvestris*/herb	curly dock/*Rumex crispus*/herb
hedge bindweed/*Convolvulus sepium*/vine	ditch stone-crop/*Penthorum sedoides*/herb
lance-leaved American aster/*Symphyotrichum lanceolata*/herb	dotted smartweed/*Persicaria punctata*/herb
nodding beggar-ticks/*Bidens cernua*/herb	eastern willow-herb/*Epilobium coloratum*/herb
purple loosestrife/*Lythrum salicaria*/herb*	green-headed coneflower/*Rudbeckia laciniata*/herb
reed canary grass/*Phalaris arundinacea*/herb*	lady's-thumb smartweed/*Persicaria maculosa*/herb
silver maple/*Acer saccharinum*/tree	nodding beggar-ticks/*Bidens cernua*/herb
silky dogwood/*Cornus amomum*/shrub	pale smartweed/*Persica lapathifolia*/herb
	pickerelweed/*Pontederia cordata*/herb
	purple loosestrife/*Lythrum salicaria*/herb*
	rice cut-grass/*Leersia oryzoides*/herb
	silky dogwood/*Cornus amomum*/shrub
	spike rush/*Eleocharis sp*/herb
	sweet flag/*Acorus americanus*/herb
	water forget-me-not/*Myosotis scorpiodes*/herb*

*Invasive

Bank 40 Aerial Views









Right Bank view from left bank



Left Bank looking downstream



Large woody debris on right bank, looking across at left bank



Left bank looking upstream



Close-up view of right bank



View of right bank from left bank

Photographs of Bank 40, September 20, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 41
Site Name and Evaluation Segment

BA 41
Location/Physical Description

9/20/2024
Date(s) of Site Visit(s) and Data Collection

Cloudy, 70
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 100' Width 110' Bank Height R: 5' L: 4' Slope: R: 80% L: 45%

Sediment / Substrate composition:

% Sand 45 % Silt 50 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 5

Bank stability / Observed erosional conditions: Right bank is undercut and slumping; Left bank is more stable with undercuts; Thalweg on Right

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other None

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☐ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☒ Moderately incised ☐ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _3__ft Top of bank slope: _4__ft Floodplain surface: _5__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank
☒ Bed and banks
☒ Shelving
☒ Wrack lines (litter and debris)
☒ Scour and/or Deposition
☐ Line of mud or silt on tree trunks/vegetation
☒ Changes in character of soil
☐ Water staining
☐ Vegetation matted down, bent or absent
☒ Change in plant community
☐ Destruction of terrestrial vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☐ Depositional bench (active channel)
☐ Depositional point bar
☐ Depositional island
☐ Middle bench for braided rivers
☒ Break in slope of banks (floodplain break)
☐ Recent changes to river bends/meanders
☒ Undercuts
☐ Staining of rocks
☐ Top of point bars
☒ Lower limits in perennial vegetation
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 70 Bank Vegetation; 50 Overhanging Vegetation; 80 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

10	50	10	0	70
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 95 (Bank Vegetation) 50 (Overhanging Vegetation) 95 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	10	0	0	95

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	25	10	0	80

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

American Bittern, Foxtail Sedge, Frank's Lovegrass, Matted Spike-Sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Goldfinch	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Purple loosestrife_

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

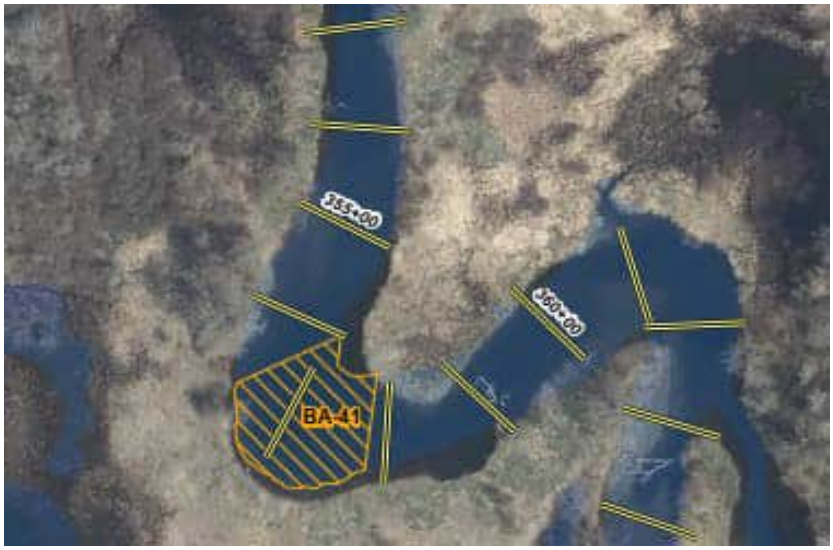
☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large woody debris; boulders

☒ Other restoration opportunities: reshape point bar on left; block revetment on right

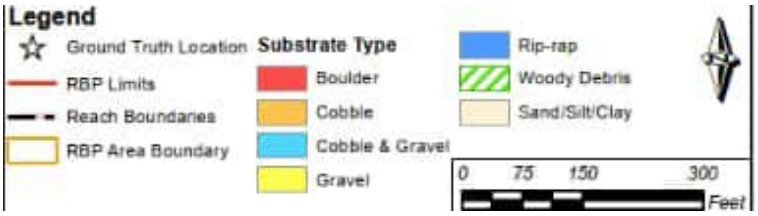
Bank 41 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	Canada goldenrod/*Solidago canadensis*/herb
black mustard/*Brassica nigra*/herb	common evening primrose/*Oenethera biennis*/herb
Canada goldenrod/*Solidago canadensis*/herb	common water-purslane/*Ludwigia palustris*/herb
common evening primrose/*Oenethera biennis*/herb	curly dock/*Rumex crispus*/herb
common water-purslane/*Ludwigia palustris*/herb	eastern willow-herb/*Epilobium coloratum*/herb
creeping yellow cress/*Rorippa sylvestris*/herb	giant chickweed/*Myosoton aquaticum*/herb
giant chickweed/*Myosoton aquaticum*/herb	green-headed coneflower/*Rudbeckia laciniata*/herb
green-headed coneflower/*Rudbeckia laciniata*/herb	hedge bindweed/*Convolvulus sepium*/vine
nodding beggar-ticks/*Bidens cernua*/herb	lance-leaved American aster/*Symphyotrichum lanceolatum*/herb
purple loosestrife/*Lythrum salicaria*/herb*	purple loosestrife/*Lythrum salicaria*/herb*
river grape/*Vitas riparia*/vine	silky dogwood/*Cornus amomum*/shrub
spike rush/*Eleocharis sp*/herb	silver maple/*Acer saccharinum*/tree
	swamp milkweed/*Asclepias incarnata*/herb

*Invasive

Bank 41 Aerial Views









Right bank looking downstream from left



View of left bank from right bank



Right bank in downstream portion



Upstream of right bank



Upstream portion of left bank (on left) with view across to right bank



Close-up view of right bank

Photographs of Bank 41, September 20, 2025

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 42
Site Name and Evaluation Segment

BA 42
Location/Physical Description

9/20/2024
Date(s) of Site Visit(s) and Data Collection

Sun/Clouds, 70
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200” Width 110’ Bank Height R: 4’ L: 5’ Slope: R: 25% L: 40%

Sediment / Substrate composition:

% Sand 40 % Silt 50 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank is very stable; Left bank is very stable; Center Thalweg

B. Bordering Habitat Types

Wetland

- ☒ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other None

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _3__ft Top of bank slope: _4__ft Floodplain surface: _5__ft

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☒ Changes in character of soil
☒ Bed and banks
☐ Water staining
☒ Shelving
☐ Vegetation matted down, bent or absent
☒ Wrack lines (litter and debris)
☒ Change in plant community
☐ Scour and/or Deposition
☐ Destruction of terrestrial vegetation
☒ Line of mud or silt on tree trunks/vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☐ Scour line
☒ Recent changes to river bends/meanders
☐ Depositional bench (active channel)
☒ Undercuts
☐ Depositional point bar
☐ Staining of rocks
☐ Depositional island
☐ Top of point bars
☐ Middle bench for braided rivers
☒ Lower limits in perennial vegetation
☒ Break in slope of banks (floodplain break)
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 100 Bank Vegetation; 60 Overhanging Vegetation; 95 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	60	10	0	95
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 95 (Bank Vegetation) 90 (Overhanging Vegetation) 100 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
10	90	20	0	50

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
20	80	20	0	70

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant list species		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☒ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

American Bittern, Bur Oak, Foxtail Sedge, Frank's Lovegrass, Jefferson Salamander (complex), Matted Spike-sedge, Mustard White, Rapids Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Catbird	Frogs
Kingbird	
Kingfisher	
Flicker	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: __Common buckthorn, Morrow's honeysuckle, Multiflora rose, Purple loosestrife, Reed canary grass, Water forget-me-not

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large trees

☐ Other restoration opportunities:

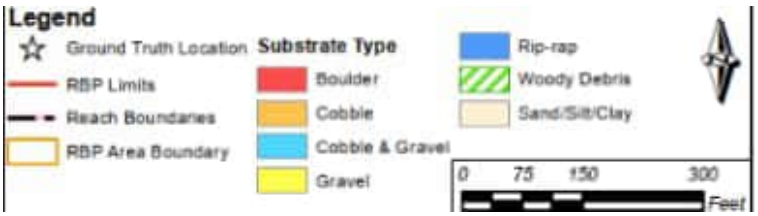
Bank 42 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American bur-reed/*Sparganium americanum*/herb
black mustard/*Brassica nigra*/herb	Asian bittersweet/*Celastrus orbiculatus*/vine*
black willow/*Salix nigra*/tree	black willow/*Salix nigra*/tree
common water-purslane/*Ludwigia palustris*/herb	common buckthorn/*Rhamnus cathartica*/shrub*
creeping yellow-cress/*Rorippa sylvestris*/herb	common water-purslane/*Ludwigia palustris*/herb
curly dock/*Rumex crispus*/herb	curly dock/*Rumex crispus*/herb
ditch-stonecrop/*Penthorum sedoides*/herb	ditch-stonecrop/*Penthorum sedoides*/herb
dotted smartweed/*Persicaria punctata*/herb	lance-leaved American aster/*Symphyotrichum lanceolatum*/herb
eastern willow-herb/*Epilobium coloratum*/herb	Morrow's honeysuckle/*Lonicera morrowii*/shrub*
lady's thumb smartweed/*Persicaria maculosa*/herb	multiflora rose/*Rosa multiflora*/herb*
nodding beggar-ticks/*Bidens cernua*/herb	pickerelweed/*Pontederia cordata*/herb
pale smartweed/*Persicaria lapathifolia*/herb	purple loosestrife/*Lythrum salicaria*/herb*
purple loosestrife/*Lythrum salicaria*/herb*	red maple/*Acer rubrum*/tree
rough cocklebur/*Xanthium strumarium*/herb	reed canary grass/*Phalaris arundinacea*/herb*
silky dogwood/*Cornus amomum*/shrub	river grape/*Vitas riparia*/vine
sweet flag/*Acorus americanus*/herb	sensitive fern/*Onoclea sensibilis*/herb
water forget-me-not/*Myosotis scorpioides*/herb*	silky dogwood/*Cornus amomum*/shrub
wild cucumber/*Echinocystis lobata*/vine	silver maple/*Acer saccharinum*/tree
woolgrass/*Scirpus cyperinus*/herb	umbrella sedge/*Cyperus strigosus*/herb
yellow-seeded false pimpernel/*Lindernia dubia*/herb	water forget-me-not/*Myosotis scorpioides*/herb*

*Invasive

Bank 42 Aerial Views









Looking downstream at Bank 42



Left bank looking from right bank; inflow from Roaring Brook



View of left bank

Photographs of Bank 42, September 20, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5B Bank 43
Site Name and Evaluation Segment

BA 43
Location/Physical Description

9/20/2024
Date(s) of Site Visit(s) and Data Collection

Sun/Clouds, 70
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 100' Bank Height R: 3' L:4' Slope: R: 25% L: 95%

Sediment / Substrate composition:

% Sand 40 % Silt 50 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank has good stability; Left bank has good stability with some undercutting; Thalweg on Left

B. Bordering Habitat Types

Wetland

- ☒ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☒ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _3__ft Top of bank slope: _4__ft Floodplain surface: _5__ft

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☒ Changes in character of soil
☒ Bed and banks
☒ Water staining
☒ Shelving
☐ Vegetation matted down, bent or absent
☐ Wrack lines (litter and debris)
☐ Change in plant community
☐ Scour and/or Deposition
☐ Destruction of terrestrial vegetation
☒ Line of mud or silt on tree trunks/vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☐ Recent changes to river bends/meanders
☒ Depositional bench (active channel)
☒ Undercuts
☐ Depositional point bar
☐ Staining of rocks
☐ Depositional island
☐ Top of point bars
☐ Middle bench for braided rivers
☒ Lower limits in perennial vegetation
☒ Break in slope of banks (floodplain break)
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 95 Bank Vegetation; 60 Overhanging Vegetation; 95 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	0	0	0	100
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 90 (Bank Vegetation) 100 (Overhanging Vegetation) 95 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
30	80	10	0	30

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
25	65	10	0	55

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☒ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bur Oak, Frank's Lovegrass, Jefferson Salamander (complex), Matted Spike-sedge, Mustard White, Rapids Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Evidence of beaver chews/sticks	
Red-bellied woodpecker	
Turtle	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: Purple loosestrife, Reed canary grass, Water forget-me-not, Yellow iris

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large trees; large woody debris

☐ Other restoration opportunities:

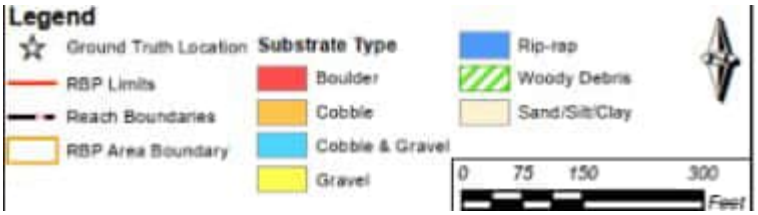
Bank 43 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American bur-reed/*Sparganium americanum*/herb
ditch-stonecrop/*Penthorum sedoides*/herb	common water-purslane/*Ludwigia palustris*/herb
eastern willow-herb/*Epilobium coloratum*/herb	green-headed coneflower/*Rudbeckia laciniata*/herb
jewelweed/*Impatiens capensis*/herb	lady's-thumb smartweed/*Persicaria maculosa*/herb
lady's-thumb smartweed/*Persicaria maculosa*/herb	lance-leaved American aster/*Symphyotrichum lanceolatum*/herb
nodding beggar-ticks/*Bidens cernua*/herb	nodding beggar-ticks/*Bidens cernua*/ herb
purple loosestrife/*Lythrum salicaria*/herb*	purple loosestrife/*Lythrum salicaria*/herb*
reed canary grass/*Phalaris arundinacea*/herb*	red-osier dogwood/*Cornus sericea*/shrub
rough cocklebur/*Xanthium strumarium*/herb	reed canary grass/*Phalaris arundinacea*/herb*
small-spiked false-nettle/*Boehmeria cylindrica*/herb	river grape/*Vitas riparia*/vine
sweet flag/*Acorus americanus*/herb	sensitive fern/*Onoclea sensibilis*/herb
water forget-me-not/*Myosotis scorpioides*/herb*	silky dogwood/*Cornus amomum*/shrub
woolgrass/*Scirpus cyperinus*/herb	silver maple/*Acer saccharinum*/tree
yellow iris/*Iris pseudacorous*/herb*	small-spiked false-nettle/*Boehmeria cylindrica*/herb
	spotted Joe-Pye weed/*Eupatorium maculatum*/herb

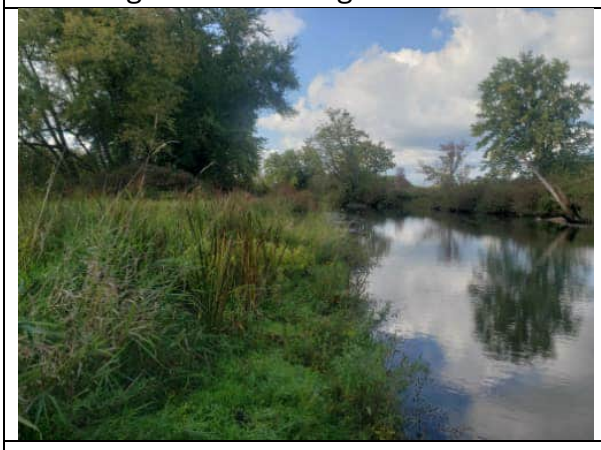
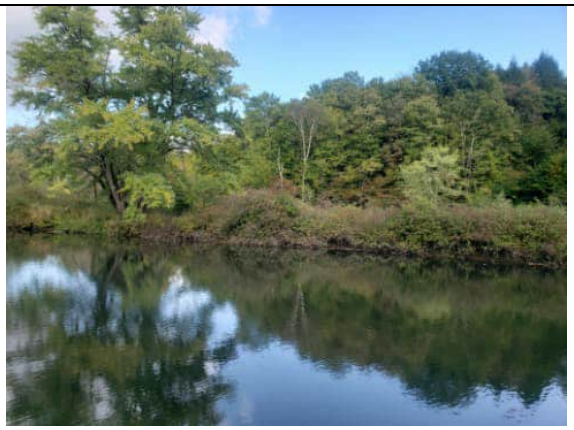
*Invasive

Bank 43 Aerial Views







	
Right Bank looking downstream	Left Bank from Right Bank
	
Right Bank looking upstream	Left Bank
	
Right Bank from upstream	Left Bank
Riverbank Station 43 Photos September 20, 2025	

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5C Bank 44
Site Name and Evaluation Segment

BA 44
Location/Physical Description

9/24/2024
Date(s) of Site Visit(s) and Data Collection

Sun/ Clouds, low 60's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 100' Bank Height: R: 7' L: 3' Slope: R: 90% L: 25%

Sediment / Substrate composition:

% Sand 40 % Silt 50 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank is deeply undercut and overhung with dense shrubs; Left bank is stable: Thalweg on Right

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other None

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☒ Moderately incised ☐ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: __3_ft Top of bank slope: _5__ft Floodplain surface: __5_ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank ☒ Changes in character of soil

☒ Bed and banks ☒ Water staining

☒ Shelving ☒ Vegetation matted down, bent or absent

☒ Wrack lines (litter and debris) ☒ Change in plant community

☒ Scour and/or Deposition ☒ Destruction of terrestrial vegetation

☒ Line of mud or silt on tree trunks/vegetation ☒ Debris stuck on overhanging tree limbs

☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line ☐ Recent changes to river bends/meanders

☒ Depositional bench (active channel) ☒ Undercuts

☒ Depositional point bar ☐ Staining of rocks

☐ Depositional island ☐ Top of point bars

☐ Middle bench for braided rivers ☒ Lower limits in perennial vegetation

☒ Break in slope of banks (floodplain break)

☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 90 Bank Vegetation 100 Overhanging Vegetation 95 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

40 Trees (> 20') 100 Shrubs (< 20') 40 Woody vines 0 Mosses 10 Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 100 (Bank Vegetation) 100 (Overhanging Vegetation) 95 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	100	10	0	75

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
55	80	20	0	70

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☐ Core Area 2 ☒ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bur Oak, Jefferson Salamander (complex), Matted Spike-sedge, Mustard White, Rapids Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Blue Jay	
Broad-winged hawk	
Crow	
Fish (jump)	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: __Asian bittersweet, Common buckthorn, Morrow's honeysuckle, Multiflora rose, Purple loosestrife, Water forget-me-not, Yellow iris

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: _large trees; cobble and gravel; large woody debris

_____

☐ Other restoration opportunities:

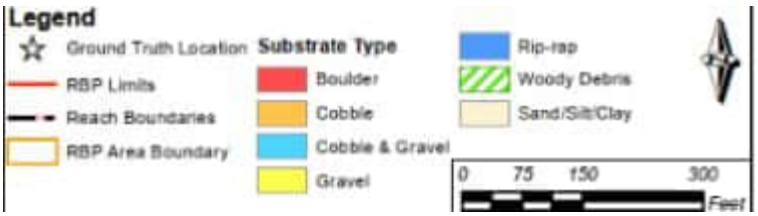
Bank 44 Plant Species	
Right Bank	**Left Bank**
Asian bittersweet/*Celastrus orbiculatus*/vine*	common buckthorn/*Rhamnus cathartica*/shrub*
Canada goldenrod/*Solidago canadensis*/herb	common soft rush/*Juncus effusus*/herb
Canada clearweed/Pilea pumila/herb	common water-purslane/*Ludwigia palustris*/herb
cinnamon fern/Osmunda cinnamomea/herb	curly dock/*Rumex crispus*/herb
common buckthorn/*Rhamnus cathartica*/shrub*	ditch-stonecrop/*Penthorum sedoides*/herb
curly dock/*Rumex crispus*/herb	giant chickweed/*Myosoton aquaticum*/herb
elderberry/*Sambucus canadensis*/shrub	green-headed coneflower/*Rudbeckia laciniata*/herb
jewelweed/*Impatiens capensis*/herb	little lovegrass/*Eragrostis minor*/herb
marsh fern/*Thelypteris palustris*/herb	marsh fern/*Thelypteris palustris*/herb
Morrow's honeysuckle/*Lonicera morrowii*/shrub*	Morrow's honeysuckle/*Lonicera morrowii*/shrub*
poison-ivy/*Toxicodendron radicans*/vine	multiflora rose/*Rosa multiflora*/shrub*
purple-stemmed beggar-ticks/*Bidens connata*/herb	nodding beggar-ticks/*Bidens cernua*/ herb
sensitive fern/*Onoclea sensibilis*/herb	purple loosestrife/*Lythrum salicaria*/herb*
silky dogwood/*Cornus amomum*/shrub	purple-stemmed beggar-ticks/Bidens connata/herb
silver maple/*Acer saccharinum*/tree	river grape/*Vitas riparia*/vine
spotted Joe-Pye weed/*Eupatorium maculatum*/herb	sensitive fern/*Onoclea sensibilis*/herb
virgin's-bower/*Clematis virginiana*/vine	silky dogwood/*Cornus amomum*/shrub
water forget-me-not/*Myosotis scorpioides*/herb*	small-spiked false-nettle/*Boehmeria cylindrica*/herb
	spike grass/*Eleocharis sp*/herb
	spotted Joe-Pye weed/*Eupatorium maculatum*/herb
	water forget-me-not/*Myosotis scorpioides*/herb*
	water-pepper smartweed/*Persicaria hydropiper*/herb
	Virginia-creeper/*Parthenocissus quinquefolia*/vine
	yellow iris/*Iris pseudacorous*/herb*

