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Via Electronic Mail

February 19, 2024

Mr. Christopher Smith
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Boston, MA 02109

**Re: GE-Pittsfield/Housatonic River Site
Rest of River (GECD850)
Revised Reach 5A Baseline Restoration Assessment Report**

Dear Mr. Smith:

In accordance with December 21, 2023 conditional approval letter for a prior version of this report, enclosed for EPA's review and approval is GE's *Revised Housatonic River Reach 5A Baseline Restoration Assessment Report*, prepared for GE by AECOM.

Please let me know if you have any questions about the enclosed report.

Very truly yours,

Kevin G. Mooney
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Enclosure

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Revised Housatonic River Reach 5A Baseline Restoration Assessment Report

Pittsfield, Massachusetts

February 2024

Prepared for General Electric Company
Pittsfield, Massachusetts

Revised Housatonic River Reach 5A Baseline Restoration Assessment Report

Pittsfield, Massachusetts

February 2024

Prepared for

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TABLE OF CONTENTS

1.0 Introduction and Objectives	1
1.1 Background.....	1
1.2 Restoration Performance Standards.....	2
1.3 Reach 5A BRA Objectives.....	2
1.4 Reach 5A BRA Requirements.....	3
1.5 Reach 5A BRA Organization.....	4
2.0 Overview of Approach for Reach 5A BRA	5
3.0 Reach 5A BRA of Riverine Habitats.....	6
3.1 Background Ecological Information.....	6
3.1.1 Woodlot Ecological Characterization (2002)	7
3.1.2 RCRA Facility Investigation Report (2003)	8
3.1.3 EPA Modeling (2006)	9
3.1.4 Corrective Measures Study Reports (2008-2010)	9
3.1.5 Stantec Bank Studies (2009).....	10
3.1.6 Example Area Evaluations (2010)	11
3.1.7 Natural Heritage Information (2000-2022)	12
3.1.8 Pre-Design Investigations of Reach 5A.....	13
3.1.9 Other Existing Information.....	14
3.2 2022 Riverine Habitat Investigations.....	15
3.2.1 Overview of Approach and Methods.....	15
3.2.2 RBP Physical Habitat Survey.....	16
3.2.2.1 Methods.....	16
3.2.2.2 Results.....	16
3.2.3 Benthic Macroinvertebrate Survey.....	18
3.2.3.1 Methods.....	18
3.2.3.2 Results.....	20
3.2.4 Assessment of Fish Species	22
3.2.4.1 Methods.....	22
3.2.4.2 Results.....	23
3.2.5 Incidental Direct Wildlife Observations	24
3.2.6 Aquatic Plant and Invasive Species Observations.....	25
3.3 Description of Reach 5A Riverine Habitats.....	25

3.3.1	Habitat Types Within the Riverine Environment	25
3.3.2	Hydrology and Physical Features	26
3.3.3	Biological Communities	28
3.4	Reach 5A Riverine Habitat Functional Assessment.....	30
4.0	Reach 5A BRA of Riverbank Habitats	35
4.1	Background Ecological Information.....	35
4.1.1	Woodlot Ecological Characterization (2002)	35
4.1.2	RCRA Facility Investigation Report (2003)	36
4.1.3	EPA's Modeling (2006)	36
4.1.4	Corrective Measures Study Reports (2008-2010)	37
4.1.5	Stantec Bank Studies (2009).....	38
4.1.6	Example Area Evaluations (2010)	38
4.1.7	Natural Heritage Information (2000-2022)	39
4.1.8	Pre-Design Investigations of Reach 5A.....	40
4.2	2022 Riverbank Habitat Investigations.....	40
4.2.1	Methods.....	40
4.2.2	Results.....	41
4.2.2.1	Physical Characterization.....	42
4.2.2.2	Bordering Habitats.....	43
4.2.2.3	Hydrologic Characterization.....	43
4.2.2.4	Plant Community Composition.....	44
4.2.2.5	Other Habitat Features.....	45
4.2.2.6	Incidental Direct Wildlife Observations	46
4.2.2.7	Rare Species Habitat	46
4.3	Description of Reach 5A Riverbank Habitats.....	47
4.3.1	Physical Description.....	47
4.3.2	Biological Communities	47
4.4	Reach 5A Riverbank Habitat Functional Assessment.....	48
5.0	Reach 5A BRA of Backwater Habitats.....	51
5.1	Background Ecological Information.....	51
5.1.1	Woodlot Ecological Characterization (2002)	51
5.1.2	RCRA Facility Investigation Report (2003)	52
5.1.3	Corrective Measures Study Reports (2008-2010)	52
5.1.4	Example Area Evaluations (2010)	52

5.1.5	Natural Heritage Information (2000-2022)	52
5.1.6	Pre-Design Investigations of Reach 5A.....	53
5.2	2022-2023 Backwater Habitat Investigations.....	54
5.2.1	Methods	54
5.2.2	Overview of Reach 5A Backwaters.....	55
5.2.3	Results.....	57
5.2.3.1	Physical Characterization.....	57
5.2.3.2	Bordering Habitats.....	57
5.2.3.3	Hydrologic Characterization.....	57
5.2.3.4	Plant Community Composition.....	58
5.2.3.5	Other Habitat Features.....	59
5.2.3.6	Incidental Wildlife Observations.....	59
5.2.3.7	Rare Species Habitat	60
5.2.3.8	Water Quality	60
5.3	Description of Reach 5A Backwater Habitats	60
5.4	Reach 5A Backwater Habitat Functional Assessment.....	61
6.0	Reach 5A BRA of Floodplain Habitats (excluding Vernal Pools)	64
6.1	Background Ecological Information.....	64
6.1.1	Woodlot Ecological Characterization (2002)	64
6.1.2	RCRA Facility Investigation Report (2003)	65
6.1.3	Corrective Measures Study Reports (2008-2010)	65
6.1.4	Example Area Evaluations (2010)	65
6.1.5	Natural Heritage Information (2000-2022)	66
6.1.6	Pre-Design Investigations of Reach 5A Floodplain.....	67
6.2	Baseline Mapping and Classification of Floodplain Habitats.....	68
6.2.1	Methods.....	68
6.2.2	Results.....	71
6.3	2022 Floodplain Wetland Habitat Investigations.....	74
6.3.1	Methods.....	74
6.3.2	Results.....	76
6.3.2.1	Plant Community Composition.....	76
6.3.2.2	NRCS Soils	77
6.3.2.3	Other Habitat Features.....	79
6.3.2.4	Incidental Direct Wildlife Observations	79

6.3.2.5	Rare Species Habitat in Wetland Floodplains.....	80
6.3.3	Description of Reach 5A Floodplain Wetland Habitats	80
6.3.4	Reach 5A Floodplain Wetland Functional Assessment.....	84
6.4	2022 Floodplain Upland Habitat Investigations.....	89
6.4.1	Methods.....	89
6.4.2	Results.....	90
6.4.2.1	Plant Community Composition.....	90
6.4.2.2	Other Habitat Features.....	91
6.4.2.3	Incidental Direct Wildlife Observations	91
6.4.2.4	Rare Species.....	91
6.4.3	Description of Reach 5A Floodplain Upland Habitats.....	91
6.4.4	Reach 5A Floodplain Upland Habitat Functional Assessment	93
6.5	Exposure Area 10 (Canoe Meadows) Base Mapping.....	94
7.0	Reach 5A BRA of Vernal Pool Habitats	96
7.1	2018-2020 Reach 5A Vernal Pool Investigations.....	96
7.2	2022-2023 Reach 5A Vernal Pool Investigations.....	97
7.2.1	Methods.....	97
7.2.2	Results.....	101
7.2.2.1	Plant Community Composition.....	101
7.2.2.2	Pool Physical and Chemical Characteristics	102
7.2.2.3	Habitat Characteristics in the Adjacent Landscape	105
7.3	Description of Reach 5A Vernal Pool Habitat	105
7.4	Reach 5A Vernal Pool Functional Assessment.....	106
8.0	Reach 5A Assessment of Rare Species	107
8.1	Methods.....	107
8.1.1	Federally Listed Species	107
8.1.2	State-Listed Species.....	107
8.2	Results	108
8.2.1	Federally Listed Species	108
8.2.2	State-Listed Species and Reach 5A Core Habitats	109
9.0	Reach 5A Invasive Species	115
9.1	Methods.....	115
9.2	Results	116

10.0 Preliminary Identification of Degraded Habitats and Restoration Opportunities in Reach 5A.....	119
10.1 Identification of Disturbed or Degraded Habitats.....	119
10.2 Identification of Restoration Opportunities.....	121
11.0 Supplemental BRA Activities and Anticipated Schedule	123
12.0 References	125

LIST OF TABLES

Table 3-1: Reach 5A Riverine Habitat Characterization
Table 3-2: RBP Riverine Parameters Collected
Table 3-3: RPB Results – Instream Features and Large Woody Debris (LWD) Coverage
Table 3-4: RPB Results – Aquatic Vegetation and Substrate Characteristics
Table 3-5: RBP Habitat Assessment Parameters
Table 3-6: Macroinvertebrate Survey Results Compiled by Order
Table 3-7: Macroinvertebrate Survey Results- Taxa Measures
Table 3-8: Small Fish Species Trapping Results
Table 3-9: Fish Composition Results from Electrofishing in Lower Reach 5A
Table 3-10: Wildlife Observations Made During the 2022 Riverine Survey
Table 3-11: State-Listed Rare Species Associated with the Aquatic Riverine Habitats of Reach 5A
Table 3-12: Reach 5A Riverine Function Assessment Factors
Table 4-1: Reach 5A Riverbank Habitat Characterization
Table 4-2: Reach 5A Riverbank Summary Data
Table 4-3: Reach 5A Riverbank Sediment/Substrate Composition
Table 4-4: Reach 5A Riverbank Hydrology Ratings: Channel Gradient, Incisement, and Floodplain Connectivity
Table 4-5: Reach 5A Riverbank Bordering Habitat Types
Table 4-6: Reach 5A Riverbank – Biotic Habitat Features
Table 4-7: Reach 5A Riverbank Habitat— Physical Bank Habitat Features
Table 4-8: Reach 5A Riverbank Plant Species Summary Data
Table 4-9: Reach 5A Riverbank Plant Community Inventory – Left Bank
Table 4-10: Reach 5A Riverbank Plant Community Inventory – Right Bank
Table 4-11: Reach 5A Riverbank Plant Community Inventory – Riparian Vegetation Cover
Table 4-12: Reach 5A Riverbanks: Other Wildlife Habitat Features
Table 4-13: Incidental Direct Wildlife Observations at Bank Survey Stations
Table 4-14: Reach 5A Riverbank – MNHESP Rare Species and Core Area Habitat Designation
Table 4-15: Reach 5A Riverbank Function Assessment Factors
Table 4-16: Reach 5A Riverbank Restoration Opportunities
Table 5-1: Reach 5A Backwater Habitat Characteristics
Table 5-2: Reach 5A Backwater Plant Species Summary Data
Table 5-3: Reach 5A Backwaters – Biotic Habitat Features
Table 5-4: Reach 5A Backwaters: Summary of Biotic Habitat Features
Table 5-5: State-Listed Rare Species Potentially Associated with Backwater Habitats of Reach 5A
Table 5-6: Reach 5A Backwater Function Assessment Factors
Table 5-7: Water Chemistry of Backwater Habitats of Reach 5A

Table 6-1: Reach 5A Wetland Community Types
Table 6-2: Reach 5A Upland Community Types
Table 6-3: Comparison of Natural Community Cover Types Mapped Between 2002 and 2023
Table 6-4: Reach 5A Floodplain Wetland Habitat Characterization
Table 6-5: Reach 5A Floodplain Plant Species Summary Data
Table 6-6: Percent Cover of Trees, Shrubs, Woody Vines, Herbs and Mosses Estimated Within Each Floodplain Natural Community Cover Type
Table 6-7: Reach 5A NRCS Soil Series Mapping
Table 6-8: Reach 5A Floodplain Natural Communities: Biotic Habitat Features
Table 6-9: Reach 5A Floodplain Natural Communities: Summary of Biotic Habitat Features
Table 6-10: Wildlife Observations Made During the 2022 Floodplain Surveys
Table 6-11: State-Listed Rare Species Potentially Associated with Floodplain Wetland Habitats in Reach 5A
Table 6-12: Reach 5A Floodplain Wetland Function Assessment Factors
Table 6-13: Reach 5A Floodplain Upland Habitat Characterization
Table 6-14: Reach 5A Plant Species in Upland Natural Communities Summary Data
Table 6-15: Percent Cover of Trees, Shrubs, Woody Vines, Herbs, and Mosses Estimated within Upland Natural Community Cover Types
Table 6-16: Reach 5A Upland Natural Communities: Biotic Habitat Features
Table 6-17: Reach 5A Upland Natural Communities: Summary of Biotic Habitat Features
Table 6-18: State-Listed Rare Species Potentially Associated with Floodplain Upland Habitats in Reach 5A
Table 6-19: Reach 5A Floodplain Upland Function Assessment Factors
Table 6-20: Canoe Meadows Bird Observations
Table 7-1: Data Collected in 2018-2019 on Vernal Pools in Reach 5A
Table 7-2: Habitat Characteristics within Reach 5A Vernal Pools and the Adjacent Landscape
Table 7-3: Summary Statistics of Vernal Pool Vegetation Cover, In-Pool Physical Structure, and the Adjacent Landscape
Table 7-4: Reach 5A Plant Species Summary Data for Certified Vernal Pools
Table 7-5: Soil and Water Chemistry within 15 Randomly Selected Vernal Pools
Table 7-6: State-Listed Rare Species Potentially Associated with Vernal Pool Habitats in Reach 5A
Table 7-7: Reach 5A Vernal Pool Tier Ratings
Table 8-1: State-Listed Species with Species Habitat Mapping Overlapping Reach 5A as shown on MNHESP Data Provided in October 2022
Table 10-1: Reach 5A BRA Form H: Site Degradation/Disturbance Evaluation Criteria

LIST OF FIGURES

Figure 1-1: Reaches 5-8 Housatonic River – Pittsfield, MA

Figure 1-2: Reach 5A of the Rest of River

Figures 3-1a – 3-1d: Reach 5A Riverine Habitat Investigations

Figure 3-2: Riverine Inorganic Substrate Components of Reach 5A

Figures 4-1a – 4-1d: Reach 5A Riverbank Habitat Investigations

Figure 5-1: Reach 5A Backwaters and Natural Communities

Figure 6-1: Example Areas within Floodplain Habitats

Figures 6-2a – 6-2e: Reach 5A Natural Communities

Figures 6-3a – 6-3e: Reach 5A Surface Hydrology and Drainage Features

Figure 6-4: Wetland Functional Units in Reach 5A

Figure 6-5: NRCS Mapped Soils in Reach 5A

Figure 6-6: Typical Cross-Section Through Riverine and Floodplain Habitats in Reach 5A

Figure 6-7: Canoe Meadows (EA 10) Existing Conditions Map

Figure 7-1: Reach 5A MNHESP Certifiable Vernal Pools

Figure 7-2a – 7-2e: Soil and Water Chemistry; Measures of Central Tendency and Boxplots

Figure 8-1: NHESP Priority Habitats

Figure 8-2: Reach 5A NHESP Core Areas

Figures 10-1a – 10-1e: Reach 5A Disturbed Areas

LIST OF APPENDICES

- A. Riverine Habitat Information
 - 1a. RBP Physical Data Sheets
 - 1b. Incidental Wildlife Observations
 - 2. Benthic Macroinvertebrate Results and Field Data Sheets
 - 3. Fisheries Photo Log
- B. Riverbank Habitat Inventory Forms
- C. Backwater Habitat Inventory Forms
- D. Floodplain Habitat Information
 - 1. Floodplain Habitat Photo Log
 - 2. Form FP-1 (Blank)
 - 3. Incidental Wildlife Observations During Floodplain Surveys
- E. Wetland Function and Value Assessment
- F. Vernal Pool Information
 - 1. Vernal Pool Photo Log (2018-2019)
 - 2. Form VP-1 (Blank)
- G. Rare Species Information
- H. Invasive Species Information
 - 1. Identification of Invasive Plant Species in Reach 5A
 - 2. General Information on Primary Invasive Species Identified

ABBREVIATIONS

BANCS	Bank Assessment for Non-Point Source Consequences of Sediment
BEHI	Bank Erosion Hazard Index
BRA	Baseline Restoration Assessment
CD	Consent Decree
cfs	cubic feet per second
CMS	Corrective Measures Study
dbh	diameter at breast height (of trees)
EA	Exposure Area
EFDC	Environmental Fluid Dynamics Code
EPA	U.S. Environmental Protection Agency
FEMA FIS	Federal Emergency Management Agency Flood Insurance Study
Final Accessibility Report	<i>Final Morphology and Accessibility Survey Report</i>
Final Revised SOW	<i>Final Revised Rest of River Statement of Work</i>
GE	General Electric Company
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
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
RMS	Red Maple Swamp

ROR	Rest of River
RU	Remediation Unit
SOP	Standard Operating Procedure
SOW	Statement of Work
UAV	Unoccupied aerial vehicle
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
WMA	Wildlife Management Area
Woodlot	Woodlot Alternatives, Inc (now Stantec)
WWTF/P	Wastewater Treatment Facility/Plant
YSI	Yellow Springs Instrument

1.0 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 ROR is shown on Figure 1-1, including river reach designations established by EPA within it, as well as the Housatonic River contributing watershed above Rising Pond (Reach 8). The Revised Final Permit set forth a Remedial Action selected by EPA to address polychlorinated biphenyls (PCBs) in the ROR.

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, after receipt of EPA's comments on an earlier version, 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.

Section II.B.1.c.(2)(a) of the Revised Permit requires GE to conduct 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 for and report on the BRA in more detail.

Pursuant to the Revised Permit requirement, on December 22, 2021, GE submitted a *Baseline Restoration Assessment Work Plan* (initial BRA Work Plan) to meet those 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 ROR area to be addressed under the Revised Permit – in advance of revising the overall BRA Work Plan to cover other areas of the ROR. Reach 5A is shown in more detail on Figure 1-2. On May 16, 2022, GE submitted a Reach 5A BRA Work Plan. On June 29, 2022, EPA issued a conditional approval letter for that work plan, requiring several modifications to be incorporated in a revised work plan. On July 14, 2022, GE submitted a Revised Reach 5A BRA Work Plan (the "Revised Reach 5A BRA Work Plan" or "Revised Work Plan"; AECOM 2022). The Revised Work Plan presented the processes and activities that GE planned to conduct to identify and document the existing ecological conditions and functions in Reach 5A. On July 18, 2022, EPA approved the Revised Reach 5A BRA Work Plan. GE subsequently initiated data collection for the Reach 5A BRA, which was conducted from July 2022 through June 14, 2023.

As prescribed in the Revised Permit, the Final Revised SOW, and the Revised Reach 5A BRA Work Plan, following implementation of the studies outlined in the Revised Work Plan, GE was to prepare a BRA Report to present the results. That report was initially submitted to EPA on August 25, 2023, providing for Reach 5A a description and assessment of the pre-remediation conditions, functions, and values of river bottom, riverbank, backwater, floodplain, impoundment, and vernal pool habitats, as well as the identified occurrence of federal or state-listed threatened or endangered species or other state-listed species and any invasive species in the areas affected by the remediation. EPA conditionally approved that report by letter dated December 21, 2023, which directed GE to submit a revised report addressing the conditions in EPA's letter. This document constitutes that Revised Reach 5A BRA Report.

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 Corrective Measures on affected ecological resources, species, and habitats, including, but not limited to, riverbanks, riverbed, floodplain, wetland habitat, and the occurrence of threatened, endangered, or other state-listed species and their 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. The Final Revised SOW also specified that following the BRA for each Remediation Unit (RU), a BRA Report would be submitted for that RU. As noted above, this document constitutes a revised BRA report for Reach 5A.¹

1.3 Reach 5A BRA Objectives

The Reach 5A BRA is intended to provide a detailed baseline ecological inventory and assessment of pre-remediation conditions and functions of the affected habitats within Reach 5A 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 this reach. The conditions and features identified in this BRA

¹ In addition, GE prepared the required Restoration Performance Objectives and Evaluation Criteria Report on a site-wide basis. That report was initially submitted on August 25, 2023, and was conditionally approved by EPA by letter dated January 29, 2024, which required GE to revise and resubmit that report within 75 days.

Report are also to be used in concert with engineering considerations in an effort to site access roads and staging areas in areas with lower habitat values where practicable. That information was also taken into account in GE's Conceptual Remedial Design/Remedial Action (RD/RA) Work Plan for Reach 5A (Anchor QEA et al. 2023), which was submitted on September 28, 2023 and is currently under review by EPA.

1.4 Reach 5A 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. Those requirements and the requirements in Section 4.2.1.5 of the Final Revised SOW indicate that the BRA for each subject area in the ROR, including Reach 5A, 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 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 March 31 and June 29, 2022 conditional approval letters set forth a number of specific requirements that were addressed in the Revised Reach 5A BRA Work Plan and are thus required to be part of the BRA; and EPA's December 21, 2023 conditional approval letter for the initial Reach 5A BRA Report specified a number of items to be addressed in this Revised Reach 5A BRA Report.

The Revised Reach 5A BRA Work Plan noted that, following the submission of the Reach 5A BRA Report, supplemental BRA activities will be necessary after the footprint of the remediation has been developed and support areas (access roads and staging areas) have been identified, as specified in the Conceptual RD/RA Work Plan for Reach 5A, and that those supplemental BRA activities would be identified in the Reach 5A BRA Report or the Conceptual RD/RA Work Plan.² It notes further that

² In fact, as discussed in Section 11, the supplemental BRA activities were proposed in Section 5 of GE's Supplemental Data Collection Work Plan, which was attached to the Conceptual RD/RA Work Plan for Reach 5A, submitted on September 28, 2023.

other supplemental BRA activities will be conducted as necessary to complete the BRA, and that the results of the supplemental BRA activities will be reported in an addendum to the Reach 5A BRA Report.

1.5 Reach 5A BRA Organization

Consistent with Revised Reach 5A Work Plan, this Revised Reach 5A BRA Report is organized according to the major habitat types which occur in Reach 5A. 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 wetland, floodplain upland, and vernal pool habitats in Reach 5A, respectively. Following those habitat assessments, Section 8 presents information on federally listed and state-listed species in Reach 5A, and Section 9 addresses invasive species identified in the different habitats. Section 10 presents information obtained during the BRA on: (a) floodplain areas with disturbed or degraded habitats that could be considered candidates for access roads and staging areas for the Reach 5A remediation; and (b) potential restoration opportunities in Reach 5A. Finally, Section 11 describes anticipated scheduling and supplemental BRA activities.

2.0 Overview of Approach for Reach 5A BRA

The general approach for conducting the BRA for each major habitat type in Reach 5A 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 Reach 5A. The relevant prior investigations through 2020 were described in Section 2 of the Revised Reach 5A BRA Work Plan. In addition, consideration was given to relevant information from the pre-design investigation (PDI) conducted in Reach 5A from December 2021 through July 2023 in accordance with GE's Revised Pre-Design Investigation Work Plan for Reach 5A Sediment and Riverbanks (Revised Reach 5A Sediment/Bank PDI Work Plan; Anchor QEA and AECOM 2022), submitted on May 2, 2022 and approved by EPA on June 1, 2022, as well as other existing information from other sources. This information was supplemented with the results of the specific habitat investigations conducted in 2022 and 2023 in accordance with the Revised Reach 5A BRA Work Plan.

Each of the habitat-specific sections of this Revised BRA Report begins by presenting the pertinent information relating to the subject habitat from the prior sources described in Section 2 of the Revised Reach 5A BRA Work Plan, as well as pertinent information from the Reach 5A PDI and other existing sources. It next presents the results of the specific BRA investigations conducted for the subject habitat, and it then describes the subject habitat based upon the collective information assembled from all sources and the functions provided by that habitat. This Revised BRA Report addresses the conditions in EPA's December 21, 2023 conditional approval letter for a prior version of this report and provides other updating.

3.0 Reach 5A BRA of Riverine Habitats

Numerous protocols have been developed pertaining to the collection of field data for evaluating the ecological conditions, functions, and values of rivers and streams. From a site-wide perspective, investigations of the ROR over the past 20-25 years have encompassed many of the parameters incorporated into such protocols. Accordingly, consolidating pre-existing information on the relevant riverine habitats in Reach 5A was the first step in the BRA for that reach. In addition, the assessment of the riverine habitat incorporated information on key parameters from the field work conducted under the Revised Reach 5A Sediment/Bank PDI Work Plan and from additional field survey work in the Reach 5A river channel. These activities have collectively provided a comprehensive description of the riverine characteristics in Reach 5A. 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. For example, importation of woody debris, movement of sediment over a range of flows, formation of scour and depositional features due to channel morphology and flow variability, and changes on dynamic riverbanks all establish habitat features. 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 Reach 5A. 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.

The riverine habitat inventory process for Reach 5A included consolidating and incorporating existing information on riverine habitats that are specific or applicable to Reach 5A. The riverine habitat characterization for Reach 5A 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 Reach 5A BRA Work Plan. In other cases, the parameters were based on information drawn from other tasks or steps in the remedial investigation process, notably the Reach 5A PDI. Still 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). The first document (Woodlot 2002a) includes information covering Reach 5A and is summarized below.

The ecological characterization study carried out by Woodlot included a variety of biological investigations which addressed rare plants, natural communities, dragonflies, freshwater mussels, reptiles, amphibians, raptors, waterfowl, forest birds, marsh, wading birds, small mammals, river otter, mink, and bats. In this section of the BRA Report, only findings from Woodlot's study which pertain specifically to the riverine habitat in Reach 5A will be discussed.

The Woodlot ecological characterization included a discussion of hydrologic influences in Reach 5A. Woodlot stated that "the main stem of the Housatonic River in this section has moderately fast water with pool, riffle, and run habitat. The channel walls are vertically cut and bottom substrate is often gravel and sand" (Woodlot 2002a, page III-1-6). Woodlot noted that the volume of water resources in the Primary Study Area (PSA), which consists of Reaches 5-6, was affected by industrial and municipal discharges that contributed significant flow quantities to the Housatonic River. Specific to Reach 5A, the Pittsfield Wastewater Treatment Facility (WWTF), which discharges its effluent at the downstream end of Reach 5A (near the midpoint of the PSA), contributes an average flow of 0.5 cms to the Housatonic River, representing approximately 17% of the local flow of the river.

Woodlot classified the Housatonic River from the Confluence to Holmes Road as medium-gradient stream (MGS), and south of Holmes Road as a low-gradient stream (LGS) with slow-moving water that may have abundant submerged aquatic plants. During its surveys, Woodlot found that riverine point bar and beaches occurred occasionally along the Housatonic River, including in Reach 5A, primarily near bends in the channel, while mud flats of limited size began to appear later in the season as the water levels declined and exposed previously flooded substrate. Channel banks were described as vertically cut and a number of mucky sand beaches and accretion bars were located that often harbored the rare mudflat spikeseed (*Eleocharis intermedia*).

During Woodlot's freshwater mussel surveys, only the triangle floater (*Alasmidonta undulata*) was found in Reach 5A. Woodlot noted in the discussion of mussel survey results that there are large areas of suitable habitat in the PSA that are uninhabited by mussels and that definitive reasons for the lack of mussels in these areas are unknown. It also noted that, during dragonfly surveys, a total of 38 Odonate species were recorded within the Housatonic River, one of which, riffle snaketail (*Ophiogomphus carolus*), was a state-listed rare species.

Fish populations were qualitatively and quantitatively sampled by Woodlot within the PSA during 1998-2000. Woodlot characterized the results of the fish species collected by feeding strategies (predator species, bottom feeders, forage fish). Fourteen species of fish were captured in Reach 5A during the 2000 biomass sampling events. White sucker (*Catostomus commersonii*), a bottom feeder, and largemouth bass (*Micropterus salmoides*), a predator, accounted for over 75% of the biomass in the samples from Reach 5A. Bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), cyprinids (Order *Cypriniformes*), and rock bass (*Ambloplites rupestris*) shared dominance of the forage fish group in Reach 5A. No rare, threatened, or endangered fish species were confirmed to exist in the PSA.

In an extensive listing of wildlife species associated with the various classified habitats, Woodlot specifically broke out medium-gradient and low-gradient stream habitat as distinct classes, and listed wildlife species associated with these habitats. However, the species compositions for these habitat classes did not specify those found in Reach 5A, but rather were more broadly listed for the entire 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 Reach 5A. 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 Reach 5A conditions as follows: "[B]etween the Confluence and the WWTF (Reach 5A), the River is relatively shallow and fast-flowing, due in large part to the relatively steep slope of the channel. This flow regime results in a high energy environment and a coarse sediment bed, both of which affect the transport of constituents that are bound to particulate matter" (RFI Report, page 8-4).

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 the fish fauna, the cyprinids, such as dace, darters, and other minnows, are common in the upstream portion of Reach 5A. In summarizing water quality data, the RFI Report indicated that phytoplankton biomass in Reach 5A is relatively low (chlorophyll-*a* concentration of about 2 µg/L), but that nutrient levels in Reach 5A do support a well-defined community of periphyton. It explained that benthic invertebrate abundance increased in the downstream direction, which was consistent with riverbed characteristics in Reach 5A. The RFI Report also indicated that total abundance of benthic invertebrates (counts per ponar grab sample) in the 1999-2000 EPA data was relatively low in Reach 5A with counts that were typically 1.5 to two per sample as compared to five to six per sample downstream 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 Reach 5A.

The EFDC modeling conducted by EPA provided calculations about the Housatonic River's continuous time series of flow, water depths, shear stresses, water surface elevations, and velocities, all of which affect habitat suitability to varying degrees. During the study, the movement of largemouth bass was assessed in Reach 5A. Fish movement was found to be limited but still sufficient to support spawning resident fish. Additionally, the study concluded that Reach 5A had a small amount of over-wintering largemouth bass habitat compared its downstream counterparts. It noted that free-flowing riverine habitat in the medium grade portions is generally made up of coarse substrates and affected by higher flow velocity. Periphyton in Reach 5A "attaches to coarse particles and to the soft bottom of open pools and slow-moving reaches. Periphyton cover in the free-flowing areas of Reaches 5 and 6 consists primarily of algae attached to the substrate, and the associated microorganisms found with the algae" (EPA 2006, page 2.4-11). It noted further that, due to less suitable conditions such as swift water velocity and scouring, macrophytes tend to be less common in Reach 5A. It indicated that, in free-flowing habitats like Reach 5A, white sucker dominated the fish community and feed on epifauna, while benthic communities mainly consist of the larvae of true flies (order *Diptera*).

3.1.4 *Corrective Measures Study Reports (2008-2010)*

In 2008, GE issued a Corrective Measures Study (CMS) Report, which provided detailed evaluations of remedial alternatives for the ROR (Arcadis and QEA 2008). During those evaluations, the CMS Report presented substantial information on ecological baseline conditions in the ROR, including Reach 5A riverine habitat conditions. In October 2010, GE issued a Revised Corrective Measures Study (RCMS) Report, which included additional remedial alternatives, provided an updated evaluation of the remedial alternatives, and responded to comments on the 2008 CMS Report (Arcadis et al. 2010). The RCMS Report included a substantially expanded description of the affected habitats in the ROR, including Reach 5A riverine habitats, and the ecological impacts and potential for restoration associated with the remedial alternatives.

With regard to the riverine habitat of Reach 5A, the RCMS Report described the habitat as including both medium-gradient stream areas from the Confluence to the Holmes Road Bridge and low-gradient stream areas throughout the entirety of the rest of Reach 5A. It noted that the transition is somewhat gradual with a boundary that is difficult to define. Additionally, riverine point bars were

noted to exist throughout Reach 5A along with mud flats in the lower water late summer months, but the extent of these mud flats was not quantified since it is dependent on river flow.

The RCMS Report discussed physical features within these habitat types in Reach 5A, describing the medium-gradient areas as having moderate water velocities with substrate dominated by coarse sand, gravel, and cobble, with small amounts of boulder and silt present. Depth in these areas was listed at 1.5 to five feet in the main channel, with most of the run habitat including some areas of riffle and pool. Riverine point bars were noted, but they only comprised approximately one acre of the entirety of the PSA.

Features within the low-gradient areas were described to include substrate dominated by silts, organic muck, and fine sand, with little gravel, cobble and boulder components; and it was noted that this area has considerable meanders throughout. Woody debris was described as being a major visual component of the medium-gradient areas and as present throughout Reach 5A, but often submerged in the low-gradient areas.

Biological communities within Reach 5A were also described in the RCMS Report, including aquatic vegetation, aquatic invertebrates, fish, and rare species habitats. It noted that the riverine habitat in Reach 5A hosts only sparse aquatic vegetation due to the sand and gravel substrate and high water velocity. Fisheries information on Reach 5A reported in the RCMS was primarily taken from Woodlot (2002a). More generally, the RCMS 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 (*Glyptemys insculpta*), 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, page 5-16). Finally, the RCMS Report provided extensive detail on state-listed species mapping and habitats in Reach 5A, including many that use riverine habitats, at least for certain life cycle requirements.

3.1.5 *Stantec Bank Studies (2009)*

On EPA'S behalf, Stantec Consulting Services, Inc (Stantec) conducted an evaluation of riverbank erosion in Reaches 5A and 5B. Stantec used field surveys to determine Bank Erosion Hazard Index (BEHI) and Near-Bank Stress (NBS) ratings. This evaluation was presented in a report entitled *A Study of Bank Erosion Rates within Selected Reaches of the Housatonic River* (Stantec 2009). In Reaches 5A and 5B, 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). Riverine habitat conditions in Reach 5A were not specifically discussed in detail in this report, but riverbank conditions are closely related to and affect riverine conditions and habitat. 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. However, no specific habitat factors were addressed in relation to this analysis.

3.1.6 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, four of which were located within Reach 5A (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 Areas #1 and #2 both include sections of the Housatonic River within Reach 5A, and habitat descriptions of both were provided. These two Example Areas are shown on Figures 3-1a and 3-1b (also discussed in Section 3.2). (The other two Example Areas in Reach 5A consisted only of floodplain habitat and are discussed in Section 6.1.4.)

Example Area #1 contains approximately 1,600 linear feet (2.4 acres) of riverine habitat, characterized by a channel 40 to 60 feet in width and one to five feet in depth, a primarily sand substrate with smaller components of gravel or cobble, and substantial amounts of large woody debris. This section of river includes two sharp bends and one broad bend with sections of pool and riffle habitat as well as two depositional point bars. Example Area #2 contains approximately 1,650 linear feet of riverine habitat, and also has a sand substrate with significant gravel components in the upstream portion and significant silt components in the downstream portion. Like Example Area #1, there was large woody debris in Example Area #2, primarily in the downstream portion.

The Example Area evaluations provide considerable detail on the riverine habitats in both sections of the river in Reach 5A. In-stream habitat is described for each area, including substrate composition, riffle/run/pool distribution, aquatic vegetation, woody debris, and depositional features such as point bars. Descriptions are provided of the habitat use of these different features, including habitat for a range of aquatic invertebrates and fish, as well as overwintering habitat for turtles. Point bars present in these sections provide foraging grounds for mammals and birds, and emergent plant habitat for amphibian, invertebrate, and fish larvae (AECOM, 2010). The following points summarize the riverine habitat descriptions provided about Example Areas #1 and #2:

- Example Area #1 consists of 1,600 linear feet of medium gradient stream (MGS), whereas the similarly sized riverine habitat in Example Area #2 transitions from MGS in the upper portion to low gradient stream (LGS) in the downstream.
- Sand and gravel is the dominant substrate in MGS areas, whereas sand and silt is dominant in LGS areas. Very limited areas of cobble occur where increased water velocity transports the sand downstream.

- On an aerial basis, in-stream habitat in both Example Areas is dominated by run habitat, which is estimated at nearly 90% of the river. Pool habitat accounts for approximately 8-9% of the total habitat in these example areas, and riffle habitat is limited to only 1-2%. Most pool habitat in both Example Areas is associated with outside bends or downstream of large woody debris collection points.
- Large woody debris is substantial within both Example Areas, adding considerable structure and complex micro-habitats to the River. These natural structures alter sediment transport and impact flow patterns and erosive forces, creating variation in depth and substrate texture.
- Aquatic vegetation in this portion of the Housatonic River is limited to small patches in sandy areas, and the invasive curly-leaf pondweed (*Potamogeton crispus*) is the most abundant aquatic species in both Example Areas. Other aquatic plant species in this section of the river include Eurasian watermilfoil (*Myriophyllum spicatum*) and water celery (*Vallisneria americana*). Algal growths are generally limited by water velocity, but blue-green and green algal mats are present in a few areas, and diatoms coat many of the rocks.

3.1.7 *Natural Heritage Information (2000-2022)*

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 rare species. This information described habitat conditions of state-wide significance and detailed the state-listed rare species (i.e., threatened, endangered, and special concern species) that were documented within the Priority Habitat limits delineated. In 2008-2009, MNHESP conducted rare species field surveys over thousands of hours 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 20 state-listed species in Reach 5A and resulted in the preparation of updated Priority Habitat mapping for each of these species, which was included in the 2010 RCMS Report. Many of these state-listed species are associated with riverine habitat in the Housatonic River, at least during some of the species' life stages. MNHESP also published two documents summarizing much of its investigations (MNHESP 2010, 2011).

The 2010 MNHESP report described rare species and natural community surveys in the Housatonic Watershed. Riverine habitats in Reach 5A were not specifically discussed; however, summaries were provided of riverine investigations documenting rare species with habitat requirements found within Reach 5A riverine habitat and included in the Priority Habitat mapping discussed above (MNHESP, 2010). The 2011 MNHESP report did note that one of the state's best populations of triangle floater mussels was documented in the Housatonic River in Pittsfield (2011, page 6); at the time, this was a

state-listed species, but it has since been de-listed. MNHESP concluded that “the project saw the updating of records and the discovery of many new occurrences of rare species and priority natural communities that were recently or historically known from the watershed, and also included the identification of several rare species never before documented in the watershed. There does not appear to have been a significant decline in the number of species or priority natural community types despite the long history of human influence in the watershed, although some have declined in abundance and distribution (population or occurrence quality).” (MNHESP 2011, pages 30-31.)

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.³ All three types of Core Areas include some riverine habitats. There are four specific sections of the Housatonic River from the Confluence to Canoe Meadows 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 Reach 5A riverine habitat.

In October 2022, MNHESP provided GE with updated digital information that included Species Habitat mapping of the state-listed species in the ROR, including Reach 5A.⁴ As described in Section 3.3 and further in Section 8, at least ten of these species utilize habitats consistent with those present in the Reach 5A riverine habitat and have mapped Species Habitat that includes the Reach 5A river channel.

3.1.8 *Pre-Design Investigations of Reach 5A*

The PDI conducted in Reach 5A collected a range of information on riverine conditions that contribute to habitat characteristics.⁵ The PDI included detailed topographic and bathymetric surveys of the river, riverbanks, and floodplain to support the remedial design. All survey work was

³ Cores Areas 1, 2, and 3 are defined in Section 6.1.5 of this report. Section 8 of this report provides further information on the Core Habitat designations by MNHESP.

⁴ 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.

⁵ The PDI of the sediments and riverbanks in Reach 5A was described in GE’s *Pre-Design Investigation Summary Report for Reach 5A Sediments and Riverbanks* (Anchor QEA and AECOM 2023a), which was submitted to EPA on September 28, 2023 along with the Conceptual RD/RA Work Plan for Reach 5A.

conducted by Spicer Group, Inc., between December 2021 and May 2022 using a combination of methods and technologies, some of which pertain to the riverine habitat of Reach 5A, including the following:

- An aerial Light Detection and Ranging (LiDAR) survey was conducted in December 2021 over the entire length of Reaches 5 and 6 (i.e., from the Confluence to Woods Pond Dam).
- A bathymetry survey was conducted through the main channel and backwaters within Reaches 5 and 6. Data collected in Reach 5A were obtained using conventional survey methods. Specifically, within the main channel, bathymetric survey cross-sections were completed every 100 feet along the centerline of the river and at every main channel sediment sampling transect spaced 250 feet apart along the centerline of the river. Top-of-water elevations were measured on both the left and right bank at every other transect.
- Water surface elevations and river current velocities were measured at various locations throughout Reach 5 to support development of a hydraulic model. Current velocities were measured at six cross-sections within Reach 5 using an acoustic Doppler current profiler. These six cross-sections included three locations in Reach 5A (Holmes Road bridge, adjacent to Joseph Drive, and near the Pittsfield WWTF). Additionally, this effort included the deployment of water level loggers at two locations (one of which was within Reach 5A) to continuously monitor water surface elevation.

Using the topography and bathymetry data sets described above, Spicer Group generated a contiguous digital elevation model (DEM) which indicates that the majority of the Reach 5A riverine habitat falls between 948 and 959 feet (NAVD88), with pockets that fall between 858 and 947 feet (mostly occurring in the southernmost stretches of Reach 5A).

The PDI also included a characterization of the riverine habitat in 5A. The PDI showed that the Reach 5A river is free-flowing, contains numerous meanders, and has riverbanks that are subject to erosion in places. The width of the river in this reach ranges from approximately 40 to 120 feet, and bankfull water depth ranges from approximately two to 10 feet. Additional surface water monitoring conducted in 2022 provided supplementary updated information on river stage, surface water elevations, and calculated flows, as described in GE's *Interim Baseline Surface Water Monitoring Report* (Anchor QEA and Arcadis 2023a).

3.1.9 Other Existing Information

A United States Geological Survey (USGS) gauge station (USGS 01197000) is present upstream on the East Branch of the Housatonic River at Coltsville. This gauge is about 5.4 miles upstream of the Confluence (i.e., the start of Reach 5A). The Coltsville gauge station provides substantial data on

water quantity and quality in the East Branch dating back to 1936. In particular, flow quantity and stage data from this station are used in defining the hydrologic and hydraulic conditions within Reach 5A of the Housatonic River. However, data from this station need to be qualified, since the station represents a watershed drainage area of 57.6 square miles, whereas the watershed drainage area above the Confluence is 134 square miles and includes the West Branch of the Housatonic River as well as the remaining watershed of the East Branch downstream of the Coltsville gauge station. Adjusting the Coltsville gauge station database to account for these watershed conditions, as done with various hydrologic models, provides hydrologic data for Reach 5A (e.g., bankfull flows), which strongly influence riverine habitat conditions. The method used for this adjustment followed the standard practice of relating such gauge station hydrologic data to various watershed locations as described in the Hydrologic/Hydraulic Analysis (HHA) included as Appendix G to the Reach 5A Conceptual RD/RA Work Plan. As described there, flow increment ratios (or drainage area ratios) are developed to relate measured flow at the USGS gauge to other downstream locations, adjusted to account for differences in land use and soil conditions in the subwatersheds. Flow ratios between the East and West Branches of the Housatonic were calculated using flows measured during GE's interim baseline surface water monitoring program (Anchor QEA and Arcadis 2023). These comparisons were used as an empirical baseline to support estimation of relative flow volumes in each branch. Those measurements were also used to develop a relationship between flows measured at the Confluence and flows recorded at the USGS Coltsville gauge. The HHA provides a full hydrological analysis of Reach 5A (as well as all of Reaches 5 and 6) to evaluate the statistical characteristics of flows within these portions of the ROR.

3.2 2022 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 Reach 5A in August and September of 2022. Those 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 Reach 5A, 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. As noted in the RBP, "the habitat quality evaluation can be accomplished by characterizing selected physicochemical

parameters in conjunction with a systematic assessment of physical structure. Through this approach, key features can be rated or scored to provide a useful assessment of habitat quality” (RBP, page 5-1).

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 18 riverine stations in Reach 5A and are provided in Appendix A-1a. 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, aquatic vegetation, large woody debris, 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 visual observations of surficial sediments (aided by view tubes), sediment grab texture observations, and observations using intrusions in the sediment with steel poles in deep areas that were too deep to be observed. Estimates of habitat areas were provided in square feet, and then calculated in proportion to the overall area.

The 18 stations at which RBP assessments were conducted were distributed between the Confluence and the downstream end of Reach 5A, as shown on Figures 3-1a through 3-1d. These segments were set based on field evaluations of stream morphology patterns by AECOM scientists. The use of segments based on representative reaches following repetitive patterns in stream morphology allowed for evaluation of the entirety of the subject river habitat without the potential error associated with subsampling small portions of the river. Each station 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. Drought conditions and low water occurred during the field effort in August and September 2022. However, flow-dependent parameters were recorded as though the flow was in its normal condition using bank and bottom indicators to approximate normal flow.

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-1a. The results for the RBP are summarized in Tables 3-3, 3-4, and 3-5.

Observations from the 18 stations provide a comprehensive evaluation of riverine habitat in the entire Reach 5A. The key findings are as follows:

- River morphology is a top-level indicator of habitat in both flow regime and substrate. Overall river morphology proportions observed in Reach 5A are Pool 53%, Run 41%, and Riffle 6%. Proportions of riffle and run were higher upstream and 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. Overall substrate proportions are as follows: Sand 42%, Gravel 21%, Silt 20%, Clay 8%, Cobble 7%, Boulder 2%, and Bedrock 0%. See Figure 3-2 (three sheets) and Table 3-4. These data were derived from recorded visual observations in accordance with the RBP protocols.
- Rocky substrate generally decreased from upstream to downstream.
- Overall organic substrate distributions are as follows: Detritus (leaves, small wood, and other organic matter) 9.5%, and Muck-Mud 2.6%. See Table 3-4.
- Large woody debris (LWD) was a consistent habitat component and the density is estimated at 33.1 m²/km² of riverine habitat across all stations, ranging from 7 to 122.8 m²/km². Large, embedded root wads and trees demonstrably entrapped other large woody debris 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.
- Overall submerged aquatic vegetation cover was sparse (4.3%). Periphyton algae was the main cover type, followed by the invasive curly-leaf pondweed.
- The qualitative habitat assessment parameters for the overall area (see Table 3-5) ranked from highest (optimal) to lowest (marginal) weighted scores are:
 1. Riparian Vegetative Zone Width- 17.32,
 2. Channel Alteration-17.29,
 3. Pool Variability- 13.74,
 4. Channel Flow Status- 13.01,
 5. Pool Substrate Characterization- 12.66,
 6. Vegetative Protection- 12.53,
 7. Available Cover- 11.34,
 8. Channel Sinuosity- 11.28,

9. Bank Stability- 10.09, and
10. Sediment deposition- 9.41.

Riparian vegetative zone width and channel alteration had the highest scores because most of Reach 5A 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 was trees, and the dominant species was silver maple (*Acer saccharinum*), with the invasive Japanese knotweed (*Fallopia japonica*) in the understory.
- Average water depth was 1.3 meters and average surface velocity was 0.5 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.

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 Reach 5A in August and September 2022. A total of five sampling stations were sampled within Reach 5A concurrently with the physical riverine habitat survey. The sampling stations are shown on Figures 3-1a-d highlighted in yellow. The objective of the macroinvertebrate sampling was to obtain updated information on the general species composition and relative abundance in the main benthic habitats in Reach 5A. The sampling method was carried out as follows:

1. Approximately 300-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-d. They were selected primarily based on their representation of benthic substrates and flow regimes in Reach 5A. There were limited areas available that presented

the variety of depth, flow, and substrates representative of this section of this medium-gradient reach. Based on field conditions, a determination was made to include the area downstream from Pomeroy Avenue Bridge. It was determined that influence from roadway stormwater runoff and other anthropogenic factors were minimal at this location because the immediate area is not densely developed and runoff from the roadway does not discharge directly to the river here. The Holmes Road Bridge is downstream from the sampling area, so it has minimal effect on the macroinvertebrate community. The area around this bridge also has minimal anthropogenic factors, other than scour protection around the abutments, which are well downstream of the sampling area.

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 methods, kicking the substrate and jabbing it with a dip net. When the kicking approach was used, a D-shaped dip net was positioned and held stationary on the substrate at the downstream end of the sampling area while the substrate immediately upstream of the net is disturbed by kicking. 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 were collected 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 kicking or jabbing, 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 kicking or jabbing from the multiple habitats and placed into the sample jar were composited 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 to be sent to a laboratory for taxonomic identification (to species level where possible).⁶ A total of five composite samples, plus a duplicate sample from one of the sample areas, were sent to the laboratory for such identification.

The analysis of water quality and riverine habitat from the macroinvertebrate data was performed with assistance by Lotic Inc. (Lotic)⁷ in a manner that is consistent with previous monitoring of restoration efforts on the 1½-Mile Reach situated upstream from Reach 5A (e.g., GE 2017). 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, Lotic has developed an in-house model based on 23 years of aggregated benthic community data that is further bolstered by its consistency with Maine Department of Environmental Protection's linear discriminant model (Davies and Tsomides, 2014). The Lotic 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

As described above, the benthic macroinvertebrate community assessment involved the collection and taxonomic identification of six composite samples (including one duplicate sample). 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-2. It should be recognized that this sampling was conducted during drought conditions. Drought causes some decrease in macroinvertebrate abundance due to loss of available habitat and some decrease in richness due to a loss in habitat diversity, as less of the channel is submerged. The water quality may also be impacted as the temperature is typically warmer than normal and dissolved oxygen is also typically lower. Thus, any comparison using these data as a baseline should consider these factors.

The goal for each subsample for laboratory processing was 300-500 organisms; however, two of the six samples did not reach that organism count. Station 1 located at the top of Reach 5A and Station 2 located just upstream of Canoe Meadows totaled only 243 and 139 organisms, respectively.

Across sampling stations, a total of 1,673 individuals were given a final identification after lab processing. Among those individuals there was high species richness, including 117 different species. These species were representative of 41 different families, from 17 distinct orders. This high species richness is typical of a suitable water quality and substrate for diverse aquatic organisms.

⁶ Cole Ecological, Inc. in Greenfield, MA provided taxonomic identification of macroinvertebrates.

⁷ Lotic Inc. (now part of Haley Ward, Inc.), Belfast, Maine.

In aggregate across the stations, the family-level taxon *Hydropsychidae* (net-spinning caddisflies) under the order *Trichoptera* was the most common, making up over 33% of the sampled community with 563 individuals. This family as a group is considered moderately pollution-tolerant, although the individual species have a variety of tolerances to pollution and disturbance. The next highest abundance was a diverse group in the order *Diptera*, with most individuals in the family *Chironomidae* (non-biting midges). This order made up 37% of the sampled community with 626 individuals. The highest count of an individual identified species found in the samples belonged to *Hydropsyche betteni* (the common net spinner caddisfly), which made up about 13% of the total sampled community at 216 individuals and is also moderately tolerant of pollution.

Table 3-7 presents the taxa measures from each station. The Lotic 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 Lotic model. All samples attained a classification in this system with fair or higher indicators of quality.

The average taxa (genus) richness of 36 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). 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 ranged from 9 to 15 with an average of 11. This EPT proportion is an indicator of fair to good water quality. The general lack of stoneflies is an indicator of potentially poor water quality in these results, but the other two orders are fairly representative. Stoneflies are particularly sensitive to low dissolved oxygen, which may be a consequence of the drought conditions during sampling.

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 5 to 15, with an average of 13.33. 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 Reach 5A channel, the abundant vegetation/habitat in riparian zone for adult emergent insects, and the soft sediment that provides forage and habitat for macroinvertebrates. It should also be considered that the proportions and total numbers of macroinvertebrates may represent metrics that are skewed towards indicators of below-average water quality because of the extensive drought that occurred in the spring and summer before and during the sampling.

Crayfish were also found and are discussed in the small fish assessment section below.

3.2.4 *Assessment of Fish Species*

3.2.4.1 *Methods*

Small fish traps (known as minnow traps) were deployed in August 2022 upstream of the electrofishing station in Reach 5A in shallower habitat to obtain information on small fish species that may not be affected or observed while electrofishing. The traps were deployed at three locations in Reach 5A, which were distributed to account for diversity in habitat and location, as shown on Figures 3-1a-d. See the Small Fish Photo Log in Appendix A-3 for pictures of the sites and the equipment setup. Each location had four traps divided into two sets of two traps distributed in prime small fish habitat representative of Reach 5A.

As noted above and shown on Figures 3-1a-d, the three locations of the trap sets were evenly distributed along Reach 5A. The northern set of traps was deployed on either side of a meander near Holmes Road upstream from Canoe Meadows. The middle set was deployed downstream of Holmes Road at the confluence of Sykes Brook, in riffle habitat adjacent to Nobles Farm. The southern set was deployed downstream of Sykes Brook adjacent to East New Lenox Road. At each of those three locations, four 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 22-26 hours. At both the late afternoon check and the final pull, the small fish species (and other species) present in the traps were identified and total length was measured by a senior AECOM fisheries scientist.

In addition, in accordance with Section 3.1.1.3 of the Revised BRA Work Plan, a fish community composition sampling event was performed on September 29, 2023 in lower Reach 5A using an electrofishing boat along with the first round of fish tissue sampling in the baseline monitoring program. This sampling occurred by boat for 33 minutes along each side of approximately 1,700 feet of river length in Reach 5A. The transect started 500 feet upstream from the Pittsfield Wastewater Treatment Plant outfall and proceeded upstream in the vicinity of the Electric Power Research Institute facility. The sampling occurred following rain during a wet late summer/fall period and flows were high with approximately 3-4 feet of visibility, but the high flows allowed for boat access in areas that might otherwise be limited. Navigation was limited by fallen trees across the river and sampling proceeded as far upstream as the boat could safely pass on the day of sampling. The high flow sampling conditions complimented the low flow sampling conditions during the trap sampling described above. Habitat within the sampling area was sand/clay/mud bottom with deep river bends and LWD interspersed in aggregation. There were two small meanders and one long sweeping meander in the transect. There was little to no submerged aquatic vegetation present. Surrounding land consisted of farmland on one side on the east and forest on the west. The majority of the banks were steep on either side. Species, age class and any apparent diseases or deformities were recorded for each fish by a senior AECOM fish scientist as the fish were captured.

3.2.4.2 Results

The results of the August 2022 small fish trapping effort are presented in Table 3-8. 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 showed that the biomass of juvenile fish species (crayfish excluded) was more proportionally dominant than that of small fish species (e.g., minnows such as shiner and dace). This is especially notable when the usual relative abundance and biomass of those species' guilds are considered. Biomass and numbers of forage species such as minnows are typically higher than that of juvenile species of predatory and bottom-feeding fish. Forage species population numbers are typically orders of magnitude more abundant than larger predatory fish. In Reach 5A, although there are some areas of LWD that provide cover, there is a lack of habitat for small fish species. Most small fish species prefer cover habitats such as submerged vegetation, non-embedded rocky substrates, and bottom roughness that is higher than sandy unconsolidated substrates provide. Although the sampling locations were chosen that fit these preferences, there is likely not enough of the preferred habitat to support abundant small fish.

Species that are moderately tolerant of pollution and soft unconsolidated substrates, such as adult spottail shiner (*Notropis hudsonius*) and juvenile white sucker (*Catostomus commersonii*) (see Grabarkiewicz and Davis 2008), comprised a majority of the catch. A few juvenile rock bass were also

captured. They are a non-native species that typically prefer habitat with abundant cover, but, like many non-native species, they are adaptable and competitive for resources.

The low representative catch numbers and habitats that the species represent may have been influenced by the drought conditions during the time of the fish capture effort in the late summer of 2022. The drought conditions brought low water and relatively warm water conditions. The low water limited the habitat available to fish in volume because of less submerged substrate and woody debris available. It also allowed more sunlight penetration and reduced the cover from birds and other predators that hunt above the water. 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 outputs, like those that have been documented throughout Reach 5A.

Many common crayfish (*Cambarus bartonii*) were captured in the fish traps. They are generally regarded as moderately tolerant of polluted and disturbed environments. The lengths obtained for this species in Table 3-8 are carapace length, which is the large segment of their shell measured dorsally from the eye socket to the junction with the tail. Because of the low detrital input to the stream during the drought, they were likely on low reserves and were willing to travel farther than usual distances to obtain the bait in the trap. This was corroborated by observations of uncharacteristic mid-day conspicuous feeding behavior. The presence of these crayfish in the traps may have discouraged fish from entering them. The crayfish may have also captured and eaten some of the captured fish while they were in the trap.

The results of the electrofishing sampling catches in the lower Reach 5A in September 2023 are summarized in Table 3-9. Although there were some potential confounding factors listed above, those results are generally consistent with the trap sampling data. Spottail shiners were the most numerous followed by white sucker, yellow perch, and rock bass. White suckers comprised the highest fish biomass. This is consistent with this species' habitat preference for medium to fast flowing waters with fine sediment. While these data may not be representative of the whole reach, the composition of species found in this survey is typical of a transitional area from MGS to LGS. There were no diseases or deformities observed in any of the sampled fish.

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 41 species (or evidence of their use) were observed in or around the river in Reach 5A. These include 19 bird species, seven species of herpetofauna, three mammal species, 10 invertebrate species, and two fish species, as shown in

Table 3-10. In addition to this listing, Appendix A-1b provides a comprehensive listing of wildlife species recorded or potentially occurring (based on habitat conditions) in Reach 5A.

3.2.6 *Aquatic Plant and Invasive Species Observations*

Submerged aquatic plant cover is generally sparse in the riverine environment in Reach 5A. Periphyton algae covers some rocks, woody debris, and shallow silty/clayey bottoms. Curly-leaf pondweed, an invasive species, was sparsely located in areas with full sun and nutrient rich soil. The invasive Eurasian watermilfoil was also found during the riverine investigations along an outside bend adjacent to an open field on the south end of RBP-12 (Figure 3-1c; between Joseph Drive and New Lenox Road). This accessible location and the presence of colored aquarium substrate on the bank suggest introduction by aquarium dumping. Watermilfoil was also found in a small patch in RBP 17. Other species of aquatic plants found include water celery, burr-reed species (*Sparganium* spp.), macrophyte algae, yellow iris (*Iris pseudacorus*, an invasive species) and blue flag iris (*Iris virginica*). 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 Reach 5A Riverine Habitats

3.3.1 *Habitat Types Within the Riverine Environment*

The Housatonic River in Reach 5A 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 4.6 river miles, the total riverine habitat in Reach 5A is approximately 45 acres. Based upon current findings, approximately 29 acres of MGS occurs in Reach 5A, with 16 acres of LGS. While Woodlot (2002a) classified only nine acres of MGS in Reach 5A (running from the Confluence to approximately the Holmes Road Bridge), with the remainder being LGS, the 2022 field survey interpreted conditions to be more variable than the Woodlot classification. For example, while most of Reach 5A above Holmes Road provides MGS habitat, some areas of slack water were present, which is more consistent with LGS habitat. Similarly, habitat conditions from Holmes Road to the downstream end of Reach 5A remain variable, with segments of MGS interspersed with LGS in fairly equal proportions (although the boundary between these two habitats is not well defined). LGS does become progressively more abundant in the lower portions of Reach 5A. Reach 5A includes significantly more pool (53%) and run (41%) habitat than riffle (6%) across the entirety of the reach; and while riffle habitat does appear in the lower stretches of Reach 5A, this habitat is more prevalent in the upstream MGS dominant stretches.

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. Figures

3-1a-d show the location of many of the point bars located in Reach 5A (along with other habitat features such as accumulations of large woody debris); and since these are transitional features between the river and riverbank, they are also shown on Figures 4-1a-d and 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 other waterbodies occur along Reach 5A that contribute flow and sediment to the riverine habitat. One notable waterbody is a small tributary stream named Wampenum Brook that flows into the Housatonic River from Morewood Lake, which is located just outside of the Reach 5A limits. The stream is six to eight feet wide and has an average depth of six inches. The total substrate within the stream channel is composed of 80% sand/gravel and 20% silt. The banks range from one to two feet in height and contain small animal burrows and woody debris (AECOM 2010).

Two other small tributary streams, Sackett Brook and Sykes Brook, feed into Reach 5A on the eastern side of the river (along station RBP 7). The brooks are similar and are approximately eight to 10 feet wide with depths ranging from 0.5 to one foot with coarse sand and gravel substrate. Small point bars, woody debris, and sandy deposits are present at many of the bends in the brooks. The banks range in height from two to four feet (AECOM 2010). Two other waterbodies are of note, although neither provides “riverine” habitat. The first is an intermittently flowing side channel that extends off the main channel just below the Confluence and runs along the east side of the Housatonic River. The second is West Pond in Canoe Meadows and the small tributary that connects this pond with the Housatonic River just downstream of the Holmes Road Bridge.

3.3.2 *Hydrology and Physical Features*

Hydrologic and hydraulic conditions in the Housatonic River in Reach 5A 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 5A is a critical factor determining its form and function. Reach 5A starts at the Confluence, with a combined watershed area of approximately 130 square miles (almost equally distributed between the two sub-watersheds: 69 acres for the East Branch and 61 acres for the West Branch). The general character of both sub-watersheds is also somewhat similar, consisting 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 5A typically drop below 20 cubic feet per second (cfs), with water levels commonly less than a foot deep and both bars and mud flats prominent along the river margins.

In contrast, storm events increase flows in Reach 5A 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 Confluence of just over 1,000 cfs, while the 100-year storm event flow is roughly 13 times higher (13,390 cfs). Further, the HHA notes that recent analyses indicate that these storm flows have increased in magnitude; for example, the 1987 FEMA 100-year (or 1% annual chance flood) flow of 12,386 cfs has increased to 13,390 cfs based on the updated HHA. The HHA indicates that bankfull flows in the upper part of Reach 5A are on the order of 2,000-3,000 cfs, reflecting the stage of overbank flooding into the adjacent floodplain which may occur every 1.5 to two years, with water levels more on the order five to six feet deep. More detailed hydrologic analysis is anticipated as the HHA is expanded for final remedial design, 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 Reach 5A transitions from moderate to low channel slope. Stream gradient generally declines downstream and a transition to more LGS occurs along the length of Reach 5A; 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 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 and very little silt. Maximum (non-flood) water depths in MGS areas are typically two to four feet in the main channel, with some pools and riffles but mostly run habitat (moderate to rapid non-turbulent flow with little exposed substrate). Banks are high in most MGS area, but there are sufficient cuts in the bank to provide functional linkage with the adjacent floodplain. During lower flow periods, the water level in MGS areas is often less than one foot, with features such as mid-channel bars exposed a foot or more above the water surface. Maximum water depths in Reach 5A LGS areas during "normal" (i.e., non-flood/non-drought) conditions in Reach 5A may approach four to five feet in the main channel, but LGS areas in Reach 5A are more typically two to three feet deep.

Riverine bar habitat is formed at points where higher water velocities transition to lower velocities as a function of channel changes, usually on the inside of a river bend, but where velocities are rarely high enough to wash away accumulated sediment. Typically, bars have a gentle slope and are often submerged during flood events and periods of high water. These river features accumulate downed woody material and other debris during times of high water levels, and are important for the emergence of insect larvae and for providing access between terrestrial and aquatic habitats for a variety of wildlife. While riverine bar habitat occupies only small portions of the overall riverine habitat, they are not uncommon features within Reach 5A. Figures 3-1a-d show the location of 55 riverine bars identified during the 2022 field surveys.

Progressing downstream in the Reach 5A river channel, the substrate typically becomes more frequently dominated by silts, organic muck, and fine sand in the LGS areas. Some gravel, cobble, or boulders may be present even in LGS areas of Reach 5A, particularly along the margins, but are not a major component of the submerged substrate. Mud flats may form as water levels decline during prolonged periods of low flow, particularly along protected lee edges of LGS areas.