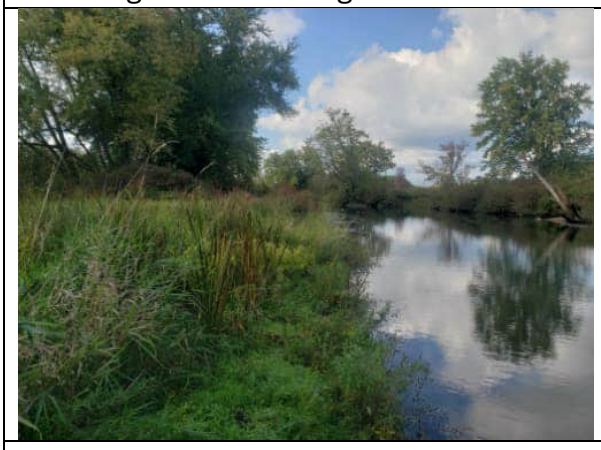
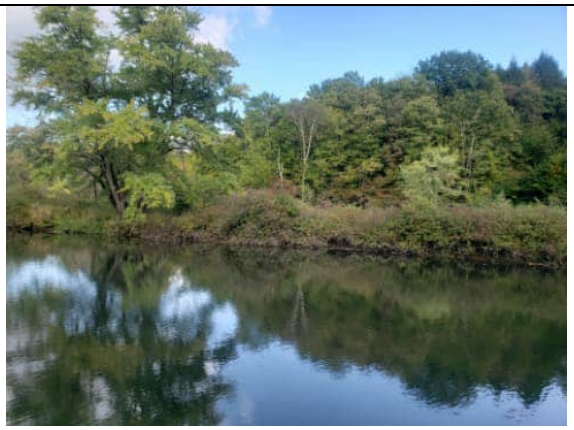
*Invasive

Bank 45 Aerial Views







	
Right Bank looking downstream	Left Bank from Right Bank
	
Right Bank looking upstream	Left Bank
	
Right Bank from upstream	Left Bank
Riverbank Station 43 Photos September 20, 2025	

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5C Bank 45
Site Name and Evaluation Segment

BA 45
Location/Physical Description

9/24/2024
Date(s) of Site Visit(s) and Data Collection

Sun/Clouds, low 60's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200" Width 90' Bank Height R: 3' L: 5' Slope: R: 25% L: 80%

Sediment / Substrate composition:

% Sand 30 % Silt 40 % Clay 0 % Gravel/cobble 20

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions:

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☒ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _3__ft Top of bank slope: _4__ft Floodplain surface: _4__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank ☒ Changes in character of soil

☒ Bed and banks ☒ Water staining

☒ Shelving ☒ Vegetation matted down, bent or absent

☒ Wrack lines (litter and debris) ☒ Change in plant community

☒ Scour and/or Deposition ☒ Destruction of terrestrial vegetation

☒ Line of mud or silt on tree trunks/vegetation ☐ Debris stuck on overhanging tree limbs

☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line ☐ Recent changes to river bends/meanders

☒ Depositional bench (active channel) ☒ Undercuts

☐ Depositional point bar ☒ Staining of rocks

☐ Depositional island ☐ Top of point bars

☐ Middle bench for braided rivers ☒ Lower limits in perennial vegetation

☒ Break in slope of banks (floodplain break)

☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 70 Bank Vegetation; 70 Overhanging Vegetation; 90 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

40	70	10	0	75
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 85 (Bank Vegetation) 75 (Overhanging Vegetation) 100 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
85	85	10	0	40

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
85	60	10	0	45

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☐ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bur Oak, Common Gallinule, Matted Spike-sedge, Mustard White, Narrow-leaved Spring-beauty, Rapids Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Beaver/Otter/Muskrat slides	Turtle
Black-capped chickadee	
Cormorants	
Mallards	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: Black locust, Common buckthorn, Japanese barberry, Morrow's honeysuckle, Purple loosestrife, Reed canary grass, Water forget-me-not

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: _large trees; large woody debris; boulders, cobble and gravel

☒ Other restoration opportunities: reshape point bar on right

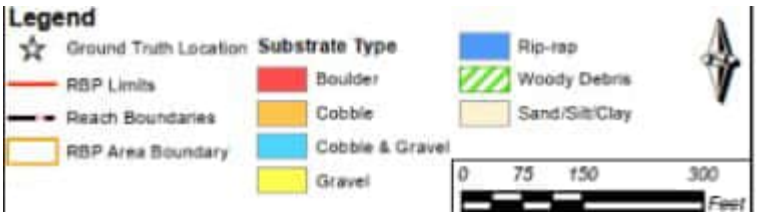
Bank 45 Plant Species	
Right Bank	**Left Bank**
black locust/*Robinia pseudocacia*/herb*	American beech/*Fagus grandifolia*/tree
Canada clearweed/*Pilea pumila*/herb	blue joint grass/*Calamagrostis canadensis*/herb
cinnamon fern/*Osmunda cinnamomea*/herb	bracken fern/*Pteridium aquilinum*/herb
common arrowhead/*Sagittaria latifolia*/herb	ironwood/*Carpinus caroliniana*/tree
common buckthorn/*Rhamnus cathartica*/shrub*	Japanese barberry/*Berberis thunbergii*/shrub*
green-headed coneflower/*Rudbeckia laciniata*/herb	maleberry/*Lyonia ligustrina*/shrub
hawthorn/*Crataegus sp/*tree	Morrow's honeysuckle/*Lonicera morrowii*/shrub*
lance-leaved American aster/*Symphyotrichum lanceolatum*/herb	mountain laurel/*Kalmia latifolia*/shrub
Morrow's honeysuckle/*Lonicera morr*owii/shrub*	northern red oak/*Quercus rubra*/tree
nodding beggar-ticks/*Bidens cernua*/ herb	purple loosestrife/*Lythrum salicaria*/herb*
pickerelweed/*Pontederia cordata*/herb	red maple/*Acer rubrum*/tree
reed canary grass/*Phalaris arundinacea*/herb*	sensitive fern/*Onoclea sensibilis*/herb
rice cut-grass*/Leersia oryzoides*/herb	silky dogwood/*Cornus amomum*/shrub
sensitive fern*/Onoclea sensibilis*/herb	Virginia-creeper/*Parthenocissus quinquefolia*/vine
silky dogwood/*Cornus amomum*/shrub	
spotted Joe-Pye weed/*Eupatorium maculatum*/herb	
water forget-me-not/*Myosotis scorpioides*/herb*	

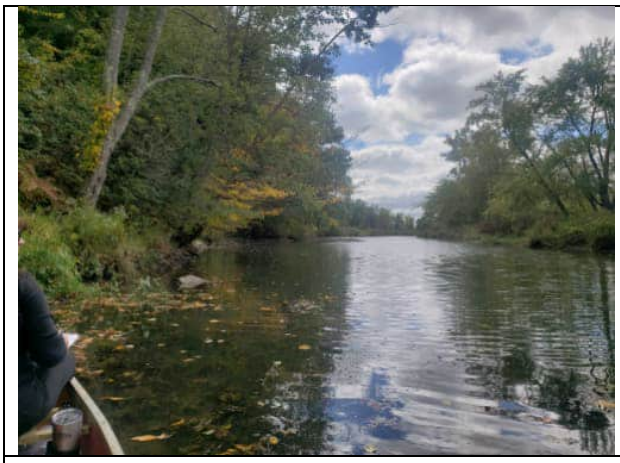
*Invasive

Bank 45 Aerial Views







	
Left bank looking downstream	Right bank from left bank
	
Left bank	Right bank looking downstream
	
Right bank	Right bank

Bank 45 Photographs, September 24, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5C Bank 46
Site Name and Evaluation Segment

BA 46
Location/Physical Description

9/27/2024
Date(s) of Site Visit(s) and Data Collection

Sunny, 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 100' Width 85' Bank Height R: 3' L: 3' Slope: R: 30% L: 60%

Sediment / Substrate composition:

% Sand 20 % Silt 70 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank very stable, vegetated; Left bank has some undercutting but overall stable; Thalweg towards Left

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☒ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☒ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☒ Somewhat incised ☐ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: 3ft Top of bank slope: _4__ft Floodplain surface: _4__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank ☒ Changes in character of soil

☒ Bed and banks ☒ Water staining

☒ Shelving ☐ Vegetation matted down, bent or absent

☐ Wrack lines (litter and debris) ☐ Change in plant community

☐ Scour and/or Deposition ☐ Destruction of terrestrial vegetation

☐ Line of mud or silt on tree trunks/vegetation ☐ Debris stuck on overhanging tree limbs

☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☐ Scour line ☒ Recent changes to river bends/meanders

☐ Depositional bench (active channel) ☒ Undercuts

☐ Depositional point bar ☐ Staining of rocks

☐ Depositional island ☐ Top of point bars

☐ Middle bench for braided rivers ☒ Lower limits in perennial vegetation

☒ Break in slope of banks (floodplain break)

☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 95 Bank Vegetation 95 Overhanging Vegetation 90 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	95	5	0	30
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 95 (Bank Vegetation) 95 (Overhanging Vegetation) 95 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
75	75	20	0	25

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
30	75	15	0	70

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☐ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bur Oak, Common Gallinule, Matted Spike-sedge, Mustard White, Wapato, Water Shrew, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Black-capped chickadees	
Salamander	
Wood ducks	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: __Asian bittersweet, Common buckthorn, Morrow's honeysuckle, Purple loosestrife, Reed canary grass _____

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large trees; large woody debris

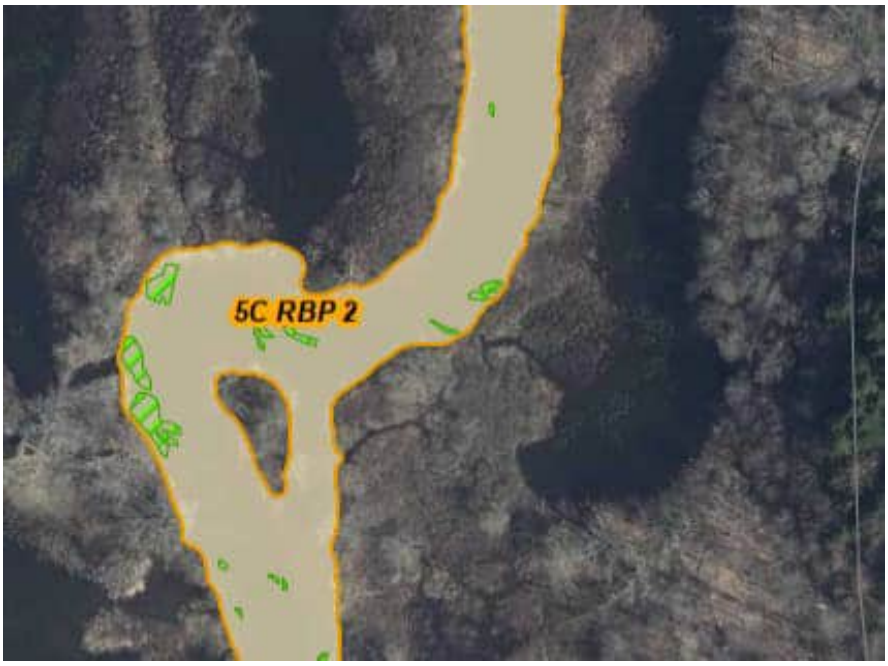
☐ Other restoration opportunities:

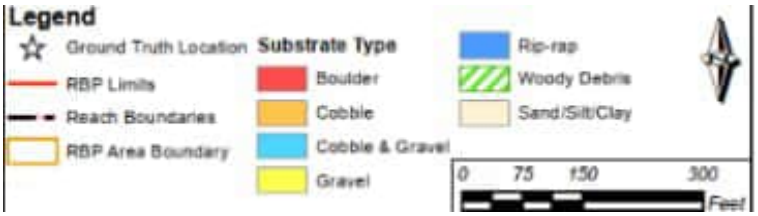
Bank 46 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	Asian bittersweet/*Celastrus orbiculatus*/vine*
arrow-arum/*Peltandra virginica*/herb	green-headed coneflower/*Rudbeckia laciniata*/herb
Canada clearweed/*Pilea pumila*/herb	Morrow's honeysuckle/*Lonicera morrowii*/shrub*
common buckthorn/*Rhamnus cathartica*/shrub*	ostrich fern/*Matteuccia struthiopteris*/herb
common water-purslane/*Ludwigia palustris*/herb	red-osier dogwood/*Cornus sericea*/shrub
common soft rush/*Juncus effusus*/herb	reed canary grass/*Phalaris arundinacea*/herb*
ditch stone-crop/*Penthorum sedoides*/herb	sensitive fern/*Onoclea sensibilis*/herb
green-headed coneflower/*Rudbeckia laciniata*/herb	silky dogwood/*Cornus amomum*/shrub
Morrow's honeysuckle/*Lonicera morrowii*/shrub*	silver maple/*Acer saccharinum*/tree
nodding beggar-ticks/*Bidens cernua*/ herb	
pale smartweed/*Persicaria lapathifolia*/herb	
purple loosestrife/*Lythrum salicaria*/herb*	
red-osier dogwood/*Cornus sericea*/shrub	
silky dogwood/Cornus amomum/shrub	
silver maple/*Acer saccharinum*/tree	
spike rush/*Eleocharis sp*/herb	
umbrella sedge/*Cyperus strigogus*/herb	

*Invasive

Bank 46 Aerial Views









Right bank, view from left bank



Left bank

Bank 46 Photographs, September 27, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5C Bank 47
Site Name and Evaluation Segment

BA 47
Location/Physical Description

9/27/2024
Date(s) of Site Visit(s) and Data Collection

Sunny, 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 100' Width 100' Bank Height R: 3' L: 4' Slope: R: 25% L: 45%

Sediment / Substrate composition:

% Sand 20 % Silt 70 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank stable, heavily vegetated; Left bank very stable , heavily vegetated; Thalweg at center

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other None

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _3__ft Top of bank slope: _3__ft Floodplain surface: _3__ft

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☒ Changes in character of soil
☒ Bed and banks
☐ Water staining
☒ Shelving
☐ Vegetation matted down, bent or absent
☐ Wrack lines (litter and debris)
☐ Change in plant community
☐ Scour and/or Deposition
☐ Destruction of terrestrial vegetation
☐ Line of mud or silt on tree trunks/vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☐ Scour line
☐ Recent changes to river bends/meanders
☐ Depositional bench (active channel)
☐ Undercuts
☐ Depositional point bar
☐ Staining of rocks
☐ Depositional island
☐ Top of point bars
☐ Middle bench for braided rivers
☒ Lower limits in perennial vegetation
☒ Break in slope of banks (floodplain break)
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 100 (Bank Vegetation) 40 (Overhanging Vegetation) 9 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

30	20	10	0	80
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 95 Bank Vegetation | 80 Overhanging Vegetation | 90 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

30	70	10	0	70
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Percent Cover of Riparian Vegetation by Strata

50	60	15	0	75
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☒ Core Area 2 ☒ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bald Eagle, Bur Oak, Common Gallinule, Gray's Sedge, Matted Spike-sedge, Mustard White, Wapato, Water Shrew, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Hairy woodpecker	
Turtle	
Vulture	
Wood duck	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Common buckthorn, Morrow's honeysuckle, Purple loosestrife, Reed canary grass, Water forget-me-not, Yellow iris

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large woody debris; cobble and gravel; large woody debris

☒ Other restoration opportunities: reshape point bar on right

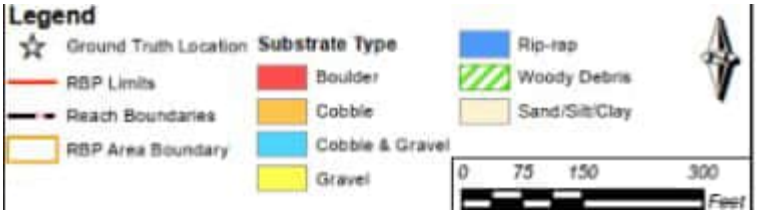
Bank 47 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American bur-reed/*Sparganium americanum*/herb
arrow-leaved tearthumb/*Persicaria sagittata*/herb	arrow-leaved tearthumb/*Persicaria sagittata*/herb
Canada clearweed/*Pilea pumila*/herb	common buckthorn/*Rhamnus cathartica*/shrub*
common buckthorn/*Rhamnus cathartica*/shrub*	common water-purslane/*Ludwigia palustris*/herb
common soft rush/*Juncus effusus*/herb	green-headed coneflower/*Rudbeckia laciniata*/herb
curly dock/*Rumex crispus*/herb	jewelweed/*Impatiens capensis*/herb
Devil's beggar-ticks/*Bidens frondosa*/herb	lady's-thumb smartweed/*Persicaria maculosa*/herb
green-headed coneflower/*Rudbeckia laciniata*/herb	moneywort/*Lysimachia nummularia*/herb*
jewelweed/*Impatiens capensis*/herb	Morrow's honeysuckle/*Lonicera morrowii*/shrub*
poison-ivy/*Toxicodendron radicans*/vine	New England American aster/*Symphyotrichum novae-angliae*/herb
purple loosestrife/*Lythrum salicaria*/herb*	nodding beggar-ticks/*Bidens cernua*/ herb
reed canary grass/*Phalaris arundinacea*/herb*	poison-ivy/*Toxicodendron radicans*/vine
sensitive fern/*Onoclea sensibilis*/herb	purple loosestrife/*Lythrum salicaria*/herb*
silver maple/*Acer saccharinum*/tree	red-osier dogwood/*Cornus sericea*/shrub
spotted Joe-Pye weed/*Eupatorium maculatum*/herb	reed canary grass/*Phalaris arundinacea*/herb*
water forget-me-not/*Myosotis scorpioides*/herb*	rice cut-grass/*Leersia oryzoides*/herb
yellow iris/*Iris pseudacorus*/herb*	sensitive fern/*Onoclea sensibilis*/herb
	silky dogwood/*Cornus amomum*/shrub
	silver maple/*Acer saccharinum*/tree
	spike rush/*Eleocharis sp*/herb
	spotted Joe-Pye weed/Eupatorium maculatum/herb
	upland milkweed/*Asclepias syriaca*/herb
	virgin's-bower/*Clematis virginiana*/herb
	yellow iris/*Iris pseudacorus*/herb*

*Invasive

Bank 47 Aerial Views







	
Left Bank, looking upstream from right	Right bank
	
Left bank	Right bank

Bank 47 Photographs, September 27, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5C Bank 48
Site Name and Evaluation Segment

BA 48
Location/Physical Description

9/27/2024
Date(s) of Site Visit(s) and Data Collection

Sunny, 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 100' Width 100' Bank Height R: 3' L: 3' Slope: R: 30% L: 30%

Sediment / Substrate composition:

% Sand 20 % Silt 70 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank very stable, no erosion; Left bank very stable, no erosion; Center Thalweg

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☒ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☒ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _3__ft Top of bank slope: __3_ft Floodplain surface: _3__ft

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☒ Changes in character of soil
☒ Bed and banks
☐ Water staining
☒ Shelving
☐ Vegetation matted down, bent or absent
☐ Wrack lines (litter and debris)
☒ Change in plant community
☐ Scour and/or Deposition
☐ Destruction of terrestrial vegetation
☐ Line of mud or silt on tree trunks/vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☐ Scour line
☐ Recent changes to river bends/meanders
☐ Depositional bench (active channel)
☒ Undercuts
☐ Depositional point bar
☐ Staining of rocks
☐ Depositional island
☐ Top of point bars
☐ Middle bench for braided rivers
☐ Lower limits in perennial vegetation
☒ Break in slope of banks (floodplain break)
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 100 (Bank Vegetation) 100 (Overhanging Vegetation) N/A island (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50	80	10	0	50
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 100 (Bank Vegetation) 90 (Overhanging Vegetation) 75 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
20	80	20	0	50

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
50	75	10	0	60

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bald Eagle, Bur Oak, Common Gallinule, Gray's Sedge, Matted Spike-sedge, Mustard White, Wapato, Water Shrew, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Catbird	
Dragonflies	
Garter snake	
White-breasted nuthatch	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Asian bittersweet, Climbing nightshade, Purple loosestrife, Reed canary grass, Water forget-me-not

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large trees; large woody debris; boulder

☐ Other restoration opportunities:

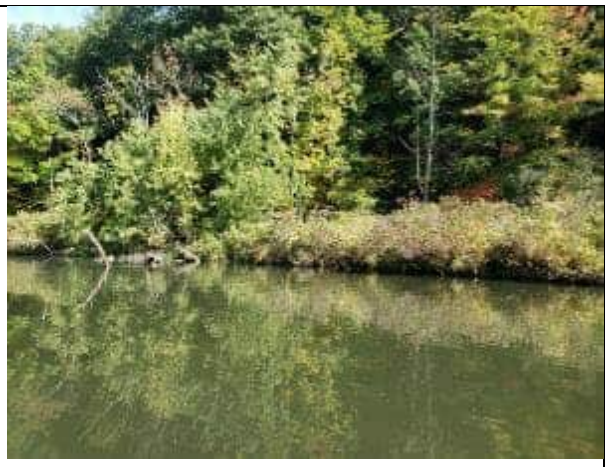
Bank 48 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American bur-reed/*Sparganium americanum*/herb
arrow-arum/*Peltandra virginica*/herb	arrow-arum/*Peltandra virginica*/herb
Asian bittersweet/*Celastrus orbiculatus*/vine*	climbing nightshade/*Solanum dulcamara*/herb*
common water-purslane/*Ludwigia palustris*/herb	curly dock/*Rumex crispus*/herb
floating pondweed/*Potamogeton natans*/herb	Devil's beggar-ticks/*Bidens frondosa*/herb
purple loosestrife/*Lythrum salicaria*/herb*	eastern black currant/*Ribes americanum*/shrub
red-osier dogwood/*Cornus sericea*/shrub	green-headed coneflower/*Rudbeckia laciniata*/herb
reed canary grass/*Phalaris arundinacea*/herb*	jewelweed/*Impatiens capensis*/herb
sensitive fern/*Onoclea sensibilis*/herb	nodding beggar-ticks/*Bidens cernua*/ herb
silky dogwood/*Cornus amomum*/shrub	purple loosestrife/*Lythrum salicaria*/herb*
silver maple/*Acer saccharinum*/tree	red-osier dogwood/*Cornus sericea*/shrub
spotted Joe-Pye weed/*Eupatorium maculatum*/herb	rice cut-grass/*Leersia oryzoides*/herb
	sensitive fern/*Onoclea sensibilis*/herb
	silky dogwood/*Cornus amomum*/shrub
	silver maple/*Acer saccharinum*/tree
	small-spiked false-nettle/*Boehmeria cylindrica*/herb
	spike rush/*Eleocharis sp*/herb
	virgin's-bower/*Clematis virginiana*/herb
	water forget-me-not/*Myosotis scorpioides*/herb*
	wild cucumber/*Echinocystis lobata*/vine