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 species. Such LWD is a consistent visual aspect of MGS and much of the transition zone to LGS. Woody debris is present but often submerged in LGS. While such debris may not be visible, it adds structure and affects depositional patterns, even within the LGS. 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. Figures 3-1a-d indicate the location of the major LWD accumulation zones in Reach 5A identified during the bank and floodplain surveys, noting that such locations are temporary and subject to change from fluvial processes. 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 Reach 5A 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 Reach 5A channel hosts only sparse aquatic vegetation due to the unconsolidated sand and gravel substrate and high water velocity. The primary aquatic plant species identified in Reach 5A were various periphyton algae, Eurasian watermilfoil, curly-leaf pondweed, American bur-reed (*Sparganium americanum*), and giant bur-reed (*Sparganium eurycarpum*). The watermilfoil and curly-leaf pondweed are invasive species and are found in sparse patches in riverine areas in Reach 5A. Shading by shoreline trees and shrubs occurs, restricting light and limiting temperature rise, and thus further controlling aquatic plant growth. Aquatic vegetation is limited to small patches in sandy areas in Reach 5A. Cover and overall habitat structure are more often associated with woody debris in this reach.

A wide range of aquatic invertebrates utilize the Housatonic River within the PSA (Woodlot, 2002a), including a number of state-listed species. The state-listed species include six species of dragonflies – brook snaketail (*Ophiogomphus aspersus*), riffle snaketail (*Ophiogomphus carolus*), arrow clubtail (*Stylurus spiniceps*), rapids clubtail (*Phanogomphus quadricolor*), spine-crowned clubtail (*Hylogomphus abbreviates*), and ocellated darner (*Boyeria grafiana*). The snaketails are restricted to MGS habitat and the transition zone to LGS within Reach 5A, preferring gravelly substrates (although gravel is not a prevalent substrate in Reach 5A). The clubtail dragonflies can be found throughout the reach in sandy or silty sediments. Other invertebrates commonly found in Reach 5A include other dragonfly species, damselflies, a variety of true bugs (*Hemiptera*), beetles, caddisflies, a wide range of true flies (*Diptera*), freshwater shrimp (*Amphipoda*), two native species of crayfish, and three species of mussels (the formerly state-listed triangle floater, the eastern floater [*Anodonta cataracta*], and the eastern elliptio [*Elliptio complanata*]). Three species of fingernail clam (*Sphaeriidae* family) 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. A few 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 Reach 5A: 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 (genus *Leopomis*), yellow perch (*Perca flavescens*), various minnow species (Order *Cypriniformes*), sucker species (Family *Catostomidae*), largemouth bass, eastern chain pickerel (*Esox niger*), northern pike (*Esox lucius*), brown bullhead (*Ameiurus nebulosus*), goldfish (*Carassius auratus*), and common carp (*Cyprinus carpio*). 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. In 2000, the most abundant fish species in Reach 5A was the white sucker, at 65% of the biomass, but other commonly occurring species included largemouth and rock bass, yellow perch, and various minnow

species (Woodlot 2002a). The recent surveys in 2022-2023 are consistent with these previous findings.

The point bars and other side and mid-river bars in Reach 5A provide access between the river and floodplain for wading birds and small and large mammals. They also serve as emergence habitat for amphibian and invertebrate larvae, including some dragonflies. The higher, more gravelly portions of the point bars provide potential nesting habitat for the state-listed wood turtle.

There are 10 state-listed plant and animal species that have MNHESP-mapped Species Habitat within the river channel in Reach 5A and that could be found in the aquatic riverine habitat in this reach (based upon habitat requirements). The list consists of dragonflies (described above), emergent vegetation, wading birds, and a reptile. There are no 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 noted previously, riverine habitat in Reach 5A is included in portions of Core Areas 1-3 as designated by MNHESP (Mass DFW 2012).

3.4 Reach 5A Riverine Habitat Functional Assessment

This section presents an assessment of the ecological functions and services of the riverine habitat in Reach 5A. 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 existing and PDI 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 in Reach 5A, 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 stream 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 Reach 5A 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 streambed 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 stream 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 Reach 5A 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 steps (vertical profile changes) also aid in attenuation and suppression of floodwater and stream flow forces. Groundwater is also both recharged and discharged along the Reach 5A channel, providing another hydrologic link between the stream channel and the landscape.

The hydrologic and hydraulic conditions prevailing in the riverine habitat in Reach 5A 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. 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 sediment and point bars found throughout Reach 5A. 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 signs of instability and disturbance to the desired equilibrium of sediment transport (discussed below), the Reach 5A river channel maintains sufficient connectivity with the floodplain to promote flood storage and peak flow/stage desynchronization, particularly during storms less intense than the two-year storm event.

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 Reach 5A channel form (dimension, pattern, and profile) is 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. Reach 5A has a relatively consistent amount of LWD in and along the stream channel which both reflects and contributes to flow diversity and channel geomorphologic variability.

The Reach 5A river channel contains sequences of riffles and pools or steps and pools that maintain channel slope and stability and contribute to aquatic habitat diversity. Riffles and pools in this reach, as well as other bed features such as runs and glides, form a diversity of aquatic habitats and provide the foundation for many of the biological and water quality functions that the Reach 5A riverine habitat provides. Macroinvertebrate benthic organisms cling to rocks and coarse substrates in riffle areas, filtering food from the flowing water and thriving on the oxygen-rich water. The oxygen in riffles and the increased flow allow a higher rate of contact with the water supporting all aquatic life and especially species and life stages that require access to high levels of dissolved oxygen. Early life forms of fish and macroinvertebrates use the fast-flowing water and higher oxygen levels in the accelerated growth of their early development.

Pools at the meanders create diverse habitats. Large woody debris 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.

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, riffles and deep pools (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.

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 Reach 5A 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 utilizes this area. These include several freshwater mussels (e.g., the previously state-listed triangle floater) and several state-listed rare dragonfly species – the brook snaketail, riffle snaketail, rapids clubtail, and spine-crowned clubtail dragonflies – as well as the ocellated darner. The snaketail dragonflies and triangle floater are largely restricted to MGS habitat and prefer the gravelly substrates present in Reach 5A. The invertebrates (including the state-listed dragonflies and previously listed mussel species) rely on foraging, shelter, and emergence habitat provided by the river.

Many areas within Reach 5A contain abundant coarse and fine 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. Pools created because of large woody debris offer shade and deeper, cooler water during summer months. Most fish species will seek out this cooler water during summer months if it is available. Pool habitat in the Housatonic River in Reach 5A 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 washed downstream or metabolically stressed.

Finally, the Housatonic River, including in Reach 5A, 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.

4.0 Reach 5A BRA of Riverbank Habitats

Riverbank conditions in the ROR have been included in numerous investigations over the past 20+ years along with other work, particularly in the PSA, including Reach 5A. As with the riverine BRA approach, the BRA of riverbanks within Reach 5A initially drew from these previous investigations and also incorporated the riverbank data collected under the Revised Reach 5A Sediment/Bank PDI Work Plan, as well as additional field surveys.⁸ As with the riverine inventory and assessment, and as directed in EPA's March 31, 2022 conditional approval letter, information on riverbank structural parameters was obtained for all riverbanks in Reach 5A, with data collection applied within discrete bank segments that have similar characteristics.

Table 4-1 provides a summary of the parameters that have been incorporated into the assessment of riverbank habitat conditions in Reach 5A. 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 Reach 5A BRA Work Plan. In other cases, the parameters were based on information drawn from other tasks or steps in the remedial investigation process, notably the Reach 5A PDI. Still 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 2022a) included some information on the riverbanks in Reach 5A. In describing the Reach 5A area, Woodlot stated that "the main stem of the Housatonic River in this section has moderately fast water with pool, riffle, and run habitat. The

⁸ The Revised Reach 5A BRA Work Plan used the same definition of riverbanks presented in the approved Revised Reach 5A Sediment/Bank PDI Work Plan, which was based on the Massachusetts Wetlands Protection Act regulations (310 CMR 10.54(2)(c)) definition, in which the toe is "the mean annual low flow level" and the top-of bank is "the first observable break in the slope or the mean annual flood level, whichever is lower." In fact, for the Reach 5A PDI, the toe of bank was defined based on the water surface elevation observed during the April 2022 topographic survey (with a river flow rate between 130-150 cfs) and the top-of-bank was the first observable break in slope based on the LiDAR survey data collected in 2021 and 2022, but no higher than the elevation of the adjacent 1 mg/kg PCB isopleth. This Revised BRA Report follows that same definition, which is also consistent with the definition used in the conceptual design for Reach 5A, included in the September 2023 Conceptual RD/RA Work Plan.

channel walls are vertically cut and bottom substrate is often gravel and sand” (Woodlot 2002a, page III-1-6). As the river slows and widens somewhat moving downstream, Woodlot noted that, “though the stream banks are generally vertically cut, a number of sand beaches were found” (*id.*, page 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 Reach 5A, but rather are more broadly listed for the entire PSA.

4.1.2 *RCRA Facility Investigation Report (2003)*

GE’s 2003 RFI Report provides substantial information characterizing ecological resources in the ROR area, including riverbank habitats in Reach 5A. Although the focus of that report was on documenting the extent of PCBs in the river, some relevant Reach 5A riverbank information is provided (e.g., total organic carbon content of riverbank soils). Minimal specific Reach 5A bank habitat characterization was provided, but rather conditions in the overall Reach 5 were typically referred to. The RFI Report summarized bank erosion investigations conducted by EPA in 2000-2002, which included the use of toe pins in Reach 5A to measure bank elevations over a 20-month period as well as bank migration measurements at 11 locations in Reach 5A. An overall bank erosion rate of -0.7 ft/yr was determined by these studies. The RFI Report noted that these values are not necessarily representative of Reach 5A 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 Reach 5A. As part of the field data collection for the EFDC modeling, detailed test pits were conducted along the riverbanks, including at six locations in Reach 5A. 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 Reach 5A. 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. The loamy sand surface that was present above this layer averaged two to four feet in thickness and was observed on about 50% to 75% of the erosion sites. At low flow, resistant silt loam benches were observed below the high-water line. 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 Corrective Measures Study Reports (2008-2010)

GE's 2008 CMS Report presented substantial information on ecological baseline conditions in the ROR, including Reach 5A riverbank habitat conditions. Its 2010 RCMS Report included a substantially expanded description of the affected habitats in the ROR, including Reach 5A riverbank habitats, and the ecological impacts of the remedial alternatives.

Section 5.0 of the RCMS Report provided the following summary of the Reach 5A riverbanks:

"Riverbanks in Reach 5A, the upper portion of the PSA, generally range in height from 2 to 5 feet, with areas of high vertical banks ranging from 8 to 12 feet. Banks consist of silts and sands with a range of physical attributes, including sloped and vegetated banks, vertical and exposed banks, erosional banks with slumping, and erosional but vegetated banks. Vertical and exposed banks lack vegetative cover but provide important habitat functions discussed in more detail below. Undercut banks are an important habitat component of the riverbanks in Reach 5A and are more prevalent in Reach 5A than anywhere else in the PSA. Mature trees overhanging the river and dense herbaceous and shrub communities are also prevalent on the banks in Reach 5A and provide shading to the river and foraging opportunities for wildlife." (RCMS Report, page 5-28.)

Additional descriptive information on the Reach 5A riverbanks from the RCMS Report includes the following regarding Reach 5A:

- Vegetation along the riverbanks consists mostly of trees in Reach 5A. Silver maple, red maple (*Acer rubrum*), eastern cottonwood (*Populus deltoides*), and box elder (*Acer negundo*) form much of the canopy in that reach, while the subcanopy, shrub, and herbaceous layers are minimized by light limitation.
- Exposed vertical banks in Reach 5A provide suitable nesting habitat for two species of bank nesting birds, the belted kingfisher (*Megasceryle alcyon*) and the bank swallow (*Riparia*

riparia). The vertical banks also provide potential nesting sites for several turtle species, including the state-listed wood turtle. The riverbanks in Reach 5A provide lodging habitat and slides for beaver and muskrat and foraging habitats for birds and mammals, including American mink (*Neovison vison*) and raccoons (*Procyon lotor*). In particular, beaver activity along the banks is common in many places, with frequently occurring burrows evident. Undercut banks and woody accumulations 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.

In addition, Appendix G of the RCMS 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 5A. 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)*

As discussed in Section 3.1.5, EPA's consultants at Stantec conducted an evaluation of erosion from the ROR riverbanks, using the BEHI and NBS ratings (Stantec 2009). In Reaches 5A and 5B, 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). As also noted in Section 3.1.5, 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 3.1.6, GE's February 2010 Supplement to Interim Response presented detailed evaluations of six Example Areas in Reaches 5A to 5C, four of which were located within Reach 5A (AECOM 2010). Only two of those Example Areas encompassed riverbank habitat – Example Areas #1 and #2, shown on Figures 3-1a and 3-1b. The descriptions provided of riverbank habitat conditions within those Example Areas included the following:

- Riverbank conditions consist predominantly of mature woodland, with severely eroded sections of bank in places, notably on the outside banks of the prominent bends in the upstream and downstream portions.

- Low slope areas of riparian banks, often occurring at the locations of point bars, provide connectivity with the floodplain. They allow for movements of aquatic invertebrates and amphibians and their larvae between in-stream and floodplain habitats. They also serve as hunting and feeding grounds for small mammals and wading birds, and are prominent access points to the river for larger mammals such as white-tailed deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*).
- Riverbanks within these Example Areas are quite variable. In some areas, such as the outside of meander bends, they are vertical and exposed (no vegetation), while in other locations they are sloped at 30 to 50 degrees and are covered in vegetation. In general, the banks are composed of silts and sands and are three to five feet in height above normal flow, but can be as much as 12 feet high. The riverbanks are typically well vegetated, although on much of them only the upper portion is vegetated while the lower portion is bare. Undercut banks are common and occur in both the exposed and the vegetated portions. Vegetated banks consist of a dense intertwining mass of fine roots and woody debris within sandy soils. Where woody shrubs and trees overhang the river, they provide perching and nesting sites above the water and provide shade over the bank and river.
- The riverbanks in Example Area #2 provide lodging habitat and slides for beavers and foraging habitat for birds and mammals, including mink and raccoons. Along the portions of the river in this area where the banks are exposed and/or undercut, the riverbank habitat provides potential nesting sites for bank swallows and belted kingfishers and hibernation habitat for the state-listed wood turtle. Nesting sites for kingfishers and swallows are limited to exposed areas of the riverbank well above the height of normal water level fluctuations.

4.1.7 *Natural Heritage Information (2000-2022)*

As described in Section 3.1.7, MNHESP conducted extensive investigations from 2000 to 2010 in the Housatonic River watershed, including the Reach 5A river, riverbank, and floodplain habitats. The results of these investigations were summarized in two reports (MNHESP 2010, 2011), and also resulted in updated designation of Priority Habitats of rare species. The 2010 and 2011 MNHESP reports provided exhaustive summaries of target species, but did not distinguish occurrences 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 specifically found in Reach 5A, and there were no specific descriptions of the riverbanks in Reach 5A. Similarly, while the Core Area designations by MNHESP in 2012 encompass riverbanks in Reach 5A, they do not specifically cite this habitat.

As also noted in Section 3.1.7, in October 2022, MNHESP provided GE with updated digital information that includes Species Habitat mapping of the state-listed species in the ROR, including Reach 5A. As described in Section 4.2.2.7 and Section 8, at least 13 of these species utilize habitats consistent with those present on the Reach 5A riverbanks and have mapped Species Habitat overlapping Reach 5A riverbanks.

4.1.8 *Pre-Design Investigations of Reach 5A*

The PDI of Reach 5A collected a range of information on riverbank conditions that apply to habitat characteristics of the banks. That information provided a definition for determining the toe and top-of-bank to allow differentiation of river sediment from bank substrate and to define the inner edge of the floodplain.⁹ It also included the 2022 focused survey of the riverbanks using a mobile LiDAR system to provide detailed information on bank morphology. Further, it included a bank erodibility assessment conducted following the methodology outlined in *Watershed Assessment of River Stability and Sediment Supply* (WARSSS; Rosgen 2006). A total of 50,033 linear feet of riverbank in Reach 5A were assessed for BEHI and NBS rating. The results of these activities were presented in GE's *Pre-Design Investigation Summary Report for Reach 5A Sediments and Riverbanks* (PDI Summary Report for Reach 5A Sediments and Riverbanks; Anchor QEA and AECOM, 2023a), submitted on September 28, 2023 along with the Conceptual RD/RA Work Plan for Reach 5A. That report also describes the Bank Assessment for Non-Point Source Consequences of Sediment (BANCS) model calibration survey that is ongoing to correlate various BEHI/NBS conditions to estimates of the annual amount of sediment eroding from the riverbank (Rosgen 2006).

4.2 2022 Riverbank Habitat Investigations

4.2.1 *Methods*

In addition to the background information discussed above, field surveys were conducted in 2022 to further document the physical/structural and biological conditions of the riverbank areas in Reach 5A. In accordance with the Revised BRA Work Plan, bank characteristics documented in the 2022 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 Reach 5A, the field bank habitat assessments occurred at approximately 34 stations in Reach 5A, distributed between the Confluence and the downstream end of Reach 5A. Those stations are shown on Figures 4-1a through 4-1d. 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 Reach 5A. In each case, "stations" were not discrete

⁹ See note 7 in Section 4 above.

transects across the river, but rather encompassed a 200-400 foot length of riverbank on both sides of the river to better characterize the range of conditions observed. Reach 5A bank field surveys were conducted from August through October of 2022.

This habitat characterization of the Reach 5A riverbanks included, at each of the 34 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 Reach 5A banks – e.g., cut banks, turtle hibernacula or observed nesting sites, kingfisher or bank swallow 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 (based on verbal direction from EPA representatives in August of 2022). 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 riverbank PDI investigations and from the floodplain habitat investigations 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 34 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 34 stations within Reach 5A. As noted above, these station locations are shown on Figures 4-1a-d, 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 34 RB-1 forms are provided in tabular form in Tables 4-2 through 4-14. That field survey information is described in the following subsections.

4.2.2.1 Physical Characterization

The 34 riverbank stations surveyed within Reach 5A encompass a total of 8,300 linear feet of the total reach, or 16.6% of the roughly 50,500 total linear feet of riverbank in this reach (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 eight relatively straight runs, six segments with right bends and seven with left bends, three segments with a straight run leading to a left bend and two with a straight run leading to a right bend, and six segments including both right and left bends. Physical characterization of the Reach 5A 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 Reach 5A, 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 characteristics of the Reach 5A riverbanks summarized in Tables 4-2 through 4-7 are as follows:

- The average height of the riverbanks in Reach 5A was estimated to be 6.2 feet (range of four to 10 feet).
- The average slope of the riverbanks in Reach 5A was estimated to be 66% (range of 25-105%).
- Riverbank substrate surveys recorded a relatively even distribution of sand and silt material (both approximately 42% of the area surveyed), with 13% cover of gravel/cobble material and minimal other substrate material.
- Stream channel widths at the bank stations ranged from 60 to 90 feet.
- Stream gradient at the 34 stations included both mid-gradient (65%) and low-gradient conditions (35%), based primarily on visible flow characteristics at low water.
- The degree of channel incisement at the survey stations was most often rated as somewhat incised (50%) or moderately incised (35%), with the remainder being not incised (no segments were rated as deeply incised or entrenched).

In addition to these physical characteristics, the bank stability and 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 is 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 34 riverbank survey stations. The following points summarize the key points related to these bordering habitat conditions:

- Transitional floodplain forest habitat borders all 34 riverbank stations to some extent.
- Other wetland habitats that border the riverbank stations include shallow emergent marsh (30% of stations), shrub swamp (20%), and deep emergent marshes (10%).
- Vernal pool habitat borders 32% of the riverbank stations.
- Upland habitats border 70% of the riverbank stations, with upland forest occurring at 56% of the stations, followed by upland fields (38%) and disturbed/developed conditions (15%).

4.2.2.3 Hydrologic Characterization

Hydrologic characterization at each bank station encompasses conditions in the channel between the riverbanks as well on the banks themselves. These include 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. Hydrologic characteristics at the 34 riverbank stations in Reach 5A are summarized in Table 4-4, with key points as follows:

- Stream channel widths at the bank stations ranged from 60 to 90 feet.
- Stream gradient at the 34 stations included both mid-gradient (65%) and low-gradient conditions (based primarily on visible flow characteristics at low water).
- Most (91%) of the bank survey segments contain some topographic break which could contribute flow into the adjacent floodplain, and 65% of the bank stations bordered floodplain with high-flow channels which could function to disperse flood waters through the floodplain.

- The degree of channel incisement at the survey stations was most often rated as somewhat incised (50%) or moderately incised (35%), with the remainder being not incised (no segments were rated as deeply incised or entrenched).
- Bankfull indicators on the riverbank segments averaged a height of three feet (range of two to five feet) above the field-estimated mean low water level, although it is noted that 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 (no rare species were observed). Tables 4-8 through 4-11 provide summary data on the plant community composition surveyed at the Reach 5A riverbank stations. The data reflect relatively diverse tree and herbaceous communities along the banks in Reach 5A, with less diverse but still significant coverage at the shrub and vine/liana strata. Invasive species are prevalent in the shrub and vine strata, and to a lesser degree in the herbaceous stratum. The following points summarize the vegetative community composition along the riverbanks within the surveyed segments:

- Overall vegetative cover along the surveyed bank segments is estimated at 75% (range of 30-100%). Overhanging vegetation covers an estimated 60% of the bank surface area.
- Riverbank vegetative cover by the tree strata averages 40% (range of 0-90%), 45% by the shrub strata (range of 0-80%), 55% by the herbaceous strata (range of 0-90%), and 30% by vines (range of 0-70%).
- Riparian zone vegetative cover along the riverbank segments is an estimated 90% overall (range of 60-100%). This consists of 58% average cover by the tree strata (range of 10-80%), 65% by the shrub strata (range of 20-85%), 68% by the herb strata (range of 40-90%), and 25% by vines (range of 10-35%).
- A total of 118 different plant species occur in the 34 bank survey segments in Reach 5A. These include 23 tree species, 11 shrub species, eight species of vines, and 76 herbaceous species (including two aquatic species along the lower margins of the banks). Sixteen different invasive species were recorded (no invasive tree species, four invasive shrub species, one invasive vine species, and 11 invasive herb species).

- Box elder is the most common tree species, occurring in 60% of the survey segments, followed by silver maple (44%) and American elm (*Ulmus americana*) (24%). Other tree species occurring in 7-10% of the survey segments are green ash (*Fraxinus pennsylvanica*), sugar maple (*Acer saccharum*), ironwood (*Ostrya virginiana*), eastern cottonwood, American linden (*Tilia americana*), and eastern hemlock (*Tsuga canadensis*). Fourteen other tree species occur less frequently (Table 4-8).
- Of the 11 shrub species, red-osier dogwood (*Cornus sericea*) is the most prevalent (30% frequency), followed by the invasive common or European buckthorn (*Rhamnus cathartica*) (29%) and Morrow's honeysuckle (*Lonicera morrowii*) (22%). All other shrub species occur in less than 5% of the survey segments.
- The invasive vine Asian bittersweet (*Celastrus orbiculatus*) is the most common vine (59% frequency), followed by river grape (*Vitis riparia*) (37%) and wild cucumber (*Echinocystis lobata*) (15%).
- Six herbaceous species occur in more than 25% of the survey segments; the most common herbaceous species are pale smartweed (*Persicaria lapathifolia*) (56%), nodding beggar-ticks (*Bidens cernua*) (48%), and the invasive Japanese knotweed (48%). Slightly less prevalent herbaceous species include blue vervain (*Verbena hastata*) (32%), ostrich fern (*Matteuccia struthiopteris*) (30%), and water purslane (*Ludwigia palustris*) (26%). Thirteen other herbaceous species occur with more than 10% frequency (Table 4-8).
- The most prevalent invasive species are Asian bittersweet (59% frequency), Japanese knotweed (48%), common buckthorn (29%), Morrow's honeysuckle (22%), water forget-me-not (*Myosotis scorpioides*) (18%), purple loosestrife (*Lythrum salicaria*) (12%), and bishop's goutweed (*Aegopodium podagraria*) (10%). 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 Confluence to the downstream end of Reach 5A, there are no discernible or significant trends or differentiation of the conditions apparent in progressing down the reach.

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:

- Nearly all (97%) bank segments contain wetland and upland plants that provide food sources for wildlife.
- Most (74%) of the bank segments contain large (>30" diameter at breast height [dbh]) live or dead standing trees, and most (88%) contain cavities in the tree trunks or limbs. In addition, live or dead tall standing trees near water offering visibility for avifauna were abundant at 68% of the bank stations or present at 32% of the stations.
- Habitat features for small mammals and herpetofauna occur at most of the bank segments, including burrows (100%), dense herbaceous cover (97%), undercut or overhanging banks, and rocks/logs/crevices (97%).
- Vertical sandy banks offering habitat for bank swallows or kingfisher nesting occur at 18% of the bank survey segments, and bank swallow nesting colonies are present at 12% of the bank stations.

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 include 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 have been assessed for each of the 34 riverbank stations in Reach 5A. The Core Area designations from MNHESP (MassDFW 2012) 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. Thirteen state-listed species have such Species Habitat mapping across the 34 riverbank stations, with potentially suitable habitat for each of these species observed within the 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. 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 only one such species within Reach

5A; habitat for the northern long-eared bat (*Myotis septentrionalis*) is mapped within the entirety of Reach 5A, and potential habitat for this species occurs along all riverbank stations. Rare species are further addressed in Section 8 of this BRA Report.

4.3 Description of Reach 5A Riverbank Habitats

4.3.1 Physical Description

The riverbanks of the Housatonic River in Reach 5 have substantial variability in physical appearance and function. The slope and height of these riverbanks vary, with height generally decreasing from the Confluence to Woods Pond. Riverbanks in Reach 5A are more consistent but still variable, generally ranging in height from three to seven feet (average of 6.2 feet among the surveyed stations), with areas of higher vertical banks ranging from eight to 12 feet high (some of these extending above the bank as defined herein, and/or above the 1 mg/kg PCB isopleth). Banks consist of silts and sands with a range of physical attributes, including sloped and vegetated banks, vertical and exposed banks, erosional banks with slumping, and erosional but vegetated banks. Vertical and exposed banks generally lack vegetative cover but provide habitat functions discussed in more detail below. Undercut banks are a common habitat component of the riverbanks in Reach 5A and are prevalent in Reach 5A, occurring in 97% of the surveyed bank stations. Mature trees overhanging the river and dense herbaceous and shrub communities are also prevalent on the banks in Reach 5A and provide shading to the river and foraging opportunities for wildlife.

Transitional between the river and the riverbanks are features such as point bars. Point bars are depositional features formed as the secondary flow of the stream sweeps and rolls sand, gravel, and small stones laterally across the floor of the stream, depositing that material on the inside bend due to slow river velocities so as to form a bar. Typically, point bars have a gentle slope and are often submerged during flood events and periods of high water. These river features accumulate downed woody material and other debris during times of high water levels, and allow for the emergence of insect larvae and for providing access between terrestrial and aquatic habitats for a variety of wildlife. Other riverine bar formations in the center of the channel and along the sides also serve similar functions.

4.3.2 Biological Communities

While the overall character of the Reach 5A riverbanks is 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. In general, the upper portions of the Reach 5A banks consists predominantly of trees, with interspersed sections being a shrub-dominated mix with some trees, vines, and herbaceous growths. Box elder, silver maple, and American elm form much of the bank canopy in Reach 5A, 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. A variety of shrubs are abundant, most commonly red-osier dogwood and several invasive species (Morrow's honeysuckle and common buckthorn in particular). Asian bittersweet and Japanese knotweed are the most abundant invasive species on and near to the riverbanks in Reach 5A. 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. Lower portions of the Reach 5A banks often support dense herbaceous growth which develop annually as the water levels recede.

The riverbanks within Reach 5A are an integral part of the overall riverine habitat in that reach. These banks provide a variety of functions for a range of wildlife species. Exposed vertical banks in Reach 5A provide suitable nesting habitat for two species of bank nesting birds – the belted kingfisher and the bank swallow. Belted kingfisher nest burrows have been documented within the 8- to 12-foot high portion of the right bank in the upper portion of Reach 5A (AECOM 2010), and bank swallow nesting cavities have also been noted in several of the higher sandy banks within Reach 5A. The vertical banks also provide potential nesting sites for several turtle species, including the state-listed wood turtle. The riverbanks in Reach 5A provide lodging habitat and slides for beaver and muskrat and foraging habitats for birds and mammals, including mink and raccoons. In particular, beaver activity along the banks is common in many places, with frequently occurring burrows evident. Undercut banks and woody accumulations 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.

Low slope areas of riparian banks, often occurring at the locations of point bars, are likely to provide better connectivity with the floodplain, including during smaller but higher frequency flood events (2- to 5-year flood frequencies). These low-lying slope zones are important for movements of aquatic invertebrates and amphibians and their larvae between in-stream and floodplain habitats. They also serve as hunting and feeding grounds for small mammals and wading birds and are prominent access points to the river for larger mammals such as deer and bear.

A total of 13 state-listed plant and animal species have NHESP-mapped Species Habitat that encompass the riverbanks in Reach 5A and could utilize those bank habitats based upon habitat requirements of each species and the riverbank habitats documented in these areas. These species are listed in Table 4-14 and discussed further in Section 8.

4.4 Reach 5A Riverbank Habitat Functional Assessment

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 Reach 5A 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 Reach 5A 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 the majority of the flow and sediment over time, forms and maintains the river channel. While the Reach 5A riverbank conditions 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 range of roughly 2,000-3,000 cfs at the Confluence.

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 Reach 5A riverbanks 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.

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 Reach 5A riverbank provision of this function 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.

Biological Functions

Section 4.3.2 above describes many of the diverse biological functions provided by the Reach 5A riverbanks. These riverbanks provide lodging habitat and slides for beavers and foraging habitat for birds and mammals, including mink and raccoons. The exposed and/or undercut banks along portions of the river in this area provide potential nesting sites for belted kingfishers, bank swallows, and several turtle species, including the state-listed wood turtle. Woody debris accumulation along the cut riverbanks may provide hibernacula for the wood turtle. Along a substantial proportion of the Reach 5A 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.

5.0 Reach 5A BRA of Backwater Habitats

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 Reach 5A. The habitat inventory process for backwaters in Reach 5A first incorporated pre-existing information consolidated from sources listed in Section 2 of the Revised BRA Work Plan where applicable to Reach 5A. In addition, information on physical conditions within each confirmed backwater in Reach 5A was generated from the updated LiDAR mapping and associated topographic/bathymetric mapping and data conducted for the PSA under the Revised Reach 5A Sediment/Bank PDI Work Plan. This information was then supplemented by a more detailed field inventory and characterization of the habitat within each of the Reach 5A backwaters in 2022 and 2023.

5.1 Background Ecological Information

5.1.1 *Woodlot Ecological Characterization (2002)*

Although, as noted above, the Woodlot ecological characterization of the PSA (Woodlot 2002a) did not map backwaters as a distinct community type, it did contain numerous references to backwaters and the associated deep marsh habitat. However, virtually all the discussion and information on backwaters in that report pertain to the main backwater areas just north of Woods Pond (most of

which are in Reach 5C, but some extend north on New Lenox Road into Reach 5B). No specific references to backwaters in Reach 5A were noted.

5.1.2 RCRA Facility Investigation Report (2003)

The RFI Report included several references to backwaters (e.g., Section 8.8.2), 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. No specific reference to backwater habitats in Reach 5A was noted in the RFI Report.

5.1.3 Corrective Measures Study Reports (2008-2010)

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 indicated four areas that were mapped as backwaters within Reach 5A; however, specific discussion of the habitat conditions within each of these was not provided.

5.1.4 Example Area Evaluations (2010)

As noted previously, the Example Area evaluations conducted by GE (GE 2010) included four areas within Reach 5A. Only one of these Example Areas (Example Area #2, within Canoe Meadows; see Figure 3-1b) contained a backwater area. This backwater, now identified as BW 5A-1, was described as follows:

“The floodplain also contains a large backwater, which retains flood waters and functions as a deep emergent marsh. This backwater provides habitat for reptiles (including the state-listed wood turtle), amphibians, and a variety of bird species (including the state-listed American bittern [*Botaurus lentiginosus*]), as well as numerous plant species (including two state-listed species – intermediate spike sedge and wapato). In addition, while this backwater was not listed by Woodlot as a vernal pool, evidence of wood frog breeding activity has been observed in this area, indicating that at least portions of the backwater may function as vernal pool breeding habitat.” (GE 2010, page 13.)