*Invasive

Bank 48 Aerial Views





	
Left bank	Right bank
	
Left bank, view from right bank	Right bank
	
	Right bank

Bank 48 Photos, September 27, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5C Bank 49
Site Name and Evaluation Segment

BA 49
Location/Physical Description

0/27/2024
Date(s) of Site Visit(s) and Data Collection

Sunny, 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 100 Width 110' Bank Height R: 3' L: 3' Slope: R: 25% L: 25%

Sediment / Substrate composition:

% Sand 20 % Silt 70 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank very stable, fully vegetated; Left bank very stable, fully vegetated; Center Thalweg

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☒ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☒ Other None

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _2__ft Top of bank slope: _3__ft Floodplain surface: _3__ft

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☒ Changes in character of soil
☒ Bed and banks
☐ Water staining
☒ Shelving
☐ Vegetation matted down, bent or absent
☒ Wrack lines (litter and debris)
☐ Change in plant community
☐ Scour and/or Deposition
☐ Destruction of terrestrial vegetation
☐ Line of mud or silt on tree trunks/vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☐ Scour line
☒ Recent changes to river bends/meanders
☐ Depositional bench (active channel)
☐ Undercuts
☐ Depositional point bar
☐ Staining of rocks
☐ Depositional island
☐ Top of point bars
☐ Middle bench for braided rivers
☐ Lower limits in perennial vegetation
☒ Break in slope of banks (floodplain break)
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 90 Bank Vegetation; 10 Overhanging Vegetation; 90 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	10	0	0	90
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 90 (Bank Vegetation) 10 (Overhanging Vegetation) 90 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	10	0	0	90

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	10	0	0	90

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☒ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bald Eagle, Bur Oak, Common Gallinule, Gray's Sedge, Mustard White, Wapato, Water Shrew,

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Crows	
Kingfisher	
Muskrat/Beaver slides	
Wood ducks	

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Purple loosestrife, Reed canary grass, Water forget-me-not

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large woody debris

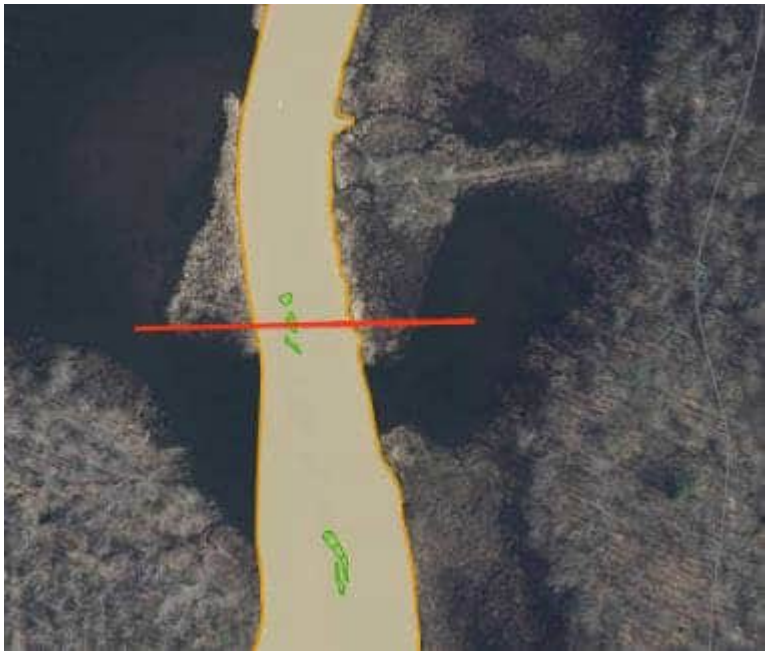
☐ Other restoration opportunities:

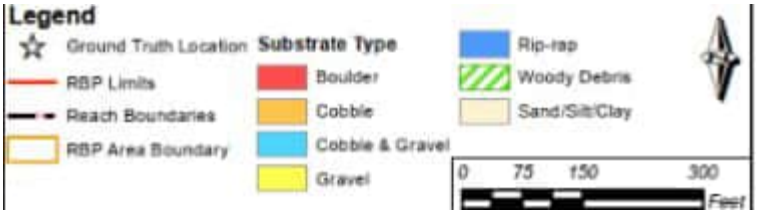
Bank 49 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American bur-reed/*Sparganium americanum*/herb
arrow-arum/*Peltandra virginica*/herb	arrow-arum/*Peltandra virginica*/herb
arrow-leaved tearthumb/*Persicaria sagittata*/herb	arrow-leaved tearthumb/*Persicaria sagittata*/herb
broad-leaved cat-tail/*Typha latifolia*/herb	common arrowhead/*Sagittaria latifolia*/herb
Canada clearweed/*Pilea pumila*/herb	pickerelweed/*Pontederia cordata*/herb
common buttonbush/*Cephalanthus occidentalis*/shrub	purple loosestrife/*Lythrum salicaria*/herb*
jewelweed/*Impatiens capensis*/herb	reed canary grass/*Phalaris arundinacea*/herb*
lady's-thumb smartweed/*Persicaria maculosa*/herb	rice cut-grass/*Leersia oryzoides*/herb
pickerelweed/*Pontederia cordata*/herb	silky dogwood/*Cornus amomum*/shrub
purple loosestrife/*Lythrum salicaria*/herb*	
red-osier dogwood/*Cornus sericea*/shrub	
small-spiked false-nettle/*Boehmeria cylindrica*/herb	
silky dogwood/*Cornus amomum*/shrub	
umbrella sedge/*Cyperus strigosus*/herb	
water forget-me-not/*Myosotis scorpioides*/herb*	

*Invasive

Bank 49 Aerial Views







	
Left bank	Right bank
	
Left bank (on right); right bank (on left)	Right bank
	
	Right bank

Bank 49 Photos, September 27, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R5C Bank 50
Site Name and Evaluation Segment

BA 50
Location/Physical Description

9/27/2024
Date(s) of Site Visit(s) and Data Collection

Sunny, 70
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 110' Bank Height R: 3' L: 4' Slope: R: 25% L: 80%

Sediment / Substrate composition:

% Sand 15 % Silt 55 % Clay 0 % Gravel/cobble 20

% Boulder Bedrock 0 % Organic matter 10

Bank stability / Observed erosional conditions: Right bank very stable on sheltered cove; Left bank stable with heavy vegetation , some undercutting; Thalweg on Left

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☐ Deep emergent marsh
- ☐ Shallow emergent marsh
- ☐ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☒ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☒ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: _3__ft Top of bank slope: _3__ft Floodplain surface: _3__ft

Field-Derived Evidence of Hydrologic Conditions

☒ Clear natural line impressed on bank
☒ Bed and banks
☒ Shelving
☒ Wrack lines (litter and debris)
☒ Scour and/or Deposition
☐ Line of mud or silt on tree trunks/vegetation
☒ Changes in character of soil
☒ Water staining
☒ Vegetation matted down, bent or absent
☒ Change in plant community
☒ Destruction of terrestrial vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☒ Scour line
☒ Depositional bench (active channel)
☐ Depositional point bar
☐ Depositional island
☐ Middle bench for braided rivers
☒ Break in slope of banks (floodplain break)
☐ Recent changes to river bends/meanders
☒ Undercuts
☐ Staining of rocks
☐ Top of point bars
☒ Lower limits in perennial vegetation
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 95 Bank Vegetation; 50 Overhanging Vegetation; 95 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

20	50	20	0	50
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Left Bank

Total % Cover: 90 (Bank Vegetation) 90 (Overhanging Vegetation) 70 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

75	80	25	0	20
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Percent Cover of Riparian Vegetation by Strata

50	55	15	0	45
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☒ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

American Bittern, Bald Eagle, Bristly buttercup, Bur Oak, Common Gallinule, Mustard White, Wapato

Rare species direct observations during current field surveys: Bald eagle

VI. Incidental Direct Wildlife Observations

Beaver slide	Dragonflies
Broad-winged hawk	Great blue heron
Kingfisher	Pileated woodpecker
small fish jump	Red-bellied woodpecker

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _Asian bittersweet, Coltsfoot, Common buckthorn, Morrow's honeysuckle, Purple loosestrife, Reed canary grass, Water forget-me-not

☐ Evidence of other human disturbance; describe: _____

VIII.Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items: large trees; large woody debris; cobble and boulders_____

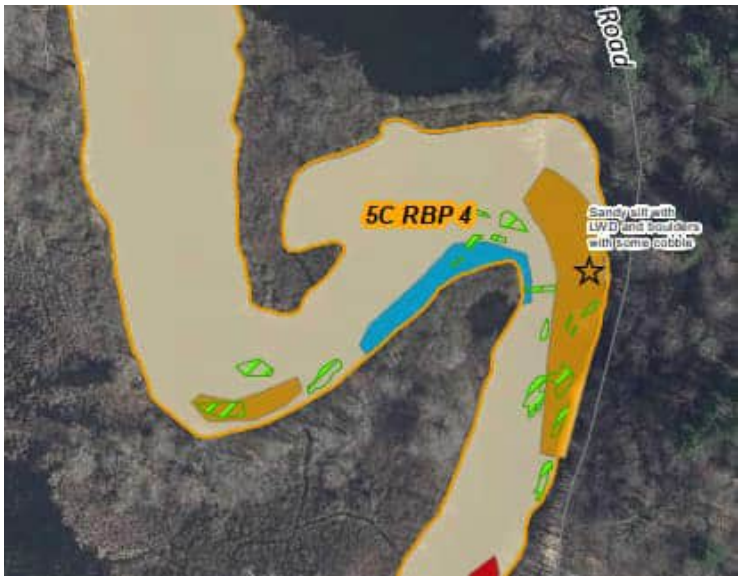
☐ Other restoration opportunities:

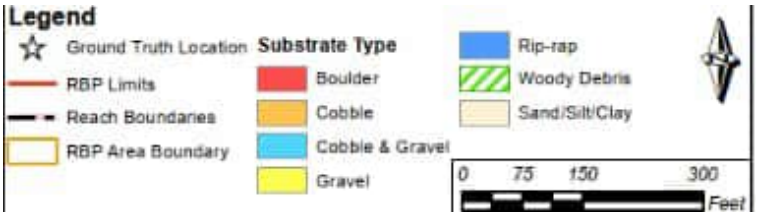
Bank 50 Plant Species	
Right Bank	**Left Bank**
American bur-reed/*Sparganium americanum*/herb	American beech/*Fagus grandifolia*/tree
arrow-arum/*Peltandra virginica*/herb	American linden/*Tilia americana*/tree
Asian bittersweet/*Celastrus orbiculatis*/vine*	Asian bittersweet/*Celastrus orbiculatis*/vine*
Canada clearweed/*Pilea pumila*/herb	black birch/*Betula lenta*/tree
common arrowhead/*Sagittaria latifolia*/herb	Canada clearweed/*Pilea pumila*/herb
common water-purslane/*Ludwigia palustris*/herb	Christmas fern/*Polystichum acrostichoides*/herb
eastern black currant/*Ribes americanum*/shrub	coltsfoot/*Tussilago farfara*/herb*
maple-leaved viburnum/*Viburnum acerifolium*/shrub	common buckthorn/*Rhamnus cathartica*/shrub*
Morrow's honeysuckle/*Lonicera morrowii*/shrub*	flowering dogwood/*Cornus florida*/shrub
pickerelweed/*Pontederia cordata*/herb	hawthorn/*Crataegus sp*/tree
purple loosestrife/*Lythrum salicaria*/herb*	lance-leaved American aster/*Symphyotrichum lanceolatum*/herb
red maple/*Acer rubrum*/tree	Morrow's honeysuckle/*Lonicera morrowii*/shrub*
red-osier dogwood/*Cornus sericea*/shrub	nodding beggar-ticks/*Bidens cernua*/herb
reed canary grass/*Phalaris arundinacea*/herb*	red maple/*Acer rubrum*/tree
rice cut-grass/*Leersia oryzoides*/herb	river grape/*Vitas riparia*/vine
river grape/*Vitas riparia*/vine	silky dogwood/*Cornus amomum*/shrub
sensitive fern/*Onoclea sensibilis*/herb	sensitive fern/*Onoclea sensibilis*/herb
silky dogwood/*Cornus amomum*/shrub	smooth arrowwood/*Viburnum dentatum*/shrub
spotted Joe-Pye weed/*Eupatorium maculatum*/herb	striped maple/*Acer pensylvanicum*/tree
sweet flag/*Acorus americanus*/herb	Virginia-creeper/*Parthenocissus quinquefolia*/vine
water forget-me-not/*Myosotis scorpioides*/herb*	

*Invasive

Bank 50 Aerial Views









Left bank



Right bank



Left bank



Right bank



Left bank



Left bank

Bank 50 Photos, September 27, 2024

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R6 Bank 51
Site Name and Evaluation Segment

BA 51
Location/Physical Description

10/5/23
Date(s) of Site Visit(s) and Data Collection

Sunny, mid 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length 200' Width 120' Bank Height: R:2' L: 0 Slope: R: 25% L: breaks to backwater

Sediment / Substrate composition:

% Sand 0 % Silt 80 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 20

Bank stability / Observed erosional conditions:
Right bank is stable, well vegetated with no erosive forces; Left bank has breaks to adjacent backwater

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☐ Vernal pool
- ☒ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☒ Other None

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☐ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: 2 ft Top of bank slope: 2 ft Floodplain surface: 2 ft

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☒ Changes in character of soil
☒ Bed and banks
☐ Water staining
☐ Shelving
☐ Vegetation matted down, bent or absent
☐ Wrack lines (litter and debris)
☒ Change in plant community
☐ Scour and/or Deposition
☐ Destruction of terrestrial vegetation
☐ Line of mud or silt on tree trunks/vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☐ Scour line
☐ Recent changes to river bends/meanders
☐ Depositional bench (active channel)
☐ Undercuts
☐ Depositional point bar
☐ Staining of rocks
☐ Depositional island
☐ Top of point bars
☐ Middle bench for braided rivers
☐ Lower limits in perennial vegetation
☒ Break in slope of banks (floodplain break)
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 90 Bank Vegetation; 80 Overhanging Vegetation; 80 Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	60	0	0	80
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Left Bank

Total % Cover: 90 (Bank Vegetation) 60 (Overhanging Vegetation) N/A adjacent to backwater

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	30	0	0	75

Percent Cover of Riparian Vegetation by Strata Left bank adjacent to backwater 5c-18

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous
0	10	0	0	70

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

Percent Cover of Riparian Vegetation by Strata: Right bank adjacent to thin fringe of marsh/shrub swamp bordered by backwater 5c-20

Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

American Bittern, Bald Eagle, Bur Oak, Common Gallinule, Mustard White, Wapato

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Beaver den	
Beaver slide	
Dragonflies	
Song sparrow	

Vulture

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage:
Climbing nightshade, Reed canary grass, Purple loosestrife

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items:
Large woody debris; root wad material

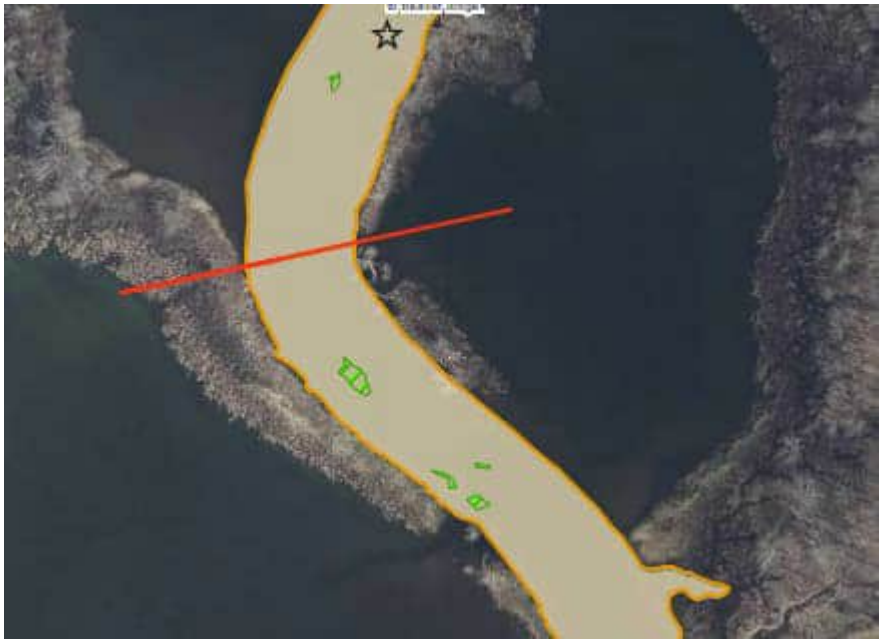
☐ Other restoration opportunities:

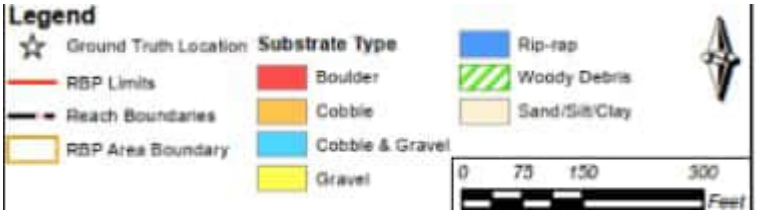
Bank 51 Plant Species	
Right Bank	**Left Bank**
arrow-arum/*Peltandra virginica*/herb	American bur-reed/*Sparganium americanum*/herb
common buttonbush/*Cephalanthus occidentalis*/shrub	blue vervain/*Verbena hastata*/herb
curly dock/*Rumex crispus*/herb	climbing nightshade/*Solanum dulcamara*/herb*
giant bur-reed/*Sparganium eurycarpum*/herb	common buttonbush/*Cephalanthus occidentalis*/shrub
lance-leaved American aster/*Symphyotrichum lanceolatum*/herb	curly dock/*Rumex crispus*/herb
purple loosestrife/*Lythrum salicaria*/herb*	fall sneezeweed/*Helenium autumnale*/herb
red-osier dogwood/*Cornus sericea*/shrub	nodding beggar-ticks/*Bidens cernua*/herb
reed canary grass/*Phalaris arundinacea*/herb*	purple loosestrife/*Lythrum salicaria*/herb*
silky dogwood/*Cornus amomum*/shrub	red-osier dogwood/*Cornus sericea*/shrub
	reed canary grass/*Phalaris arundinacea*/herb*
	silky dogwood/*Cornus amomum*/shrub
	smooth arrowwood/*Viburnum dentatum*/shrub

*Invasive

Bank 51 Aerial Views







General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

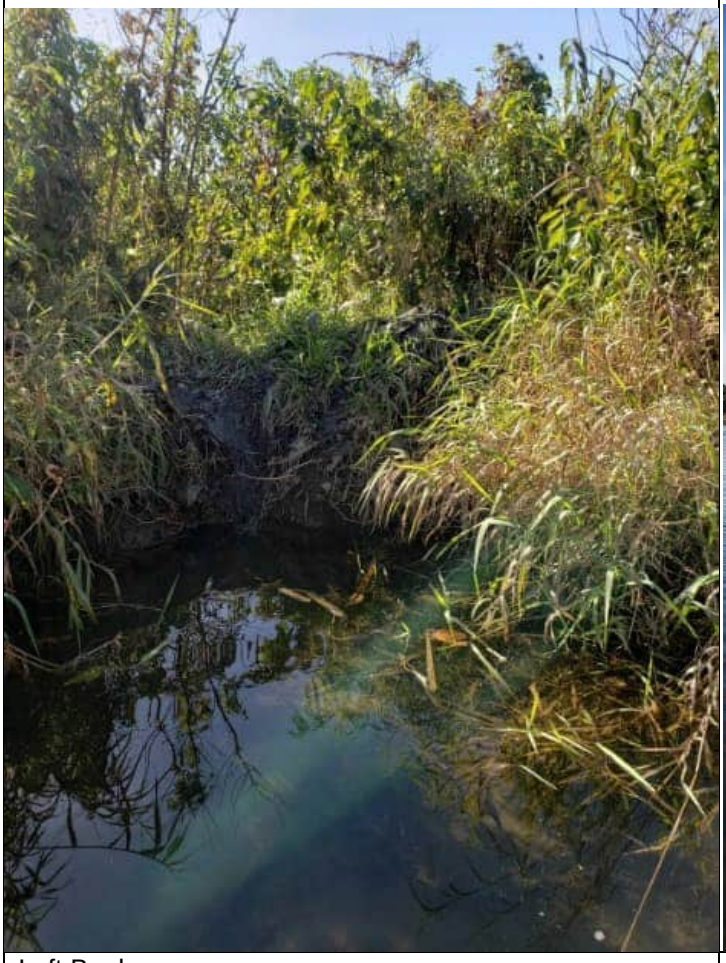
Photos of Bank 51 Area October 5, 2023



Left Bank looking north from Woods Pond



Left Bank looking east across River



Left Bank



Left Bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 51 Area

	
Left Bank	Left Bank
	
Right Bank	Right Bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

I. General Information

Housatonic ROR R6 Bank 52
Site Name and Evaluation Segment

BA 52
Location/Physical Description

10/5/23
Date(s) of Site Visit(s) and Data Collection

Sunny, mid 70's
Weather Conditions During Site Visit

AECOM
Field Staff Performing Evaluation

Date this form was completed

II. Site Description (R=Right Bank; L=Left Bank)

A. Bank Characterization

Physical Dimensions (ft):

Length: 200' Width: 130' Bank Height: R 2' L 2' Slope: R 20% L 25% disrupted by beaver

Sediment / Substrate composition:

% Sand 0 % Silt 80 % Clay 0 % Gravel/cobble 0

% Boulder Bedrock 0 % Organic matter 20

Bank stability / Observed erosional conditions:
Left bank stable except for areas of beaver activity exposure; Right bank stable; No erosive forces evident on Left or Right banks.

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☒ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☒ Deep emergent marsh
- ☒ Shallow emergent marsh
- ☒ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☒ Other None

Notes:

C. Hydrology

Stream gradient: ☒ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

☐ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank

☐ Channel is deeply incised ☐ Moderately incised ☐ Somewhat incised ☒ Not incised

Degree of Water level fluctuation (estimated vertical difference from mean low water to):

Bankfull indicators: 2 ft Top of bank slope: 2 ft Floodplain surface: 2 ft

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☒ Changes in character of soil
☐ Bed and banks
☒ Water staining
☐ Shelving
☐ Vegetation matted down, bent or absent
☒ Wrack lines (litter and debris) - beaver
☒ Change in plant community
☐ Scour and/or Deposition
☒ Destruction of terrestrial vegetation
☒ Line of mud or silt on tree trunks/vegetation
☒ Debris stuck on overhanging tree limbs
☐ Other_____

Field-Derived Evidence of Bankfull Stage/Discharge Water

☐ Scour line
☐ Recent changes to river bends/meanders
☐ Depositional bench (active channel)
☐ Undercuts
☐ Depositional point bar
☐ Staining of rocks
☒ Depositional island
☐ Top of point bars
☐ Middle bench for braided rivers
☐ Lower limits in perennial vegetation
☒ Break in slope of banks (floodplain break)
☐ Other_____

D. Inventory (Plant Community)

Right Bank

Total % Cover: 90 (Bank Vegetation) 20 (Overhanging Vegetation) N/A adjacent to backwater

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0	10	0	0	90
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Left Bank

Total % Cover: 70 (Bank Vegetation) 70 (Overhanging Vegetation) 90 (Riparian Vegetation)

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

10	30	5	0	70
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Percent Cover of Riparian Vegetation by Strata: Data for Left bank only; Right bank N/A

20	60	10	0	80
Trees (> 20')	Shrubs (< 20')	Woody vines	Mosses	Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
	See attached for plant species lists		

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☒ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Bank swallow colony(ies)

☐ Abundant ☐ Present ☒ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (little connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☒ Riverbank is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☒ Core Area 2 ☐ Core Area 3 ☒ Core Area 4

☒ Federally listed threatened or endangered species habitat (including species with known overlapping habitat): Northern long-eared bat, Tricolored bat, Monarch butterfly

☒ State-listed species habitat (including species with known overlapping Priority Habitat):

Bald Eagle, Bur Oak, Common Gallinule, Mustard White, Wapato

Rare species direct observations during current field surveys: Bald eagle

VI. Incidental Direct Wildlife Observations

Beaver channels, dams, slides	Kingfisher
Canada geese	Pileated woodpecker
Cooper's hawk	Red-bellied woodpecker
Dragonflies	Wood duck

Great blue heron Bald Eagle Turkey Vulture Painted turtle

VII. Habitat Degradation (identify specific location on bank segment if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☒ Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: Common buckthorn, Morrow's honeysuckle, Purple loosestrife, Reed canary grass, Water forget-me-not, Yellow iris

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

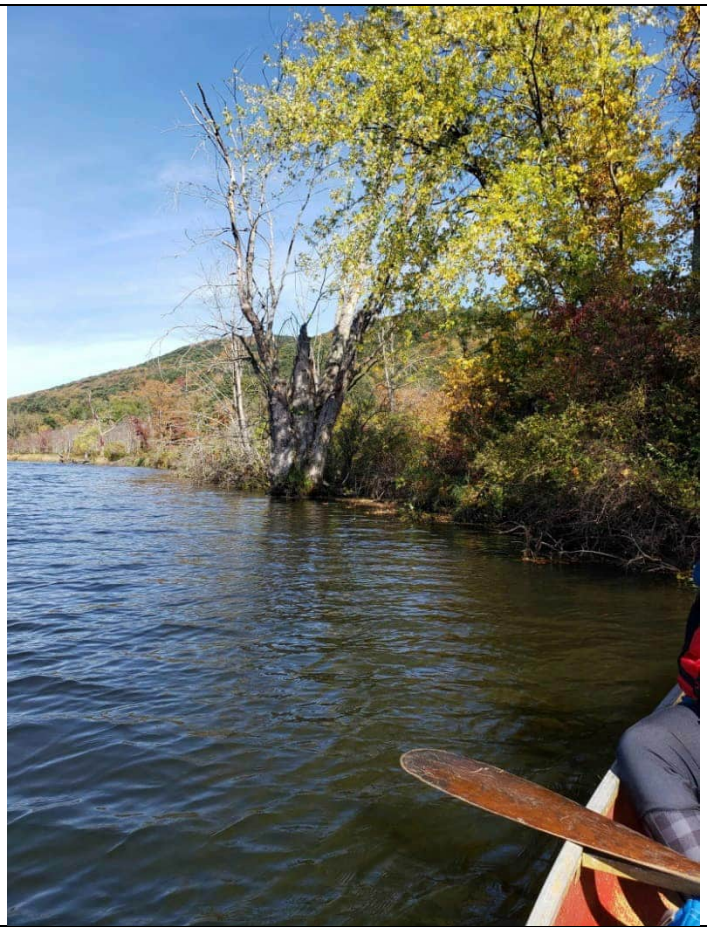
☒ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, root wad material for bank stabilization or hibernacula, plant propagation source material). Identify specific items:
Large woody debris; root wad material

☐ Other restoration opportunities:

Bank 52 Plant Species	
Right Bank	**Left Bank**
American elderberry/*Sambucus canadensis*/shrub	American bur-reed/*Sparganium americanum*/herb
arrow-arum/*Peltandra virginica*/herb	arrow-arum/*Peltandra virginica*/herb
common buttonbush/*Cephalanthus occidentalis*/shrub	arrow-leaved tearthumb/*Persicaria sagittata*/herb
common water purslane/*Ludwigia palustris*/herb	blue vervain/*Verbena hastata*/herb
curly dock/*Rumex crispus*/herb	calico aster/*Symphyotrichum lateriflorum*/herb
false water-pepper smartweed/*Persicaria hydropiperoides*/herb	common buckthorn/*Rhamnus cathartica*/shrub*
giant bur-reed/*Sparganium eurycarpum*/herb	curly dock/*Rumex crispus*/herb
purple loosestrife/*Lythrum salicaria*/herb*	elderberry/*Sambucus canadensis*/shrub
red maple/*Acer rubrum*/tree	jewelweed/*Impatiens capensis*/herb
reed canary grass/*Phalaris arundinacea*/herb*	Morrow's honeysuckle/*Lonicera morrowii*/shrub*
sensitive fern/*Onoclea sensibilis*/herb	nodding beggar-ticks/*Bidens cernua*/herb
stinging nettle/*Urtica dioica*/herb	purple loosestrife/*Lythrum salicaria*/herb*
water forget-me-not/*Myosotis scorpioides*/herb*	red maple/*Acer rubrum*/tree
	reed canary grass/*Phalaris arundinacea*/herb*
	river grape/*Vitis riparia*/vine
	sandbar willow/*Salix nigra*/shrub
	silky dogwood/*Cornus amomum*/shrub
	silver maple/*Acer saccharinum*/tree
	swamp rose/*Rosa palustris*/shrub
	tussock sedge/*Carex stricta*/herb
	water forget-me-not/*Myosotis scorpioides*/herb*
	winterberry holly/*Ilex verticillata*/shrub
	woolgrass/*Scirpus cyperinus*/herb
	yellow iris/*Iris pseudacorus*/herb*

*Invasive

Photos of Bank 52 Area



Left Bank



Left Bank



Left Bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 52 Area



Left Bank



Left Bank



Left Bank



Left Bank



Left Bank



Left Bank

Photos of Bank 52 Area



Right Bank



Right Bank



Right Bank



Right Bank



Right Bank



Right Bank

Appendix C

Backwater Habitat Information

C.1 Form BW-1 (Blank)

C.2 Backwater Photo Log (2023-2024)

Appendix C.1

Form BW-1 (Blank)

General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory

I. General Information

Site Name and Backwater Number

Location/Physical Description

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Backwater Characterization

Physical Dimensions (ft): Length_____ Width _____ Depth_____Area_____

Sediment / Substrate composition: % Sand_____% Silt _____ %Organic _____ Other _____

Bank stability / Observed erosional conditions: _____

B. Bordering Habitat Types

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☐ Deep emergent marsh
- ☐ Shallow emergent marsh
- ☐ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

C. Hydrology

Stream gradient adjacent to Backwater: ☐ Low Gradient ☐ Mid-Gradient ☐ High-Gradient

Backwater Hydrologic Connectivity to River

☐ Permanently connected (Baseflow hydrology is connected to and controlled by the river)

☐ Intermittently exposed connection (Surface connection is dry for a short time annually)

Describe any other inlets, outlets, and other surface water inputs to backwater: _____

_____

Water level fluctuation: _____

Field-Derived Evidence of Hydrologic Conditions

☐ Clear natural line impressed on bank
☐ Bed and banks
☐ Shelving
☐ Wrack lines (litter and debris)
☐ Scour and/or Deposition
☐ Line of mud or silt on tree trunks/vegetation
☐ Changes in character of soil
☐ Water staining
☐ Vegetation matted down, bent or absent
☐ Changes in plant community
☐ Destruction of terrestrial vegetation
☐ Debris stuck on overhanging tree limbs
☐ Other _____

D. Inventory of Aquatic Plant Community

% Cover: _____ _____ _____
Overall Aquatic Vegetation Floating -Leaved Cover Emergent Cover

Plant Lists (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Strata: AL=Algal, AM=Aquatic Moss, RV=Rooted Vascular, FV=Floating Vascular, PE=Persistent Emergent, NE=Non-persistent Emergent

III. Important Habitat Features

Wildlife Food

Important aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live) > 30" DBH adjacent to backwater

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Standing dead trees in or adjacent to backwater (potential for cavities and perches)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs in or adjacent to backwater

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Small mammal burrows on banks of backwater

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover on banks of backwater (voles, small mammals, amphibians & reptiles)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Large woody debris in contact with the water (fish & turtles)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, logs, tree roots or hummocks under water's surface (turtles, snakes, frogs)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, fallen logs, overhanging branches or hummocks at, or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Live or dead tall standing vegetation overhanging water or offering good visibility of open water (e.g., bald eagle, osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Other Important Habitat Characteristics

Flat rocks and logs on banks or within exposed portions of the backwater (cover and basking for herpetofauna)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Mud flats

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

Bank swallow colony(ies) (adjacent to backwater)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Turtle nesting sites

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

Emergent Wetlands within Backwater (if Applicable)

Emergent wetland vegetation at least seasonally flooded during the growing season (American bittern, wood duck, green heron, black-crowned night heron, rails [sora, king, Virginia], moorhen, coot, etc.)

Flooded > 5 cm ☐ Present ☐ Absent

Flooded > 25 cm (pied-billed grebe) ☐ Present ☐ Absent

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (no connectivity function)

☐ Backwater has a limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☐ Backwater is embedded in a large area of natural habitat with unimpeded connection between backwater and other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☐ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☐ Federally listed threatened or endangered species habitat (including species with known overlapping habitat):

☐ State-listed species habitat (including species with known overlapping Priority Habitat):

Rare species direct observations during current field surveys (list):

VI. Incidental Direct Wildlife Observations

VII. Habitat Degradation (identify specific location within backwater if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☐ Presence of invasive plants (e.g., purple loosestrife, *Phragmites*, Eurasian water-milfoil) or aquatic animals (e.g., zebra mussels, Asian clams); identify and estimate approximate percent coverage of invasive plants; identify invasive aquatic animals: _____

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☐ Presence of potential restoration resources (e.g., boulders, large downed trees or woody debris, plant propagation source material). Identify specific items: _____
_____

☐ Other restoration opportunities:_____

_____

Notes:

_____

_____

_____

IX. General Water Chemistry

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): _____

pH _____
Temperature _____
Conductivity _____
Dissolved Oxygen_____
Chlorophyll-a (or other measure of photosynthetic organisms) _____

Location 2 (describe): _____

pH _____
Temperature _____
Conductivity _____
Dissolved Oxygen_____
Chlorophyll-a (or other measure of photosynthetic organisms) _____

Location 3 (describe): _____

pH _____
Temperature _____
Conductivity _____
Dissolved Oxygen_____
Chlorophyll-a (or other measure of photosynthetic organisms) _____

Appendix C.2

Backwater Photo Log (2023-2024)

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 1	Date: 08/08/24	Photo No. 2	Date: 05/08/24

Description: 5B-BW-1.

Photo Direction: N



Description: 5B-BW-2.

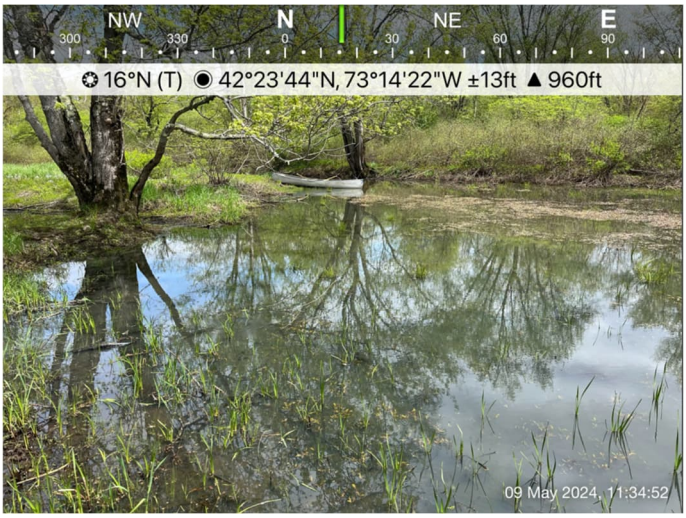
Photo Direction: S



Photo No. 3	Date: 05/09/24	Photo No. 4	Date: 05/08/24

Description: 5B-BW-3

Photo Direction: N



Description: 5B-BW-4.

Photo Direction: NE

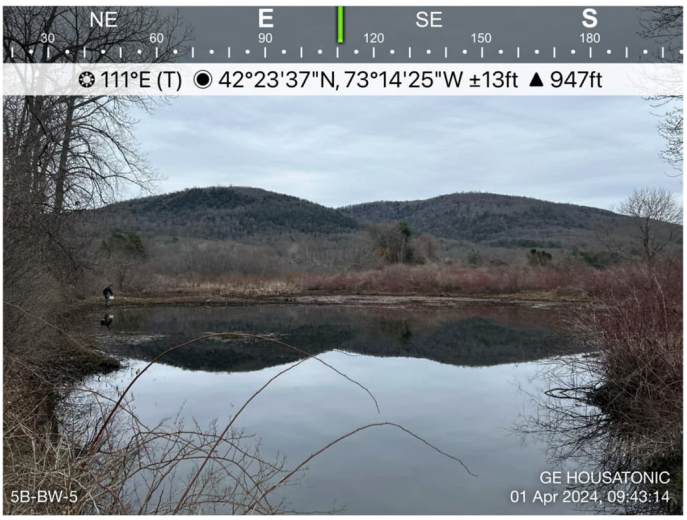


AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 5	Date: 04/01/24	Photo No. 6	Date: 04/02/24
Description: 5B-BW-5. Photo Direction: E		**Description:** 5B-BW-6. Photo Direction: N	



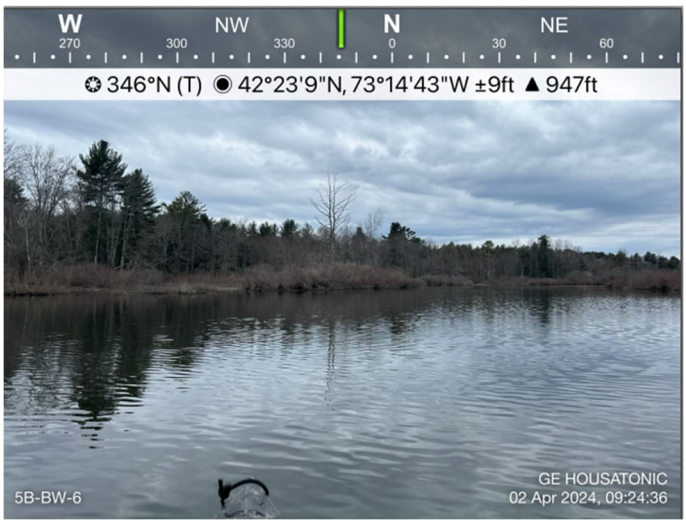


Photo No. 7	Date: 05/09/24	Photo No. 8	Date: 08/08/24
Description: 5B-BW-7. Photo Direction: NW		**Description:** 5B-BW-8. Photo Direction: N	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 9	Date: 08/08/24	Photo No. 10	Date: 08/08/24
Description: 5C-BW-1. Photo Direction: S		**Description:** 5C-BW-2. Photo Direction: W	

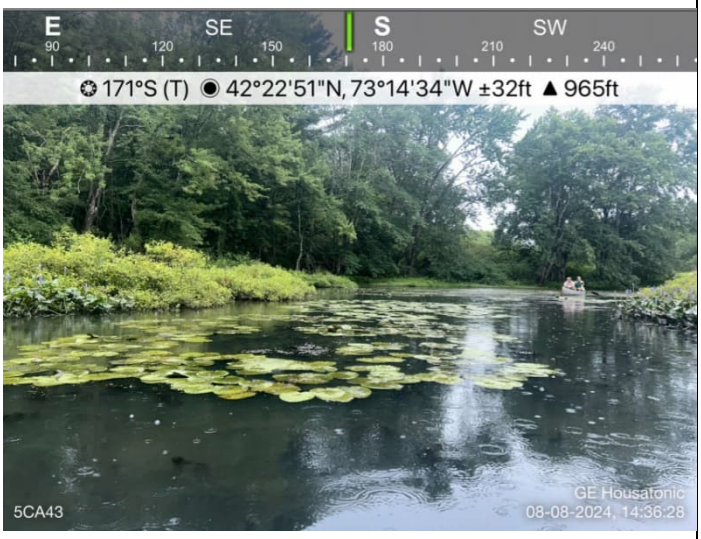
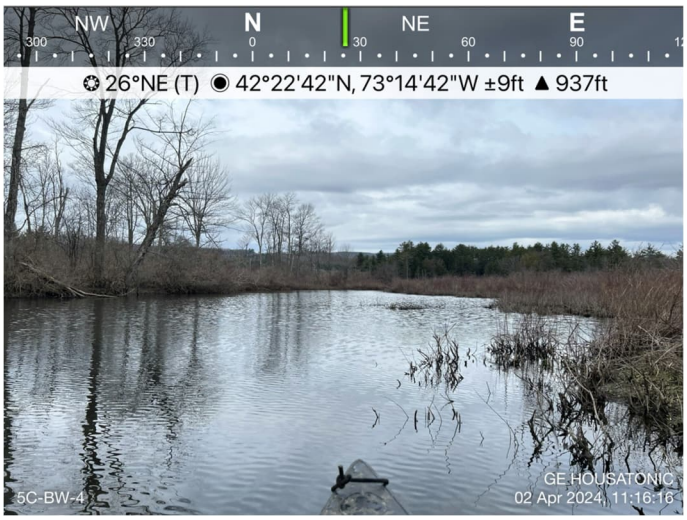




Photo No. 11	Date: 09/14/23	Photo No. 12	Date: 08/16/24
Description: 5C-BW-3. Photo Direction: S		**Description:** 5C-BW-4. Photo Direction: N	

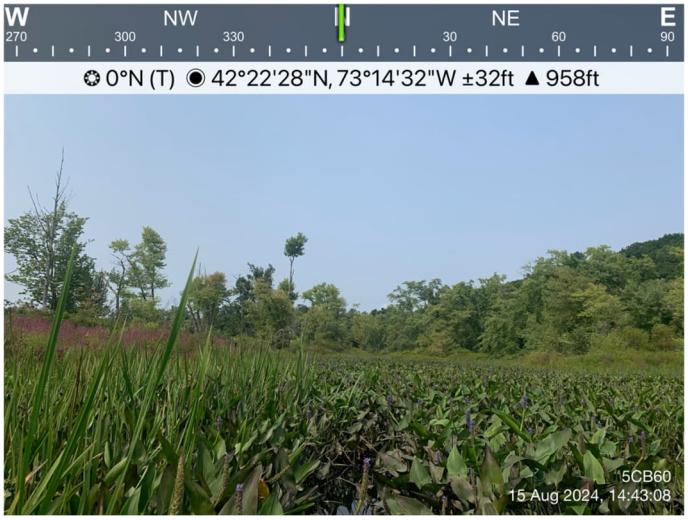




PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 13	Date: 08/15/24	Photo No. 14	Date: 04/17/24
Description: 5C-BW-5 Photo Direction: N		**Description:** 5B-BW-6. Photo Direction: N	



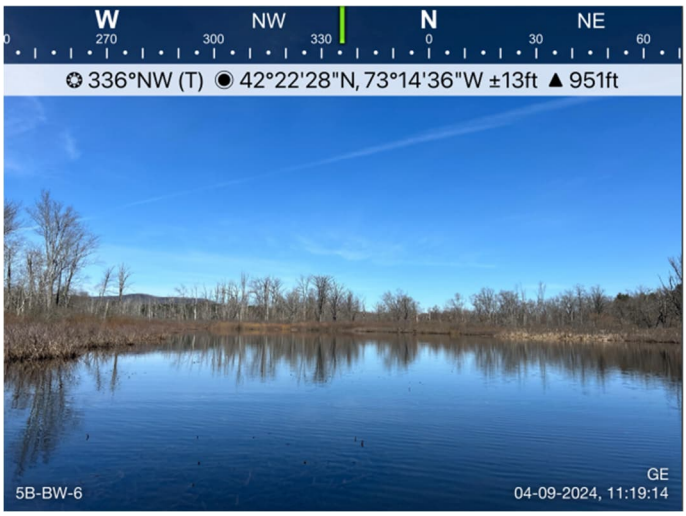


Photo No. 15	Date: 08/16/24	Photo No. 16	Date: 05/10/24
Description: 5C-BW-7. Photo Direction: W		**Description:** 5C-BW-8. Photo Direction: SW	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

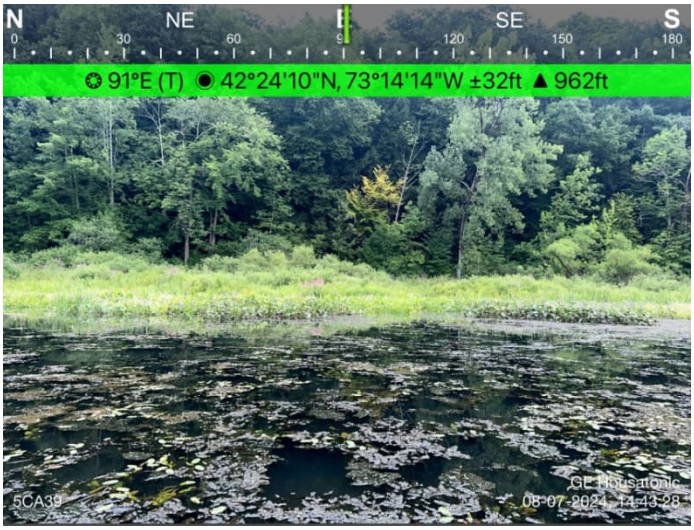
Photo No. 17	Date: 04/27/23	Photo No. 18	Date: 03/19/24
Description: 5C-BW-9. Photo Direction: NE		**Description:** 5C-BW-10. Photo Direction: NA	