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 rare species, without distinguishing occurrences within backwaters from those within the riverine and floodplain environments. However, the reports listed occurrences of 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 Reach 5A backwaters, and the figures are provided for larger general regions which include Reach 5A. There were no specific descriptions of the conditions of backwaters in Reach 5A.

As noted In Section 3.1.7, 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, and presented the criteria for the designations.¹⁰ All three types of Core Areas include some backwater habitats. These are discussed further in Section 5.2.3.7.

As also previously noted, the updated digital information that MNHESP provided to GE in October 2022 included Species Habitat mapping of the state-listed species in the ROR, including Reach 5A. As described in Section 5.2.2.7 and further in Section 8, at least 11 of those species utilize habitats consistent with those present in the Reach 5A backwaters and have mapped Species Habitat overlapping Reach 5A backwaters.

5.1.6 Pre-Design Investigations of Reach 5A

Backwaters in Reach 5A were subject to further survey and identification in the 2018-2019 morphology and vernal pool investigations, and those changes have been carried forward into this current backwaters assessment process.

In 2018 through 2019, GE conducted investigations in Reach 5A in accordance with a Floodplain PDI Work Plan that was conditionally approved by EPA (Anchor QEA and AECOM 2017). Part of that work involved the classification of waterbodies in Reach 5A, including whether they are to be considered vernal pools, backwaters, or other waterbodies. The 2018-2019 field investigations and subsequent data analyses identified which waterbodies met the MNHESP criteria for vernal pool certification, and also identified which non-vernal pool areas met the criteria as "backwaters" as defined in the Revised Permit. That information was presented in 2020 reports to EPA (AECOM 2020; AECOM and Anchor QEA 2020). As reported therein, only two of the Reach 5A backwater areas identified in the RCMS met the backwater criteria, but four other areas identified and mapped within Reach 5A were determined to meet the criteria for backwaters, resulting in a total of six backwaters in Reach 5A. Accordingly, as provided in the Revised Reach 5A BRA Work Plan, the BRA for Reach 5A backwaters was conducted in those six backwaters. Those backwaters are shown on Figure 5-1 and described in Section 5.2.2.

Backwater investigations were also included as part of the Reach 5A PDI activities. As part of these investigations, a bathymetric survey was conducted throughout the main channel and backwaters

¹⁰ As also noted above, Cores Areas 1, 2, and 3 are defined in Section 6.1.5 of this report; and Section 8 provides further information on the Core Habitat designations by MNHESP.

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.

Sampling of the six backwaters within Reach 5A (BW5A-1 through BW5A-6) was conducted on a 50-foot grid as prescribed in the Revised Sediment/Bank PDI Work Plan. At each location, water depth was measured, and a 0.5-inch-diameter (or less) steel probe was used to determine the sediment composition and to determine if advancement of a sediment sampler to the target depth of 5 feet in the backwaters was possible. A total of 484 samples (including 461 environmental samples and 23 field duplicates) were collected from all 127 target locations in the Reach 5A backwaters and sent for analysis of PCBs as Aroclors using EPA Method 8082 and total organic carbon. In addition, porewater PCB concentrations were measured at 20 locations within the main channel and backwaters of Reach 5A. The results of these sampling activities were presented in the September 28, 2023 PDI Summary Report for Reach 5A Sediments and Riverbanks.

The updated topographic/bathymetric mapping and sediment sampling of the Reach 5A backwaters contribute to the documentation and understanding of backwater habitat conditions.

5.2 2022-2023 Backwater Habitat Investigations

5.2.1 Methods

In addition to the information described in Section 5.1, a more detailed field inventory and characterization of the habitats within the six Reach 5A backwaters was conducted during field surveys in 2022 and 2023. Table 5-1 provides a summary of the parameters that were incorporated in the assessment of backwater habitats in Reach 5A. The parameters inventoried are documented on Form BW-1 (provided in Appendix C), 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 Reach 5A.

GE also collected water quality data from the backwaters during the 2023 growing season (due to the lack of sufficient surface water during the 2022 field surveys). 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 six backwaters in Reach 5A. These data were collected three times in each backwater during the 2023 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, 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 Overview of Reach 5A Backwaters

Before presenting the results of the 2022-2023 field investigations, this section provides an overview of each of the six backwaters in Reach 5A (as shown on Figure 5-1), including location, setting, and general description of each area, based both on previous pre-design investigations (including the updated LiDAR mapping) and on the 2022-2023 field surveys.

BW 5A-1

This backwater is situated along the eastern side of the Housatonic River between Stations 73 and 86 (as used in the riverine and riverbank habitat assessments). BW 5A-1 covers approximately two acres within Canoe Meadows and is connected hydrologically to the Housatonic River by a well-defined swale which extends northeast off the main channel of the river near Station 86. The swale is approximately three feet wide at its bottom elevation and extends for a distance of roughly 50 feet between the river and the backwater. This connecting swale typically runs dry during low flow periods. In addition, there is another high-flow channel that allows surface waters to be conveyed from the backwater to the southeast directly to Sackett Brook during larger flooding conditions.

While classified as a deep marsh, this backwater is subject to extreme variations in water depth, with depths of at least four feet during spring flooding followed by near complete draw-down during summer low flow periods. This backwater has formed in what is likely a remnant meander scar of the Housatonic River and is bounded by steep upland forested slopes on the northern and eastern sides, and floodplain forest along the western and southern sides.

BW 5A-2

This backwater is situated along the western side of the Housatonic River between Stations 117 and 120 in the northern portion of the George L. Darey Housatonic Valley Wildlife Management Area (WMA). Based on its geomorphology, this backwater appears to be a remnant oxbow channel of the river. It is approximately 460 feet in length and 26-44 feet wide and covers an area of 0.38 acre. It is connected hydrologically to the river at the southern end with a low, broad channel, and at high water (likely at bankfull) on the northern end with a higher elevation opening. This backwater is largely deep marsh habitat and is likely flooded throughout the growing season in most years.

BW 5A-2 is bordered by floodplain forest in the northern and southern portions, and by wet meadow floodplain in the central portion.

BW 5A-3 and BW 5A-4

These two backwaters occur in close proximity to each other along the western side of the River between Stations 126 and 128 in the northern portion of the George L. Darey Housatonic Valley WMA and southwest of BW 5A-2. The primary connection for both of these backwaters to the river is at their southernmost points; however, during high water stages, flow from the river discharges over the floodplain to the northern ends of these backwaters. These are relatively small backwater pools, ranging in size from 0.04 to 0.16 acre. The connecting channels between these backwaters and the river range in length from 60 to 80 feet in width and from two to three feet deep, and typically remain with standing water one to two feet deep even at low flow periods. Both of these areas primarily provide shallow marsh habitat, and BW 5A-3 also contains some deep marsh habitat. BW 5A-3 is bordered on the western side by upland forest (with a sewer utility line in close proximity) and on the eastern side by floodplain forest. BW 5A-4 is bordered by a combination of floodplain forest and floodplain wet meadow.

BW 5A-5

This backwater is situated along the southern/western side of the Housatonic River between Stations 143 and 150 in the southern portion of the George L. Darey Housatonic Valley WMA. It is a long, linear depression (1,020 feet long by 25-70 feet wide), covering approximately 1.6 acres, that runs along the base of a steep upland slope on its eastern side, and is bordered on the western side by an extensive marsh which discharges surface water into the southwestern end of BW 5A-5. The northern end of this backwater is connected to the river at high water by a low-lying marsh roughly 100 feet wide, but during lower flow periods, only two narrow channels through the marsh provide a hydrologic connection. BW 5A-5 is classified as a deep marsh and is likely flooded throughout the growing season in most years.

BW 5A-6

This backwater is situated along the western side of the Housatonic River at the downstream end of Reach 5A, and it receives the discharge from the Pittsfield WWTF along its southwestern edge. This backwater is approximately 0.33 acre in size and classified as deep marsh habitat. The surface water connection to the river along the eastern side of this backwater is approximately 130 feet long; however, at low water, only a small (25 foot long) section of this remains with flowing water open to the river (to allow the WWTF effluent to discharge).

5.2.3 Results

The data collected during the 2022-2023 field surveys of the six backwaters were recorded on Form BW-1. The completed forms for all six backwaters are provided in Appendix C. Based upon information in those forms, the following subsections provide an overall characterization of the Reach 5A backwater habitats.

5.2.3.1 Physical Characterization

The physical characteristics of the Reach 5A backwaters are important in assessing the habitat functions that these areas may support. These backwaters are relatively small, ranging in size from 0.04 to two acres in area, and in all but one case are linear features which extend out from bends in the river into the surrounding floodplain (with upland forest also bordering three of the six backwaters along one side). 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.

5.2.3.2 Bordering Habitats

Figure 5-1 includes the habitat cover types which border the Reach 5A backwaters. As is typical for much of the Reach 5A area, the most common bordering habitat condition for the six backwaters is transitional floodplain forest, although wet meadow floodplain habitat also borders three of the backwaters and upland forested habitat also borders portions of three of the backwaters.

5.2.3.3 Hydrologic Characterization

Integral to the definition of backwater areas, all six of the Reach 5A backwaters share a similar hydrologic regime based upon ephemeral surface water connections to the river. While the physical dimensions of the surface water connections between these six backwaters and the river vary (as described above), each affords 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. 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. Despite the drought conditions observed during the 2022 field investigations, the hydrologic conditions within the Reach 5A backwaters were adequately characterized based on hydrologic indicators (e.g., high water marks on trees) and vegetative composition. Hydrologic characterizations of the backwaters were also augmented by reviews of

these areas during water quality sampling in May and June of 2023. Further, all Reach 5A backwaters were reviewed intensively during the 2018-2020 PDI field surveys as presented in 2020 reports to EPA (AECOM 2020; AECOM and Anchor QEA 2020), contributing to the understanding of hydrologic regimes in these backwater habitats.

5.2.3.4 Plant Community Composition

During the 2022 surveys, a total of 55 plant species were documented within the six backwater habitats in Reach 5A. These plant species are listed in Table 5-2. They include 49 herbaceous species (including submerged, emergent, and floating-leaved aquatics), one shrub, four trees, and one woody vine. The most frequently occurring species were nodding beggar-ticks and rice cut-grass (*Leersia oryzoides*), with both occurring in all six backwaters. Silver maple occurred in five backwaters and dotted smartweed (*Persicaria punctata*) occurred in four backwaters. In addition, 14 plant species occurred in three backwaters, 15 plant species occurred in two backwaters, and 22 plant species occurred in one backwater (see Table 5-2).

A total of seven invasive herbaceous plant species were observed in the backwater habitats, as shown in Table 5-2. These include two aquatic plants, Eurasian watermilfoil and water chestnut (*Trapa natans*). No invasive shrubs, trees, or vines were observed in the backwaters. Three of the invasive herbaceous species were observed in three backwaters, two were observed in two backwaters, and the remaining two were observed in one backwater. In addition, one non-native (but not invasive) plant species was observed in BW 5A-2. The backwater observed to have the most species of invasive plants was BW 5A-2 with five invasive plant species, followed by BW 5A-3 with four invasive plant species, and then BW 5A-1, 5A-4, 5A-5, and 5A-6, each with two invasive plant species.

During the 2022 surveys, western Massachusetts was in a moderate to severe drought and backwater habitats were observed to be dry or nearly dry. These conditions likely affected the species composition and total cover of floating-leaved versus aquatic submergent and emergent cover types observed. In 2022, the dominant cover type was emergent marsh and submerged aquatic plant species, with an average cover of 84.3% (range 63.0%-98.0%). Floating-leaved plants such as the yellow pond lily (*Nuphar variegata*) exhibited comparatively low cover and were observed only in BW 5A-1. Tree cover was also relatively low, with an average of 16.7% cover and a range from zero (BW 5A-2) to 38.0% (BW 5A-1 and 5A-4).

Plant community composition in backwaters can change dramatically with hydrologic variability and with seasonality, particularly in the herbaceous layer. Although the 2022 surveys were conducted at a time of low water, the organic and mucky substrates remained mostly saturated and retained the floating-leaved and submerged aquatic plant community indicative of more aquatic conditions, while also indicating what is present in the seed bank of these systems (in the form of colonizing

herbaceous plants). As water levels drop, species intolerant of flooding germinate from the existing seedbank, but species that grow in flooded conditions are still visible, thereby providing a more comprehensive picture of the plant community in these systems compared to conducting plant surveys during flooded conditions (see representative photographs in Appendix C).

All six backwaters were re-visited in May and June of 2023 to collect data on water chemistry. Water levels at this time were generally higher than during the 2022 inspections. Although no additional data on plant species composition were collected in 2023, representative photographs show that a much higher diversity of plant species was present during low-water conditions as observed in 2022 than during the higher water levels in 2023. However, GE will revisit each backwater once in 2024 during mid- to late-spring to verify species occurrences and check for aquatic submergent, emergent, and floating-leaved plants that may not have been observed in 2022.

5.2.3.5 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 5-3 and summarized in Table 5-4 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.
- No open sandy to gravelly soils with sparse vegetation suitable for turtle nesting or vertical sandy banks typically used by kingfishers and bank swallows for nesting were observed.

5.2.3.6 Incidental Wildlife Observations

During field surveys in the six backwaters in Reach 5A, observations were recorded on the backwater form to document wildlife use of these areas (see Appendix C). 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, coyote (*Canis latrans*), and black bear.

5.2.3.7 Rare Species Habitat

There are 11 state-listed plant and animal species that have MNHESP-mapped Species Habitat within the backwater habitats of Reach 5A and that could utilize those habitats based upon habitat requirements of each species and the backwater habitat conditions documented to occur there. The species with mapped habitat that overlays 5A backwaters are listed in Table 5-5 and are further discussed in Section 8. As noted previously, all three Core Areas designated by MNHESP include backwater areas. Two backwaters (BW 5A-1 and 5A-2) fall within Core Areas 1, 2, and 3, and three backwaters (BW 5A-3, 5A-4, and 5A-5) fall within Core Areas 2 and 3. The backwater near the Pittsfield WWTF discharge (BW 5A-6) does not fall with any Core Area.

5.2.3.8 Water Quality

Baseline water chemistry was collected from the backwaters in 2023, using a YSI meter, three times during the early growing season – May 9, June 6, and June 14, 2023 – in backwaters BW 5A-1 through BW 5A-5. In BW 5A-6, no water was present in the backwater for the two June inspections and therefore only one round of sampling was completed.

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), and Chlorophyll-*a* (mg/l). Results are presented in Table 5-7. The backwaters generally have pH (7.69 average) and specific conductivity (463 average) levels that indicate the influence of calcareous groundwater discharge. Chlorophyll-*a* readings were generally within the normal range (1-3 mg/l) of surface waters in non-eutrophic lotic habitats, with one high reading (40 mg/l) found in BW 5A-6 where the Pittsfield WWTF discharge likely influenced the level.

To develop a more representative baseline of water chemistry in backwater habitats, and as directed in EPA's December 21, 2023 conditional approval letter, GE will conduct two additional rounds of sampling in each of the six backwaters during mid- to late summer in 2024 if water is available for sampling in these backwaters.

5.3 Description of Reach 5A Backwater Habitats

The six designated backwaters in Reach 5A consist generally of deep marsh habitat occurring on saturated, mucky mineral soils that are seasonally inundated and permanently saturated. The substrate is flooded by waters that are not subject to significant wave action, with water depths ranging from six inches to six feet. Water levels fluctuate seasonally, but the substrate is rarely dry, and there is usually some standing water throughout the year. The vegetation in deep marshes is quite variable. It may be co-dominated by a mixture of species or have a single dominant species. In Reach 5A, dominant plant species within backwaters are nodding beggar-ticks and rice cut-grass,

both of which occurred in all six backwaters, plus silver maple and dotted smartweed. Reach 5A contains approximately 3.91 total acres of backwaters areas, with individual backwaters ranging in area from 0.04 to 2 acres.

The presence of fish in the Reach 5A backwaters likely varies considerably from that in the backwaters and deep marshes within the remaining portions of the PSA. The key feature of backwaters and deep emergent marshes that drives the wildlife function of these habitats is the hydrologic connection to the Housatonic River. During periods of high water when these areas are connected to the Housatonic River, fish can migrate between the backwater habitat and mainstem of the river. In smaller backwater areas of Reach 5A, as the high water recedes, fish would be expected to return to the river, although some may be trapped within the backwaters. By contrast, the 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. The fisheries habitat of the Reach 5A backwaters is quite different and much more seasonal in use.

The Reach 5A backwater areas and associated deep emergent marshes are also utilized by a range of bird, mammal, amphibian, and reptile species that rely on these areas for foraging, shelter, and breeding. These backwater and marsh habitats can be used for nesting and foraging for a variety of bird species, including the state-listed American bittern, the state-listed common gallinule (*Gallinula galeata*), wood duck (*Aix sponsa*), mallard duck (*Anas platyrhynchos*), great blue heron, and green heron (*Butorides virescens*). Wading birds prefer these backwater and emergent marsh areas of open water with minimal current for foraging. Species presence may vary among years depending upon the hydrologic conditions of the backwater and marsh habitats. Amphibian and reptile species also use these habitats for foraging, breeding, and thermal regulation, including northern leopard frog (*Lithobates pipiens*), green frog, snapping turtle, spotted turtle (*Clemmys guttata*), eastern painted turtle (*Chrysemys picta picta*), eastern garter snake, northern water snake (*Nerodia sipedon*) and the state-listed wood turtle. In addition, during years when standing water exists through the amphibian breeding season, obligate vernal pool species such as wood frog (*Lithobates sylvaticus*) and spotted salamander (*Ambystoma maculatum*) may use portions of these areas for breeding. Although other amphibian species will often prey on obligate vernal pool species, the diversity of micro-habitats within certain backwaters, particularly BW-5A-1, may allow for some coexistence between obligate species and those that normally prey on these species – e.g., by providing secluded areas in dense vegetation and organic debris for egg masses and developing larvae of the obligate species.

5.4 Reach 5A Backwater Habitat Functional Assessment

Key functions of backwater areas within Reach 5A consist of wildlife habitat, fisheries habitat, flood storage, and water quality functions, as shown in Table 5-6. These are described qualitatively in this

Reach 5A BRA Report, using the data obtained during the 2022-2023 field surveys, with a focus on describing key characteristics and parameters to be considered in 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.

Wildlife Habitat Function

As described in the previous section, Reach 5A backwater areas and associated deep emergent marshes provide habitat for a variety of bird, mammal, amphibian, and reptile species that rely on these areas for foraging, shelter, and breeding. Of the six individual backwater areas, BW 5A-1 in Canoe Meadows provides the highest quality habitat, despite it having the most ephemeral surface water connection to the river, due to its secluded setting among mature floodplain and upland forested area, diversity of vegetative cover resulting from variable hydrologic conditions, and a secondary overflow swale connection to Sackett Brook to the southeast of the backwater.

Fisheries Habitat Function

As described in the previous section, during periods of high water when the backwaters are connected to the Housatonic River, fish can migrate between the backwater habitat and mainstem of the River. In smaller backwater areas of Reach 5A, as the high water recedes, fish would be expected to return to the river, although some may be trapped within the backwaters. Given the relatively small total area of backwater habitat in Reach 5A, those backwaters would not provide much overall fisheries habitat; but 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. This is especially true of BW 5A-1 in Canoe Meadows, because it has the most ephemeral surface water connection to the River and is the most likely to draw down to a dry surface during the summer.

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 six backwaters in Reach 5A 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. Given the overall small area of these backwaters, the significance of this storage function by itself is not likely to be high. However, 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 Reach 5A.

Water Quality Function

Water quality functions of the backwaters in Reach 5A 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. BW 5A-6 is in a particularly relevant setting to improve water quality in the discharge from the Pittsfield WWTF, which discharges into the southwestern corner of this backwater and is dispersed across the area to the main stem of the river.

6.0 Reach 5A BRA of Floodplain Habitats (excluding Vernal Pools)

Reach 5A includes approximately 365 acres of floodplain habitat between the riverbanks and the 1 mg/kg PCB isopleth (which approximates the 10-year floodplain). Since the Housatonic River itself comprises approximately 45 acres, there are a total of approximately 410 acres within the 1 mg/kg isopleth. The BRA of the floodplain in Reach 5A 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. It also included, as required by the Final Revised SOW, a survey of features in the area designated in the Revised Permit as expanded Exposure Area (EA) 10, which is in Canoe Meadows and is owned by the Massachusetts Audubon Society (Mass Audubon).

6.1 Background Ecological Information

The floodplain habitat inventory process for Reach 5A was initiated by incorporating information from the sources referenced in Section 2 of the Revised Reach 5A BRA Work Plan (where applicable to the Reach 5A floodplain), as well as from the Reach 5A floodplain PDI. A summary of information on floodplain habitats in Reach 5A 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 Woodlot report, specific references to floodplain conditions within Reach 5A are infrequent. However, 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 Reach 5A. For example, the Woodlot mapping includes 361 acres of floodplain habitat in Reach 5A, with most of it (84%) consisting of wetland habitat, and most of the wetland habitat (40%) consisting of transitional floodplain forest. Comparison of the Woodlot mapping with the current habitat mapping, as provided in the following sections, is useful to assess successional patterns and habitat changes in Reach 5A.

Specific to Reach 5A, Woodlot notes that “beginning from the confluence of the East Branch and West Branch Housatonic River, the floodplain is relatively narrow (ca. 100 – 250 m) and less structurally diverse compared to downstream portions of the PSA. Where the natural communities are intact, the upstream region is primarily vegetated by riparian forests that receive over bank flow during high-water events. Herb- and shrub-dominated, seasonally flooded depressions occurred in this area and were found to be utilized by breeding amphibians” (Woodlot 2002a, page III-1-6).

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, some of it specific to Reach 5A. In general, however, 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 Reach 5A, and the depicted community types are based on those presented in the Woodlot ecological characterization.

6.1.3 *Corrective Measures Study Reports (2008-2010)*

GE's 2008 CMS Report presented substantial information on ecological baseline conditions in the PSA, including the Reach 5A floodplain; and the 2010 RCMS Report included a substantially expanded description of the affected habitats. In particular, Section 5 of the RCMS Report described the habitat characteristics of each of the floodplain habitats in the overall PSA, including those in Reach 5A. Other than describing potential impacts from remedial alternatives, however, there are few details provided specific to Reach 5A, such as descriptions of floodplain habitat conditions which apply directly or only to this reach of the PSA.

6.1.4 *Example Area Evaluations (2010)*

As discussed in Section 3.1.6, GE's February 2010 Supplement to Interim Response presented detailed evaluations of six Example Areas in Reaches 5A to 5C (AECOM 2010). Four of those Example Areas included portions of the floodplain in Reach 5A. 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 four Example Areas in Reach 5A contain a variety of floodplain habitats, including transitional floodplain forest, high terrace floodplain forest, shrub swamp, shallow and deep marshes, wet meadow, and vernal pools. 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 four Example Areas:

- The floodplain bordering the river in Example Area #1 consists predominantly of transitional floodplain forest, and includes swales, depressions, former river meanders, and complex microtopography. Dense herbaceous and shrub vegetation, numerous mature large-diameter trees, and abundant coarse woody debris and dead tree snags are present in this

area. The transitional floodplain forest connects other natural communities in this area, which include shallow and deep emergent marsh, shrub swamp, and wet meadow. These habitats are periodically flooded and contain varied soil textures typical of such wetlands. This Example Area also contains several depressions that were at that time confirmed or potential vernal pools. The transitional floodplain forest around these pools provides non-breeding habitat for the vernal pool amphibians.

- The floodplain in Example Area #2 is also dominated by transitional floodplain forest, with abundant large woody debris and standing dead snags and dense herbaceous cover. The floodplain also contains a large backwater, which retains flood waters and functions as a deep emergent marsh and may also provide breeding habitat for vernal pool species. The surrounding forested areas would provide non-breeding habitat for the vernal pool species.
- The floodplain in Example Area #3 is dominated by transitional floodplain forest, which has a dense tree canopy, a sparse shrub layer, a dense herbaceous layer, and abundant large woody debris. The floodplain in this area also contains red maple swamp – a forested habitat consisting of a fairly open canopy, a dense shrub layer, and little herbaceous vegetation. Example Area #3 also contains several types of non-forested wetlands. These include: (a) three areas of shallow emergent marsh, which are dominated by invasive plant species such as purple loosestrife and/or reed canary grass (*Phalaris arundinaceae*); (b) a deep emergent marsh; and (c) a wet meadow, which is maintained as part of a natural gas pipeline right-of-way.
- The floodplain in Example Area #4 consists predominantly of high terrace floodplain forest, shrub swamp/emergent marsh, and former agricultural fields. Overbank flooding and deposition has formed swales, deep depressions, levees, and complex microtopography through the floodplain. The high terrace floodplain forest, which is a relatively uncommon habitat type in the PSA, is characterized by rich calcareous (derived from calcium-rich bedrock) soils and supports large-diameter canopy trees, dead tree snags, and large woody debris, along with dense herbaceous cover. In the central portion of the example area, a large shrub swamp/emergent marsh complex receives surface water supply from a broad shallow swale to the north and is semi-permanently flooded as a result of an active beaver dam within a deep swale draining toward the Housatonic River to the south. Five vernal pools designated by Woodlot (2002) were present in Example Area 4.

6.1.5 *Natural Heritage Information (2000-2022)*

The MNHESP investigations, data, mapping, and reports on the Housatonic River watershed (described in Section 3.1.7) encompassed the habitats of the Reach 5A floodplain (MNHESP 2010, 2011). These efforts included targeted surveys to provide updated information on state-listed

species within the floodplain habitats, as well as designation of Priority Habitats of rare species. As noted in Section 3.1.7, as of 2010, this research confirmed the presence of at least 20 state-listed species in Reach 5A and resulted in the preparation of updated Priority Habitat mapping for each of these species, which was included in the 2010 RCMS Report. Many of these state-listed species are associated with floodplain habitat in the Housatonic River, at least during some of the species' life stages.

The 2011 MNHESP report did not specifically describe the conditions of Reach 5A but did characterize the "Upper Housatonic River Valley area at the lower ends of the East and West Branches" as containing "extensive floodplain wetlands and forests, and high-quality headwater streams that drain the western slopes of October Mountain" (page 11). The report listed occurrences of state-listed turtle and amphibian target species, which may be encountered in Reach 5A floodplain habitats at certain stages of life.

As also discussed previously, 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, along with the criteria for the designations. Core Areas 1, 2, and 3 include floodplain habitats in Reach 5A. Core Area 1, which MNHESP classifies as the highest quality habitat for species that are most likely to be adversely impacted by PCB remediation activities, comprises 59 acres in Reach 5A and includes seven state-listed species with mapped Species Habitat in the Reach 5A floodplain; and it also includes a floodplain forest community type (the high terrace floodplain forest) which occurs in Reach 5A. Core Area 2 (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) comprises 263 acres in Reach 5A and includes four state-listed species with mapped Species Habitat in the Reach 5A floodplain. Core Area 3 consists of areas where Species Habitat mapping of at least eight state-listed species overlap and comprises 105 acres in Reach 5A.

Further, as previously noted, the updated digital information that MNHESP provided to GE in October 2022 included Species Habitat mapping of the state-listed species in the ROR, including Reach 5A. As described in Section 6.3 and further in Section 8, at least 21 of these species utilize habitats consistent with those present in the Reach 5A floodplain and have mapped Species Habitat in the Reach 5A floodplain.

6.1.6 *Pre-Design Investigations of Reach 5A Floodplain*

Floodplains in Reach 5A were subject to further survey and identification in the 2018-2019 morphology and vernal pool investigations, and those changes have been carried forward into this current floodplain assessment process. Specifically, in 2018 and 2019, GE conducted investigations in Reach 5A in accordance with its 2017 Floodplain PDI Work Plan (Anchor QEA and AECOM 2017).

Part of that work pertained to identifying changes in floodplain cover types that could affect “super habitat” delineations and accessibility categories. In particular, in its January 25, 2018 conditional approval letter for that work plan, EPA directed GE to identify “any visually apparent changes in morphology that have occurred since the Woodlot (2002) survey or other appropriate baseline survey of topographic features and that could affect property boundaries, super habitat boundaries, (and) application of accessibility factors.” The resulting information was obtained and presented in 2020 reports to EPA (AECOM 2020; AECOM and Anchor QEA 2020), and has been taken into account in this BRA, as discussed further in Section 6.2.1.

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 Reach 5A floodplain 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. In addition, the Reach 5A floodplain was mapped by drainage class as described in a *Classification of Wetlands and Deepwater Habitats of the United States* (FGDC 2013). Vernal pools in the floodplain are discussed separately in Section 7.

Characterization of floodplain habitats and natural communities along the Housatonic River in the PSA was originally performed by Woodlot and presented in its ecological characterization report (Woodlot 2002a). 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 Reach 5A. Updated floodplain community cover mapping conducted in Reach 5A during the 2018-2019 morphology surveys was also incorporated into the floodplain classification and mapping process. As documented in GE’s 2020 Final Accessibility Report for Reach 5A (GE 2020), portions of the floodplain within that reach 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 Reach 5A, as characterized by Woodlot (2002a). 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 the Reach 5A BRA, the updated natural community mapping was generally consistent with the Woodlot 2002 ecological characterization, except that several palustrine habitats (mud flats, black ash-red maple-tamarack calcareous seepage swamp, calcareous seepage marsh, and woodland vernal pools) are not included as wetland classes in the updated floodplain mapping, as they either do not occur within Reach 5A or are encompassed within other habitat assessments. The 2022 field surveys and floodplain mapping for the BRA also included a review of the recently updated *Classification of Natural Communities of Massachusetts* (Swain 2020).

As discussed in the Revised Reach 5A BRA Work Plan, although the BRA divided the floodplain into wetland and upland habitats, it did not include an effort to delineate wetlands from a regulatory jurisdictional standpoint or to classify and delineate specific individual resource area types within the floodplain under the Massachusetts Wetlands Protection Act regulations (310 CMR 10.00). This is because the entire floodplain is recognized to be a resource area subject to these regulations, and the remedial work is classified as a limited project pursuant to these regulations. Further, Woodlot classified more than 80% of the Reach 5A floodplain as palustrine wetland, and nearly 33% of the floodplain in Reach 5A was mapped as transitional floodplain forest, which is an extremely complex community relative to wetland regulatory criteria due to many factors, including varied microtopography, diverse floodplain soils, intermittent flooding, and differential surface water conveyance through the forest based on microrelief. See Section 6.2.1 of the Revised Reach 5A BRA Work Plan for further discussion of this issue.

Nevertheless, understanding conditions on the floodplain relative to wetland versus upland conditions is important for identifying suitable access roads and staging areas during restoration and maintaining floodwater conveyance and hydrologic conditions in wetlands and vernal pools across the floodplain. Therefore, the Reach 5A floodplain was mapped by flooding regimes used to describe non-tidal parts of palustrine, lacustrine, and riverine systems (FGDC 2013) to help differentiate areas that are regularly flooded and consistently exhibit wetland conditions (hydric soils and hydrophytic vegetation) from areas that may be a mix of wetland and upland. In addition, swales across the floodplain that connect wetlands to each other and to the river were identified and mapped.

To prepare the updated mapping including the wetlands and natural community/cover types as described above, a combination of desktop analyses and field surveys, followed by aerial photographic-interpretation and heads-up digitizing in ArcGIS, was performed. 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);
- Vernal pool surveys, mapping, and classification and morphology surveys conducted in 2018-2019;
- Low-altitude aerial photography flown across Reach 5A by GE in 2018, using an unoccupied aerial vehicle (UAV);
- 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 2022.¹¹

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 aeriels 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 Reach 5A 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 Reach 5A; these surveys occurred from August 1 to September 28, 2022. 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-

¹¹ As directed in EPA's March 31, 2022 conditional approval letter, GE also considered utilizing recent advances in UAV technology, including review of a document cited by EPA on UAV applications, to support field resource surveys. As noted in the Revised Reach 5A BRA Work Plan, GE concluded that additional use of UAVs (beyond the 2018 aerial photography produced from UAV flights) was not warranted at the present time. The on-ground field surveys and mapping described herein were sufficient to achieve the detailed mapping and classification of habitat types, and the 2018 aerial photographs were sufficient to supplement these detailed field surveys with aerial views.