Photo No. 19	Date: 08/07/24	Photo No. 20	Date: 08/07/24
Description: 5C-BW-11. Photo Direction: N		**Description:** 5C-BW-12. Photo Direction: E	





PHOTOGRAPHIC LOG

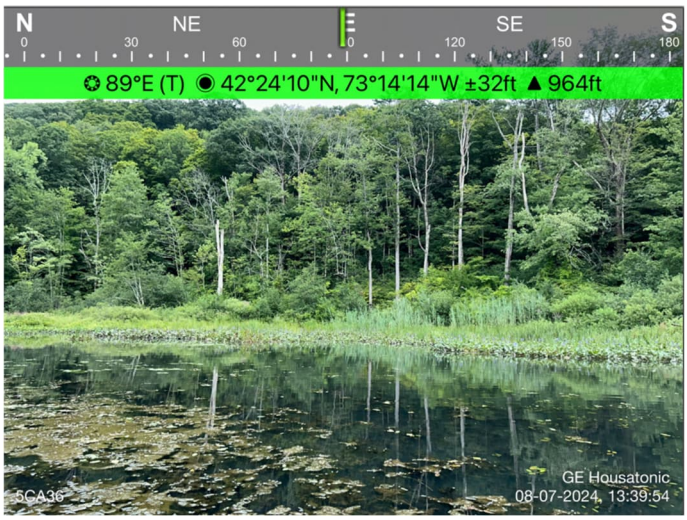
Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

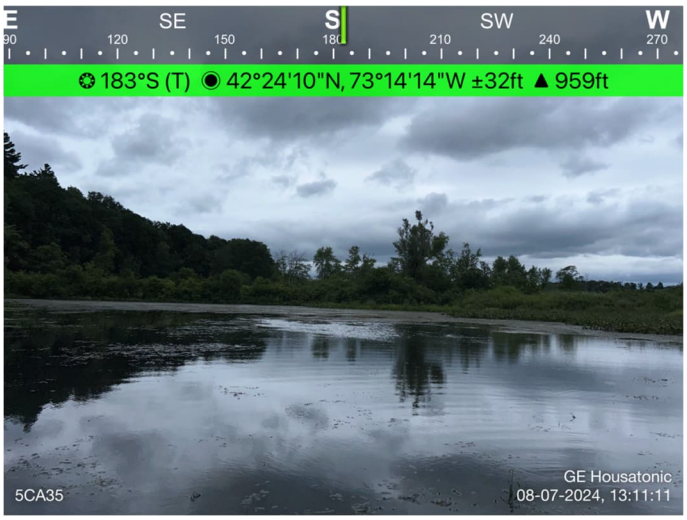
Photo No. 21	Date: 04/27/23	Photo No. 22	Date: 08/07/24
Description: 5C-BW-13. Photo Direction: S		**Description:** 5C-BW-14. Photo Direction: N	





Photo No. 23	Date: 08/07/24	Photo No. 24	Date: 08/07/24
Description: 5C-BW-15. Photo Direction: E		**Description:** 5C-BW-16. Photo Direction: S	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 25	Date: 04/10/24	Photo No. 26	Date: 05/09/23
Description: 5C-BW-17 Photo Direction: N		**Description:** 5C-BW-18. Photo Direction: S	

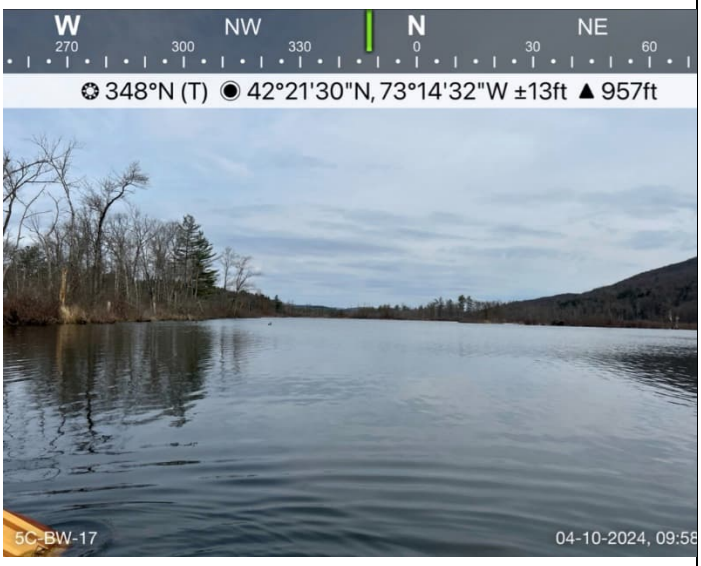
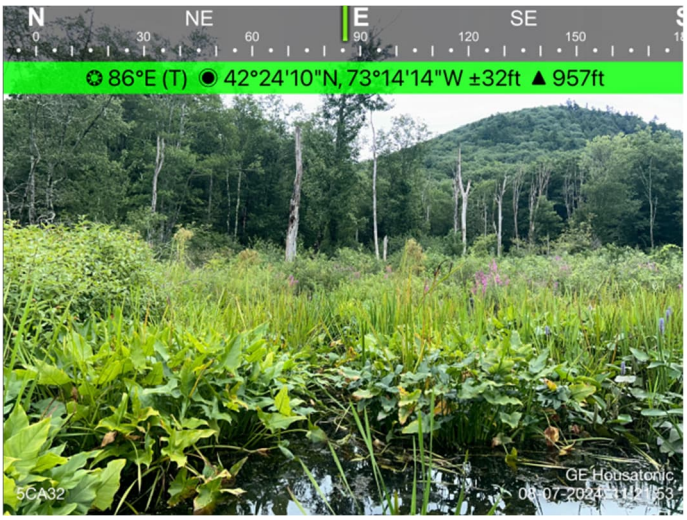
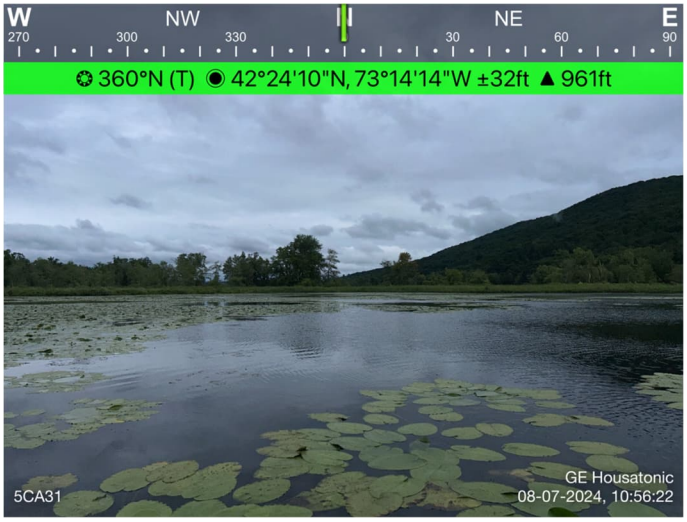




Photo No. 27	Date: 08/07/24	Photo No. 28	Date: 08/07/24
Description: 5C-BW-19. Photo Direction: E		**Description:** 5C-BW-20. Photo Direction: N	





AECOM

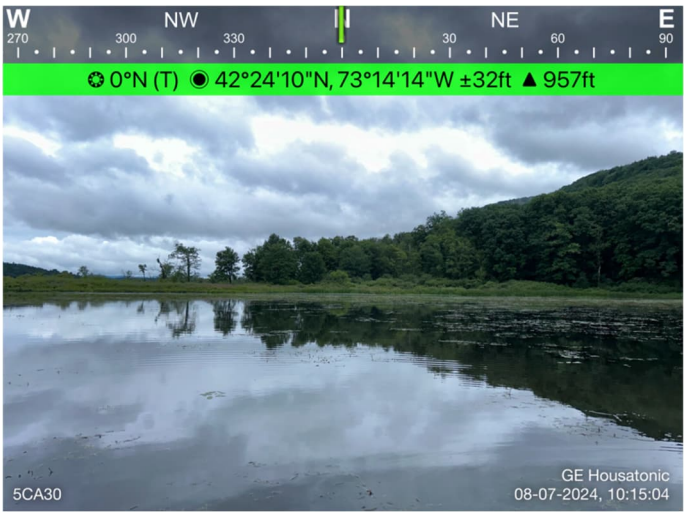
PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 29	Date: 08/07/24	Photo No. 30	Date: 05/06/24

Description: 5C-BW-21.

Photo Direction: N



Description: Painted turtles basking on woody debris in 5B-BW-20.

Photo Direction: NA

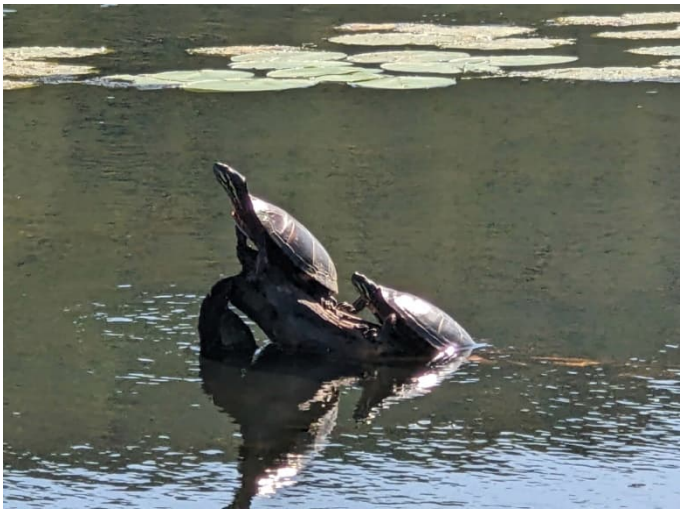


Photo No. 31	Date: 05/10/24	Photo No. 32	Date: 08/07/24

Description: Beaver dam in 5C-BW-6.

Photo Direction: N



Description: Active beaver lodge and large snag in 5C-BW-18.

Photo Direction: W



Appendix D

Floodplain Habitat Information

D.1 Floodplain Habitat Photo Log

D.2 Form FP-1 (Blank)

D.3 Incidental Wildlife Observations During Floodplain Surveys

Appendix D.1

Floodplain Habitat Photo Log

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 1	Date: 07/23/24	Photo No. 2	Date: 08/16/24
Description: Cultural grasslands natural community in Reach 5B. Photo Direction: E		**Description:** Agricultural fields in Reach 5B. Photo Direction: NE	



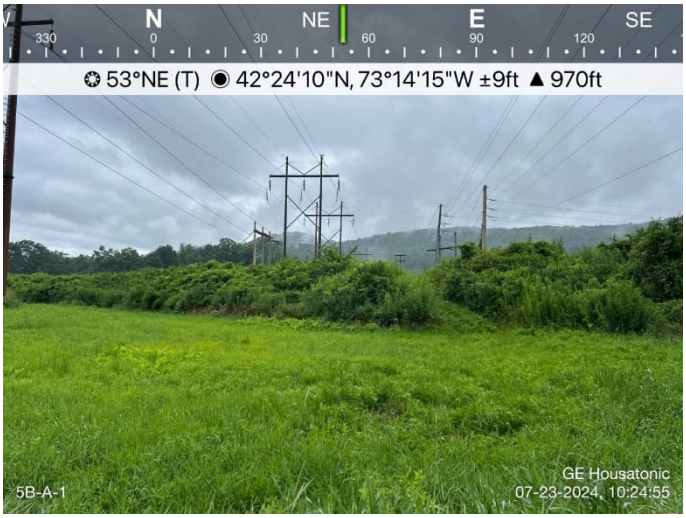


Photo No. 3	Date: 07/24/24	Photo No. 4	Date: 07/30/24
Description: Northern hardwoods-hemlock-white pine forest natural community in Reach 5B. Photo Direction: E		**Description:** Northern hardwoods-hemlock-white pine forest natural community in Reach 5C. Photo Direction: S	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 5	Date: 08/16/24	Photo No. 6	Date: 07/30/24
Description: Rich mesic forest natural community in Reach 5C. Photo Direction: S		**Description:** Red oak-sugar maple transition forest community in Reach 5B. Photo Direction: E	





Photo No. 7	Date: 09/14/23	Photo No. 8	Date: 07/30/24
Description: Red oak-sugar maple transitions forest natural community in Reach 5C. Photo Direction: E		**Description:** High-terrace floodplain forest natural community in Reach 5B. Photo Direction: N	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 9	Date: 07/25/24	Photo No. 10	Date: 07/30/24
Description: Transitional floodplain forest community in Reach 5B. Photo Direction: E		**Description:** Transitional floodplain forest natural community in Reach 5C. Photo Direction: N	





Photo No. 11	Date: 07/24/24	Photo No. 12	Date: 07/24/24
Description: Red maple swamp natural community in Reach 5B. Photo Direction: W		**Description:** Red maple swamp natural community in Reach 5C. Photo Direction: NW	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 13	Date: 08/01/24	Photo No. 14	Date: 08/02/24
Description: Red maple, black ash, bur oak swamp grading into shrub swamp habitats in Reach 5C. Photo Direction: NW		**Description:** Red maple, black ash, bur oak swamp in Reach 5C Photo Direction: S	





Photo No. 15	Date: 07/25/24	Photo No. 16	Date: 08/16/24
Description: Buttonbush shrub swamp in Reach 5B. Photo Direction: E		**Description:** Shrub swamp dominated by speckled alder in Reach 5C. Photo Direction: N	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 17	Date: 05/10/24	Photo No. 18	Date: 05/08/24
Description: Shrub swamp dominated by silky dogwood in Reach 5C. Photo Direction: W		**Description:** Deep emergent marsh community in Reach 5B. Photo Direction: S	





Photo No. 19	Date: 08/07/24	Photo No. 20	Date: 05/13/24
Description: Deep emergent marsh community in Reach 5C. Photo Direction: NW		**Description:** Fine-leaved shallow and deep emergent marsh communities in Reach 5B. Photo Direction: E	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 21	Date: 05/15/24	Photo No. 22	Date: 07/24/24

Description: Shallow emergent marsh natural community in Reach 5B

Photo Direction: NE



Description: Wet meadow natural community in Reach 5B.

Photo Direction: S



Photo No. 23	Date: 05/13/24	Photo No. 24	Date: 05/02/23

Description: Moderately alkaline lake/pond natural community in Reach 5C.

Photo Direction: N



Description: Moderately alkaline lake/pond natural community in Reach 5B.

Photo Direction: NE



AECOM

PHOTOGRAPHIC LOG

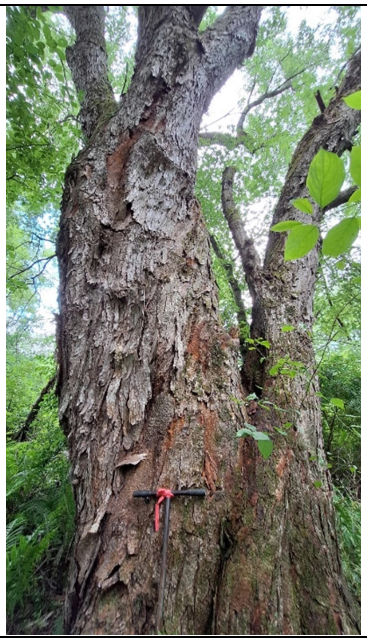
Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 25	Date: 05/04/23	Photo No. 26	Date: 09/20/23
Description: High gradient stream natural community surrounded by red maple swamp in Reach 5C. Photo Direction: W		**Description:** Low gradient stream natural community (Housatonic River) in Reach 5C. Photo Direction: N	





Photo No. 27	Date: 07/31/24	Photo No. 28	Date: 08/07/24
Description: 6-foot dbh silver maple tree with cavities in Reach 5B. Photo Direction: S		**Description:** 38-inch dbh bur oak tree in Reach 5C Photo Direction: S	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 29	Date: 07/23/24	Photo No. 30	Date: 03/19/24
Description: Osprey nesting on powerline in disturbed/developed area of Reach 5B. Photo Direction: NA		**Description:** Bald eagle perched on snag in Reach 5C. Photo Direction: NA	





Appendix D.2

Form FP-1 (Blank)

General Electric Housatonic Rest of River
Form FP-1: Floodplain Habitat Inventory Form

I. General Information

Site Name and Evaluation Area (including whether wetland or upland)

Location/Physical Description

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

Field Staff Performing Evaluation | Date this form was completed

II. Site Description

A. Hydrology/Water Regime

- ☐ Permanently flooded
- ☐ Intermittently exposed
- ☐ Semi-permanently flooded
- ☐ Seasonally flooded
- ☐ Upland
- ☐ Saturated
- ☐ Temporarily flooded
- ☐ Intermittently flooded
- ☐ Artificially flooded

Estimated Flooding Regime: __Flooded Annually __2-Year Flood __10-Year __100-Year Flood
Notes:

B. Community Cover Type(s)

Wetland

- ☐ Transitional floodplain forest
- ☐ High terrace floodplain forest
- ☐ Red maple swamp
- ☐ Vernal pool
- ☐ Black ash-red maple-tamarack calcareous seepage swamp
- ☐ Deep emergent marsh
- ☐ Shallow emergent marsh
- ☐ Shrub swamp
- ☐ Wet meadow
- ☐ Other _____

Upland

- ☐ Northern Hardwoods-Hemlock-White Pine Forest
- ☐ Rich mesic forest
- ☐ Red Oak-Sugar Maple Transition Forest
- ☐ Agricultural fields
- ☐ Cultural grassland
- ☐ Successional northern hardwoods
- ☐ Spruce-fir-northern hardwood forest
- ☐ Developed/disturbed cover types
- ☐ Other _____

Notes:

Bordering Riverine/Aquatic Habitat

- ☐ High-gradient stream
- ☐ Low-gradient stream
- ☐ Medium-gradient stream
- ☐ Moderately alkaline lake/pond
- ☐ Backwater
- ☐ Other: _____

C. Inventory (Plant community: tree and vine data obtained in a 30' radius plot; shrubs in a 15' radius plot; and herbaceous plant data in a 5' radius plot.)

% Cover: _____ Trees (> 20') _____ Shrubs (< 20') _____ Woody vines _____ Mosses _____ Herbaceous

Plant Lists (species that comprise 10% or more of the vegetative cover in each strata or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

D. Inventory (Soils)

_____ Soil Survey Unit _____ Drainage Class

_____ Texture (upper part) _____ Depth

Representative Soil Pit Log

Soil Horizon	Depth (inches)	Color	Soil Texture	Mottling

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Shrub thickets with suitable earthworm habitat (American woodcock)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Shrub and/or herbaceous vegetation (suitable for birds such as veery nesting)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Trees (live or dead) > 30” DBH

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Standing dead trees (potential for cavities and perches)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Tree cavities in trunks or limbs

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Small mammal burrows:

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Rocks, crevices, hollow logs, tree roots or hummocks (for multiple wildlife habitat purposes)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Live or dead standing vegetation overhanging water or offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Depressions that may serve as seasonal (vernal/autumnal) pools

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Standing water present at least part of the growing season, suitable for use by

☐ Breeding amphibians ☐ Non-breeding amphibians (foraging, re-hydration)

☐ Turtles ☐ Foraging waterfowl

Sphagnum hummocks or mats, moss-covered logs or saturated logs, overhanging or directly adjacent to pools of standing water in spring (four-toed salamander)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Wildlife Dens/Nests (if observed)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

Other nests or dens (identify species): _____

Emergent Wetlands (if Applicable)

Persistent emergent wetland vegetation at least seasonally flooded during the growing season (American bittern, wood duck, green heron, black-crowned night heron, rails [sora, king, Virginia], moorhen, coot, etc.)