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 a large patch 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 Reach 5A are provided in Appendix D-1.

6.2.2 Results

Upon completion of the field surveys, surveyed GPS data points, polygons, and polylines were overlaid with existing site data in GIS for post-processing and mapping. The new ArcGIS data layers produced for Reach 5A 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 through 6-2e;
- A polygon data layer estimating the flooding regimes (FGDC 2013) within the floodplain based on inspection of LIDAR data, aerial photograph interpretation and field verification (including wetter areas such as vernal pools, other depressions, swales, and ditches), as shown on Figures 6-3a through 6-3e;¹²
- A polygon 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 10.1).

Natural community mapping based on the 2022 field surveys and other recent investigations conducted in Reach 5A is presented on Figures 6-2a-e. There were some notable differences between the Woodlot natural community mapping and the latest (2023) mapping (i.e., changes in community type and spatial juxtaposition). Major changes are identified in Table 6-3 and described

¹² To identify these wetter areas, the aerial photograph interpretation included identification and delineation of "wetness signatures," as defined in the 2012 USACE Regional Wetland Manual. These wetter zones are clearly noted on bare earth Digital Elevation Model imagery. They have also been noted preliminarily to correlate with areas of lower elevations on the 2021-2022 LiDAR mapping (see Figures 6-3a-e).

further below.¹³ In the latest field survey, a total of 504 individual polygons representing 15 natural community and cover types were mapped over the approximately 410-acre Reach 5A survey area. They include:

- Two open water categories totaling 56.8 acres;
- Two open field / early successional categories totaling 30.6 acres;
- Five wetland categories totaling 154.2 acres;
- Five forested categories totaling 167.7 acres;
- One developed/disturbed category totaling 0.6 acres, and
- Riverine point bar and beach, which are identified on Figures 6-2a-e as point locations because these areas were too narrow to map as a polygon feature and be represented effectively on scaled drawings.

Woodlot originally mapped the upper portion of the Housatonic River from the Confluence down to Holmes Road as MGS, with the rest of Reach 5A mapped as LGS. Based on observations made during the 2022 field investigations, river conditions were determined to be more complex and variable than that. Therefore, the 2023 mapping identifies the Housatonic River within Reach 5A as a “Stream.” See Section 3 for more discussion on stream characteristics and morphology in that reach. As described there, based upon current findings, approximately 29 acres of MGS occurs in Reach 5A, with 16 acres of LGS.

As with the mapping effort conducted by Woodlot in 2002, transitional floodplain forest remains the dominant cover type mapped within Reach 5A (Table 6-3). The 2023 mapping includes approximately 21 more acres of transitional floodplain forest than what was originally mapped. Much of this difference can be attributed to areas that have matured substantially over the last 20 years or have been impacted by beaver activity and undergone retrogressive succession (i.e., reverted to scrub-shrub or marsh habitats). However, some areas that differ are likely due to interpretation of conditions on the ground and/or during the remote mapping exercise.

The cover type that has changed the most within Reach 5A is a significant decrease in areas mapped as red maple swamp, with a commensurate increase in wet meadow, shallow emergent marsh and shrub swamp. Since 2002, the amount of area identified as red maple swamp has decreased by approximately 39 acres, while the other three cover types have increased by a total of approximately

¹³ As discussed below in this section, it is unlikely that the comparison of natural communities between the Woodlot 2002 ecological characterization and the updated community mapping in 2022 was significantly affected by the fact that the latter was conducted during abnormally dry conditions.

41 acres. Nearly all these changes occurred in Canoe Meadows and directly across the river from the Sackett Brook confluence, where heavy beaver activity has increased water levels by one to two feet (and possibly more in some areas of Canoe Meadows), causing tree species to die off and shrub and emergent marsh species to become more dominant. These changes were addressed in the morphology investigations conducted in 2018-2019 (AECOM and Anchor QEA 2020).

Finally, the only other cover type with a notable change was agricultural field. This cover type has decreased by approximately 14 acres since the 2002 mapping effort. These changes are evident southwest of Joseph Drive and northeast of the Pittsfield WWTF on Massachusetts Department of Fish and Game (Wildlife Management Area) lands where agricultural field areas have gone fallow and are growing in with dense shrub and tree cover. These areas are now mapped primarily as cultural grasslands, with approximately 1.5 acres southwest of Joseph Drive that is now mapped as wet meadow and transitional floodplain forest.

Although the 2022 surveys were conducted during a period of drought conditions, the natural plant communities mapped are broad cover types and one season of drought would not alter a particular area sufficiently to change it from one community type to another. Communities most likely to appear different during periods of low water would be shallow emergent marsh, and deep emergent marsh. As water levels drop, species intolerant of flooding germinate from the existing seedbank, giving the appearance of a wet meadow habitat. However, mapping is not based strictly on the plant community that was observed at that time. Incorporated into the designation of community type are previous knowledge of the floodplain habitats (based on observations made during other seasons and under different hydrologic conditions), the shape and size of depressions, water marks on trees and other vegetation, micro-topographic relief, and soil conditions. For these reasons, it is unlikely that the cover types identified during the surveys conducted during abnormally dry conditions in 2022 would be significantly different from those present under normal hydrologic conditions.

Flooding regimes in the Reach 5A floodplain (FGDC 2013) are presented on Figures 6-3a-e. Areas mapped as seasonally flooded or wetter (i.e., seasonally flooded/saturated, semi-permanently flooded) would generally meet the criteria for a state or federal jurisdictional wetland. Areas mapped as temporarily or intermittently flooded generally do not exhibit hydric soils and would not meet the definition of a jurisdictional wetland, but may have some wetland inclusions due to the complex nature of this natural community cover type.

Floodplain areas between the riverbank and the 1 mg/kg isopleth within Reach 5A include approximately 230 acres of habitats that are mapped as seasonally flooded or wetter (63.2% of the total floodplain area). These include approximately 2.8 acres of area functioning as floodplain channels and swales, which typically have poorly to very poorly drained soils. The remaining approximately 134 acres of floodplain (36.8%) are mapped as intermittently or temporarily flooded.

These areas tend to have moderately to excessively drained soils, with water tables that can be up to several feet below the ground surface for much of the growing season. However, these areas may also contain wetland inclusions or other features (e.g., floodplain channels and swales).

6.3 2022 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 Reach 5A 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 habitats in Reach 5A; these surveys occurred from August 1 to September 28, 2022. 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 D to the Revised BRA Work Plan and a blank version of which is provided in Appendix D-2 hereto) was completed in the field.¹⁴ 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,

¹⁴ 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.

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 previously delineated vernal pools, which were mapped independently of this size threshold.

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 Reach 5A 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 Reach 5A wetland assessments. This included information from Mass Audubon on bird observations at Canoe Meadows), as well as data from Cornell's ebird web site for Canoe Meadows (<https://ebird.org>), as described in Section 6.4.4. As discussed further 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 Reach 5A floodplain wetlands were assessed by grouping the wetland systems into three general wetland functional units, shown on Figure 6-4, which consist of:

- Wetlands in Reach 5A from the Confluence to Holmes Road;
- Wetlands of Canoe Meadows (including the association with Sackett Brook/Sykes Brook and other surface waters); and
- Wetlands in the remainder of Reach 5A.

Functional units consider functional and spatial relationships of habitats, both surface and subsurface hydrological connections and wildlife habitat to provide context for the network of wetlands. This grouping also facilitated the functions and values functional assessment described in Section 6.3.4.

6.3.2 Results

The following text and Tables 6-5 through 6-10 provide a summary of field data collected during the 2022 Reach 5A floodplain surveys using Form FP-1. Due to the large number of observation plots (201), most of the information on Form FP-1 was collected digitally and is presented in tabular form rather than in a collection of completed forms. The following sections include discussion on plant community composition including invasive species, soil types mapped by the NRCS and observed in the field, physical features needed to support wildlife habitat (including 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 240 plant species were documented from 201 plots surveyed on the floodplains within Reach 5A, as shown in Table 6-5. These included 166 species of herbs, forbs, and grasses, 30 shrubs, 35 trees, five woody vines, and four mosses. The frequency of species occurrence ranged considerably among each plant stratum. Observations of herbaceous species ranged from the identification of 66 species of herbs, forbs, and grasses in one plot to the identification of only one herbaceous species in 58 plots. The most frequently encountered herbaceous species were purple loosestrife, sensitive fern (*Onoclea sensibilis*), jewelweed (*Impatiens capensis*), moneywort (*Lysimachia nummularia*), and ostrich fern. Six species of woody shrubs occurred in only one plot while one species occurred in 80 plots. The most frequently encountered shrub species were silky dogwood (*Cornus amomum*), common buckthorn and Morrow's honeysuckle. Seven species of trees occurred only in one plot, while one tree species occurred in 35 plots. The most frequently encountered tree species were boxelder maple, silver maple, red maple, and eastern cottonwood. Finally, the observations of woody vine species occurred in varying number of plots depending on the species, ranging from seven plots for one species (virgin's-bower [*Clematis virginiana*]) to 41 plots for another species (river grape). In addition to river grape, the invasive woody vine Asian bittersweet was observed with a relatively high frequency and documented in 30 plots.

Data were collected on invasive species presence at the 201 plot locations across the floodplain. Invasive plant species were observed at 179 of these plots (89%). Out of the 22 plots where no invasive plants were observed, nine of them were clustered in an area between Eric Drive east of the river and Palomino Drive west of the river on state lands (the George L. Darey Housatonic Valley WMA). As shown in Table 5-5, a total of 21 species listed as invasive or likely invasive were observed growing in the floodplain plots that contained such species (11 herbs, eight shrubs, one tree, and one woody vine). Invasive plants were included in the list of most frequently encountered for the herbaceous, shrub, and vine layers, as described above. These consisted of purple loosestrife and moneywort in the herbaceous layer, common buckthorn and Morrow's honeysuckle in the shrub layer, and Asian bittersweet in the woody vine layer. Only one invasive tree species, Norway maple

(*Acer platanoides*), was observed on the floodplain and occurred in only two plots. In addition, species considered non-native but not listed as invasive or likely invasive in Massachusetts were observed at 36 of these plots (18%). There were 30 such non-native species (28 herbs, one shrub, and one tree). A total of 188 native plants (126 herbs, 21 shrubs, 33 trees, and four woody vines) were observed on the floodplain. Mosses included two plants identified to species and two generalized groups (i.e., *Sphagnum spp.* and *Bryophytes*), all considered to be native.

Percent cover of mosses, herbs, shrubs, woody vines, and trees was also estimated at all 201 plot locations across the floodplain. Total vegetation cover within plots ranged from 5.9% to 72% percent, with herbs representing the most cover on average (72%). Average cover of trees and shrubs was similar with 36.6% and 38.5% cover, respectively. Woody vines and mosses represented a smaller proportion of the total cover on average, with 7.1% cover for each.

The percent cover results are presented in Table 6-6 for each cover type. As would be expected, tree cover on average was generally low or non-existent in deep emergent marsh, shallow emergent marsh, wet meadow and cultural grassland habitats. Tree cover in forested natural communities ranged from approximately 38% to 93% cover on average, with the highest tree cover observed in high-terrace floodplain forest and northern hardwoods-hemlock-white pine forest. On average, shrub cover was highest in shrub swamp, with forested community types ranging from approximately 14% to 53% cover on average. Average cover of woody vines ranged from approximately 3% to 21% in forested community types and were generally lower in open community types including deep emergent marsh, shallow emergent marsh, wet meadow and shrub swamp. Herbaceous species cover was generally high among all community types with the exception of northern hardwoods-hemlock-white pine forest and successional northern hardwoods. This is to be expected because communities with greater cover of coniferous trees (i.e., hemlock and white pine) and those that are in successional stages with dense shrub and tree layers typically have lower densities of herbs due to the effects of shading.

6.3.2.2 NRCS Soils

The Natural Resources Conservation Service (NRCS) soil survey has mapped 16 different soil series in Reach 5A, plus three mapping units that represent disturbed conditions. These soil types are listed in Table 6-7 and depicted on Figure 6-5. Approximately 295 acres of Reach 5A (72%) contain soils that have formed in alluvial deposited sediments (i.e., on floodplains) and consist of very fine sandy loam (Winooski) to loamy (Limerick) and silty alluvium (Saco and Hadley). Limerick and Saco series soils are poorly drained and very poorly drained soils, respectively, and indicate true wetland conditions. 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 (USDA NRCS 2023).

Approximately 44 acres of Reach 5A (11% of the total floodplain area) consist of soils that were formed in glaciofluvial (water-deposited) materials (Copake, Groton, Hinckley, Hero, Hoosic and Merrimac series) or deposited in place as glacial till (Berkshire and Marlow series). One soil series (Oakville) is formed in sandy eolian (i.e., wind-blown) post-glacial deposits (approximately one acre within Reach 5A). The remaining approximately 21 acres of Reach 5A consist of mapping units that represent disturbed conditions (urban land, pits, gravel, and udorthents [man-altered soil units]). These areas are typically moderately well drained to excessively drained and have been disturbed by cutting, filling, or smoothing, or by buildings and pavement. They are typically sandy to gravelly textured and exhibit no evidence of soil profile development.

During the 2022 floodplain surveys, soils were inspected to depths up to 48 inches (range = 8-48 inches, mean = 20.8 inches). Hydric soil conditions were documented in 131 of the 222 locations and included soils with low chroma matrices, redoximorphic features, gleyed soils, and soils with mucky mineral and organic layers at the surface. Soils exhibiting organic and mucky mineral soils at the surface were documented at 83 locations and were 10.9 inches thick on average (range = 2-48 inches thick). At 38 of these locations, depths of mucky mineral soils and organic accumulation were greater than 14 inches thick. In addition, buried organic layers were documented at three locations, which is not uncommon in a floodplain setting. The texture of subsoils typically ranged from silt loam to fine sandy loam in soils meeting hydric criteria (NEIWPCC 2018).

The remaining 91 soil sample locations from the floodplain were moderately well drained to well drained and would not be considered hydric. Soil texture ranged from silt loam to very fine and fine sandy loams in upper portions of the soil solum, with some coarser textured material at depth (e.g., loamy fine sand). In general, field conditions were comparable to those mapped by the NRCS. However, the information collected to describe soils and other components of the NRCS soil mapping units were collected at scales ranging from 1:12,000 to 1:63,360 (USDA NRCS 2023). Floodplain surveys in 2022 inspected and described soil profiles at 222 locations on the floodplain, including samples collected in all 59 certified vernal pools. Mapping of natural communities and flooding regime was conducted at 1:400 using aerial photography and 2018-2019 LiDAR data. Therefore, discrepancies are to be expected when comparing the NRCS data to the observations of the detailed field investigation performed for the Reach 5A BRA. The largest discrepancies were observed at three locations, which are described below.

The first location, located south of Revilla Terrace and west of Pomeroy Avenue, is an approximately 9.4-acre area mapped as udorthents. A total of 13 soil profiles were inspected within that area, including from seven vernal pools. Aside from the east-west running sewer line that bisects this area and some recent restoration efforts along the northern edge by 5A-VP-13, no evidence of past disturbance was observed. Soils within the vernal pools are poorly drained to very poorly drained

mucky mineral over fine sandy loam and silt loam soils (e.g., Limerick and Saco series), and areas of the adjacent floodplain are moderately well drained and similar to the Winooski silt loam soil series.

The second area is located within Canoe Meadows. A large proportion of this area, approximately 52 acres, is mapped by the NRCS as a moderately well drained Winooski silt loam. However, based on field observations from 27 sample points and mapping of flooding regime using aerial photographs and LiDAR data, only about 10 acres of this area can be described as having moderately well drained soils. The remaining 42 acres exhibit poorly and very poorly drained soils, with other channels and ponded areas that are semi-permanently to permanently flooded. Portions of these 42 acres exhibited very deep organic soils (greater than 30 inches) and would fall into the Natchaug-Catden complex, while other areas are dominated by silt loam throughout the soil solum and match more closely the description for Saco or Limerick series.

Finally, an approximately three-acre area located just east of the Pittsfield WWTF is mapped as a Groton gravelly sandy loam. This area is actually an old gravel pit that has been excavated to within 12-18 inches of the water table. Soils were extremely gravelly, sandy loam with a thin A-horizon developing at the surface (approximately six inches thick). Based on the LiDAR topographic data, this area was excavated approximately 14-27 feet down from the adjacent landscape.

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 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 that were encountered with high frequency included shrub and herbaceous vegetation suitable for bird nesting (86%) and dense herb cover suitable for small mammals, amphibians, and reptiles (85%). Habitat structures, such as standing dead or live trees with cavities and perches, large woody debris on the ground, rocks, crevices, logs or roots at the water's edge and areas with standing water at least part of the growing season, were all present in or near half or more of the plots (range = 47%-59%).

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 80 species (or evidence of their use) were observed on the floodplain. These include 52 bird species, 12 species of herpetofauna, eight mammal species,

and eight invertebrates. A detailed listing of the incidental wildlife observations is provided in Appendix D-3.

6.3.2.5 Rare Species Habitat in Wetland Floodplains

A total of 21 state-listed plant and animal species have MNHESP-mapped Species Habitat that encompass the floodplain wetlands in Reach 5A and that could utilize those habitats based upon habitat requirements of each species and the floodplain habitat conditions documented to occur there. These species are listed Table 6-11 and are further discussed in Section 8.

6.3.3 *Description of Reach 5A Floodplain Wetland Habitats*

Floodplain wetlands in Reach 5A are composed of seven different plant community cover types and one open water community type. Several forested wetland types comprise the greatest area of these floodplain habitats, followed by shrub swamp, shallow marsh, wet meadow, and deep marsh. These habitats are described below. The relationship between these different habitats in the floodplain and the river is shown graphically in Figure 6-6, which is a schematic cross-section of habitats typically present in Reach 5A.

Floodplain Wetland Forest Habitats

Based upon the 2022-2023 community type mapping described herein, approximately 163 acres of forested wetland floodplains occur within Reach 5A. Three different natural community types are represented within these forested wetlands – transitional floodplain forest (144 acres), red maple swamp (8.8 acres), and high terrace floodplain forest (10.3 acres).

Transitional floodplain forest is the dominant matrix habitat connecting all other intervening floodplain natural communities (e.g., vernal pools, shrub swamps, emergent marsh, etc.) within Reach 5A, and accounts for approximately 35% of the total Reach 5A floodplain area. Topography within this habitat is 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 typically 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 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, green-headed coneflower (*Rudbeckia laciniata*), 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 (*Myosotis spp.*), Japanese knotweed, garlic mustard (*Allaria petiolata*), spotted knapweed (*Centaurea stoebe*), Japanese barberry (*Berberis thunbergii*), Morrow's honeysuckle, common buckthorn, glossy buckthorn (*Rhamnus frangula*), and Asian bittersweet. In many cases, invasive species are most prevalent (i.e., occur at greater densities) along or near to the utility corridors, reflecting the influence of anthropogenic (human-caused) factors in the spread of such species. For example, significant portions of the floodplain between the river and the powerline easement just downstream from the Confluence exhibit large patches of Japanese knotweed that likely took hold during ground-disturbing activities associated with the powerline easement and the sewer line easement that also crosses through that area.

Woody debris is abundant throughout the transitional floodplain forest habitats in Reach 5A. 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 often with seven to 10 and as many as 15 primary trunks ranging in size from 12" to 36" dbh.

When the Housatonic River overtops its banks, coarse bedload sediments are deposited directly adjacent to the river, forming banks that are typically two to three feet higher than elevations of the adjacent floodplain forest. Such levees are prevalent in Reach 5A along the bank edges adjacent to the floodplain forests. Tunnels and slides created by beavers and other semi-aquatic mammals are common along the bank of the river adjacent to the floodplain forest. These features also serve as conduits for the river water to flood the floodplain forest during lower stage flood events without having to rise the additional two to three feet to crest the bank. Through the digging of dens and channels, beavers affect not only the flow patterns and thus the hydrology of the area, but also riverbank dynamics, since the washing-out and collapsing of their dens alter the shape and character of the riverbank. Beaver foraging also affects vegetation growth patterns both by altering hydrology and by the cutting and removal of trees and branches for food. As a result of this repeated cutting or "coppicing" of the trees, the beavers create low dense shrub habitats preferred by other wildlife.

Selective foraging of certain tree species while allowing other species to grow changes the vegetative succession of the forested community.

The two other wetland forests which occur within the Reach 5A floodplain – high terrace floodplain forest and red maple swamp – may have similar characteristics to those described above for the transitional floodplain forest, but typically vary slightly in hydrology, soils, and vegetative composition. High terrace floodplain forest occurs slightly higher in the floodplain, typically above the two-year floodplain, and is therefore drier and better drained. In contrast, red maple swamp typically is more often seasonally flooded to saturated and associated with higher organic content soils derived from groundwater.

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 can include silver maple, American elm, box elder, and black willow (*Salix nigra*). Red maple swamp areas often have a dense shrub understory; in Reach 5A, the more common shrubs in this habitat are silky dogwood and the invasive Morrow's honeysuckle. Herbaceous vegetation comprises most commonly ferns such as ostrich fern, sensitive fern, and cinnamon fern (*Osmundastrum cinnamomeum*).

Shrub Swamp Habitats

After transitional floodplain forest, shrub swamp is the most prevalent cover type mapped in the Reach 5A floodplain and accounts for approximately 16% (64 acres) of the total area. Shrub swamps in Reach 5A occur in small discrete patches within fluvial swales, isolated depressions, and vernal pools surrounded by transitional floodplain forest, and as broad seasonally flooded to seasonally flooded/saturated wetland systems that cover extensive portions of the floodplain (see Figure 6-2). Shrub swamp habitat situated within the smaller isolated depressions and vernal pools ranges in size from 0.06 to 0.72 acre, with a few larger depressions containing up to four acres of shrub swamp habitat. Soils in the smaller depressions are typically 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

in Canoe Meadows east of the river and on state lands to the west (i.e., George L. Darey Housatonic Valley WMA located northeast of Palomino Drive). Canoe Meadows contains approximately 21 acre of shrub swamp, and wetland areas on the WMA to the west have up to nine acres of shrub swamp. 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 (*Salix discolor*), speckled alder (*Alnus incana*), white meadowsweet (*Spiraea alba*) and elderberry (*Sambucus canadensis*). Invasive species such as glossy buckthorn, multiflora rose (*Rosa multiflora*), 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 Reach 5A 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 the third most prevalent natural community mapped on the floodplain in Reach 5A and accounts for approximately 11% of the total area (46.3 acres).

The largest areas of shallow emergent marsh habitat are in Canoe Meadows, the WMA lands northeast of Palomino Drive, and just north of the Pittsfield WWTF (see Figures 6-2b, 6-2c, and 6-2d). Soils are variable but tend to exhibit thicker mucky mineral and organic soils than observed in shrub swamp or transitional floodplain forest. Shallow marshes are often found in shallow depressions in the floodplain or in areas affected by beaver impoundments. The most frequently encountered species in the shallow emergent marsh habitats were purple loosestrife, a variety of sedges and smartweeds, American bur-reed (*Sparganium americanum*), broad-leaved cattails (*Typha latifolia*), jewelweed, marsh bedstraw (*Galium palustre*), reed canary grass, woolgrass (*Scirpus cyperinus*), and rice cutgrass.

Deep Emergent Marsh Habitats

The deep emergent marsh habitat occupies approximately 12.6 acres (3.1%) of the Reach 5A floodplain. 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 Reach 5A, dominant plant species within this natural community include sedges, rushes, purple loosestrife, smartweeds, floating pondweed (*Potamogeton natans*), arrowhead (*Sagittaria latifolia*), soft-stemmed bulrush (*Schoenoplectus tabernaemontani*), American bur-reed, and great bur-reed (*Sparganium eurycarpum*). Deep emergent marshes are closely associated with open backwater habitats in Reach 5A.

Wet Meadow Habitats

Wet meadow habitat occupies approximately 22 acres (5.4%) of the Reach 5A floodplain. Wet meadows are wetlands that often resemble grasslands and are typically drier than other marshes except during periods of seasonal high water. 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 Reach 5A, 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 (*Urticadioica*), marsh bedstraw, ostrich fern, and silky dogwood. Wet meadows are located throughout the Canoe Meadows area and in scattered locations across the floodplain.

Moderately Alkaline Lake/Pond (Open Water) Habitats

Dispersed among the Reach 5A floodplain are a number of smaller open-water habitats, also called moderately alkaline lake/pond (following Woodlot 2002 terminology). Collectively these areas comprise 8.5 acres (2.1%) of the Reach 5A floodplain. 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 dam by on-going digging of the organic soils. This habitat type is most common in the Canoe Meadows area where beaver impoundments of Sackett Brook and other tributaries have long been active.

6.3.4 Reach 5A Floodplain Wetland Functional Assessment

This section presents an assessment of the ecological functions and values of the floodplain wetlands in Reach 5A. 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 6-12, 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 (shown on Figure 6-4). 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 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 evaluation units. The results are discussed below. Although these results are discussed in this floodplain wetland section, the combined assemblage of the Reach 5A riverine, riverbank, floodplain, and vernal pool habitats has been incorporated into the functional assessment.

Groundwater Recharge/Discharge

Based upon landscape setting, soil conditions, and surficial geologic conditions, the floodplain wetlands in Reach 5A provide conditions suitable for interactions between ground and surface waters. Much of the transitional floodplain forest, which comprises a majority of the area, contains floodplain soils that are sufficiently sandy to afford vertical and horizontal movement of surface and ground waters. 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. At other times, groundwater flow from the adjacent highlands may intersect the land surface within the floodplain of Reach 5A

(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. Recent seepage meter results from the Reach 5A PDI indicate that both groundwater discharge to and recharge from the river occurs within the Reach 5A floodplain.

Floodflow Alteration

Given the location and characteristics of Reach 5A 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.

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 the Reach 5A 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 Habitat

The Reach 5A floodplain wetland consists 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 transitional floodplain forest habitat in Reach 5A 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*), northern long-eared bat (*Myotis septentrionalis*), 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 below). Amphibian species, such as the wood frog 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 Reach 5A floodplain, 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 a carpet of herbaceous vegetation, including ostrich fern and wood nettle, and 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 of the type present in the Reach 5A 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 the utility right-of way provides open and edge habitat used by birds such as the scarlet tanager (*Piranga olivaceae*), common yellowthroat, yellow warbler, and ruby-throated hummingbird (*Archilochus colubris*).

Finally, the Reach 5A wetland areas provide habitat for rare species, as described in detail in Section 8 and Appendix G of this report. Reach 5A is documented to support habitat for 21 state-listed species, one of which is also a federally listed species.

Other Functions and Values

As described in Appendix E, 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.

Comparison with Earlier Functional Assessment

An earlier wetland functional assessment was conducted that included Reach 5A as well as areas upstream and downstream of this reach (TechLaw 1998). That effort also employed the ACOE Highway Method as well as other methods in use at the time. Reach 5A was incorporated into "Section Two" of the evaluation, which encompassed the Housatonic River from Confluence to below New Lenox Road (approximating what is now Reach 5A and 5B). 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 2022 Floodplain Upland Habitat 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 Reach 5A floodplain 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 Reach 5A 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 6-13 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 6-13), 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 Reach 5A 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) or other designated habitats for federal or state-listed rare species, any observation of a listed rare species, information from Mass Audubon and from Cornell's ebird web site on bird observations at Canoe Meadows, 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 Reach 5A floodplain within the 1 mg/kg isopleth includes 44.2 acres of upland consisting of five natural community types, two of which are fields and three are forests. Cultural grassland is by far the most extensive cover type in these upland floodplains, comprising 26.1 acres (59%) of the area. Agricultural fields add another 4.4 acres (10%) of the upland floodplain. Three upland forest cover types make up 13.7 acres (31%) of the upland area, with northern hardwoods-hemlock-white pine forest the most prevalent (7.4 acres/16.7%), followed by successional northern hardwood forest (3.7 acres/8.4%) and red oak-sugar maple transition forest (2.6 acres/5.9%). Developed or disturbed cover within the floodplain upland comprises only 0.6 acre.

As might be expected, these upland habitats are generally situated along the outer margins of the floodplain area (see Figure 1-2 for a simplified view). Upstream of Pomeroy Avenue, there are only minor fringe upland habitats along the outer portion of the floodplain. Between Pomeroy Avenue and Holmes Road and downstream along Canoe Meadows, the upland floodplains are generally associated with either open fields (some mowed) or utility lines, with some upland forests in the outer perimeter areas both east and west of the River. In the central portion of Reach 5A, there are several larger areas of floodplain uplands with both open and forested cover mixed; these occur primarily in the Joseph Road area and then west of the River towards the Pittsfield WWTF. Finally, there are upland agricultural fields toward the downstream end of Reach 5A.

The following summarizes the floodplain upland habitat surveys from data collected in 2022-2023.

6.4.2.1 Plant Community Composition

Table 6-14 provides a list of plants recorded in the upland natural communities with the frequency of occurrence. The upland forests contain a diversity of tree species (28 species). The most common tree species observed were American hornbeam (*Carpinus caroliniana*), American linden, black cherry (*Prunus serotina*), white pine (*Pinus strobus*), and sugar maple. A total of 16 shrub species were

recorded in the upland habitats, with Morrow's honeysuckle and silky dogwood the most common. Woody vines were quite abundant in many of the upland communities, with Asian bittersweet, poison ivy (*Toxicodendron radicans*), and river grape the most common species. Only a few herbaceous species appeared in more than several of the 26 upland plots, with Canada goldenrod, sensitive fern, and ostrich fern the most common. Table 6-15 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 6-16 and 6-17. The most commonly occurring biotic habitat features in these areas consisted of upland plant food sources, shrub thickets for earthworm habitat, standing dead trees with cavities and perches, shrubs and/or herbs for bird nesting, and large woody debris.

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 13 species of birds,¹⁵ one amphibian (wood frog), and one insect (monarch butterfly; *Danaus plexippus*).

6.4.2.4 Rare Species

A total of 11 state-listed plant and animal species have MNHESP-mapped Species Habitat that encompass the floodplain upland habitats in Reach 5A and could utilize these habitats based upon habitat requirements and the habitat characteristics identified during these surveys. These species are listed in Table 6-18 and further discussed in Section 8.

6.4.3 Description of Reach 5A Floodplain Upland Habitats

Based upon the updated community type mapping conducted in 2022-2023, five different natural community cover types comprise the floodplain upland habitat areas in Reach 5A. These are listed below along with a brief summary of each cover type and the area each comprises within the Reach 5A floodplain.

¹⁵ 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 (*Haliaeetus leucocephalus*), Baltimore oriole (*Icterus galbula*), hairy woodpecker, belted kingfisher, black capped chickadee, American robin (*Turdus migratorius*), and mourning dove (*Zenaida macroura*).

Successional Northern Hardwoods

This upland forest type comprises 3.7 acres within the Reach 5A floodplain (1% of the floodplain). Successional northern hardwood forests are limited in Reach 5A to small areas mostly around borrow pits and other disturbed areas and near residential lots or abandoned fields. Typical species include quaking aspen (*Populus tremuloides*), gray birch (*Betula populifolia*), and white pine. These forests tend to be younger and less developed in plant community structural diversity and organic composition.

Red-Oak Sugar Maple Transition Forest

This upland forest type comprises 2.6 acres within the Reach 5A floodplain (0.6% of the floodplain). The red oak-sugar maple transition forests are relatively level to sloping upland forests dominated by larger canopy trees of red oak (*Quercus rubra*), white ash (*Fraxinus americana*), sugar maple, American beech (*Fagus grandifolia*), eastern hemlock and black birch (*Betula lenta*). This forest type typically includes a sparse subcanopy of American hornbeam as well as a sparse shrub layer of maple-leaved viburnum (*Viburnum acerifolium*) and witch-hazel (*Hamamelis virginiana*). The herbaceous layer is generally dominated by New York fern (*Parathelypteris noveboracensis*), white wood aster (*Eurybia divaricate*), and wild sarsaparilla (*Aralia nudicaulis*).

Northern Hardwoods-Hemlock-White Pine Forest

This upland forest type comprises 7.4 acres within the Reach 5A floodplain (1.8% of the floodplain). 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. Typically, the canopy layer is dominated by red oak, eastern hemlock, white pine, and sugar maple, and a poorly developed subcanopy is dominated by eastern hemlock and American beech. Shrub layer plants generally include hobblebush (*Viburnum lantanoides*), striped maple (*Acer spicatum*), and mountain maple. The herbaceous layer, which is variable and dependent on canopy dominants, can include Christmas fern (*Polystichum acrostichoides*), shining firmoss (*Huperzia lucidula*), evergreen woodfern (*Dryopteris intermedia*), Canada mayflower (*Maianthemum canadense*), bracken fern (*Pteridium aquilinum*), wintergreen (*Ilex verticillata*), southern ground cedar (*Diphasiastrum digitatum*), and partridge berry (*Mitchella ripens*).

Agricultural Fields

There are 4.4 acres of active upland agricultural fields within the Reach 5A floodplain (1.1% of the floodplain). Agricultural upland fields are open fields typically situated on level ground within floodplains of actively farmed areas and include crop cultivation and/or grazing. Because of their proximity to rivers and streams, agricultural fields typically contain fertile soils.

Cultural Grasslands

Cultural grasslands comprise 26.1 acres of upland area within the Reach 5A floodplain (6.4% of the floodplain). 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, it may include sparse patches of stunted shrubs that are often confined to dense colonies along the grassland edges. Typical shrubs found within this community include pussy willow, beaked willow (*Salix bebbiana*), red-osier dogwood, and staghorn sumac (*Rhus hirta*). Herbaceous vegetation is usually dense and can include 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 (*Daucus carota*), common evening primrose (*Oenothera biennis*), and spreading dogbane (*Apocynum androsaemifolium*).

Other Developed/Disturbed Areas

Other developed/disturbed areas are present within the Reach 5A floodplain upland areas, but make up only a small portion of those areas (0.6 acre, 0.2% of the floodplain). These consist of areas that have been impacted by historical disturbances such as filling, former sand and gravel mining operations, and existing structures (specifically, two buildings and a small portion of a tennis court).

6.4.4 Reach 5A Floodplain Upland Habitat Functional Assessment

The information obtained for the inventory and characterization of floodplain upland habitats in Reach 5A 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 6-19. The impact of invasive species in the floodplain upland habitats was also considered. The site-specific information collected for each floodplain upland in Reach 5A, 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 5A 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 of Reach 5A (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 Reach 5A uplands within the 10-year floodplain of the Housatonic River 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

The structural components of the floodplain upland community cover types in Reach 5A 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 than 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 Reach 5A.

6.5 Exposure Area 10 (Canoe Meadows) Base Mapping

In accordance with Section 4.2.1.4 of the Final Revised SOW, the BRA assessment of Reach 5A included a survey of the trails, signage, boardwalk, and access areas in the expanded Exposure Area (EA) 10, owned by the Massachusetts Audubon Society. This consisted of an existing conditions

survey using GPS instrumentation, with documentation of the location and photographs of these features on an aerial photographic base. Specifically, during field surveys in August-October of 2022, GPS instrumentation was used to locate the features listed above within the Canoe Meadows property encompassing EA 10 on a base map. Figure 6-7 presents that base map.

In accordance with the Revised Reach 5A Work Plan, direct observations of bird species recorded at Canoe Meadows have been consolidated in a separate table (Table 6-20). This list has been generated from Canoe Meadows information provided on the MAS website, as well as the listing for Canoe Meadows observations provided at "ebird.org": [Canoe Meadows Wildlife Sanctuary, Pittsfield, Berkshire County, MA, US - eBird Hotspot](#). This listing indicates that over 180 species of birds have been observed within Canoe Meadows, much of which is located in Reach 5A.

7.0 Reach 5A BRA of Vernal Pool Habitats

Extensive investigations on vernal pool habitats have been conducted in Reach 5A over the past 25 years to develop a comprehensive mapping and classification of these habitats as well as to provide a detailed inventory of their characteristics. Detailed vernal pool investigations were initially conducted as part of the Woodlot ecological characterization of the PSA (Woodlot 2002a). Vernal pool investigations in Reach 5A also occurred during preparation of the RCMS, as reported by AECOM (2010) and Arcadis et al. (2010). Subsequently, GE conducted additional investigations on the identification and evaluation of vernal pools in the Reach 5A floodplain from 2018 to 2020 and presented the results to EPA in various reports, most notably those in 2020 and 2021 (AECOM 2020; GE 2021). Those reports included the identification of the pools in Reach 5A that met the MNHESP biological and physical criteria for vernal pools, as well as providing information on the hydrology of the pools and the faunal species observed in those pools (specifically, invertebrates, amphibians, reptiles, and fish).¹⁶ Those investigations are further described in Section 7.1 below. In addition, more recent investigations of the vernal pools in Reach 5A were conducted in 2022 and 2023 in accordance with the Revised Reach 5A BRA Work Plan. Those investigations are described in Section 7.2.

7.1 2018-2020 Reach 5A Vernal Pool Investigations

As discussed above, GE completed an identification and evaluation of vernal pools in the Reach 5A floodplain in 2018 and 2019, with some follow-up surveys in 2020. This work included field surveys of a total of 99 potential vernal pools. The final results, presented to EPA in the 2020 and 2021 reports noted above, included information collected historically and during the 2018-2020 investigations, along with observations on physical parameters. Specifically, the data presented included the obligate, facultative, and other species observed (if any), as well as presence of fish, habitat class, waterbody permanence, presence of a permanently flowing outlet, and evidence regarding an established fish population. A photographic log of the 2018-2019 investigations is provided in Appendix F-1.

These activities resulted in the identification of 59 pools in Reach 5A that met the MNHESP biological and physical criteria for certification as vernal pools and were thus subject to this BRA.¹⁷ Those

¹⁶ That information was also presented to the MNHESP, which certified the vernal pools that it concluded met its criteria, although the Revised Permit does not require such certification for pools to be considered as vernal pools, only that they meet the MNHESP criteria for vernal pools.

¹⁷ In addition to these vernal pools, EPA's June 16, 2020 conditional approval letter for GE's November 2019 vernal pool report noted that there is a certified vernal pool southeast of pool 5A-VP-24 and east of sample location F0435006, located outside of but near the floodplain boundary; and it directed GE to investigate that vernal pool. GE inspected that pool in the spring of 2022 and confirmed that it meets the applicable vernal pool criteria. That pool

vernal pools are shown on Figure 7-1. The biological and physical data collected historically (Woodlot 2002a) and during the 2018-2020 investigations and used to show that those 59 vernal pools met the criteria for vernal pool certification are presented in Table 7-1. The data shown in this table include the obligate, facultative, and other species observed (if any), including the presence of fish, as well as the permanence of water in the pool and the presence of a permanently flowing outlet.

The species used as evidence to show that the pools meet the applicable criteria were wood frog, spotted salamander, and fairy shrimp (*Eubrachyus vernalis*). Wood frogs were the most frequently encountered species in Reach 5A vernal pools and were observed in 48 of the pools. Spotted salamanders were observed in only 11 pools and were only found in one pool without other obligate vernal pool species (e.g., wood frogs or fairy shrimp). Fairy shrimp were observed in 29 pools, and in four pools, they were the only obligate species observed. No state-listed species (e.g., Jefferson salamander complex) were observed during these vernal pool surveys.

During the course of the 2018-2019 investigations, some additional information was also obtained, but not reported, on other aspects of the vernal pools in Reach 5A. While that information is relevant and was considered in the Reach 5A BRA (as described below), it was not a systematic or comprehensive collection of such data to meet the current BRA objectives (since it was not necessary to determine whether the pools met the MNHESP vernal pools criteria). Therefore, additional surveys and data collection described in the Revised Work Plan were conducted in the Reach 5A vernal pools in 2022 and 2023.

7.2 2022-2023 Reach 5A Vernal Pool Investigations

7.2.1 Methods

For the vernal pools in Reach 5A, the additional characterization activities in 2022 and 2023 consisted of the following, as provided in the Revised Reach 5A BRA Work Plan: (1) compiling the existing information collected during the 2018-2019 surveys on other relevant attributes of those vernal pools – namely, flora, topography, bottom sediment/soil composition, in-pool physical structure, surrounding land use, and relationship/proximity to other vernal pools; and (2) collecting additional information on those relevant attributes, as well as data on the general water and soil chemistry of the vernal pools, as described below. A Vernal Pool Characterization Form (Form VP-1, which was provided in Appendix F to the Revised Work Plan and a blank version of which is provided in

was then subject to updated PCB sampling in 2022. That sampling showed the presence of PCBs within that vernal pool to be less than 1 mg/kg. Therefore, no further evaluation of this vernal pool has been or will be conducted.

Appendix F-2 hereto) was completed for each certifiable vernal pool, with the data from this form presented in tabular form herein (Tables 7-2 and 7-3), along with other data as described below.

To estimate percent cover of tree canopy, woody shrubs, herbaceous plants (including sedges, rushes, and grasses), and woody vines within each vernal pool, a line-intercept sampling procedure was implemented in most pools. 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. In general, pools less than 0.2 acre in size had two transects, and pools between 0.2 and one acre had three transects. For pools that were too big (i.e., larger than one acre) or too deep, contained soft organic sediments that could not support the weight of a person, or were too thick with woody shrubs to penetrate in a straight line from shoreline to shoreline with a tape measure, the percent cover of tree canopy and woody shrubs was estimated by in-field observations along with inspection of the 2018 high-resolution UAV aerial photography for Reach 5A.

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](https://www.nrcs.usda.gov/plants)) for the Massachusetts region (USDA NRCS 2022).

In accordance with the Revised Reach 5A 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 plotted along that line in GIS. For pools that were too big (i.e., larger than one acre) or too deep, contained soft organic sediments that could not support the weight of a person, or were too thick with woody shrubs to penetrate in a straight line from shoreline to shoreline with a tape measure, data on water depth were collected up to approximately three feet. 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 (USGS 2014). 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 Manual.

In-pool physical structure other than the plants measured during the line-intercept sampling described above was quantified within each pool. Observations of coarse woody debris, 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 hydrologic regime, or hydroperiod of each vernal pool had been assessed during the 2018-2020 field surveys as temporary or permanently flooded. However, using observations of pool hydrology made during the 2022 surveys along with detailed mapping of flooding regime as described in Section 6.2.2 and presented on Figures 6-3a-e, pool hydrology was updated and classified on a continuum from shortest to longest hydroperiod as seasonally flooded, seasonally flooded/saturated, or semi-permanently flooded.

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. These 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 the MassGIS 2016 Land Cover/Land Use data-layer. 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.

In addition, data were collected on the general water and soil chemistry data of the vernal pools, other than PCB concentrations, which were previously determined separately.¹⁸ The collection of the general water and soil chemistry data occurred in May of 2023 and was conducted in a stratified random selection of the 59 certifiable vernal pools in Reach 5A to obtain data from 25% (15) of these pools. To select those pools, the 59 certifiable vernal pools were spatially stratified from north to

¹⁸ Specifically, the PCB concentrations in the Reach 5A vernal pools were determined through 2022 sampling conducted under the *Second Revised Pre-Design Investigation Work Plan for Reach 5A Non-Residential Floodplain Exposure Areas* (Anchor QEA 2021). The results have been reported in GE's *Revised Vernal Pool Pilot Study Work Plan* (Anchor QEA and AECOM 2023b), submitted on November 13, 2023 and approved by EPA on December 5, 2023, and in GE's *Pre-Design Investigation Summary Report for Reach 5A Non-Residential Floodplain Exposure Areas* (Anchor QEA and Arcadis 2023b), submitted on September 28, 2023 and approved by EPA on January 30, 2024.

south into three groups of 19-20 pools, and five pools were randomly selected within each group using a random number generator.

A Yellow Springs Instrument (YSI) Pro Dss Sonde 4M and data logger was used to collect general water chemistry from the 15 randomly selected vernal pools in Reach 5A. Water chemistry data were collected at one location within each of the selected vernal pools once during the growing season. Parameters collected were temperature, dissolved oxygen (DO), specific conductivity (SC), and pH. The Pro Dss Sonde 4M YSI was calibrated for each parameter prior to use daily. Deploying the meter 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, 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 cases at the end of each day.

Composite soil samples were also collected within each of the 15 randomly selected vernal pools. Each pool was visually divided into three quadrants from which a single sample was collected and combined into the one composite sample. Using a clean hand-held Edelman Auger, samples were collected at depths up to eight inches below the soil surface. Soil from the three locations were placed into a clean stainless-steel bowl and stirred with a clean stainless-steel spoon until homogenized then placed in four-ounce amber jars provided by the laboratory. The stainless-steel bowl and spoon were rinsed with clean water between each pool and then rinsed again with pool sample-specific water. Sample jars were labeled and placed on ice.

The Revised Reach 5A BRA Work Plan provided that: (1) if the data from these selected pools show significant spatial variability in one or more of the measured parameters, water quality measurements will be made and/or soil samples will be collected in additional vernal pools, selected in consultation with EPA, for determination of those parameters; and (2) in any case, after a determination has been made as to which vernal pools in Reach 5A require remediation, any such pools requiring remediation that have not already been subject to the collection of soil samples for analysis of pH and organic content will be sampled for those parameters as part of supplemental BRA activities. GE has subsequently identified the vernal pools that require remediation under the criteria in the Revised Permit. There are 48 such vernal pools. During the BRA, soil and water quality data were collected from 11 of those 48 vernal pools. As discussed in Section 7.2.2.2, GE has evaluated whether these data show significant spatial variability; and it proposes to collect soil samples from the remaining 37 vernal pools requiring remediation, as well as water quality data from six additional vernal pools, as part of supplemental BRA activities.

7.2.2 Results

This section describes results of the 2022-2023 field surveys conducted within the 59 vernal pools in Reach 5A. These include the within-pool parameters and habitat characteristics of the adjacent landscape, as described in Section 7.2.1. These results are also presented by pool in Table 7-2, with summary statistics in Table 7-3.

7.2.2.1 Plant Community Composition

As shown in Table 7-2, cover types within the vernal pools occur along a gradient from wetter to drier conditions – i.e., from deep and shallow emergent marsh to shrub swamp and transitional floodplain forest – which typically correlate well with pool maximum depth and hydroperiod. Most pools exhibited multiple cover types within their estimated flooding limits. However, 12 pools located within the floodplain were characterized as transitional floodplain forest. These pools tended to be smaller, 0.15 acre on average, as opposed to pools with multiple cover types (mean = 0.4 acre), and tended to have relatively high canopy cover (average of 73.2%, with a range of 32.6% to 100%).

Percent cover of vegetation layers, as measured from line-intercept transects across each vernal pool (n = 49) and estimated for those with restricted access across the pool (n = 10), is also presented in Table 7-2 and summarized in Table 7-3. Vegetation cover in the vernal pools varied with herbaceous and tree cover being relatively high on average compared to other cover types (i.e., woody vines, shrubs, and mosses). As would be expected, tree canopy cover is negatively correlated with the total percent cover of shrubs and observed in the pools. Estimates of fine and coarse woody debris were generally low, ranging from 3.7% to 8.2% on average. In addition, windthrown trees and exposed root wads were infrequently encountered. Hummocks composed of tussock forming grasses and sedges or woody shrubs were also generally low, although two pools were estimated to have greater than 38% of these features (5A-VP-1B and 5A-VP-77).

Data were collected on species presence at all 59 vernal pools in Reach 5A. The species found are listed in Table 7-4. A total of 132 plant species were documented within the 59 certified vernal pools in Reach 5A.¹⁹ These included 19 species of trees, 18 shrubs, four woody vines and 91 herbs. A total of 41 species (three trees, five shrubs, one woody vine, and 32 herbs) were encountered in only one pool. The most frequently encountered trees were silver maple, boxelder maple, red maple, and American elm. Shrubs included silky dogwood, Morrow's honeysuckle, and common buckthorn and woody vines included river grape. The most frequently encountered herbs were sensitive fern,

¹⁹ As noted in EPA's December 21, 2023 conditional approval letter, although 48 of the 59 vernal pools require remediation, the species occurrence in all 59 pools, including the 11 pools that do not require remediation, will be considered part of baseline conditions.

moneywort, and purple loosestrife. Moneywort, sensitive fern, silky dogwood, and silver maple were all encountered in more than 30 pools.

As shown in Table 7-4, a total of 14 species listed as invasive or likely invasive were observed growing in vernal pools (six herbs, seven shrubs, and one woody vine). Invasive plants were included in the list of most frequently encountered for the herb, shrub, and vine layers as described above. This included purple loosestrife and moneywort in the herb layer, common buckthorn and Morrow's honeysuckle in the shrub layer, and Asian bittersweet in the woody vine layer. No invasive tree species were observed in the vernal pools. In addition, four species (all herbaceous) were identified as non-native but are not listed as invasive in Massachusetts. A total of 113 native plants (80 herbs, 11 shrubs, 19 trees and three woody vines) were observed in the pools.

7.2.2.2 Pool Physical and Chemical Characteristics

As shown in Table 7-2, of the 59 total vernal pools, 45 pools were characterized as discrete depressions in the floodplain and 14 pools were part of a larger wetland system. Further, 32 pools were truly isolated with no inlet or outlet observed and 27 pools had inlets and/or outlets that were estimated to be either seasonally or temporarily flowing. No pools were documented to have a permanently flowing outlet. Estimated hydroperiod of most vernal pools ranged from seasonally flooded ($n = 29$) to seasonally flooded/saturated ($n = 26$). These are pools that likely dry out in late June to early July (seasonally flooded), or dry in July into early August but remain saturated at the surface or with small shallow pooled areas (seasonally flooded/saturated). Three pools were characterized as semi-permanently flooded. These pools retain some surface water in most years. One pool (5A-VP-1) is a large, flooded depression that has a deep and semi-permanently flooded section at the southern end, while the northern portions are more shallow and seasonally flooded.

The 2022 field surveys were conducted in August during a period of moderate to severe drought in western Massachusetts and hence most pools contained little or no water. Therefore, a second round of visits to each pool was conducted during the spring of 2023 to map the relative shape of each basin by measuring water depths at intervals along transects within each pool. Except for one flooding event that occurred near the end of April 2023, water levels were generally quite low for most of the spring 2023 survey period. This is apparent when looking at the transect data that were collected. Among all pools surveyed, maximum depths ranged from four to 37 inches (mean = 17.2 inches), not including three pools that were dry during the survey period. Average depths within each pool ranged from approximately 1.8 to 19.9 inches. The flooding event began April 23, 2023, when approximately 1.58 inches of rain fell over a 24-hour period (as reported at the Pittsfield Municipal Airport Weather Station), resulting in an increase in river flows from approximately 61.3 to 798 cfs at the Coltsville, MA USGS staff gage. During this time, pools that were connected to the river were then back-flooded through channels and/or overtopping of the bank, with some pools becoming three to four feet deep or more.

On average, soils within each vernal pool were inspected to 19.9 inches on average (range of 12-32 inches) below the ground surface. Most of the pools (n = 45) exhibited a mineral or mucky mineral surface horizon underlain by silt loam, very fine to fine sandy loam, and at two locations (i.e., 5A-VP-20 and 5A-VP-22) by a loamy sand. Eleven pools exhibited organic horizons overlying mineral soils ranging from silt loam to loamy sand in texture, and three pools exhibited deep organic soils with no underlying mineral soil encountered. In addition, in three pools (5A-VP-21, 5A-VP-22 and 5A-VP-80), organic horizons buried beneath mineral soil deposits were observed. The depth of organic surface horizons (including both organic and mucky mineral soils) ranged from approximately two to 32 inches and were 13.1 inches thick on average.

The results of the soil and water quality sampling in the 15 randomly selected Reach 5A vernal pools are provided in Table 7-5.²⁰ As required by EPA's December 21, 2023 conditional approval letter, GE has reevaluated these data in terms of spatial variability, as discussed in the following paragraphs.

Abiotic parameters in the surface water and soil of wetlands and vernal pools typically exhibit inter- and intra-specific variability. That is, within a single pool, measured parameters such as pH, SC, and DO can exhibit variability over time, and these parameters may also vary significantly among pools. For example, studies have documented significant variations in pH seasonally within pools and among vernal pools in Maine (Kifner 2017) and among vernal pools in Massachusetts (Coburn 2004). Similarly, in both of these studies, seasonal fluctuations in DO were documented over time and were significantly different among pools. Rowe and Dunson (1993), looking at relationships between abiotic parameters and breeding effort by amphibians, found that vernal pools are rather heterogeneous in their abiotic characteristics with significant variability within and among pools sampled for a wide variety of chemical parameters. Ayayee et al. (2020) also observed seasonal and spatial variability in soil percent organic carbon (%OC) and soil pH within and among vernal pools, respectively.

The variability in measured water chemistry and soil %OC derives from both within-pool and landscape-level effects. In-pool factors affecting these parameters may include pool size, depth, substrate and soil type, plant community composition, canopy closure, and source of hydrologic input (i.e., precipitation, surface runoff, groundwater exchange) (Rowe and Dunson 1993, Korfel et al. 2009, Herve et al. 2020). Landscape-level effects may include proximity to roads and development (Forman and Alexander 1998, Forman and Deblinger 2000, Karraker et al, 2008) and the landscape position of the pool (e.g., whether the pool is isolated or part of a larger wetland complex with surface water inlets or outlets).

²⁰ A surface water sample from one of the selected vernal pools (5A-VP-27) was not obtainable due to lack of surface water.

Among the 15 vernal pools sampled in 2023 in Reach 5A, results of the soil and water chemistry were variable. However, even with this relatively small sample size, the variability was correlated with both within-pond and landscape level characteristics. For example, using a Spearman rank correlation test (s_r), the amount of development within the critical terrestrial habitats (0-100 feet from the pool edge) was correlated with DO ($s_r=0.57$, $T=2.39$, $p = 0.034$) and SC ($s_r=0.64$, $T=2.88$, $p = 0.014$), and soil %OC was correlated with cover of herbaceous vegetation within the pool ($s_r=0.63$, $T=2.79$, $p = 0.016$).

Although the sample results exhibited variability, most of those results were within the 25th to 75th percentile range, with a few data-points that were mathematical outliers (e.g., %OC and pH in soils), as shown on Figures 7-2a through 7-2e. In addition, the standard error of the mean suggests that variability may not be as high as first apparent when considering the numerical spread between minimum, maximum and outlier values only. For example, although the %OC in soil ranged from 1.5 to 11%, the standard error of the mean (4% OC) was only 0.74%. When looking at characteristics of the individual pools, the observed variability can also be explained qualitatively. For example, VP-3, with primarily a sandy substrate and no surface organic layers documented, had only 1.5% OC, while the pool with 11% OC was VP-72, which has deep (approximately 24 inches) organic/muck soils. Similarly, pools with the highest SC were closer to roads and had development within 100 feet of the pool edge. VP-18, which is approximately 22 feet from the edge of Pomeroy Ave, exhibited the highest SC out of any pool (1578 $\mu\text{S}/\text{cm}$) (see Figure 7-2d).

Based on these considerations, the observed variability in the soil and water chemistry data in the 15 vernal pools sampled would be expected and is consistent with previous studies as well as the range of within-pond and landscape-level factors that may contribute to such variability. None of the results is beyond typical ranges of soil and water quality parameters anticipated in this floodplain setting, particularly with proximity to roads and development. Accordingly, GE has concluded that the data do not represent the type of "significant spatial variability" that would warrant additional sampling of these parameters. Indeed, additional sampling of Reach 5A vernal pools would still not be expected to provide a complete picture of abiotic variability within and among the pools in Reach 5A. Further, these abiotic data do not appear to provide significant information contributing to the vernal pool breeding habitat functions.

However, since soil sampling has not been conducted in 37 of the 48 vernal pools requiring remediation, soil samples will be collected from those 37 pools for analysis of pH and organic carbon (or organic matter) content as part of supplemental BRA activities. In addition, to comply with EPA's December 21, 2023 conditional approval letter, GE will collect water quality data from six additional vernal pools during this soil sampling. Those pools are 5A-VP-7, VP-10, VP-32, VP-57, VP-59A, and VP-60, which have been selected using the same spatial stratification approach described above in Section 7.2.1, as well as stratified by the amount of development within 750 feet of the pool (in order to sample pools from both developed and undeveloped portions of the landscape). These additional

data will further indicate the range of soil and water chemistry conditions within Reach 5A vernal pools.

7.2.2.3 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) around 58 of the 59 vernal pools is composed mainly (over 99% on average) of forest, scrub-shrub, and other open space habitats, with little or no development in that envelope. The one exception is 5A-VP-18, where the vernal pool envelope is 23.2% developed by residential homes and paved areas associated with Pomeroy Avenue, which is directly adjacent to this pool. Extending further out into the adjacent landscape, the critical terrestrial habitats (100-750 feet from the pool edge) are only slightly more developed, with approximately 91% of that total area composed of forest, scrub-shrub, and other open space habitats. Seven of the eight pools with the most developed critical terrestrial habitat are located north of Holmes Road and west of Pomeroy Avenue, with a range of 21.4% (5A-VP-6) to 39% (5A-VP-18) developed. Seventeen pools have less than 1% of their critical terrestrial habitat developed, and 36 pools have less than 10% of that habitat developed.

On average, each pool has 6.3 vernal pools within 1000 feet, with a range of one to 11 pools within that distance. The largest cluster of pools is located upstream of Pomeroy Avenue, with 20 pools located within approximately 57.4 acres of contiguous floodplain habitats. The remaining vernal pools are distributed throughout the Reach 5A floodplain habitats downstream of Holmes Road, with 32 pools along the western side of the Housatonic River, and seven pools located east of the river in Canoe Meadows (two pools), west and south of Joseph Drive (three pools), and at the southern end of Reach 5A (two pools).

A total of 12 state-listed plant and animal species have MNHESP-mapped Species Habitat that encompasses the vernal pools in Reach 5A 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 7-6.

7.3 Description of Reach 5A Vernal Pool Habitat

The vernal pools in Reach 5A 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. These depressions function as vernal pool breeding habitat for obligate vernal pool species, such as wood frog, spotted salamander, and fairy shrimp, 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 Reach 5A vernal pools. In addition, ribbon snakes (*Thamnophis sauritus*), wood turtles, and spotted turtles frequently forage and estivate in riparian pools.

7.4 Reach 5A Vernal Pool Functional Assessment

For the vernal pools in Reach 5A, their functional assessment is based primarily on their status as vernal pools that meet the applicable MNHESP criteria. In short, since each of the 59 vernal pools in Reach 5A 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, fairy shrimp, and spotted salamander, 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.²¹

To further evaluate the relative ecological value of each of the vernal pools in Reach 5A, a tier ranking system developed by Calhoun and Klemens (2002) may be utilized, using Form VP-2 (which was provided in Appendix G to the Revised Work Plan). Table 7-7 summarizes the results of the vernal pool tier ranking, as provided by Form V-2. This is a rating system designed strictly as a planning tool to determine the relative ecological value of pools in a community (Calhoun and Klemens 2002). According to Calhoun and Klemens, pools with a Tier I rating denote exemplary pools. Most of the pools in Reach 5A (32 of 59) 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 27 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.

²¹ 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 (Gibbs and Read 2008).

8.0 Reach 5A Assessment of Rare Species

This section provides an assessment of the presence of federal and state-listed rare species and their associated habitats in Reach 5A. 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.); “candidate species” under consideration for listing are also noted herein. 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)). 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 Species*

The occurrence of any federally listed threatened or endangered species or their habitat in Reach 5A has been identified based on the USFWS IPaC. The IPaC online mapping tool was consulted in August 2023 to document the potential presence of federally listed rare species under the ESA within Reach 5A (including candidate species). In addition, the habitat requirements for such listed species were researched using appropriate source material, primarily that available from the USFWS ([ECOS: Home \(fws.gov\)](https://ecos.fws.gov/)) as well as MNHESP ([List of Endangered, Threatened, and Special Concern species | Mass.gov](https://www.mass.gov/info-details/list-of-endangered-threatened-and-special-concern-species)). These habitat requirements were then assessed relative to the documented conditions in the Reach 5A habitats.

8.1.2 *State-Listed Species*

State-listed species and their habitats in Reach 5A have been determined based primarily on information provided by MNHESP. In October 2022, MNHESP provided GE with digital information presenting its delineation of state-listed species habitats in Reaches 5 through 8 of the ROR. These individual species maps are referred to as Species Habitat Maps. 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 Reach 5A mapped for all state-listed species collectively, may report the overall acreage in Reach 5A 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 Species

Based upon the IPaC review, the northern long-eared bat (*Myotis septentrionalis*) is the only federally listed species indicated to potentially occur within the limits of Reach 5A. Another candidate species (under consideration for federal listing), the monarch butterfly (*Danaus plexippus*), is also indicated to potentially occur within Reach 5A. A brief summary of the habitat requirements for these two species is provided below, and Appendix G provides more extensive information on these two species and the potential for their habitat requirements to be met in all or portions of Reach 5A. This information will be used as guidance in the remedial design process to minimize impacts on habitats of federally listed species to the extent practicable.

Northern Long-Eared Bat (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 fungus. Infected hibernacula in caves in the Northeast have caused catastrophic population losses of 90-100%. The USFWS IPaC consultation indicates that potential habitat for northern long-eared bat occurs throughout all of Reach 5A.

Monarch Butterfly (Candidate): 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 is a candidate for listing by the USFWS. 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 (USFWS 2022). The monarch butterfly is not currently a state-listed species in Massachusetts. Open meadows (both wetland and upland) in Reach 5A provide potentially suitable habitat for monarch butterflies. These habitats support several milkweed species which serve as the larval host plants for monarch butterflies.

8.2.2 *State-Listed Species and Reach 5A Core Habitats*

Based upon information provided by MNHESP in October of 2022, a total of 20 state-listed plant and animal species have MNHESP-mapped Species Habitat that encompass the various habitats in Reach 5A. An additional species (the northern long-eared bat), which is both state- and federally listed, also potentially occurs within Reach 5A (based upon IPaC results), but MNHESP did not include that species in its Species Habitat mapping. All 21 species are listed in Table 8-1, along with the acreage of mapped habitat for each species, the MESA status of each, and the taxonomic group that each species belongs in. Included in the list of state-listed species are 10 plants, seven invertebrates, two birds, one reptile, and one mammal. Since MNHESP did not provide a Species Habitat Map for the northern long-eared bat, the entire Reach 5A area is included as that species' habitat based upon the IPaC results.

As noted above, MNHESP has advised GE that it will not allow presentation of the Species Habitat Maps by individual species. The overall area mapped for all state-listed species collectively in Reach 5A encompasses all of Reach 5A.

Figure 8-1 shows the limit of the latest Priority Habitat mapping from MNHESP in the Reach 5A area (along with certified vernal pools for informational purposes). As noted above, this is generated from publicly available mapping of Priority Habitats of state-listed species. As shown on Figure 8-1, the Priority Habitat in Reach 5A extends upstream and downstream as well as laterally beyond the isopleth bounds that define the limits of Reach 5A. Figure 8-1 shows that virtually all of Reach 5A falls within Priority Habitat, with only one small area along East New Lenox Road in the southeastern part of Reach 5A extending outside of mapped Priority Habitat.