Flooded > 5 cm ☐ Present ☐ Absent

Flooded > 25 cm (pied-billed grebe) ☐ Present ☐ Absent

Fine-leafed emergent vegetation (grasses and sedges) at least seasonally flooded during the growing season (common snipe, spotted sandpiper, sedge wren)

Flooded > 5 cm ☐ Present ☐ Absent

Flooded > 25 cm (least bittern, common moorhen) ☐ Present ☐ Absent

Notes:

IV. Connectivity with Adjoining Natural Habitats

☐ No direct connections to adjacent areas of wildlife habitat (no connectivity function)

☐ Limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)

☐ Area is embedded in a large area of natural habitat with unimpeded connection to other habitats (high connectivity function)

V. Rare Species and MNHESP Core Area Habitat Designation

☐ Core Area 1 ☐ Core Area 2 ☐ Core Area 3 ☐ Core Area 4

☐ Federally listed threatened or endangered species habitat (including species with known overlapping habitat):

☐ State-listed species habitat (including species with known overlapping Priority Habitat):

Rare species direct observations during current field surveys (list):

VI. Incidental Direct Wildlife Observations

VII. Habitat Degradation (identify specific location within area if applicable)

☐ Evidence of significant levels of dumping

☐ Evidence of significant erosion or sedimentation problems

☐ Presence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _____

☐ Disturbance from roads or highways ☐ Evidence of fire

☐ Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

☐ Potential suitability of area for access road or staging area

☐ Presence of potential restoration resources (e.g., boulders, large trees or woody debris, plant propagation source material). Identify specific items: _____

_____

☐ Other restoration opportunities: _____

_____

_____

_____

Appendix D.3

Incidental Wildlife Observations During Floodplain Surveys

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 9/14/2023

Time: 1000-1220

Weather: Partly Cloudy

Team member(s): SE, TO

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
1000	Small Mammal	No	Porcupine	190	Other	Snapped branch (branch from basswood on the ground)
1020	Bird	No	Crow	Near 190	Call/Animal	Flying
1130	Large mammal	No	Black Bear	Near 199	Track	Trail
1130	Small mammal	No	Beaver	198	Other	Snipped limbs
1140	Bird	No	Canada Goose	198	Animal	Flying
1200	Bird	No	Cedar Waxwing	198	Animal/Call	1 individual observed in flight, many others heard calling
1200	Bird	No	Hummingbird	198	Animal	1 individual flying
1200	Insect	No	Dragonfly	198	Animal	1 individual flying
1220	Amphibian	No	Green Frog	Stream leading into BW5C-21	Animal	Multiple Individuals

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 9/20/2023						
Time: 0830-1400						
Weather: Sunny						
Team member(s): TF, WM, SE, TO						
Team activity: Floodplain Surveys/Vegetation Plot Assessments						
Details of Observations:						
Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
	Bird	Photo	Juvenile Bald Eagle	Paddling to site (Plot 183)	Animal	Roosting, then flying
	Bird	No	Green Heron	183	Animal	Fly-over
	Bird	Photo	Great Egret	Paddling to site (Plot 183)	Animal	Wading, then flying
	Bird	No	Great Blue Heron	183	Animal	Wading
	Bird	No	Osprey	183	Animal	Fly-over
	Bird	No	Common Yellowthroat	241	Animal	In brush
	Bird	No	Cormorant (unknown species)	241	Animal	Fly-over
	Bird	No	Bluejay	189	Animal	In trees
	Bird	No	Bluejay	188	Animal	In trees
	Mammal	No	Beaver	188	Other	Fresh gnawing on red maple trees
	Amphibian	No	Lithobates sp. larvae	191	Animal	Assumed *L. clamitans*
	Bird	No	Cedar Waxwing	204	Animal	In brush
	Bird	No	American Goldfinch	203	Call	In nearby habitat

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1400	Bird	No	Cedar Waxwing	210	Animal/Call	Perched in a tree
1400	Bird	No	Goldfinch	210	Animal/Call	Flying
	Bird	No	Mallards	BW5C-21	Animal	Flying, swimming
	Bird	No	Canada Goose	BW5C-20	Animal	Flying, swimming

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 9/21/2023

Time: 0940-1300

Weather: Sunny

Team member(s): SE, TO

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0940	Bird	GPS Coordinates	Carolina Wren	202	Call	
1000	Bird	GPS Coordinates	Chickadee	202	Animal/Call	Flying/feeding
1008	Mammal	No	Chipmunk	201, 202, 208	Animal/Call	Alarm Call
1050	Bird	No	Goldfinch	209	Call	
1050	Bird	No	Bluejay	209	Call	
1300	Fish	GPS Coordinates	Largemouth Bass		Animal	swimming
1300	Bird	No	Pileated woodpecker	Upland Forest	Animal/Call	Flying/feeding

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 7/23/2024

Time: 1000-1330

Weather: Cloudy

Team member(s): SE, TF, TW, AL

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
1000	Amphibian	No	Leopard Frog	8	Animal	Moving
1040	Bird	No	Kingfisher	7	Animal	Flying
1040	Bird	No	Red-tailed Hawk	6	Animal	Perch/Flight
1110	Bird	No	Woodcock	6	Call	Flight/Song
1110	Bird	No	Cedar Waxwing	6	Animal	Flight/Perch/Song
1123	Bird	No	Tufted Titmouse	6	Call	Song in shrubs
1123	Bird	No	Goldfinch	6	Call	Song in shrubs
1147	Bird	No	Eastern Kingbird	West of 6	Animal	Flight
1200	Amphibian	No	Green Frog	GPS Coordinates	Egg mass	
1211	Bird	No	Great Blue Heron	Edge of river	Animal	Hunting/Flight
1230	Bird	No	Downy Woodpecker	5	Call	Flight
1230	Bird	No	Northern Flicker	5	Animal/Call	Flight
1245	Bird	No	American Robin	GPS Coordinates	Call	Flight

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1245	Bird	No	Catbird	GPS Coordinates	Call/Animal	Flight
1245	Bird	No	Hummingbird	GPS Coordinates	Animal	Feeding
1245	Bird	No	Song Sparrow	GPS Coordinates	Call	In backwater
1330	Bird	No	Osprey	14	Call	Flight
1330	Bird	No	Raven	14	Call/Animal	Flew to nest on structure at EPRI

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 7/24/2024

Time: 0830-1303

Weather: Partly Cloudy/Cloudy

Team member(s): TW, TF, SE, AL

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0830	Amphibian	GPS Coordinates	Green Frog	5B-VP-19	Call	Breeding, full chorus
0840	Amphibian	GPS Coordinates	Green Frog	5B-VP-5	Call	Breeding, full chorus
0845	Mammal	GPS Coordinates/ Photo	Black Bear	ROW	Bed/Sign	
0845	Bird	No	Canada Geese	13	Call	From South
0900	Bird	No	Great Blue Heron	13	Call	In adjacent wetland
0900	Bird	No	Green Heron	13	Call	In adjacent wetland
0930	Fish	No	Brook Trout	GPS Coordinates	Animal	Swimming
0930	Bird	No	Bluejay	37	Call	Flight
0930	Bird	No	Great Blue Heron	37	Animal	Flying
0945	Amphibian	No	American Toad	GPS Coordinates	Animal	
0950	Amphibian	No	Wood Frog	GPS Coordinates	Animal	
1000	Bird	No	Barred Owl	East of 36	Animal	Flight
1015	Bird	No	Goldfinch	36	Call	Flight
1020	Bird	No	Red-tailed Hawk	GPS Coordinates	Animal	Feeding/Flight

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1057	Mammal	No	Black Bear	1	Animal	Running through swamp
1057	Bird	No	Great Blue Heron	1	Animal	Jumped into air by running bear
1303	Bird	No	Eastern Wood Pewee	12	Call	Flight

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 7/25/2024

Time: 0845-1503

Weather: Cloudy

Team member(s): SE, TW, AL

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0845	Bird	No	Wood Pewee	20	Call	
0845	Bird	No	Red Eyed Vireo	GPS Coordinates	Call	
0930	Bird	No	Woodcock	GPS Coordinates	Call/Animal	Sitting on ground/flight
0930	Bird	No	Osprey	17	Animal	Flight
0930	Bird	No	Yellow Warbler	17	Call	
0930	Bird	No	Catbird	17	Call	
0930	Bird	No	Red-tailed Hawk	17	Animal/Call	Flight
1000	Bird	No	Turkey Vulture	17	Animal	Flight
1045	Bird	No	Yellow Throated Warbler	18	Animal/Call	Flight
1045	Bird	No	Hummingbird	18	Animal	Flight
1045	Bird	No	Ravens	Near 5B-VP-5	Animal/Call	Flight
1145	Bird	No	Kestrel	21	Animal/Call	Sitting on utility pole/flight
1230	Bird	No	Kestrel (2)	GPS Coordinates	Animals	Perched/Hunting

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1330	Bird	No	Green Heron	24	Animal	Flight
1345	Bird	No	Goldfinch	24	Animal	Flight
1503	Bird	No	Woodcock	GPS Coordinates	Animal	Sitting in tree/flight

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 7/26/2024

Time: 0830-1330

Weather: Sunny

Team member(s): TF, AL (with HDR: Steve)

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0830	Bird	No	Kestrel (3)	GPS Coordinates	Animal	Flight (3); 1 was also sitting on the utility structure
0845	Bird	No	Wood Thrush	32	Call	
0845	Bird	No	Great Crested Flycatcher	32	Call	
0945	Amphibian	No	Wood Frog	GPS Coordinates	Animal	Sitting on the ground on the edge of the vernal pool
1030	Bird	No	Downy Woodpecker	GPS Coordinates	Animal	Sitting in a tree
1045	Bird	No	Woodcock	GPS Coordinates	Animal	Sitting in a tree
1130	Bird	No	Chickadees	34	Call	
1140	Bird	No	Great Blue Heron	GPS Coordinates	Animal	Flight
1140	Bird	No	Goldfinches	GPS Coordinates	Call	
1140	Bird	No	Cedar Waxwing	GPS Coordinates	Call	
1330	Bird	No	Great Blue Heron	GPS Coordinates	Animal	Flight

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

6. If animal then record:

- **a. Behavior** Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
- **b.** Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
- **c. Life stage** Adult/Subadult/Juvenile/Unknown
- **d. Sex** Female/Male/Unknown
- **e. Other** Diseased/Injured/Dead – Describe
- **f. Number observed** Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 7/29/2024						
Time: 1000-1620						
Weather: Partly Cloudy						
Team member(s): TF, AL, SE (with HDR: Steve and Brett)						
Team activity: Floodplain Surveys						
Details of Observations:						
Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
	Bird	No	Yellow Warbler	49	Call	
	Bird	No	Yellow Throat	49	Animal/Call	Flight/Perched
1000	Birds	No	Cardinal, Crow, Goldfinch, Hawk	79	Call	
1130	Birds	No	Cardinal, Catbird, Red-eyed Vireo	71	Call	
1200	Birds	No	Eastern Wood Pewee, Song Sparrow, Red-eyed Vireo, Goldfinches	72	Call	
1200	Bird	No	Chickadee	52	Call	
1200	Bird	No	Hummingbird	52	Animal	Flight
1200	Bird	No	Hairy Woodpecker	52	Animal/Call	Flight
1200	Bird	No	Eastern Phoebe	52	Call	
1215	Bird	No	Downy Woodpecker	52	Animal/Call	Perched/feeding
1230	Amphibian	No	Green Frog	GPS Coordinates	Animal	Sitting on a log
1254	Bird	No	Red-winged Blackbird	53	Animal/Call	
1315	Bird	No	Flicker	66	Call	
1330	Bird	No	Great Blue Heron	GPS Coordinates	Animal	Flight

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1330	Bird	No	Bluebird	54	Animal	Flight
1330	Bird	No	Flicker	54	Call	
1400	Birds	No	Catbird, Goldfinch, Song Sparrow	65	Call	
1500	Birds	No	Song Sparrow, Catbird, Goldfinch	60	Call/Animal	Flight
1530	Bird	No	Bittern	GPS Coordinates	Animal/Call	Flight
1545	Bird	No	Ruby-throated Hummingbird	59	Animal	Flight/perched on a branch
1550	Bird	No	Swamp Sparrow	62	Animal	Flight
1550	Bird	No	Cedar Waxwing	62	Call	
1610	Bird	No	Hummingbird	62	Animal	Flight/Perch
1620	Bird	No	Bald Eagle (Juvenile)	GPS Coordinates	Animal	Flight

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 7/30/2024

Time: 0830-1140

Weather: Sunny

Team member(s): TF, AL, SE

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0830	Bird	No	Goldfinches	GPS Coordinates	Animal	Sitting on a tree branch
0830	Bird	No	Flycatcher	GPS Coordinates	Animal	Sitting on vegetation in a meadow
0900	Bird	No	Swamp Sparrow	61	Call	
0900	Bird	No	Red-shouldered Hawk	61	Call	
0915	Bird	No	Great Blue Heron	64	Animal	Flight
0915	Birds	No	Crow, Catbird, Goldfinch, Red-eyed Vireo, Red-winged Blackbird	64	Call	
0930	Mammal	No	Deer	67	Track	Tracks, Trails and Beds
0950	Bird	No	Red-tailed Hawk	69	Animal/Call	Perched on tree/flight
1000	Bird	No	American redstart	67	Call	
1000	Bird	No	Red-winged Blackbird	67	Call	
1000	Bird	No	Cedar Waxwing	67	Call	
1000	Bird	No	Red-shouldered Hawk	67	Call	
1000	Bird	No	Black-capped Chickadee	67	Call	

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1015	Bird	No	Red-shouldered Hawk	69	Call	
1140	Bird	No	Kingfisher	GPS Coordinates	Call	
	Amphibian	No	Bullfrog	GPS Coordinates	Call	
	Amphibian	No	Greenfrog	5C-VP-1	Call	
	Reptile	No	Garter Snake	5C-VP-1	Animal	Basking
	Mammal	No	Black Bear	5C-VP-1	Scat/Other	Scat/Logs rolled

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 7/31/2024						
Time: 0930-1315						
Weather: Showers/Partly Cloudy						
Team member(s): SE, TW, AL (with HDR: Steve and Brett)						
Team activity: Floodplain Surveys						
Details of Observations:						
Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0930	Reptile	No	Painted Turtle	GPS Coordinates	Animal	Sitting on a log
0930	Bird	No	Great Blue Heron	GPS Coordinates	Animal	Flight
1011	Bird	No	Sandpiper	GPS Coordinates	Animal	Foraging along riverbank; flight
1025	Mammal	No	Muskrat	GPS Coordinates (near 55)	Animal	Swimming around vegetation in river
1045	Bird	No	Mallards	GPS Coordinates (near 55)	Animal	2 hens swimming with 5 ducklings
1050	Bird	No	Black and White Warbler	GPS Coordinates	Animal	Sitting in a sugar maple
1105	Reptile	No	Painted Turtles (3)	GPS Coordinates	Animal	Sitting on riverbank/logs
1107	Bird	No	Sandpiper	GPS Coordinates	Animal	Foraging along riverbank
1109	Bird	No	Swamp Sparrow	GPS Coordinates	Animal	Sitting on a log near the riverbank
1140	Bird	No	Kingfisher	68	Animal/Call	Flight
1145	Bird	No	Hummingbird	68	Animal	Flight
1215	Reptile	No	Painted Turtles (10)	GPS Coordinates	Animal	Basking on logs
1230	Bird	No	Hummingbird	75	Animal	Flight

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1305	Bird	No	Kingfisher (2)	78	Animal/Call	Flight
1315	Bird	No	Cedar Waxwing	78	Call	

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 8/1/2024						
Time: 0945-1600						
Weather: Sunny						
Team member(s): SE, AL, TF (with HDR: Steve and Brett)						
Team activity: Floodplain Surveys						
Details of Observations:						
Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0945	Birds	No	Ruby-throated Hummingbird, Catbird, Great Blue Heron, Red-tailed Hawk	112	Call/Animal	
0945	Insect	No	Bumble Bee	112	Animal	
0947	Bird	No	Red-shouldered Hawk	4	Animal/Call	Far off call; flight at 1000
1000	Birds	No	Red-tailed Hawk, Broad-winged Hawk	4	Animal	Flight
1005	Bird	No	Eastern King Birds	4	Animal/Call	Perched on tree
1005	Bird	No	Kingfisher	4	Animal/Call	Flight
1030	Birds	No	Pileated Woodpecker, Grackle, Catbird, Carolina Wren, Great Blue Heron	111	Call/Animal	
1030	Bird	No	Red-shouldered Hawk	85	Call	
1040	Bird	No	Cardinal	85	Call	
1120	Amphibian	No	Pickerel Frog	88	Animal	In shallow water along the river's edge
1150	Birds	No	Tufted titmouse; catbird	88	Call	
1200	Birds	No	Goldfinch, Red-bellied Woodpecker, Catbird, Grackle	113	Animal/Call	

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1235	Birds	No	Juvenile Red-tailed Hawk, Goldfinch, Catbird, Song Sparrow	121	Animal	
1300	Bird	No	Woodcock	Near 97	Animal	Flight
1425	Bird	No	Red-tailed Hawk	96	Animal/Call	Perched in tree; flight
1515	Birds	No	Goldfinch, Kingbird, Catbird	126	Animal/Call	
1530	Bird	No	Red-shouldered Hawk	101	Animal/Call	Flight
1545	Birds, Insects	No	Monarch, Fritillary sp., Goldfinch, Bumble Bee, Spotted Sandpiper	132	Animal	Spotted sandpiper was observed on the mudflat on the way to Plot 132
1600	Birds, Insects	No	Goldfinch, Catbird, Bluejay, Song Sparrow, Cedar Waxwing, Monarch, Bumble Bee	130	Animal/Call	Flight

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 8/2/2024

Time: 0815-1250

Weather: Partly Cloudy

Team member(s): SE, AL, TF

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0815	Birds	No	Kingfisher, Bluejay, Great Blue Heron, Cardinals, Goldfinch	In river while paddling downstream to 102	Animal/Call	
0815	Birds	No	Mallards	In river while paddling downstream to 102	Animal	Female mallard with 6 ducklings
0815	Bird	No	Red-shouldered Hawk	In river while paddling downstream to 102	Animal	Flight
0815	Reptile	No	Painted Turtles	In river while paddling downstream to 102	Animal	
0815	Mammal	No	Muskrat	In river while paddling downstream to 102	Animal	
0915	Birds	No	Juvenile Red-tailed Hawk, Catbird, Willow Flycatcher	118	Animal/Call	PFO/SS1
0930	Bird	No	Red-tailed Hawk	107	Animal/Call	Flight; perched
0950	Birds	No	White-breasted Nuthatch, Goldfinch, Common Yellowthroat,	125	Call	PFO/SS1

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

			Catbird, Carolina Wren, Eastern Wood Pewee			
1000	Bird	No	Red-shouldered Hawk	107	Call	
1110	Birds, Insect	No	Ruby-throated Hummingbird, Mourning Dove, Catbird, Bluejay, Wood Pewee, Raven, Monarch	129	Animal/Call	PFO1 (transitional floodplain forest)
1205	Bird	No	American Redstart	GPS Coordinates	Call	
1220	Bird	No	Great Blue Heron, Catbird	138	Call	Great Blue Heron was heard in the distance
1250	Birds, Insect	No	Flicker, Catbird, Downy Woodpecker, Spicebush Swallowtail	139	Animal/Call	

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 8/7/2024

Time: 0945-1545

Weather: Cloudy

Team member(s): SE, AL (with HDR: Steve and Brett)

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0945	Bird	No	Kingfisher	Decker Boat Launch	Call	
1000	Mammal	No	Beaver	GPS Coordinates	Animal	Swimming
1100	Bird	No	Hummingbird	162	Animal	Flight
1130	Bird	No	Cooper's Hawk	GPS Coordinates	Animal	Flight
1150	Bird	No	Red-shouldered Hawk	161	Animal/Call	Perched and flight
1250	Bird	No	Red-shouldered Hawk	155	Animal/Call	Perched
1345	Bird	No	Red-bellied Woodpecker	146	Call	
1350	Amphibian	No	Spring Peeper	146	Call	
1355	Bird	No	Great Blue Heron	146	Animal	Flight
1450	Bird	No	Barred Owl	142	Call	
1545	Amphibian	No	Green Frog	143	Animal	

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    - **a. Behavior** Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    - **b.** Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    - **c. Life stage** Adult/Subadult/Juvenile/Unknown
    - **d. Sex** Female/Male/Unknown
    - **e. Other** Diseased/Injured/Dead – Describe
    - **f. Number observed** Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 8/8/2024

Time: 0915-1350

Weather: Cloudy

Team member(s): SE, AL

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0915	Bird	No	Osprey	Near launch (farm near EPRI site)	Animal/Call	Flight
0930	Bird	No	Kestrel	Along river between launch (farm near EPRI site) and Plot 4	Animal/Call	Flight
0930	Reptile	No	Painted Turtle	Along river between launch (farm near EPRI site) and Plot 4	Animal	Perched on log
1115	Amphibian	No	Green Frogs	BW5B-3	Call	
1310	Bird	No	Red-shouldered Hawk	BW5B-6	Animal/Call	Perched and flight
1310	Bird	No	Great Blue Heron (2)	BW5B-6	Animal	Foraging and flight
1345	Bird	No	Phoebe	GPS Coordinates	Animal	Flight
1350	Bird	No	Osprey	Between BW5B-6 and BW5B-8	Animal	Flight

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

e. **Other** Diseased/Injured/Dead – Describe

f. **Number observed** Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 8/15/24

Time: 0930-1710

Weather: Cloudy

Team member(s): SE, AL

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0930	Bird	No	Great Blue Heron	BW5C-12	Animal	In Flight
1200	Bird	No	Goldfinch	BW5C-6	Animal/Call	Flight
1235	Bird	No	Red-shouldered Hawk	BW5C-3	Animal/Call	Flight
1340	Bird	No	Kingfisher	BW5C-4	Animal/Call	Flight
1340	Amphibian	No	Green Frog	BW5C-4	Call	
1440	Bird	No	Barred Owl	BW5C-5	Call	
1445	Bird	No	Great Blue Heron	BW5C-5	Animal	Flight
1445	Reptile	No	Painted Turtle	BW5C-5	Animal	Swimming
1530	Amphibian	No	Green Frog	BW5C-8	Call	
1600	Reptile	No	Snapping Turtle	In river near BW5C-8	Animal	Swimming
1610	Bird	No	Bald Eagle	BW5C-8	Animal	Perched on snag; flight with prey in talons
1610	Reptile	No	Painted Turtle	BW5C-8	Animal	Basking
1645	Bird	No	Mallard	GPS Coordinates	Animal	Preening

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

1710	Reptile	No	Painted Turtle	BW5C-10	Animal	

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 8/16/2024

Time: 0815

Weather: Cloudy

Team member(s): SE, AL

Team activity: Floodplain Surveys

Details of Observations:

Time	Observation[1]	Data Collected:[2]	Species Observed[3]	Location[4]	Observation Type[5]	Behavior/Condition Description/Habitat Type[6]
0815	Amphibian	Photo	Red-spotted newt	GPS Coordinates	Animal	Walking on the ground

1. **Observation**: Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
2. **Data Collected:**
    a. Photos/video: Yes (number)/No
    b. Sketch: Yes (attach)/No
3. **Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
4. **Location:** Station #/GPS coords/Description
5. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
6. **If animal then record:**
    a. Behavior Rest or Roost/Feeding/Watering/Courtship/Reproduction/Territorial/Trapped/
    b. Nesting/Predation/Flying/Swimming/Running/Walking/Standing/Grooming/Other
    c. Life stage Adult/Subadult/Juvenile/Unknown
    d. Sex Female/Male/Unknown
    e. Other Diseased/Injured/Dead – Describe
    f. Number observed Individual/Pair/Family/Multiple (# or range)

Appendix E

Wetland Function and Value Assessment

Appendix E Wetland Functions and Values Assessment

1.0 Wetland Functions and Values

1.1 Introduction

This appendix presents an assessment of the ecological functions and services of the floodplain wetlands in Reaches 5B and 5C. This functional assessment utilized the information obtained in the wetland inventory described within the Reaches 5B and 5C BRA Report, along with the consolidation of previous documents. As noted in Section 6 of the report, the assessment of the existing functions was based primarily on the consolidation and collection of data on measurable and observable structural parameters that are known to give rise to the functions of the relevant habitats.

An initial step in any wetland functional assessment is to define the evaluation unit. All the wetlands in Reaches 5B and 5C are connected by surface waters, namely the Housatonic River and its floodplain and tributaries; further, these continue in a connected system both upstream and downstream of these reaches. However, for the purposes of wetland functional assessment, some divisions to this connected system is warranted. Accordingly, as described in the Revised Reaches 5B-8 Work Plan, the wetland functional assessment is based on a grouping of functional wetland units. The selected floodplain wetland functional units in Reaches 5B and 5C are depicted on Figure 6-4 and consists of the following:

- Area 5B-1: Wetlands in Reach 5B from the Reach 5A/5B boundary to New Lenox Road;
- Area 5B-2: Wetlands in Reach 5B from New Lenox Road to the Reach 5B/5C boundary; and
- Area 5C: Wetlands in all of Reach 5C.