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 Reach 5A that were designated as Core Area 1, Core Area 2, and Core Area 3.²²

Each of the state-listed species with mapped habitat in Reach 5A, along with its habitat requirements, the extent (acreage) of its mapped Species Habitat in Reach 5A, and a general description of that area, are summarized briefly below, with more information provided in Appendix G. The general information on each species is largely taken from species-specific fact sheets prepared by MNHESP, as available on its website at [List of Endangered, Threatened, and Special Concern species | Mass.gov](https://www.mass.gov/info-details/list-of-endangered-threatened-and-special-concern-species), with additional information for some species based upon historical information and published literature. The extent of mapped Species Habitat for each species is taken from the Species Habitat maps provided by MNHESP.

American Bittern (*Botaurus lentiginosus*; Endangered): The American bittern is a wading bird that inhabits freshwater wetlands, spending most of its time secretly dwelling in marshland emergent vegetation. According to the 2022 MNHESP maps, Species Habitat for the American bittern in Reach 5A totals 164 acres covering three general areas, all of which contain suitable marsh habitat along the Housatonic River.

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 buttercup 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. According to the 2022 MNHESP maps, the Species Habitat of the bristly buttercup occurs in one area of Reach 5A, approximately 29 acres in size in the central portion of Reach 5A to the west of the Housatonic River.

Brook Snaketail (*Ophiogomphus asperus*; Special Concern) is a dragonfly member of the Gomphidae family known as the clubtails. The nymphs of the brook snaketail prefer sandy substrates in clear running water. Adults may live out the rest of the summer far from the stream, often in dense woodland or shrubland. In Massachusetts, the flight period of the adult is mid-May through August. Mapped Species Habitat of the brook snaketail occurs in 240.65 acres within Reach 5A, extending from the Confluence downstream for approximately two miles.

²² The definitions of those Core Areas are provided in Section 6.1.5 above.

Common Gallinule (*Gallinula galeata*; *Special Concern*): Formerly known as the common moorhen, the gallinule is a duck-like swimming bird that inhabits large freshwater or brackish marshes and water bodies with cattails and other emergent vegetation. According to the 2022 MNHESP maps, the Species Habitat of the common gallinule occurs in two small areas in Reach 5A, both in marshes north of the Pittsfield WWTF on the western side of the Housatonic River. The mapped Species Habitat for this species in Reach 5A comprises 16.23 acres.

Culver's-root (*Veronicastrum virginicum*; *Threatened*): This is an herbaceous perennial wildflower of tall stature (2.6-6.5 ft) with showy arrays of dense pink or white flowers on several candelabra-like terminal spikes. Species Habitat of the culver's-root occurs within one small (0.12 acre) area of Reach 5A, located near the Confluence to the east of the Housatonic River.

Frank's lovegrass (*Eragrostis frankii*; *Special Concern*): Also known as sandbar lovegrass, Frank's lovegrass is an annual grass species identified by its repeatedly branching clusters on straight stems from about four inches up to a foot high. This species prefers sandy substrate within or at edges of the river channel. In Massachusetts, Frank's lovegrass occurs on sandbars and sandy riverbanks found only along the Housatonic and Connecticut Rivers. The Reach 5A mapped Species Habitat for Frank's lovegrass consists of river channel, including sandbars within the river, riverbank, and some floodplain habitat, and totals approximately 25.90 acres in size along a roughly 2.5-mile stretch of the Housatonic River in the downstream end of Reach 5A.

Gray's Sedge (*Carex grayi*; *Threatened*) is a perennial member of the sedge family (Cyperaceae) that is a clump-forming plant with an identifying striking "spiked-ball looking" flower. Gray's sedge is found in rich, mesic soils of forests, calcareous seepage Swamps, marshes, banks, 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. The Species Habitat for Gray's sedge within Reach 5A occurs in 27.5 acres of floodplain wetland along a roughly one-mile section of the river north of the Pittsfield WWTF.

Great Laurel (*Rhododendron maximum*; *Threatened*) is an evergreen shrub or small tree that grows up to 33 feet high belonging to the Ericaceae or Heath family. Great laurel grows best in filtered light in moist woods, swamps, and pond edges. The mapped Species Habitat for great laurel occurs within a single small area (1.72 acres) of Canoe Meadows east of the river in Reach 5A.

Hairy Wild Rye (*Elymus villosus*; *Endangered*) is a native perennial, tufted grass in the family Poaceae, distinguished by its bristly, white pubescent "bottle-brush" inflorescence. Hairy wild rye is found in floodplain forests, rich moist thickets, and rocky woodlands. In Massachusetts, hairy wild rye inhabits high terrace floodplain forests with moist alluvial soils, and moist to dry, rich, rocky open woods and thickets. Mapped Species Habitat of hairy wild rye comprises 18.9 acres in the central portion of Reach 5A northeast of the Pittsfield WWTF on the western side of the Housatonic River.

Matted Spike-sedge (*Eleocharis intermedia*; Threatened), formerly known as the intermediate 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. Mapped Species Habitat of the matted spike-sedge extends from the Confluence south through all of Reach 5A, covering 116.8 acres.

Mustard White (butterfly) (*Pieris oleraceae*; Endangered) 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 introduced cuckoo-flower from Eurasia (*Cardamine pratensis*) growing in forests, floodplains, and meadows. Other larval hosts may include several species of the mustard family, as well as the invasive garlic mustard. The mapped Species Habitat of the mustard white butterfly in Reach 5A extends south contiguously through the southern two-thirds of Reach 5A below the Holmes Road bridge, covering 327.4 acres.

Northern Long-eared Bat (*Myotis septentrionalis*; Endangered--both state and federal):
Discussed above,

Ocellated Darner (*Boyeria graefiana*; Special Concern) is an insect member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Aeshnidae family known as the darners. It is known to inhabit clear, shallow, swift-flowing streams and large, rocky, poorly vegetated lakes. In Massachusetts, it has been observed only in shaded, clear, cold, rocky streams and rivers. The mapped Species Habitat of the ocellated darner in Reach 5A occurs from the Confluence through to the southern extent of the Pittsfield WWTF, covering 276.78 acres.

Ostrich Fern Borer (*Papaipema sp.2 near pterisii*; Special Concern) is a noctuid moth from the Noctuidae (owelet moth) family associated with mature floodplain forests and wooded swamps with stands of ostrich fern (*Matteucia struthiopteris*). The ostrich fern borer moth inhabits mature floodplain forests and wooded swamps where ostrich fern grows in moderate to dense stands, preferably in a shaded or partially shaded microhabitat. Mapped Species Habitat of the ostrich fern borer moth comprises 171.26 acres in the north-central portion of Reach 5A, just downstream of the Holmes Road Bridge.

Rapids Clubtail (*Phanogomphus quadricolor*; Endangered) is an insect member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Gomphidae family, specifically clubtails, which are typically burrowers and predators. The rapids clubtail inhabits clear, cold streams and rivers with intermittent sections of rocks and rapids. Mapped Species Habitat of the rapids clubtail comprises 55 acres in the southern portion of Reach 5A.

Riffle Snaketail (*Ophiogomphous carolus*; *Threatened*), is a large and stocky insect member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Gomphidae family or clubtails. The riffle snaketail inhabits clear, cold, rocky streams that are fast flowing with few pools and fine gravel or sand sediment. During maturation, riffle snaketail adults wander from woodland to forest clearings and fields, feeding on small aerial insects such as flies and mosquitos. The mapped Species Habitat of the riffle snaketail comprises 192 acres in the upstream portion of Reach 5A, from the Confluence to a point just upstream of the Joseph Road area.

Spine-crowned Clubtail (*Hylogomphus abbreviates*; *Special Concern*) is a large insect member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Gomphidae family, the clubtails. 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. They are rarely observed during this time and thought to spend much of this stage in tree tops. Mapped Species Habitat of the spine-crowned clubtail in Reach 5A occurs from the Confluence to the southern extent of the Pittsfield WWTF, comprising 256 acres.

Tuckerman's sedge (*Carex tuckermanii*; *Endangered*) is a perennial herbaceous wetland sedge (family Cyperaceae) that grows in loose clumps up to a meter tall in habitats including river and lake shores, swamps, and vernal pools. In Massachusetts, Tuckerman's sedge inhabits the rich soils of lowland river floodplain habitats such as oxbows adjacent to river channels, low depressions, forests, meadows, swales, and vernal pools in the western and central part of the state. Mapped Species Habitat of Tuckerman's sedge occurs in the central portion of Reach 5A northeast of the Pittsfield WWTF on the western side of the Housatonic River, covering less than one acre in area.

Wapato (*Sagittaria cuneata*; *Threatened*) 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 entirely submerged plant depending on its growth conditions. Mapped Species Habitat of wapato in Reach 5A extends from the Confluence south along the river corridor through Reach 5A, comprising 171 acres.

White Adder's-mouth (*Malaxis monophyllos* var. *brachypoda*; *Endangered*) is a single-leaved orchid member of the family Orchidaceae found in small, shaded, calcareous wetland habitats. White-adder's mouth prefers habitats with accumulations of incompletely decomposed organic material, or peat, dominated by coniferous trees and influenced by highly calcareous water. Mapped Species Habitat for white adder's-mouth occurs in the northern section of Reach 5A, comprising approximately 1.62 acres.

9.0 Reach 5A Invasive Species

Assessment of invasive species in Reach 5A was initiated by establishing a definition of “invasive species,” including the plant and animal species that will be considered invasive. 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).²³

For animals, to implement EPA’s directive in Condition 9 of its March 31, 2022 conditional approval letter to evaluate “invasive aquatic 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 \(usgs.gov\)](#)). In this determination, it is important to distinguish “exotic invasives” from other non-native species (which may or may not be invasive).²⁴ Based on this assessment, the zebra mussel (*Dreissena polymorpha*) and Asian clam (*Corbicula fluminea*) have been identified as exotic aquatic invasive animals which could potentially occur in the Reach 5A area. Non-native fish species documented in Reach 5A 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 Reach 5A. 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 riverine, riverbank, backwater, and floodplain habitats as described previously.

For Reach 5A, as described in Section 6.2.1, an aerial photograph overlay provided an initial depiction of known areas of invasive species based on the available information and aerial photographic interpretation. This baseline information was also transferred on to the 2022 LiDAR topo-bathymetry mapping. The aerial photographic base mapping was then used during field surveys to document

²³ 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.

²⁴ 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).

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 0-5%, 5-25%, 25-50%, 50-75%, or >75%. 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. Aquatic invasive species (both plant and animal) in the river and backwaters were documented during the field surveys for each of those habitats, including location references in the base mapping.

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 dating back to 2018, but in particular during the more recent surveys in 2022-2023. 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. Additional information on the field assessment of invasive species in Reach 5A is provided in Appendix H-1, and general information regarding the primary invasive species identified in Reach 5A is provided in Appendix H-2.

Overall, among the Reach 5A habitats surveyed, only one invasive tree species was observed (Norway maple). Eight invasive shrub species, one woody vine, and fourteen herbaceous species were observed. In terms of "invasive aquatic animals," only one such potential species was observed, as described below. 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 Reach 5A; and the invasive yellow iris was observed along the river edge.
- Asian clams are suspected to be present in Reach 5A 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

- Sixteen different invasive species were recorded (no invasive tree species, four invasive shrub species, one invasive vine species, and 11 invasive herbaceous species).
- The invasive vine Asian bittersweet was the most common vine (59% frequency).
- The most prevalent invasive species on the riverbanks were Asian bittersweet (59% frequency), Japanese knotweed (48%), common buckthorn (29%), Morrow's honeysuckle (22%), water forget-me-not (18%), purple loosestrife (12%), and bishop's goutweed (10%).

Backwater Invasive Species

- A total of seven invasive plant species were observed in the six Reach 5A backwater habitats.
- No invasive shrubs, trees, or vines were observed in the backwaters, 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-not, 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 BW5A-2 with five invasive plant species, followed by BW-3 with four invasive plant species, and then BW-1, BW-4, BW-5 and BW-6, each with two invasive plant species.

Floodplain Invasive Species (including Vernal Pools)

- Invasive plant species were observed at 179 of 201 floodplain plots (89%).
- A total of 21 species listed as invasive or likely invasive were observed growing in floodplain habitats (11 herbs, eight shrubs, one tree, and one woody vine).
- Only one invasive tree species (Norway maple) was recorded in the observation plots, and occurred in only 1% of the plots.
- The most common invasive shrub species were Morrow's honeysuckle (25.2%), common buckthorn (26.2%), and multiflora rose (7.4%).

- The most prevalent invasive herbaceous species encountered were purple loosestrife (28.7%) and moneywort (23.7%), followed by reed canary grass (7.9%), bishop's goutweed (6.9%), garlic mustard (4%), and Japanese knotweed (3.5%).
- A total of 14 species listed as invasive or likely invasive were observed growing in vernal pools (six herbs, seven shrubs, and one woody vine).
- Invasive plants in vernal pools were included in the list of most frequently encountered for the herb, shrub and vine layers. This included purple loosestrife and moneywort in the herb layer, common buckthorn and Morrow's honeysuckle in the shrub layer, and Asian bittersweet in the woody vine layer. No invasive tree species were observed in the vernal pools.

In addition to the overall data summary provided above on invasive species in Reach 5A, three species of invasive plants within Reach 5A 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 phragmites (or common reed). The limits of the discrete areas of dominance by these species were therefore mapped, as shown on Figures 10-1a through 10-1e (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.

10.0 Preliminary Identification of Degraded Habitats and Restoration Opportunities in Reach 5A

The Revised Reach 5A BRA Work 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 Reach 5A. Those activities and their results are described in this section.

10.1 Identification of Disturbed or Degraded Habitats

To assist in identifying disturbed or degraded floodplain habitat areas that could be suitable for access roads or staging areas, Form FP-1 included a section (Section VII) for the recording of observations pertaining to habitat degradation. These included evidence of significant levels of dumping or of significant erosion or sedimentation, the relative abundance of invasive species, disturbance from roads or highway, evidence of fire, and evidence of other human disturbances. In addition, in accordance with EPA's June 29, 2022 conditional approval letter, GE developed a Site Degradation/Disturbance Evaluation Form, provided in Appendix H of the Revised Work Plan, to qualitatively assess the level of degradation in each wetland or upland cover type unit for which Form FP-1 is completed. The information used for this form was to be generated from the floodplain site inventories described previously. This form includes ratings for eight factors or evaluation criteria which relate to the level of disturbance or habitat degradation. Each factor has an assigned significance coefficient (from 1 to 3), which is multiplied by the rating assigned to each condition that the factor is recorded as having. The product of these values yields a score that provides a relative measure of the level of disturbance/degradation for the area assessed.

In applying the Site Degradation/Disturbance Form to the more than 400 acres of floodplain habitat that comprises Reach 5A, it was determined that developing a degradation/disturbance score for each wetland or upland cover type for which Form FP-1 was completed would not be a constructive or useful procedure for identifying discrete areas of the floodplain where degradation could be defined for the purposes of aiding in assessing the locations of access and/or staging areas. For example, the contiguous area of transitional floodplain forest comprising much of the floodplain area upstream of Pomeroy Road is one cover type unit, but the sewer utility line within this cover type is not distinctly shown due to the growth of floodplain forest that has developed over this utility line corridor. Therefore, providing a degradation score for this floodplain forest cover type unit would not be sufficiently refined to delineate areas of greater degradation.

Site Degradation/Disturbance Evaluation Forms and associated scores were completed for the more broadly defined wetland functional units (Areas 5A-1, 5A-2, and 5A-3 on Figure 6-3, as well as a separate form for the western side of 5A-1) to assess the overall relative level of degradation of these sections of the Reach 5A floodplain. The results are compiled for each such area in Table 10-1. This table consolidates the criteria and scoring from the Site Degradation/Disturbance Evaluation Forms in one table for clarity and ease of comparison among the four units evaluated. While the results provide some differentiation among evaluation units (e.g., showing the area west of the Confluence as the least degraded/disturbed), the use of even these broader forms remains too general to provide useful information to identify discrete disturbed or degraded areas of the floodplain that could be considered for access roads and staging areas.

As an alternative to the use of these forms to assess levels of degradation and the types of disturbance factors that occur within Reach 5A and which 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 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; and (4). areas that have been impacted by historical disturbances. Accordingly, these four disturbance conditions were delineated on Reach 5A cover maps. Figures 10-1a through 10-1e show the resulting delineation of those portions of the Reach 5A floodplain that contain degraded or disturbed conditions. These are summarized as follows:

- Utility lines: Three types of utility lines traverse the Reach 5A floodplain in various areas. An electric transmission line crosses the Housatonic River from the western side of Miss Hall's School upstream of Pomeroy Avenue and extends north through the Reach 5A floodplain to the eastern side of the Confluence. Sewer utility line corridors also extend across this portion of the floodplain extending west from Pomeroy Avenue, and this line continues south along the western side of the River to the Pittsfield WWTF; this sewer line also crosses the floodplain from the Joseph/Eric Drive area. Finally, a gas transmission line extends across the floodplain from the Palomino Drive area to northwest of Eric Drive at Anita Drive. 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.
- Areas that have a strong dominance of invasive plant species: As discussed in Section 9.2, three species of invasive plants within Reach 5A 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 are Japanese knotweed, reed canary grass, and phragmites (or common reed). The discrete areas of dominance by these species are shown on Figures 10-1a-e. 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 open space land uses: This category consists of areas that are subject to ongoing land uses such as agriculture, mowing, or similar land management uses (i.e., cultural grasslands).
- Areas impacted by historical disturbances: This category consists of areas that have been impacted by historical disturbances such as filling, former sand and gravel mining operations, and existing structures (specifically, two buildings, a small portion of a tennis court, and the concrete outfall channel from the WWTF).

These delineated areas of specific degradation/disturbance were considered in the preliminary selection of access roads and staging areas presented in the Reach 5A Conceptual RD/RA Work Plan, with the objective of minimizing ecological impact from those activities.

10.2 Identification of Restoration Opportunities

In accordance with the Revised BRA Work Plan, during the BRA activities, GE has also evaluated potential restoration opportunities within the various Reach 5A habitats 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 all 34 bank stations, rock material (cobbles to boulders) at 88% of the stations, large trees at 60% of the stations, and root wads at 50% 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 of the RCMS Report and consistent with Natural Channel Design options. 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 5A riverbank remediation/restoration design.

For the Reach 5A floodplain, vernal pool, and backwater 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. Any such restoration measures will be described further in the Restoration Corrective Measures Coordination Plan and the Restoration Plan for Reach 5A.

11.0 Supplemental BRA Activities and Anticipated Schedule

Supplemental BRA activities will be conducted to take into account in greater detail the actual extent of remediation in Reach 5A and the access roads and staging areas identified in the September 2023 Conceptual RD/RA Work Plan after that work plan is approved by EPA. These activities were proposed in Section 5 of the Supplemental Data Collection Work Plan attached to the Conceptual RD/RA Work Plan. They include the following surveys (as described in that plan) in specific areas that will be affected by remediation and support activities:

- Supplemental riverbank habitat surveys;
- Supplemental backwater habitat surveys;
- Habitat surveys in the Reach 5A hydrographic features that do not constitute backwaters (referred to as Other Waterbodies); and
- Supplemental floodplain habitat surveys.

In addition, as noted in Section 1.4 of the Supplemental Data Collection Work Plan, there were certain previously proposed and approved BRA activities that had not been conducted at that time. These included the fish community survey proposed in Section 3.1.1.3 of the Revised BRA Work Plan, which was subsequently conducted in late September 2023, as described in Section 3.2.4 of this Revised BRA Report. Other supplemental BRA activities that were either previously proposed or added in this Revised BRA Report in response to conditions in EPA's December 21, 2023 conditional approval letter include the following:

- As discussed in Section 5.2.3.4, GE will revisit each backwater in Reach 5A once in 2024 during mid- to late spring to verify species occurrences and check for aquatic plants that may not have been observed in 2022.
- As discussed in Section 5.2.3.8, GE will conduct two additional rounds of water quality sampling in each backwater during mid- to late summer in 2024 if water is available for sampling.
- As described in Section 7.2.2.2, GE will collect soil samples for pH and organic content analysis from the 37 vernal pools subject to remediation that have not already been sampled for those parameters, and will also collect water quality data from six additional vernal pools.

The results of the above-described supplemental BRA activities will be reported in an addendum to this Reach 5A BRA Report (or other appropriate deliverable) following the completion of those activities and prior to development of the Final RD/RA Work Plan for Reach 5A. Further, as noted in Section 10.2, restoration measures will be described further in the Restoration Corrective Measures Coordination Plan and the Restoration Plan for Reach 5A.

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Tables

Table 3-1: Reach 5A Riverine Habitat Characterization

Parameter	Description of Parameter	Reach 5A 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); 2022 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); 2022 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, 2010 Example Area evaluations, and PDI of Reach 5A banks (including updated BEHI/NBS assessment); consolidate other bank-related information (from sources below); 2022 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); 2022 site reconnaissance and RBP surveys
Water quality	Temperature, pH, TSS, turbidity, clarity, dissolved oxygen	Consolidate existing information (from sources below); 2022 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); 2022 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 2022 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 2022 field surveys (RBP, bank, and floodplain inventories)
* The existing information used for the Reach 5A riverine habitat characterization included 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, and the Final Accessibility Report – all described and referenced in Section 2 of the Reach 5A BRA Work Plan – as well as USGS gauge data and previous hydrologic modeling (e.g., EFDC model) referenced in Section 3.1.1 of the Work Plan.		

Table 3-2: RBP Riverine Parameters Collected

Category	Name	Parameter Details
INSTREAM FEATURES	Reach Length (m)	Reach length measured along river centerline
	Stream Width (m)	Estimated average width of river
	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
	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 of 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, totals to 100%
	Boulder %	
	Cobble %	
	Gravel %	
	Sand %	
	Silt %	
	Clay %	
Substrate (Organic)	Detritus %	% coverage of organic substrate. Does not total to 100%, detritus includes fine wood cover
	Muck-Mud %	
	Marl %	

Table 3-2: RBP Riverine Parameters Collected (continued)

Category	Name	Parameter Details
HABITAT ASSESSMENT PARAMETERS	Epifauna; Substrate/ Available Cover	Rating of each characteristic, following 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 – Instream Features and Large Woody Debris (LWD) Coverage

RBP Station #	INSTREAM FEATURES								LWD	
	Reach Length (m)	Stream Width (m)	Sampling Reach Area (Sq. Meter)	Depth (m)	Surface Velocity (m/sec)	% Riffle	% Pool	% Run	LWD (m²)	Density of LWD (m²/km²)
1	154.4	27	2,753	1.5	0.5	20	60	20	50	18.2
2	200	17	3,535	1	0.5	5	25	70	200	56.6
3	365	25	7,701	1	0.5	25	10	65	150	19.5
4	500	25	8,872	1.5	0.5	10	20	70	500	56.4
5	490	25	10,404	0.75	0.25	15	30	55	200	19.2
6	975	25	19,568	1.5	0.25	5	65	30	500	25.6
7	550	20	10,658	1.5	0.25	10	45	45	700	65.7
8	400	18	8,180	1.5	0.3	2	28	70	350	42.8
9	579	28	14,001	1	0.75	16	32	52	1000	71.4
10	500	20	10,429	1.5	0.3	2	60	38	200	19.2
11	180	25	4,985	0.5	0.25	0	10	90	100	20.1
12	518	25	12,030	1	0.3	0	35	65	75	6.2
13	450	30	14,004	1.25	2	2	13	85	125	8.9
14	610	28	14,201	1	0.4	0	50	50	100	7.0
15	300	30	7,764	1	0.3	0	10	90	150	19.3
16	280	25	6,899	1	0.5	15	50	35	400	58.0
17	200	20	4,070	2	0.2	0	65	35	500	122.8
18	533	30	12,122	2	0.125	0	88	12	400	33.0
Area Weighted Average	432.5	24.6	9,565	1.3	0.5	6%	41%	53%	316.7	33.1

Table 3-4: RBP Results – Aquatic Vegetation and Substrate Characteristics

RBP Station #	Aquatic Vegetation		Substrate (Inorganic)							Substrate (Organic)		
	Dominant Aquatic Veg	% Aquatic Vegetation	Bedrock %	Boulder %	Cobble %	Gravel %	Sand %	Silt %	Clay %	Detritus %	Muck-Mud %	Marl %
1	Potamogeton crispus	3	0	2	15	20	5	48	10	10	5	0
2	Algae	0.5	0	0	15	15	40	20	10	20	5	0
3	Potamogeton crispus	2	0	0	10	30	25	25	10	7	1	0
4	Potamogeton crispus	2	0	0	10	25	40	20	5	10	0	0
5	Potamogeton crispus	2	0	6	2	30	30	29	3	5	3	0
6	Potamogeton crispus, algae	20	0	3	3	32	32	20	10	5	0	0
7	Potamogeton crispus, water celery, blue flag iris	1	0	2	5	25	35	30	3	5	0	0
8	Yellow flag iris, algae	0.5	0	5	10	25	30	25	5	15	0	0
9	Algae	15	0	1	2	30	40	17	10	10	1	0
10	Potamogeton crispus, sparse macrophyte algae	15	0	0.5	10	10	50	20	10	10	0	0
11	Water celery	0.5	0	5	10	20	35	20	10	10	0	0
12	Water celery, algae, Eurasian milfoil	2	0	5	20	20	47	5	3	8	5	0
13	Bur-reed	5	0	0	15	10	50	20	5	15	0	0
14	Grasses	4	0	1	2	20	65	10	2	10	10	0
15	Bur-reed, macrophyte algae	2	0	0	0	20	55	20	5	15	5	0
16	Burr reed, algae	0.5	0	0	5	20	35	20	20	10	0	0
17	Bur-reed, Eurasian milfoil	2	0	0	0	20	60	10	10	15	5	0
18	Burr-reed	1	0	2	2	5	50	30	11	6	8	0
Area Weighted Average			0.0%	1.9%	6.9%	21.5%	41.9%	20.4%	7.3%	9.5%	2.6%	0.0%

Table 3-5: RBP Habitat Assessment Parameters. Each Scored 0-20; 0-5=Poor, 6-10=Marginal (red), 11-15=Sub-optimal (yellow/orange), 16-20=Optimal (green)

RBP Station #	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
1	14	12	17	11	14	19	17	8	9	18	139
2	13	16	16	12	15	19	14	11	10	20	146
3	10	10	16	9	12	17	6	11	12	16	119
4	16	10	13	11	14	17	12	9	10	20	132
5	10	11	14	8	9	13	8	8	12	14	107
6	12	12	11	8	10	13	6	10	12	14	108
7	15	12	12	9	13	19	13	10	12	18	133
8	11	13	15	9	15	20	8	12	16	20	139
9	8	15	16	7	13	18	8	8	10	18	121
10	12	14	15	7	15	20	16	6	10	20	135
11	10	10	6	10	14	20	8	16	18	20	132
12	13	19	15	12	14	19	10	10	12	20	144
13	13	14	18	12	13	17	10	16	18	20	151
14	10	13	17	9	14	18	15	9	14	18	137
15	11	13	6	13	15	18	13	14	14	14	131
16	9	11	12	12	11	16	15	14	16	16	132
17	12	10	13	13	18	20	18	6	7	15	132
18	8	9	12	6	13	17	18	6	10	14	113
Area Weighted Average	11.34	12.66	13.74	9.41	13.01	17.29	11.28	10.09	12.53	17.32	128.67

Table 3-6: Macroinvertebrate Survey Results Compiled by Order

Phylum	Class	Order	Station Number (from N to S)						Total by Order
			1	2	3	4	5	6	
Annelida	Clitellata	Lumbriculida		1					1
		Tubificida			4	5	29	4	42
Arthropoda	Arachnida	Trombidiformes	1						1
	Insecta	Coleoptera	14		17	28	6	4	69
		Diptera	7	24	65	166	129	235	626
		Ephemeroptera	14	69	77	24	42	16	242
		Hemiptera				4			4
		Megaloptera					1		1
		Odonata	2	1	5	4	4		16
		Plecoptera				2			2
		Trichoptera	202	39	156	85	62	60	604
	Malacostraca	Amphipoda			1	1	4		6
		Decapoda		2	1	1	4	0	8
		Isopoda				1	21	1	23
Mollusca	Bivalvia	Sphaeriida				1	4		5
		Unionoida			1				1
	Gastropoda	Basommatophora	2	1	5	2	5	1	16
Nematoda			1	2		2			5
Plathyhelminthes	Trepaxonemata					1			1
Grand Total			243	139	332	327	311	321	1673

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

Station	Taxa Richness	Abundance	EPT Richness	Dominant Organism	Chironomidae Richness
1	21 C	243	9 C	Hydropsyche betteni (35.0%) B	5 A
2	23 C	139	9 C	Iswaeon anoka (27.3%) A	9 A/B
3	45 B	332	14 B	Hydropsyche betteni (26.8%) B	17 B
4	51 B	327	15 B	Tanytarsus sp. (27.5%) C	18 B
5	46 B	311	12 C	Cheumatopsyche sp. (12.5%) B	16 B
6	32 C	321	9 C	Simulium sp. (40.5%) C	15 A/B
Average	36	286	11	--	13.33

Notes:

- Richness metrics were summed at the genus level per the Lotic Inc. model used to evaluate water quality and habitat. Richness calculated at the species level would be higher.
- 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: Small Fish Species Trapping Results

Northern 5A – Upstream of Canoe Meadows

N1- Located on the edge of a pool in LWD, 2 ft depth			N2- Located in gravel bar with LWD in 1 ft depth		
Species	Life stage	Length (mm)	Species	Life stage	Length (mm)
crayfish	adult	51	crayfish	adult	34
crayfish	adult	57	crayfish	adult	29
crayfish	adult	35	crayfish	adult	40
crayfish	adult	34	rock bass	juvenile	39
crayfish	adult	31	spottail shiner	adult	34
crayfish	adult	42			
crayfish	adult	41			
crayfish	adult	38			

Middle 5A- Near East New Lenox Road

M1- Located downstream of falls in 1.5 ft depth			M2- Located in large boulders in 1.5 ft depth		
Species	Life stage	Length (mm)	Species	Life stage	Length (mm)
spottail shiner	adult	33	crayfish	adult	34
spottail shiner	adult	33	crayfish	adult	29
spottail shiner	adult	41	crayfish	adult	40
rock bass	adult	171	crayfish	adult	31
crayfish	adult	37	parts from 2 other eaten crayfish		
crayfish	adult	28			
crayfish	adult	33			
crayfish	adult	38			
crayfish	adult	22			

Southern 5A- Near East New Lenox Road

S1- Located in milfoil bed in 1 ft depth			S2- Located in LWD in 2.5 ft depth		
Species	Life stage	Length (mm)	Species	Life stage	Length (mm)
yellow perch	juvenile	71	spottail shiner	adult	56
rock bass	juvenile	27	crayfish	adult	35
rock bass	juvenile	42	crayfish	adult	32
white sucker	juvenile	88	crayfish	adult	38
white sucker	juvenile	82	crayfish	adult	32
white sucker	juvenile	68	Note: a 4"x4" hole was found in each trap after the night (2nd) set.		
finescaled dace	adult	56			

Table 3-9: Fish Composition Results from Electrofishing in Lower Reach 5A from September 29, 2023 showing life stages and total of each species. (Note YOY= Young of Year)

Species	YOY	Juvenile	Adult	Large adult	Total
Black crappie	1				1
Bluntnose minnow			1		1
Bluegill	2				2
Pickereel		2			2
Fallfish	1	1	2		4
Smallmouth bass		4	1		5
Largemouth bass	5	1			6
Pumpkinseed	8				8
Rock bass			10		10
Yellow perch	12	5	2	1	20
White sucker		4	25		29
Spottail shiner			36		36
Grand Total	29	17	77	1	124

Table 3-10: Summary of Wildlife Observations Made During the 2022 Riverine Surveys

Common Name	Scientific Name	Common Name	Scientific Name
Amphibians and Reptiles		Birds	
American Toad	<i>Anaxyrus americanus</i>	American goldfinch	<i>Spinus tristis</i>
Common snapping turtle	<i>Chelydra serpentina</i>	Belted kingfisher	<i>Megaceryle alcyon</i>
Green frog	<i>Lithobates clamitans</i>	Blue jay	<i>Cyanocitta cristata</i>
Green tree frog	<i>Hyla cinerea</i>	Canada goose	<i>Branta canadensis</i>
Painted turtle	<i>Chrysemys picta</i>	Cedar waxwing	<i>Bombycilla cedrorum</i>
Pickereel Frog	<i>Lithobates palustris</i>	Common grackle	<i>Quiscalus quiscula</i>
Red eared slider	<i>Trachemys scripta elegans</i>	Cooper's hawk	<i>Accipiter cooperii</i>
		Common yellow throat warbler	<i>Geothlypis trichas</i>
Invertebrates		Gray catbird	<i>Dumetella carolinensis</i>
Bumblebee	<i>Bombus spp.</i>	Great Blue Heron	<i>Ardea herodias</i>
Caddisflies	Order <i>Trichoptera</i>	Hummingbird	<i>Trochilidae spp.</i>
Freshwater Clams	Family <i>Veneridae</i>	Killdeer	<i>Charadrius vociferus</i>
Common water strider	<i>Aquarius remigis</i>	Mallard	<i>Anas platyrhynchos</i>
Crayfish	<i>Cambarus spp.</i>	Red bellied woodpecker	<i>Melanerpes carolinus</i>
Damselflies	Order <i>Zygoptera</i>	Red-tailed hawk	<i>Buteo jamaicensis</i>
Dragonflies	Order <i>Anisoptera</i>	Redwing blackbird	<i>Agelaius phoeniceus</i>
Eastern Elliptio	<i>Elliptio complanata</i>	Sandpiper	<i>Scolopacidae</i>
Honeybee	<i>Apis mellifera</i>	White-breasted nuthatch	<i>Sitta carolinensis</i>
Whirligig beetles	Family <i>Gyrinidae</i>	Wood duck	<i>Aix sponsa</i>
Mammals		Yellow warbler	<i>Setophaga petechia</i>
American Beaver	<i>Castor canadensis</i>	Fish	
Raccoon	<i>Procyon lotor</i>	Bluegill	<i>Lepomis macrochirus</i>
White-tailed deer	<i>Odocoileus virginianus</i>	Brook trout	<i>Salvelinus fontinalis</i>

Table 3-11: State-Listed Rare Species Associated with the Aquatic Riverine Habitats of Reach 5A

Scientific Name	Common Name	State Status
<i>Botaurus lentiginosus</i>	American Bittern	Endangered
<i>Ophiogomphus aspersus</i>	Brook Snaketail	Special Concern
<i>Gallinula galeata</i>	Common Gallinule	Special Concern
<i>Eleocharis intermedia</i>	Matted Spike-sedge	Threatened
<i>Boyeria grafiana</i>	Ocellated Darner	Special Concern
<i>Phanogomphus quadricolor</i>	Rapids Clubtail	Endangered
<i>Ophiogomphus carolus</i>	Riffle Snaketail	Threatened
<i>Hylogomphus abbreviatus</i>	Spine-crowned Clubtail	Special Concern
<i>Sagittaria cuneata</i>	Wapato	Threatened
<i>Glyptemys insculpta</i>	Wood Turtle	Special Concern

Table 3-12: Reach 5A Riverine Function Assessment Factors

Functional Category	Description of Functions	Parameters Considered in Assessing Function (see Table 3-1)
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: Reach 5A Riverbank Habitat Characterization

Parameter	Description of Parameter	Reach 5A 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; 2022 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 dispersment into the floodplain	Consolidate existing information (from sources below); 2022 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); PDI of Reach 5A banks (including updated BEHI/NBS assessment); 2022 field surveys using Form RB-1
Bank stability and migration	Observed erosional conditions; documentation of river channel/bank migration	BEHI/NBS information from Stantec 2009 evaluation; 2010 Example Area evaluations, and PDI of Reach 5A banks (including updated BEHI/NBS assessment); consolidate other bank-related information (from sources below); 2022 field surveys using Form RB-1
Large woody debris (LWD)	Density of LWD; woody debris on the bank	Consolidate existing information (from sources below); 2022 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; 2022 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); 2022 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; 2022 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); 2022 field surveys using Form RB-1

¹ The existing information used for the Reach 5A 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, the Final Accessibility Report – all described and referenced in Section 2 of the Reach 5A BRA Work Plan.