1.2 Assessment Method

The floodplain wetland functional assessment draws upon the criteria and functions described in the USACE New England District's *The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach* (USACE Wetland Workbook Supplement; USACE New England District 1995). This approach is a multi-disciplinary assessment of wetland functions, including the following: groundwater recharge/discharge; floodflow alteration; fish and shellfish habitat; sediment, toxicant, and pathogen retention; nutrient removal, retention, and transformation; production export; sediment and shoreline stabilization; wildlife habitat; recreation; education and scientific value; uniqueness and heritage; visual quality and aesthetics; and threatened or endangered species habitat. The assessment is a qualitative description of the physical characteristics of the wetlands, including a determination of the principal functions exhibited. This method is not based on quantitative metrics, but rather provides criteria for assessing whether a wetland's characteristics could contribute to providing the functions listed above.

Table 6-13, which has been developed and adapted from the USACE Wetland Workbook Supplement cited above, lists the functions assessed in this process. In addition to a description of each function, that table lists the characteristics or criteria from Table 6-4 used in assessing the function. This functional assessment was conducted for each of the three functional wetland units described above. For each such functional unit, the functional assessment process was documented on a Wetland

Function Form (Form FP-2). This form lists each function and records the criteria considered in documenting the wetland characteristics that contributed to the functional assessment of the particular wetland functional unit. The completed forms for the three wetland functional units are provided at the end of this appendix.

The basic concept behind most wetland evaluation or assessment methods is that wetland characteristics contribute or give rise to wetland functions that have certain values to natural systems, including man. The relative significance of a particular wetland's role in providing certain functions can be determined by assessing the relative importance of certain characteristics that contribute toward a particular function(s) (e.g., the dominant vegetative class affects wildlife habitat value), and then weighing the various conditions which that characteristic may occur in wetlands (e.g., shallow marsh, wooded swamp, etc.). This concept is fundamental to the ACOE wetland evaluation procedure that was used to assess the functions and values of the wetlands in Reaches 5B and 5C.

In recent years there has been a general tendency to move away from numerical or quantitative wetland evaluation procedures. The basic understanding of how physical characteristics, setting, and other factors affect functional significance, however, has not changed appreciably. As stated in the Corps of Engineers' Descriptive Approach, "*…we advocate an approach that includes a qualitative description of the physical characteristics of the wetlands, identifies the functions and values exhibited, and most importantly, the basis for the conclusions using 'best professional judgment'*." Accordingly, rather than focus on model output results, the rationale encompassed in the evaluation procedure is on determining "principal functions and values". As noted in the Highway Methodology, functions and values of a wetland can be considered "principal" if they are an important physical component of a wetland ecosystem (function only) and/or are considered of special value to society from a local, regional, or national perspective.

1.3 Results

The results of the evaluation process are provided in the completed Wetland Function Forms FP-2 for the three wetland functional units. These results are summarized in Table E-1 below:

Table 2: Wetland Functional/Value Assessment Summary Table

Wetland ID	Wetland Functions and Values												
	GW Recharge Discharge	Floodflow Alteration	Fish and Shellfish Habitat	Sediment / Toxicant / Patho Retention	Nutrient Removal / Retention / Trans	Production Export	Sediment / Shoreline Stabilization	Wildlife Habitat	Recreation	Education/ Scientific Value	Uniqueness Heritage	Visual Quality / Aesthetics	T / E Species Habitat
5B-1	X	X	X	X	X	X	X	X	X	X	X	X	X
5B-2	X	X	X	X	X	X	X	X	X	X	X	X	X
5c	X	X	X	X	X	X	X	X	X	X	X	X	X

Abbreviations used in table: X = "Principal" function or value. Functions and values can be principal if they are an important physical component of a wetland ecosystem (function only), and/or are considered of special value to society, from a local, regional, and/or national perspective.

As shown in Table 2, and as also indicated on the completed Forms FP-2 provided after this summary text, principal functions and values of all three wetland functional units extend through all the

evaluation subject areas. In short, all three floodplain wetland areas are indicated to provide a full range of functions and values. The functional discussion below refers to the overall functions of Reaches 5B and 5C, focusing on the floodplain wetlands, but incorporating the overall ecological setting of the riverine/riparian system:

Groundwater Recharge/Discharge

Based upon landscape setting, soil conditions, and surficial geologic conditions, the floodplain wetlands in Reaches 5B and 5C provide conditions suitable for interactions between ground and surface waters. Much of the forested wetland area contains floodplain soils that are sufficiently sandy to afford vertical and horizontal movement of surface and ground waters. More permanently saturated wetland conditions typically contain finer grained and organic soils which tend to inhibit vertical groundwater interflow. Overbank flooding that is stored in the forested floodplain wetlands is at least partially infiltrated to the shallow groundwater table and moves laterally to discharge in the river. At other times, groundwater flow from the adjacent highlands may intersect the land surface within the floodplain of Reaches 5B and 5C (especially along the margins of vernal pools and other lower depressions) and discharge to the surface, contributing to base flow. The Housatonic River is a reflection of the regional groundwater table, and groundwater discharge to it provides base flow

Floodflow Alteration

Given the location and characteristics of Reaches 5B and 5C within the 10-year floodplain of the Housatonic River, this area provides floodflow alteration functions. These include not only the general provision of flood storage capacity, but also the function of providing temporary attenuation of the floodwaters, followed by a delayed and gradual release of the floodwaters draining back into the river. The characteristics within the floodplain wetlands that contribute to the latter floodflow alteration function include the surface topography and varied microtopographic surface features, the sinuous surface flow paths, the presence of dense herbaceous cover and shrubs in some pockets, and the dense mature woody vegetation that produces coarse woody debris. For example, vegetation impedes surface water flow and reduces the energy of storm runoff, causing water to deposit sediment and debris. Heavy vegetation, including dense areas of herbaceous and shrub species and mixed age classes of trees, slows flow and provides areas of slack water, allowing more water to seep down through soil and be stored as groundwater. Microtopographic complexity increases the tortuosity of flow pathways, reduces average velocity, and increases the gradient of moisture conditions. Coarse woody debris, derived from large trees, blocks flows and modifies flow patterns. These characteristics create naturally produced roughness, which increases flow resistance on the floodplain. This flow resistance, in turn, enhances retention of floodwaters, reduces erosion, increases infiltration, increases retention of inorganic sediments and organic particulates, and diversifies both moisture gradients and microhabitats for biota. Downstream of New Lenox Road, particularly in the lower portion of Reach 5C, the floodflow attenuation functions become integrated with the storage and release functions afforded by Woods Pond Dam.

Water Quality Maintenance, Nutrient Processing, and Production Export

The separate but related functions of water quality maintenance, nutrient processing, and production export are generally related to the cumulative effects of hydrology, sediment transport and deposition,

and plant productivity. Sediment is transported into and through Reaches 5B and 5C from upstream sources, and bank erosion within this reach contributes further to this sediment load. When overbank or backwater flooding occurs from the main stem of the Housatonic River into the adjacent floodplains, inorganic sediment carried by the river is deposited within the floodplain, and adsorbed constituents (such as nutrients) settle out with the sediment; some sediment also settles within the quiescent pools of the river itself. This function maintains surface water quality by removing sediments, nutrients, and other pollutants from the water column. In addition, nutrients are processed within the floodplain as primary plant productivity converts inorganic forms into organic forms of nutrients. The floodplain then serves as a source of organic forms of nutrients back to the river, either during further flood flows or by direct deposition of leaves and related vegetative parts, and these contribute to sustaining the base food chain in the river and ultimately the entire biotic community. This is the production export function.

Wildlife and Rare Species Habitat

The floodplain wetlands in Reaches 5B and 5C consist of varied wetland cover types interspersed throughout the floodplain; the specific cover type in a particular area is typically first and foremost related to the surface hydrology. The wildlife habitat value of the floodplain wetlands is ultimately related to the collective contribution of the habitat features in each cover type, discussed below.

The floodplain forest habitat in Reaches 5B and 5C contains numerous dead tree snags of varying diameter and height, which have resulted from periodic flooding, sediment deposition, and beaver activity. Standing dead timber provides foraging habitats for all the woodpecker species and provides summer roosting sites for bats such as the big brown bat *(Eptesicus fuscus*) and little brown bat (*Myotis lucifugus*). Abundant live trees with greater than 12-inch dbh are also present. Many of these trees are greater than 30 inches dbh. Both the dead standing trees and large living trees contain cavities ranging in size from less than six inches to 18 inches or larger and are used during the breeding season for nesting and as escape cover by a wide variety of birds such as wood duck, woodpeckers, tree swallow (*Tachycineta bicolor*), owls, bluebird (*Sialia sialis)*, black-capped chickadee (*Poecile atricapillus*), hooded merganser (*Lophodytes cucullatus*), and common merganser (*Mergus merganser*). These cavities also provide habitat for several mammals, including mink, fisher (*Pekania pennanti*), raccoon, porcupine (*Erethizon dorsatum*, black bear, Virginia opossum (*Didelphis virginiana*) and flying squirrels. Larger live trees in the forest can be as tall as 100 feet with a fairly open understory, which can provide suitable foraging and nesting habitat for raptors such as the great horned owl (*Bubo virginianus*) and red-shouldered hawk (*Buteo lineatus*).

The dense herbaceous cover and other characteristic features of the transitional floodplain forest also play a role in providing non-breeding habitat for amphibians around the vernal pools in this area (the in-pool habitat functions of these vernal pools themselves are discussed further in Section 7.3). Amphibian species, such as the wood frog (*Lithobates sylvaticus*) and northern spring peeper (*Pseudacris crucifer*), rely on the shade, deep litter, and woody debris in forested areas immediately surrounding the pools. Such areas within 100 feet from a vernal pool's edge, sometimes referred to as the vernal pool protection zone or envelope, protect the vernal pool amphibians, especially juveniles, from dessication and predation, protect the water quality in the pools from runoff and sedimentation, and provide shade and litter for the pool ecosystem.

In many parts of the floodplain in Reaches 5B and 5C, a system of fluvial worked swales, depressions, and meander scars directs flood flows across the floodplain and reduce water velocities, allowing the accumulation of very fine silt loams and formation of organic muck soils that perch and retain surface waters for extended periods. As a result, these areas have developed shrub swamp thickets of silky dogwood and nannyberry (*Viburnum lentago*), which can be used for a variety of foraging and nesting birds. Shrub swamp habitat also provides suitable conditions for earthworms and insects which are preyed upon by birds, small mammals, and bat species including the big brown bat and little brown bat.

Shallow and deep emergent marsh habitats present in the Reaches 5B and 5C floodplain are typically used for early season forage by several reptile species and as breeding habitat for several amphibian species. Reptiles also often use these moist habitats to regulate body temperatures and rehydrate during the summer. Wet meadow associated with drier portions of the floodplain provides open and edge habitat used by birds such as the American bittern, common yellowthroat (*Geothlypis trichas)*, yellow warbler (*Dendroica petechia)*, and ruby-throated hummingbird (*Archilochus colubris*).

Finally, the Reaches 5B and 5C wetland areas provide habitat for rare species, as noted above and described in detail in Section 8 of this report.

Other Functions and Values

Other principal functions and values of the Reach 5A wetlands, as indicated by the evaluation process, include recreation, educational/scientific, uniqueness/heritage, and visual quality/aesthetics.

Principal Functions and Values

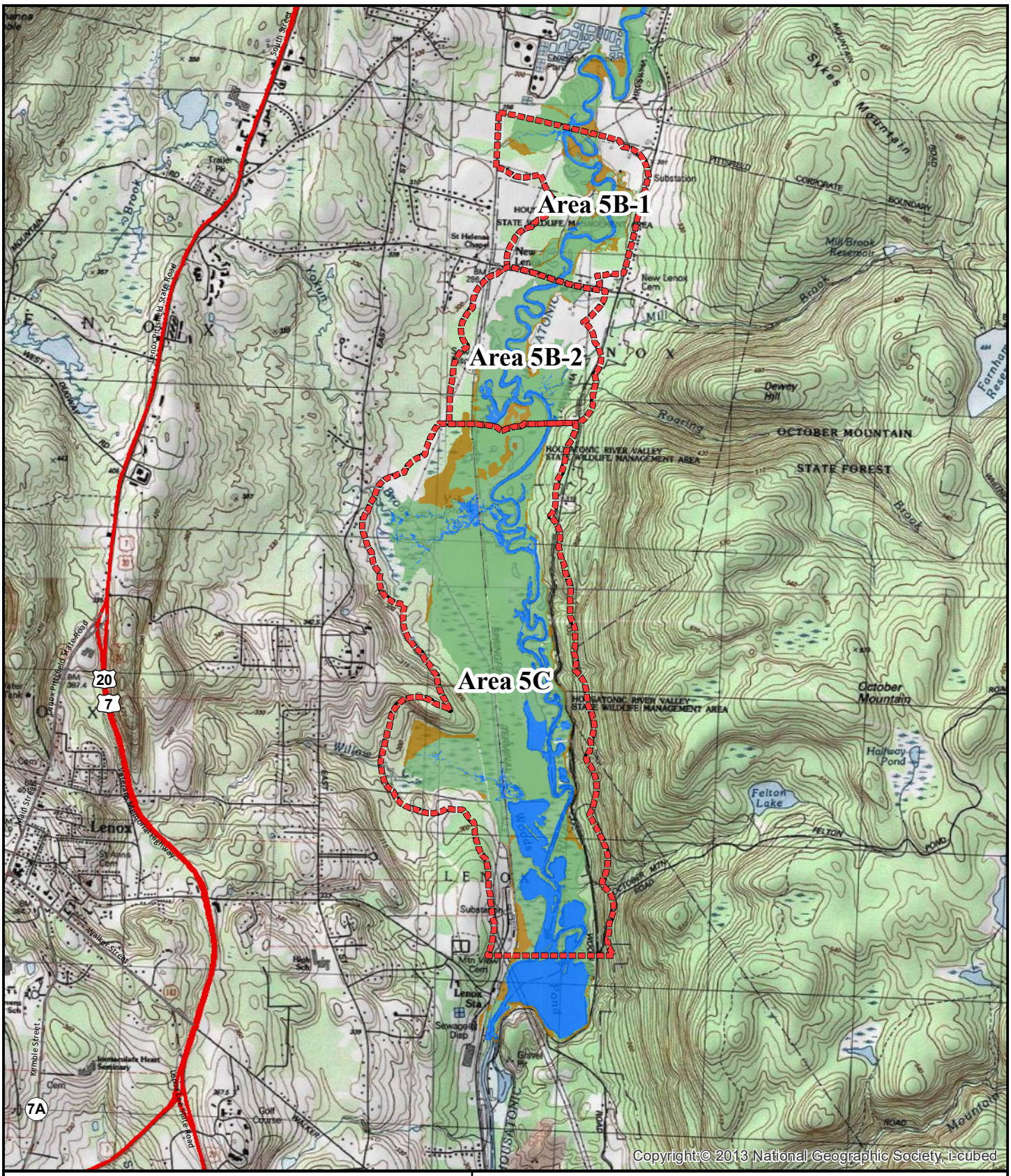
As noted in the Highway Methodology, functions and values of a wetland can be considered "principal" if they are an important physical component of a wetland ecosystem (function only) and/or are considered of special value to society from a local, regional, or national perspective. As shown in the evaluation forms which follow this summary, all functions and values considered in this assessment have been rated as principal for all three wetland functional units.

An earlier wetland functional assessment was conducted that included Reaches 5B and 5C as well as areas upstream and downstream of this reach (TechLaw 1998). That effort also employed the USACE Highway Method as well as other methods in use at the time. Reach 5B was grouped with Reach 5A as one evaluation unit and Reach 5C was grouped with Woods Pond (Reach 6) as another evaluation unit; therefore, comparison of the results should consider these differences in evaluation units. TechLaw assessed the principal wetland functions and values to include: floodflow alteration, wildlife habitat, sediment/toxicant retention, sediment/shoreline stabilization, fish and shellfish habitat, production export, uniqueness/heritage, educational/scientific value, recreation, and visual/aesthetics. The only difference between that earlier wetland assessment and the current one is that the current one also found groundwater recharge/discharge to be a principal function.

References

TechLaw, Inc., 1998. *Preliminary Report: Wetland Characterization and Function-Value Assessment, Housatonic River from Newell Street to Woods Pond*. TechLaw, Inc., Boston, MA.

USACE, New England Division, 1995. *The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach*, NEDEP-360-1-30a.



Legend

Cover Types

- Wetland Functional Units
- Stream
- Upland
- Wetland

1 inch = 3,000 feet

0 1,500 3,000 6,000 Feet

Reaches 5B and 5C Wetland Functional Units

Housatonic River - Massachusetts

SCALE	DATE	PROJECT NO.
1:8,400	2/12/2025	60670015

AECOM

Figure 6-4

Table 6-4: Floodplain Wetland Habitat Characterization in Reaches 5B and 5C

Parameter	Description of Parameter	Inventory Approach*
Mapping and classification; watershed setting/factors	Mapping of physical location and limits; natural community cover type classification and delineation; wetland-watershed relationships (position in watershed; size of wetland relative to watershed; watershed factors)	Woodlot 2002 Ecological Characterization mapping and classification in Reaches 5B and 5C (updated during 2023-2024 natural community mapping and morphology surveys); aerial photograph interpretation and updated LiDAR mapping; 2023-2024 field surveys to confirm mapping and obtain data for Form FP-1
Hydrogeologic setting	Surficial geology	USGS surficial geology information; U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil survey mapping
Hydrology	Degree of surface flooding; connectivity to river or other surface water flow; water regime (mean water level, fluctuation/maximum water depth to lowest water level). Evidence of groundwater discharge (springs/seeps, etc.)	Consolidate existing information (from sources below); Federal Emergency Management Agency Flood (FEMA) Flood Insurance Study (FIS); 2023-2024 field surveys to obtain data for Form FP-1
Soil composition and characteristics	Soil profile description; soils series as mapped by the USDA NRCS	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Plant community	Plant species by community type	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Overall wildlife habitat/use	Wildlife use; habitat suitability; surrounding land uses; corridor connectivity	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Special habitat features	Wolf trees; standing dead timber; tree cavities; large woody debris; turtle hibernacula or nesting sites	Consolidate existing information (from sources below); 2023-2024 field surveys to obtain data for Form FP-1
Rare species habitat	Priority Habitat/Core Area Habitat mapping; IPaC results from USFWS on-line data base	MNHESP investigations and designations (including updated outreach to MNHESP); IPaC results; 2023-2024 field surveys to confirm mapping and obtain data for Form FP-1
Invasive species	Invasive plant species as designated by ACOE New England District or MIPAG	Review of invasive plant species lists from USACE New England District and MIPAG; consolidate existing information (from sources below); 2023-2024 field surveys to map invasive species and obtain data for Form FP-1

* The existing information used for Reaches 5B and 5C floodplain wetland habitat characterization includes information from the following sources: the 2002 Woodlot Ecological Characterization reports, the 2003 RFI Report, the 2010 example area evaluations and RCMS Report, the MNHESP investigations of state-listed species through 2022, the Reaches 5B and 5C vernal pool investigations; all described and referenced in Section 2 of the Revised Reaches 5B-8 BRA Work Plan – as well as the USDA NRCS soil surveys, USGS surficial geology mapping, and FEMA FIS.

Table 6-13: Reaches 5B and 5C Floodplain Wetland Function Assessment Factors* (Functional Assessment Documented on Form FP-2).

Function	Description of Function	Parameters Considered in Assessing Function
Groundwater recharge/discharge	This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. Recharge relates to the potential for the wetland to contribute water to an aquifer. Discharge relates to the potential for the wetland to serve as an area where groundwater can be discharged to the surface.	Hydrogeologic setting; soil composition and characteristics
Floodflow alteration (storage & desynchronization)	This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
Sediment, toxicant, and 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.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
Nutrient removal, retention, and 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.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
Production export (nutrient)	This function relates to the effectiveness of the wetland to produce food or usable products for humans or other living organisms.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community; overall wildlife habitat/use
Sediment/shoreline stabilization	This function relates to the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community
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. Species lists of observed and potential animals should be included in the wetland assessment report.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community; special habitat features; overall wildlife habitat/use; rare species habitat; invasive species; incidental wildlife observations
Fish and shellfish habitat	This function considers the effectiveness of seasonal or permanent waterbodies associated with the wetland in question for fish and shellfish habitat.	Watershed setting/factors; hydrology; soil composition and characteristics; plant community; special habitat features; overall wildlife habitat; rare species habitat; invasive species
Rare species habitat	This value relates to the effectiveness of the wetland or associated waterbodies to support threatened, endangered, or other rare species.	Rare species habitat (mapped Priority Habitat and Core Area habitat and IPaC results)

* Generally adapted from USACE New England District, 1995: *The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach*, NEDEP-360-1-30a

Form FP-2: Wetland Function-Value Evaluation Form
Project Name: GE/Housatonic River

Total area of Evaluation Unit: ~200 acres **Is area part of a wildlife corridor?** Yes

Adjacent land use: Residential and Recreational

Distance to nearest roadway or development: within 100 feet

Dominant wetland/aquatic systems present: Shrub Swamp, Red Maple Swamp, Wet Meadow, Deep Emergent Marsh, Transitional Floodplain Forest, Shrub Swamp.

Contiguous undeveloped buffer zone present? Yes

Upland communities present: Cultural Grasslands, Northern Hardwoods-Hemlock-White Pine Forest.

Rare species habitat? Yes, NHESP Estimated Habitats and Priority Habitats of Rare species

Site I.D.: Area 5B-1

Latitude: 42.399725 **Longitude:** -73.240035

Prepared by: Julia Stearns **Date:** 2/10/2025

Wetland Impact
Type: Shrub Swamp, Wet Meadow Deep Emergent Marsh, Floodplain Forest
Area: 200 acres
Evaluation based on:
Office: Yes **Field:** Yes
Delineation completed? No

Function/Value		Suitability		Rationale (Reference #*)	Principle F/V	Comments
		Y	N			
	Groundwater Recharge/Discharge		**X**	1, 5, 6, 7, 9	**F**	Wetlands meet some of the qualifiers though water quality may not be considered high.
	Floodflow Alteration	**X**		1, 2, 3, 5, 6, 7, 8, 10, 13, 14, 15, 18	**F**	Wetlands relatively flat, receive and detain excessive flood water from adjacent river, contains high density of vegetation.
	Fish and Shellfish Habitat	**X**		1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17	**F**	Stream width greater than 50', wetlands are part of a larger, contiguous watercourse, , evidence of fish present.
	Sediment/Toxicant Retention	**X**		1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16	**F**	Known sources of toxicants in watershed above the wetland, diffused water flow, high degree of water and vegetation interspersion.
	Nutrient Removal	**X**		4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14.	**F**	Sources of excess nutrients present in watershed, water retention/detention increased by thick vegetation.
	Production Export	**X**		1, 2, 4, 6, 7, 8, 10, 12	**F**	High degree of plant community structure, wildlife food sources present, flowering plants used by nectar-gathering insects.
	Sediment/Shoreline Stabilization	**X**		1, 2, 3, 4, 5, 6, 7, 8. 9, 10, 11, 12, 14, 15, 16	**F**	Dense vegetation, fine grained mineral and organic soils present.
	Wildlife Habitat	**X**		3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22.	**F**	Animal signs observed, high degree of plant species diversity, diversity of plant community structure, wildlife food sources, wildlife overland access to other wetlands.
	Recreation	**X**		1, 4, 5, 7, 8, 9, 10, 11, 12	**V**	Wetlands are a part of the Housatonic River Valley State Wildlife Management Area, fishing is available and boat access.
	Educational/Scientific Value	**X**		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16	**V**	Wetlands are associated with and within wildlife sanctuary.
	Uniqueness/Heritage	**X**		1, 4, 5, 6, 7, 11, 12, 22, 24,	**V**	Value is high for wildlife and opportunities are present for visual observations available.
	Visual Quality/Aesthetics	**X**		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	**V**	Wetlands associated with wildlife sanctuary with access paths.
ES	Endangered Species Habitat	**X**		1, 2	**V**	Wetlands contain threatened/endangered species and contains critical habitat for state listed species.
	Other					

*See USACE NED 1995. Highway Methodology Workbook, Wetland Functions and Values, A Descriptive Approach

Form FP-2: Wetland Function-Value Evaluation Form
Project Name: GE/Housatonic River

Total area of Evaluation Unit: ~240 acres **Is area part of a wildlife corridor?** Yes

Adjacent land use: Residential and Recreational

Distance to nearest roadway or development: within 100 feet

Dominant wetland/aquatic systems present: Shrub Swamp, Red Maple Swamp, Wet Meadow, Deep Emergent Marsh, Transitional Floodplain Forest, Shrub Swamp.

Contiguous undeveloped buffer zone present? Yes

Upland communities present: Cultural Grasslands, Northern Hardwoods-Hemlock-White Pine Forest.

Rare species habitat? Yes, NHESP Estimated Habitats and Priority Habitats of Rare species

Site I.D.: Area 5B-2

Latitude: 42.390340 **Longitude:** -73.242485

Prepared by: Julia Stearns **Date:** 2/10/2025

Wetland Impact
Type: Shrub Swamp, Wet Meadow Deep Emergent Marsh, Floodplain Forest
Area: 240 acres
Evaluation based on:
Office: Yes **Field:** Yes
Delineation completed? No

Function/Value		Suitability		Rationale (Reference #*)	Principle F/V	Comments
		Y	N			
	Groundwater Recharge/Discharge		**X**	1, 5, 6, 7, 9	**F**	Wetlands meet some of the qualifiers though water quality may not be considered high.
	Floodflow Alteration	**X**		1, 2, 3, 5, 6, 7, 8, 10, 13, 14, 15, 18	**F**	Wetlands relatively flat, receive and detain excessive flood water from adjacent river, contains high density of vegetation.
	Fish and Shellfish Habitat	**X**		1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17	**F**	Stream width greater than 50', wetlands are part of a larger, contiguous watercourse, evidence of fish present.
	Sediment/Toxicant Retention	**X**		1, 2, 3, 4, 5, 6, 7, 8, 10,11, 12, 14, 15, 16	**F**	Known sources of toxicants in watershed above the wetland, diffused water flow, high degree of water and vegetation interspersion.
	Nutrient Removal	**X**		4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14.	**F**	Sources of excess nutrients present in watershed, water retention/detention increased by thick vegetation.
	Production Export	**X**		1, 2, 4, 6, 7, 8, 9, 10, 12	**F**	High degree of plant community structure, flowering plants used by nectar-gathering insects, wildlife food sources present.
	Sediment/Shoreline Stabilization	**X**		1, 2, 3, 4, 5, 6, 7, 8. 9, 10, 11, 12, 13, 14, 15, 16	**F**	Open water fetch present, dense vegetation, fine grained mineral and organic soils present.
	Wildlife Habitat	**X**		3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22.	**F**	Wildlife overland access to other wetlands, animal signs observed, high degree of plant species diversity and diversity of plant community structure, wildlife food sources.
	Recreation	**X**		1, 2, 4, 5, 7, 8, 9, 10, 11, 12	**V**	Wetlands are a part of the Housatonic River Valley State Wildlife Management Area, fishing is available and boat access.
	Educational/Scientific Value	**X**		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16	**V**	Wetlands are associated with and within wildlife management area, access to perennial stream and potential educational sites.
	Uniqueness/Heritage	**X**		1, 4, 5, 6, 7, 8, 11, 12, 13, 16, 19, 22, 24, 27	**V**	Value is high for wildlife and opportunities are present for visual observations available and boat access.
	Visual Quality/Aesthetics	**X**		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	**V**	Wetlands associated wildlife management area, multiple wetland classes visible from viewing locations.
ES	Endangered Species Habitat	**X**		1, 2	**V**	Wetlands contain threatened/endangered species and contains critical habitat for state listed species.
	Other					

*See USACE NED 1995. Highway Methodology Workbook, Wetland Functions and Values, A Descriptive Approach

Form FP-2: Wetland Function-Value Evaluation Form
Project Name: GE/Housatonic River

Total area of Evaluation Unit: ~1,000 acres **Is area part of a wildlife corridor?** Yes

Adjacent land use: Residential and Recreational

Distance to nearest roadway or development: within 100 feet

Dominant wetland/aquatic systems present: Shrub Swamp, Red Maple Swamp, Wet Meadow, Deep Emergent Marsh, Transitional Floodplain Forest, Shrub Swamp, High-gradient Stream.

Contiguous undeveloped buffer zone present? Yes

Upland communities present: Cultural Grasslands, Northern Hardwoods-Hemlock-White Pine Forest.

Rare species habitat? Yes, NHESP Estimated Habitats and Priority Habitats of Rare species

Site I.D.: Area 5C

Latitude: 42.369681 **Longitude:** -73.244271

Prepared by: Julia Stearns **Date:** 2/10/2025

Wetland Impact
Type: Shrub Swamp, Wet Meadow Deep Emergent Marsh, Floodplain Forest,
Area: 1,000 acres
Evaluation based on:
Office: Yes **Field:** Yes
Delineation completed? No

Function/Value		Suitability		Rationale (Reference #*)	Principle F/V	Comments
		Y	N			
	Groundwater Recharge/Discharge		X	1, 5, 6, 7, 9, 15	F	Wetlands meet some of the qualifiers though water quality may not be considered high.
	Floodflow Alteration	X		1, 2, 3, 5, 6, 7, 8, 10, 13, 14, 15, 16, 18	F	Wetlands relatively flat, receive and detain excessive flood water from adjacent river.
	Fish and Shellfish Habitat	X		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17	F	Stream width greater than 50', wetlands are part of a larger, contiguous watercourse, fish present.
	Sediment/Toxicant Retention	X		1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16	F	Known sources of toxicants in watershed above the wetland, areas of slow-moving water and deepwater habitat present.
	Nutrient Removal	X		2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	F	Sources of excess nutrients present in watershed, diverse/abundance of vegetation.
	Production Export	X		1, 2, 4, 6, 7, 8, 9, 10, 12	F	High degree of plant community structure, flowering plants used by nectar-gathering insects.
	Sediment/Shoreline Stabilization	X		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	F	Dense vegetation, vegetation comprised of large trees and shrubs that withstand major flood events and stabilize the shoreline on a large scale.
	Wildlife Habitat	X		3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22	F	Animal signs observed, high degree of plant species diversity and diversity of plant community structure, wildlife food sources.
	Recreation	X		1, 2, 4, 5, 7, 8, 9, 10, 11, 12	V	Wetlands are associated with Housatonic River Valley State Wildlife Management Area, includes boat access points.
	Educational/Scientific Value	X		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16	V	Wetlands are associated with and within wildlife sanctuary and Housatonic River Valley State Wildlife Management Area, includes access points.
	Uniqueness/Heritage	X		1, 3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 19, 21, 22, 24, 27,	V	Value is high for wildlife and opportunities are present for visual observations available.
	Visual Quality/Aesthetics	X		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	V	Wetlands associated with wildlife sanctuary and Housatonic River Valley State Wildlife Management Area with access paths.
ES	Endangered Species Habitat	X		1, 2	V	Wetlands contain threatened/endangered species and contains critical habitat for state listed species.
	Other					

*See USACE NED 1995. Highway Methodology Workbook, Wetland Functions and Values, A Descriptive Approach

Appendix F

Vernal Pool Information

F.1 Vernal Pool Photo Log (2023-2024)

F.2 Form VP-1 (Blank)

Appendix F.1

Vernal Pool Photo Log (2023-2024)

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 1	Date: 05/10/2023	Photo No. 2	Date: 07/23/24
Description: 5B-VP-1 looking northwest		**Description:** 5B-VP-1 looking northwest, dry	





Photo No. 3	Date: 03/28/24	Photo No. 4	Date: 05/08/24
Description: 5B-VP-5 looking southeast from north end of pool		**Description:** 5B-VP-5 looking west from east end of pool	





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PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 5	Date: 07/25/2024	Photo No. 6	Date: 04/19/2023
Description: 5B-VP-5 looking west from east end of pool during low water period. Not dry		**Description:** 5B-VP-6 looking south	





Photo No. 7	Date: 05/13/24	Photo No. 8	Date: 05/13/2024
Description: 5B-VP-7 looking north		**Description:** 5B-VP-8 looking south	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

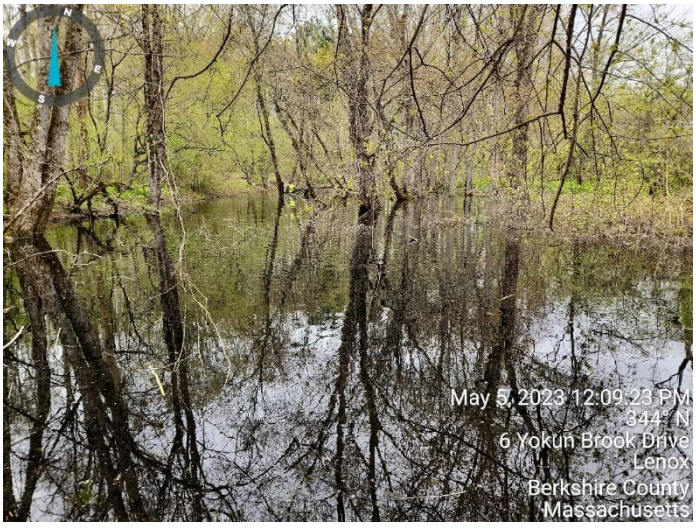
Photo No. 9	Date: 05/13/2023	Photo No. 10	Date: 07/25/24
Description: 5B-VP-10 looking north		**Description:** 5B-VP-10 looking north. Nearly dry with dense cover false water-pepper smartweed	





Photo No. 11	Date: 05/05/23	Photo No. 12	Date: 05/05/23
Description: 5B-VP-11 looking northwest from southern end of pool		**Description:** 5B-VP-12 looking north from south end of pool	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 13	Date: 07/25/2024	Photo No. 14	Date: 05/02/23
Description: 5B-VP-12 looking south from north end of pool under dry conditions.		**Description:** 5B-VP-13 looking south from north end of pool	





Photo No. 15	Date: 05/02/23	Photo No. 16	Date: 05/08/24
Description: 5B-VP-13 looking north from south end of pool		**Description:** 5B-VP-15 looking south from north side of pool	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 17	Date: 05/08/24	Photo No. 18	Date: 07/26/24
Description: 5B-VP-17 looking east from west end of pool		**Description:** 5B-VP-17 looking east from west end of pool under dry conditions	





Photo No. 19	Date: 4/19/23	Photo No. 20	Date: 07/26/24
Description: 5B-VP-18 looking southwest from north end of pool		**Description:** 5B-VP-18 looking north from southern end of pool under nearly dry conditions	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 21	Date: 05/15/2023	Photo No. 22	Date: 10/31/2024
Description: 5B-VP-18A looking south from north end of pool		Description: 5B-VP-18B looking northwest of dry pool conditions	



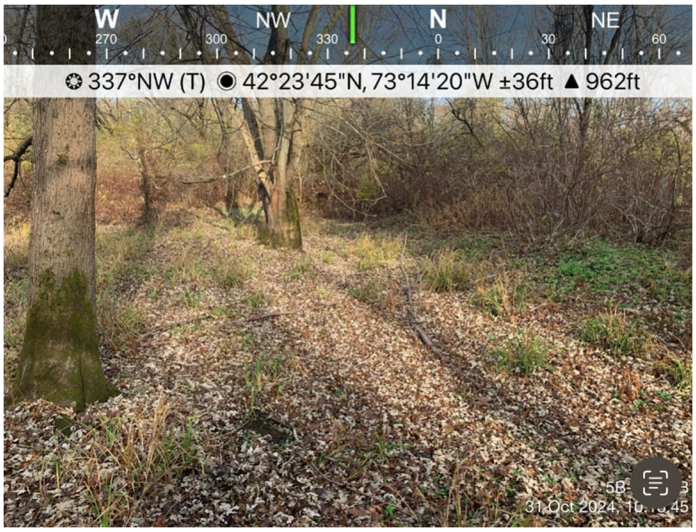


Photo No. 23	Date: 04/9/2024	Photo No. 24	Date: 05/9/2023
Description: 5B-VP-19 looking south		Description: 5B-VP-22 looking southeast from western end of the pool.	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 25	Date: 4/21/2023	Photo No. 26	Date: 05/9/2023
Description: 5B-VP-24 looking west		**Description:** 5B-VP-25 looking west from eastern end of pool	





Photo No. 27	Date: 04/21/2023	Photo No. 28	Date: 03/28/2024
Description: 5B-VP-26 looking north		**Description:** 5B-VP-27 looking south-southwest	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 29	Date: 04/01/2024	Photo No. 30	Date: 04/01/2024
Description: 5B-VP-28 looking south. 5B-VP-29 can be seen in the background		**Description:** 5B-VP-29 looking north	





Photo No. 31	Date: 05/11/2023	Photo No. 32	Date: 03/28/2024
Description: 5B-VP-30 looking south		**Description:** 5B-VP-32 looking south	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 33	Date: 04/17/2024	Photo No. 34	Date: 03/28/2024
Description: 5B-VP-33A looking southwest		**Description:** 5B-VP-35 looking east	





Photo No. 35	Date: 07/29/2024	Photo No. 36	Date: 04/01/2024
Description: 5B-VP-35 looking east across dry pool		**Description:** 5B-VP-38 looking Northwest	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 37	Date: 04/26/2023	Photo No. 38	Date: 04/10/2024
Description: 5B-VP-46 looking north		**Description:** 5B-VP-47 looking north	





Photo No. 39	Date: 04/20/2023	Photo No. 40	Date: 05/08/2023
Description: 5C-VP-2 looking south from north end of pool		**Description:** 5C-VP-3 looking southeast	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 41	Date: 04/10/2024	Photo No. 42	Date: 04/20/23
Description: 5C-VP-4 looking south from northeast end of the pool		**Description:** 5C-VP-4 looking southwest at MALP mapped portion of the pool.	





Photo No. 43	Date: 04/10/24	Photo No. 44	Date: 05/08/2023
Description: 5C-VP-4 looking east across the northwestern end of the pool		**Description:** 5C-VP-5 looking northeast	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 45	Date: 04/26/2023	Photo No. 46	Date: 05/15/2023
Description: 5C-VP-6 looking northeast		**Description:** 5C-VP-7 looking north	





Photo No. 47	Date: 08/01/2024	Photo No. 48	Date: 05/02/2023
Description: 5C-VP-8 looking east		**Description:** 5C-VP-11	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

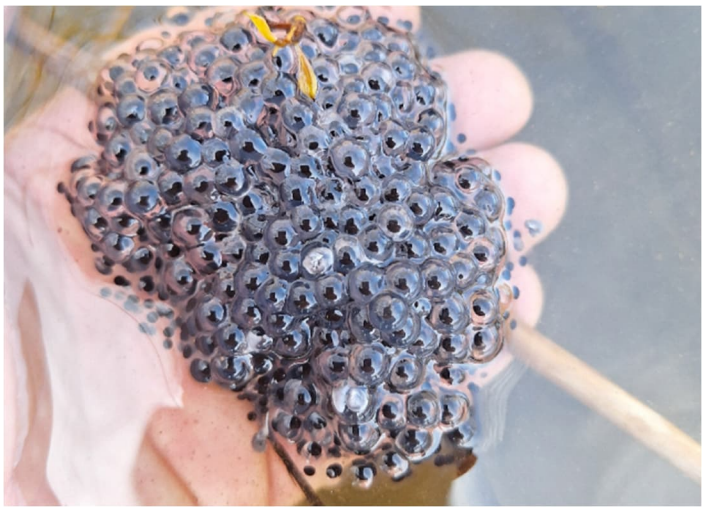
Photo No. 49	Date: 05/11/2023	Photo No. 50	Date: 05/02/2023
Description: 5C-VP-14A looking north		**Description:** 5C-VP-16 looking south	





Photo No. 51	Date: 05/04/2023	Photo No. 52	Date: 05/08/2024
Description: 5C-VP-17 looking east		**Description:** Wood frog egg mass	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 53	Date: 04/01/2024	Photo No. 54	Date: 04/26/2023
Description: Cluster of wood frog egg masses attached to herbaceous vegetation		**Description:** Spotted salamander egg masses attached to stems of woody shrubs	





Photo No. 55	Date: 04/26/2023	Photo No. 56	Date: 04/18/2024
Description: Wood frog tadpoles		**Description:** Wood frog adult	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 49	Date: 04/26/2023	Photo No. 50	Date: 04/26/2023
Description: Green frog tadpole		**Description:** Green frog adult	





Photo No. 51	Date: 05/11/2023	Photo No. 52	Date: 04/20/2023
Description: Leopard frog adult		**Description:** Red spotted newt	





AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 49	Date: 04/20/2023	Photo No. 50	Date: 04/20/2023
Description: Fairy shrimp		Description: Log cabin caddisfly (Limnephilidae)	





Photo No. 51	Date: 04/20/2023	Photo No. 52	Date: 04/17/2023
Description: Water scorpion		Description: Mayfly larva	





PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
General Electric Company	Reaches 5B & 5C Housatonic River Massachusetts	60719336

Photo No. 53	Date: 04/19/2023	Photo No. 54	Date: 05/01/2023
Description: Painted turtle		**Description:** Snapping turtle	





Appendix F.2

Form VP-1 (Blank)

Form VP-1: Vernal Pool Characterization Form[1]

Pool ID _____

Observers: _____

Location of vernal pool: _____

Survey date(s): _____

Coordinates (decimal degrees)

Latitude(X): _____ Longitude (Y): _____

A. General Vernal Pool Characteristics

1. Landscape setting (check all that apply)

[ ] Discrete depression in floodplain

[ ] Pool part of a larger wetland

[ ] Pool part of a pool network (____ pools within 1000 feet)

2. Vernal pool condition (describe any recent modification to the pool, including natural changes such as beaver impoundments): _____

_____ _____

3. Describe the aquatic resource type(s) in pool (e.g., forested, scrub-shrub, etc.) -

_____

4. Pool canopy cover (%): _____

5. Predominant substrate (e.g., mineral soil, organic matter): _____

6. Pool measurements:

a. Approximate pool dimensions at maximum inundation condition (include units):

Length _____ Width: _____ Area: _____

b. Maximum water depth at deepest point (include units): _____

7. Hydrology

a. Estimated month pool dries, or if never: _____

b. Inlet/outlet (none, temporary, permanent): _____

8. Water quality (clear, high turbidity, high algal content, tannic): _____

[1] Adapted from USACE New England Division Vernal Pool Characterization Form

B. Plant Community: Inventory tree and vine data obtained in a 30' radius plot; shrubs in a 15' radius plot; and herbaceous plant data in a 5' radius plot.

% Cover: _____ Trees (> 20') _____ Shrubs (< 20') _____ Woody vines _____ Mosses _____ Herbaceous

Plant Lists (species that comprise 10% or more of the vegetative cover in each stratum or any amount of an invasive plant species; "*" designates a dominant plant species for the stratum):

Strata	Plant Species	Strata	Plant Species

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Identify any federal or state-listed threatened, endangered, or other rare species in or adjacent to the vernal pool: _____

C. Soil/Substrate Composition

_____ Soil Survey Unit _____ Drainage Class

_____ Texture (upper part) _____ Depth

Representative Soil Pit Log

Soil Horizon	Depth (inches)	Color	Soil Texture	Mottling

D. In-Pool Physical Habitat Structure

Describe physical structure in the vernal pool which may contribute to vernal pool habitat functions:

[ ] Coarse woody debris _____% cover: Describe _____

[ ] Fine woody debris _____% cover: Describe _____

[ ] Shrub and herbaceous stems _____%: Describe _____

[ ] Wind-thrown trees and/or root wads _____%: Describe _____

[ ] Hummocks _____%: Describe _____

[ ] Other _____%: Describe _____

E. Surrounding Land Use

1. Vernal Pool Envelope (0-100 feet from pool edge)[2]

[ ] Forested _____%

[ ] Shrub _____%

[ ] Open (e.g., meadow, agriculture, golf course) _____%

[ ] Developed (includes area beyond barriers) _____%

2. Critical Terrestrial Habitat (100-750 ft from pool edge)[3]

[ ] Forested _____%

[ ] Shrub _____%

[ ] Open (e.g., meadow, agriculture, golf course _____ %

[ ] Developed (includes area beyond barriers) ___% _

F. General Water and Soil Chemistry (for selected pools only)

1. Water Quality

[ ] pH _____

[ ] Temperature _____

[ ] Conductivity _____

[ ] Dissolved Oxygen_____

2. Soil

[ ] pH _____

[ ] Organic Carbon Content _____

[2] As defined by Calhoun and Klemens (2002).

[3] As defined by Calhoun and Klemens (2002).