Table 4-2: Reach 5A Riverbank Summary Data*

Parameter		Average	Range
Bank Height		6.2 ft	4-10 ft
Bank Slope		66%	25-105%
Bankfull Indicators		2.97 ft	2-5 ft
Bank Substrate	Sand	41.8%	30-50%
	Silt	42.4%	30-50%
	Clay	0%	N/A
	Gravel/Cobble	12.9%	0-30%
	Boulder/Bedrock	2.6%	0-20%
	Organic	1%	0-5%
Stream Gradient	Low	35%	
	Mid	65%	
Total Vegetative Cover	Bank	75%	30-100%
	Overhanging	60%	10-100%
	Riparian	90%	60-100%
Vegetative Cover by Strata	Tree	40%	0-90%
	Shrub	45%	0-80%
	Herb	55%	0-90%
	Vine	30%	0-70%
	Moss	0%	0%
Riparian Zone Vegetative Cover by Strata	Tree	58%	10-80%
	Shrub	65%	20-85%
	Herb	68%	40-90%
	Vine	25%	10-35%
	Moss	1%	0-5%

*Data summarized from 34 riverbank stations ranging from 100-400 feet in length (8,300 lf in total), combining both left and right bank data

Table 4-3: Reach 5A Riverbank Sediment/Substrate Composition

Bank Station	%Sand	%Silt	%Clay	%Gravel/ Cobble	%Boulder/ Bedrock	%Organic Matter
1	50	40	0	10	0	5
2	50	50	0	0	0	5
3	50	50	0	0	0	5
4	40	30	0	30	0	3
5	50	50	0	0	0	5
6	40	50	0	10	0	0
7	40	40	0	20	0	3
8	30	50	0	20	0	0
9	45	45	0	10	0	0
10	45	45	0	10	0	0
11	40	40	0	20	0	0
12	30	30	0	20	20	0
13	40	50	0	10	0	0
14	40	40	0	20	0	0
15	40	50	0	10	0	0
16	40	30	0	20	10	0
17	30	30	0	20	20	0
18	45	45	0	10	0	0
19	40	50	0	10	0	0
20	50	35	0	15	0	0
21	30	30	0	20	20	0
22	45	45	0	10	0	0
23	40	40	0	20	0	0
24	30	30	0	30	10	0
25	40	40	0	0	10	5
26	45	45	0	10	0	0
27	45	50	0	5	0	0
28	45	45	0	10	0	0
29	45	45	0	10	0	0
30	40	40	0	20	0	0
31	45	45	0	10	0	0
32	45	45	0	10	0	0
33	40	40	0	20	0	0
34	50	50	0	0	0	0

Table 4-4: Reach 5A Riverbank Hydrology Ratings: Channel Gradient, Incisement, and Floodplain Connectivity

Bank Station	Stream Gradient	Incisement Rating	Floodplain Connectivity	
			High-flow Channels in Floodplain	Topographic Breaks in Bank
1	Mid-gradient	Somewhat incised	√	√
2	Low-gradient	Moderately incised	√	√
3	Mid-gradient	Moderately incised		√
4	Mid-gradient	Moderately incised	√	√
5	Mid-gradient	Somewhat incised	√	√
6	Mid-gradient	Moderately incised	√	√
7	Mid-gradient	Moderately incised	√	√
8	Mid-gradient	Somewhat incised	√	√
9	Mid-gradient	Somewhat incised	√	
10	Mid-gradient	Somewhat incised	√	√
11	Low-gradient	Not incised		√
12	Low-gradient	Somewhat incised		√
13	Low-gradient	Somewhat incised	√	√
14	Mid-gradient	Moderately incised	√	√
15	Mid-gradient	Moderately incised	√	√
16	Mid-gradient	Somewhat incised	√	√
17	Mid-gradient	Not incised	√	√
18	Low-gradient	Somewhat incised	√	√
19	Low-gradient	Moderately incised	√	√
20	Mid-gradient	Not incised	√	√
21	Mid-gradient	Somewhat incised	√	√
22	Low-gradient	Not incised	√	√
23	Mid-gradient	Somewhat incised	√	√
24	Mid-gradient	Moderately incised	√	
25	Mid-gradient	Somewhat incised		
26	Mid-gradient	Moderately incised	√	√
27	Low-gradient	Somewhat incised		√
28	Mid-gradient	Not incised		√
29	Mid-gradient	Somewhat incised		√
30	Mid-gradient	Somewhat incised		√
31	Low-gradient	Somewhat incised		√
32	Low-gradient	Moderately incised		√
33	Low-gradient	Moderately incised		√
34	Low-gradient	Somewhat incised		√

Table 4-5: Reach 5A Riverbank Bordering Habitat Types

Bank Station	Bordering Wetland Habitats ¹						Bordering Upland Habitats ²			
	TFF	SS	SEM	DEM	VP	RMS	HTF	HPF	GG-AF	DD
1	√		√	√						
2	√									
3	√									
4	√									
5	√		√	√				√		
6	√							√		
7	√							√		√
8	√				√			√		
9	√	√			√			√		
10	√	√			√			√		
11	√								√	
12	√								√	
13	√									
14	√			√						
15	√								√	
16	√								√	√
17	√			√	√					√
18	√	√			√					
19	√	√	√							
20	√	√	√					√		
21	√				√		√	√	√	√
22	√	√			√			√	√	√
23	√						√	√		
24	√				√			√		
25	√	√			√	√				
26	√							√		
27	√							√		
28	√		√						√	
29	√							√	√	
30	√		√					√	√	
31	√		√					√	√	
32	√		√		√			√	√	
33	√		√		√			√	√	
34	√		√	√				√	√	

¹TFF: 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

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

Table 4-6: Reach 5A Riverbank –Biotic Habitat Features

Bank #	Wildlife Food					Cover/Perches/Basking/Denning/Nesting Habitat						
	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
1	√	√	√	√	∅	√	*	√	√	*	∅	*
2	√	√	√	√	√	√	√	√	√	√	∅	√
3	√	√	∅	√	√	√	√	*	*	√	∅	√
4	√	√	∅	√	√	√	√	*	*	√	√	√
5	√	√	√	√	√	√	√	*	*	√	√	*
6	√	√	√	√	√	√	√	√	√	√	√	*
7	√	√	√	∅	√	√	√	√	√	√	√	*
8	√	√	√	√	√	√	√	√	√	√	∅	*
9	√	√	√	√	√	√	√	*	*	√	√	*
10	√	√	√	√	√	√	*	∅	∅	√	∅	*
11	√	√	∅	∅	∅	√	√	√	√	√	∅	√
12	√	√	√	√	√	√	√	√	√	√	√	√
13	√	√	√	√	√	√	√	√	√	√	√	*
14	√	√	∅	√	√	√	√	√	√	√	√	*
15	√	√	√	√	√	√	√	*	*	√	√	*
16	√	√	√	√	√	√	√	*	*	*	√	*
17	√	√	√	√	√	√	√	*	*	√	√	*
18	√	√	√	√	√	√	*	√	√	√	√	*
19	√	√	∅	∅	√	√	*	√	√	√	√	√
20	√	√	√	√	√	√	√	√	√	√	√	*
21	√	√	√	√	√	√	√	*	*	√	*	*
22	√	√	∅	∅	∅	√	*	√	√	∅	∅	√
23	∅	√	√	√	√	√	∅	√	√	√	√	*
24	√	√	√	√	√	√	√	√	*	√	√	*
25	√	√	√	√	√	√	√	√	√	√	√	*
26	√	√	√	√	√	√	√	*	√	√	√	*

Table 4-6: Reach 5A Riverbank –Biotic Habitat Features (continued)

Bank #	Wildlife Food			Cover/Perches/Basking/Denning/Nesting Habitat								
	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
27	√	√	√	√	√	√	√	√	√	√	√	*
28	√	√	√	√	√	√	√	√	√	√	√	*
29	√	√	√	√	√	√	√	√	√	√	√	*
30	√	√	√	√	√	√	√	√	√	√	√	*
31	√	√	∅	∅	∅	√	√	√	√	√	∅	√
32	√	√	∅	√	√	√	√	√	√	√	√	√
33	√	√	√	√	√	√	*	√	√	√	√	√
34	√	√	∅	√	√	√	√	√	√	√	√	√

*=Abundant; √=Present; ∅=Absent

⁺OH: Overhanging

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

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

³Habitat suitable for turtles, snakes, frogs

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

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

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

Table 4-7: Reach 5A Riverbank Habitat—Physical Bank Habitat Features

Bank #	Physical Bank Habitat Features					Wildlife Dens/Nests	
	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
1	√	√	∅	√	√	∅	∅
2	√	√	∅	√	√	∅	∅
3	√	√	∅	√	∅	∅	∅
4	√	√	∅	√	∅	∅	∅
5	√	√	*	√	√	∅	√
6	√	√	∅	√	∅	∅	∅
7	√	√	∅	√	∅	∅	∅
8	√	√	√	√	√	∅	√
9	√	√	√	√	√	∅	∅
10	√	√	∅	√	∅	∅	∅
11	√	√	∅	√	∅	∅	∅
12	√	√	∅	√	∅	∅	∅
13	√	√	∅	√	∅	∅	∅
14	√	√	∅	√	∅	∅	∅
15	√	√	√	√	√	∅	∅
16	√	√	√	√	√	∅	√
17	√	√	∅	√	√	∅	∅
18	√	√	∅	√	√	∅	∅
19	*	√	∅	√	√	∅	∅
20	√	√	∅	√	√	∅	∅
21	√	√	∅	√	√	∅	∅
22	√	∅	∅	√	∅	∅	∅
23	√	√	∅	√	√	∅	∅
24	√	√	∅	√	∅	∅	∅
25	√	√	∅	√	∅	∅	∅
26	√	√	∅	√	∅	√	∅
27	*	√	∅	*	∅	∅	∅
28	√	√	∅	√	∅	∅	∅
29	√	√	∅	√	∅	∅	∅
30	√	√	∅	√	√	∅	∅
31	√	√	∅	√	√	∅	∅
32	√	√	∅	√	√	∅	∅
33	*	√	*	√	√	∅	√
34	√	√	∅	√	∅	∅	∅

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

¹Features suitable for beaver, muskrat, otter

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

³Features suitable for bank swallow, kingfisher

⁴Features suitable for turtle nesting

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

Table 4-8: Reach 5A Riverbank Plant Species Summary Data

	Common Name	Scientific Name	Status ¹	Occurrence (Number of Survey Segments N=68) ²
Tree Species	boxelder	<i>Acer negundo</i>	Native	41
	striped maple	<i>Acer pensylvanicum</i>	Native	1
	red maple	<i>Acer rubrum</i>	Native	1
	silver maple	<i>Acer saccharinum</i>	Native	30
	sugar maple	<i>Acer saccharum</i>	Native	6
	yellow birch	<i>Betula alleghaniensis</i>	Native	3
	paper birch	<i>Betula papyrifera</i>	Native	1
	river birch	<i>Betula nigra</i>	Native	1
	ironwood	<i>Carpinus caroliniana</i>	Native	7
	northern catalpa	<i>Catalpa speciosa</i>	Non-native	1
	Dotted hawthorn	<i>Crataegus punctata</i>	Native	3
	American beech	<i>Fagus grandifolia</i>	Native	1
	white ash	<i>Fraxinus americana</i>	Native	1
	green ash	<i>Fraxinus pennsylvanica</i>	Native	6
	black walnut	<i>Juglans nigra</i>	Non-native	3
	American sycamore	<i>Platanus occidentalis</i>	Native	3
	eastern cottonwood	<i>Populus deltoides</i>	Native	6
	northern red oak	<i>Quercus rubra</i>	Native	2
	black oak	<i>Quercus velutina</i>	Native	1
	black willow	<i>Salix nigra</i>	Native	1
	American linden	<i>Tilia americana</i>	Native	5
	eastern hemlock	<i>Tsuga canadensis</i>	Native	8
	American elm	<i>Ulmus americana</i>	Native	16
Shrub Species	silky dogwood	<i>Cornus amomum</i>	Native	3
	red-osier dogwood	<i>Cornus sericea</i>	Native	21
	burning bush	<i>Euonymus alatus</i>	Invasive ^{A,B,C}	1
	European spindle-tree	<i>Euonymus europaeus</i>	Non-native	1
	American witch hazel	<i>Hamamelis virginiana</i>	Native	2
	border privet	<i>Ligustrum obtusifolium</i>	Invasive ^D	2
	Morrow's honeysuckle	<i>Lonicera morrowii</i>	Invasive ^{A,B}	15
	Atlantic ninebark	<i>Physocarpus opulifolius</i>	Non-native	1
	common buckthorn	<i>Rhamnus cathartica</i>	Invasive ^{A,B,C}	20
	eastern black currant	<i>Ribes americanum</i>	Native	1
Vine Species	red raspberry	<i>Rubus idaeus</i>	Native	1
	Asian bittersweet	<i>Celastrus orbiculatus</i>	Invasive ^{A,B,C}	40
	virgin's-bower	<i>Clematis virginiana</i>	Native	1
	hedge bindweed	<i>Convolvulus sepium</i>	Native	1
	wild cucumber	<i>Echinocystis lobata</i>	Native	10
	climbing bindweed	<i>Fallopia scandens</i>	Native	1
	Virginia-creeper	<i>Parthenocissus quinquefolia</i>	Native	5

Table 4-8: Reach 5A Riverbank Plant Species Summary Data (continued)

	Common Name	Scientific Name	Status ¹	Occurrence (Number of Survey Segments N=68) ²
Herb Species	poison-ivy	<i>Toxicodendron radicans</i>	Native	2
	river grape	<i>Vitis riparia</i>	Native	25
	yarrow	<i>Achillea millefolium</i>	Native	0
	bishop's goutweed	<i>Aegopodium podagraria</i>	Invasive ^{A,B}	7
	northern water-plantain	<i>Alisma triviale</i>	Native	1
	garlic-mustard	<i>Alliaria petiolata</i>	Invasive ^{A,B}	1
	common ragweed	<i>Ambrosia artemisiifolia</i>	Native	1
	swamp milkweed	<i>Asclepias incarnata</i>	Native	2
	nodding beggar-ticks	<i>Bidens cernua</i>	Native	33
	purple-stemmed beggar-ticks	<i>Bidens connata</i>	Native	1
	Devil's beggar-ticks	<i>Bidens frondosa</i>	Native	8
	small-spiked false-nettle	<i>Boehmeria cylindrica</i>	Native	1
	black mustard	<i>Brassica nigra</i>	Non-native	8
	lurid sedge	<i>Carex lurida</i>	Native	1
	awl-fruited sedge	<i>Carex stipata</i>	Native	1
	tussock sedge	<i>Carex stricta</i>	Native	1
	white turtlehead	<i>Chelone glabra</i>	Native	2
	water hemlock	<i>Cicuta bulbifera</i>	Native	1
	wood-reed grass	<i>Cinna arundinacea</i>	Native	1
	red-root flatsedge	<i>Cyperus erythrorhizos</i>	Native	1
	umbrella sedge	<i>Cyperus strigosus</i>	Native	2
	crested wood fern	<i>Dryopteris cristata</i>	Native	1
	spike rush	<i>Eleocharis sp</i>	Native	1
	eastern willow-herb	<i>Epilobium coloratum</i>	Native	3
	field horsetail	<i>Equisetum arvense</i>	Native	1
	spotted Joe-Pye weed	<i>Eupatorium maculatum</i>	Native	7
	Japanese knotweed	<i>Fallopia japonica</i>	Invasive ^{A,B,C}	33
	American burnweed	<i>Erechtites hieraciifolius</i>	Native	1
	spotted crane's-bill	<i>Geranium maculatum</i>	Native	0
	Gill-over-the-ground	<i>Glechoma hederacea</i>	Invasive ^B	0
	American manna grass	<i>Glyceria grandis</i>	Native	1
	dame's-rocket	<i>Hesperis matronalis</i>	Invasive ^{A,B,C}	1
	jewelweed	<i>Impatiens capensis</i>	Native	6
	yellow iris	<i>Iris pseudacorus</i>	Invasive ^{A,B}	6
	common soft rush	<i>Juncus effusus</i>	Native	1
	Canada wood nettle	<i>Laportea canadensis</i>	Native	1
	rice cut-grass	<i>Leersia oryzoides</i>	Native	6
	lance-leaved tiger-lily	<i>Lilium lancifolium</i>	Non-native	1
	yellow-seeded false pimpernel	<i>Lindernia dubia</i>	Native	3
	common water-purslane	<i>Ludwigia palustris</i>	Native	18

Table 4-8: Reach 5A Riverbank Plant Species Summary Data (continued)

Common Name	Scientific Name	Status ¹	Occurrence (Number of Survey Segments N=68) ²
Virginia water-horehound	<i>Lycopus virginicus</i>	Native	1
purple loosestrife	<i>Lythrum salicaria</i>	Invasive ^{A,B,C}	8
ostrich fern	<i>Matteuccia struthiopteris</i>	Native	21
American wild mint	<i>Mentha canadensis</i>	Native	1
Allegheny monkeyflower	<i>Mimulus ringens</i>	Native	9
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>	Invasive ^{A,B,C}	1
water forget-me-not	<i>Myosotis scorpioides</i>	Invasive ^D	12
giant chickweed	<i>Myosoton aquaticum</i>	Non-native	1
common evening primrose	<i>Oenothera biennis</i>	Native	1
sensitive fern	<i>Onoclea sensibilis</i>	Native	8
cinnamon fern	<i>Osmunda cinnamomea</i>	Native	2
ditch-stonecrop	<i>Penthorum sedoides</i>	Native	2
water-pepper smartweed	<i>Persicaria hydropiper</i>	Native	8
false water-pepper smartweed	<i>Persicaria hydropiperoides</i>	Native	2
pale smartweed	<i>Persicaria lapathifolia</i>	Native	38
lady's-thumb smartweed	<i>Persicaria maculosa</i>	Native	2
arrow-leaved tearthumb	<i>Persicaria sagittata</i>	Native	1
jumpseed	<i>Persicaria virginiana</i>	Native	4
reed canary grass	<i>Phalaris arundinacea</i>	Invasive ^{A,B,C}	3
Canada clearweed	<i>Pilea pumila</i>	Native	9
pickerelweed	<i>Pontederia cordata</i>	Native	1
curly pondweed	<i>Potamogeton crispus</i>	Invasive ^{A,B}	0
creeping yellow-cress	<i>Rorippa sylvestris</i>	Non-native	1
green-headed coneflower	<i>Rudbeckia laciniata</i>	Native	13
curly dock	<i>Rumex crispus</i>	Non-native	1
common arrowhead	<i>Sagittaria latifolia</i>	Native	1
common soapwort	<i>Saponaria officinalis</i>	Non-native	1
dark-green bulrush	<i>Scirpus atrovirens</i>	Native	1
American bur-reed	<i>Sparganium americanum</i>	Native	10
giant bur-reed	<i>Sparganium eurycarpum</i>	Native	0
lance-leaved American aster	<i>Symphyotrichum lanceolatum</i>	Native	1
small white aster	<i>Symphyotrichum racemosum</i>	Native	1
marsh fern	<i>Thelypteris palustris</i>	Native	1
stinging nettle	<i>Urtica dioica</i>	Native	6
common mullein	<i>Verbascum thapsus</i>	Native	1
blue vervain	<i>Verbena hastata</i>	Native	22
American speedwell	<i>Veronica americana</i>	Native	4
rough cocklebur	<i>Xanthium strumarium</i>	Non-native	8

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

²Data are from 34 riverbank stations in Reach 5A, with surveys of both left and right banks tabulated separately for total number of observation points of 68.

Table 4-9: Reach 5A Riverbank Plant Community Inventory – Left Bank

Bank Station	Total % Cover	OH+ % Cover	Riparian % Cover	OH Tree % Cover	OH Shrub % Cover	OH Vine % Cover	OH Moss % Cover	OH Herb % Cover
1	50	75	100	50	60	30	0	40
2	75	50	90	30	30	25	0	75
3	75	20	100	25	50	25	0	75
4	60	70	90	50	40	60	0	50
5	90	75	100	60	50	50	0	50
6	60	60	90	75	75	50	0	25
7	70	60	90	75	50	25	0	25
8	75	50	100	50	30	20	0	50
9	80	30	90	20	50	30	0	70
10	70	10	90	10	50	25	0	80
11	80	60	80	20	60	25	0	75
12	80	60	70	70	80	30	0	30
13	90	80	100	50	50	30	0	90
14	70	100	100	20	80	60	0	50
15	80	70	100	80	60	50	0	40
16	60	90	100	80	40	20	0	70
17	80	80	100	70	70	50	0	20
18	70	80	100	30	50	30	0	70
19	60	10	100	10	10	10	0	60
20	90	80	90	0	75	40	0	20
21	60	50	80	50	30	20	0	80
22	80	10	70	0	80	10	0	80
23	60	70	100	70	20	0	0	10
24	70	80	90	80	40	50	0	10
25	75	50	90	50	70	40	0	70
26	50	80	100	80	10	10	0	10
27	90	75	80	90	50	70	0	0
28	90	70	75	20	60	30	0	70
29	75	50	80	10	0	0	0	90
30	80	60	80	30	30	10	0	60
31	80	30	80	20	40	20	0	70
32	60	80	60	40	60	30	0	60
33	60	20	90	10	30	20	0	60
34	80	30	90	20	50	30	0	70

+OH: Overhanging

Table 4-10: Reach 5A Riverbank Plant Community Inventory – Right Bank

Bank #	Total % Cover	OH⁺ % Cover	Riparian % Cover	OH Tree % Cover	OH Shrub % Cover	OH Vine % Cover	OH Moss % Cover	OH Herb % Cover
1	75	50	100	50	40	30	0	75
2	30	70	100	50	40	30	0	30
3	50	80	90	60	40	30	0	25
4	60	70	90	50	40	50	0	50
5	80	50	100	60	40	30	0	75
6	75	75	100	50	25	25	0	75
7	80	40	90	60	50	30	0	75
8	60	50	100	40	60	20	0	20
9	80	60	100	40	40	10	0	70
10	90	80	100	70	75	30	0	50
11	75	60	70	60	50	20	0	25
12	80	50	80	30	60	30	0	70
13	30	100	100	50	70	75	0	10
14	100	80	100	10	10	10	0	90
15	90	75	100	50	10	10	0	70
16	90	80	100	60	30	10	0	80
17	90	75	100	30	0	0	0	90
18	100	25	100	20	20	20	0	90
19	100	10	100	10	10	10	0	90
20	80	60	80	60	20	20	0	60
21	70	50	90	80	50	50	0	10
22	80	30	100	10	10	10	0	80
23	80	60	90	70	70	30	0	50
24	70	60	100	40	50	30	0	70
25	80	60	100	50	60	40	0	60
26	80	50	90	50	40	0	0	60
27	75	60	90	10	20	10	0	90
28	80	60	100	60	40	20	0	30
29	80	60	100	30	70	20	0	70
30	80	60	90	80	10	10	0	80
31	80	80	90	20	70	20	0	40
32	50	30	80	30	70	70	0	10
33	90	25	90	20	50	30	0	70
34	70	60	90	40	70	30	0	70

⁺OH: Overhanging

Table 4-11: Reach 5A Riverbank Plant Community Inventory – Riparian Vegetation Cover

Bank Station	Tree % Cover	Shrub % Cover	Vine % Cover	Moss % Cover	Herb % Cover
1	60	70	30	3	75
2	50	70	30	3	75
3	50	70	30	3	75
4	70	70	30	3	55
5	40	70	30	0	75
6	70	70	30	3	75
7	70	70	25	0	75
8	75	75	30	0	60
9	75	60	25	3	75
10	65	70	30	0	70
11	10	20	10	0	80
12	60	60	20	0	70
13	75	80	30	5	75
14	75	85	35	0	70
15	80	80	30	0	60
16	50	60	20	0	90
17	80	70	30	0	60
18	60	80	20	0	75
19	40	70	25	0	80
20	50	75	20	0	90
21	70	60	20	0	40
22	10	80	10	0	80
23	80	60	20	0	60
24	70	60	30	0	60
25	80	60	30	0	50
26	70	40	10	0	50
27	70	60	20	0	60
28	50	50	25	0	60
29	70	75	25	0	70
30	40	70	30	0	60
31	40	60	30	0	70
32	40	60	20	0	60
33	50	50	30	0	80
34	30	50	30	0	60

Table 4-12: Reach 5A 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	0	97	3
Imp. Upland Food Plants	Overall food	0	100	0
Trees (live or dead) >30" DBH	Cover/perching/nesting	0	74	26
Standing Dead Trees	Cavities/perching/nesting	0	85	15
Tree Cavities in Trunks or Limbs	Cavities/perching/nesting	0	88	12
Small Mammal Burrows	Nesting/escape/cover	0	100	0
Dense Herbaceous Cover	Voies, small mammals, amphibians, reptiles	18	79	3
Large Woody Debris on Ground	Small mammals, amphibians, reptiles, invertebrate emergence	26	71	3
Rocks, Crevices. Logs, Tree Roots, or Hummocks Under or at Water's Edge	Turtles, snakes, frogs, invertebrate emergence	26	71	3
OH Branches ≤ 1M above Water	Turtles, snakes, frogs, wading birds, wood duck, mink, raccoon	6	91	3
Rock Piles, Crevices, Hollow Logs	Mammals: otter, mink, porcupine, raccoon	3	73	24
Live or Dead Tall Standing Veg. OH or Near Water Offering Visibility	Perching (Osprey Kingfisher, Flycatchers, Cedar Waxwings)	0	68	32
Underwater Banks of Fine Silt and/or Clay	Beaver, Muskrat, Otter	9	91	0
Undercut or OH Banks	Small mammals (Mink, Weasels), Turtles	0	97	3
Vertical Sandy Banks	Nesting bank swallows and kingfishers; Turtles	6	12	83
Mud Flats	Feeding sites for birds, small mammals, herps	3	97	0
Exposed well drained soil	Turtle nesting	0	50	50
Turtle nesting sites observed	Turtle nesting	0	3	97
Bank Swallow colony observed	Bank swallow nesting	0	12	88

*Data summarized from 34 riverbank stations ranging from 100-400 feet in length (8,300 lf in total)

Table 4-13: Incidental Direct Wildlife Observations at Bank Survey Stations

Bank Station	Incidental Direct Wildlife Observations
1	Catbird, Cardinal, Raccoon Tracks
2	Catbird; Great blue heron; Raccoon tracks; Spotted sandpiper; Song sparrow; Green frog; Dragonflies
3	Green frog; Raccoon tracks; Spotted sandpiper
4	
5	Kingfisher; Deer tracks; Raccoon tracks; Spotted sandpiper; Song sparrow; Green frog; Wood pewee
6	Great blue heron; Deer tracks; Raccoon tracks; Spotted sandpiper; Mussels (Elliptio or Eastern Lampmussel; Green frog; Dragonflies
7	Green frogs; Raccoon tracks
8	Green heron; Spotted sandpiper; Mallards; Catbird; Cardinal; Tennessee warbler; Green frogs
9	Raccoon tracks; Catbird
10	
11	
12	Spotted sandpiper
13	Deer; Green heron; Kingfisher; Painted turtle
14	Mallards; Deer; Catbird; Painted turtle
15	Green heron; Black-capped chickadee; Wood pewee
16	Kingfisher; Red-bellied woodpecker; Crow; Raccoon tracks; Deer tracks; Painted turtle
17	Kingfisher
18	Canada geese; Great blue heron; Painted turtle; Titmouse; Goldfinch;
19	
20	Kingfisher; Wood pewee; Phoebe; Painted turtle
21	
22	Spotted sandpiper; Red-tailed hawk; Green frog; Raccoon tracks; Deer
23	Kingfisher; Veery
24	
25	Dragonflies; Phoebe; Great crested flycatcher; Titmouse
26	Great blue heron; Red tail hawk; Redstart; Pheobe; Painted turtle
27	Creek chub
28	
29	
30	Spotted sandpiper
31	Spotted sandpiper; Canada geese
32	Deer tracks; Raccoon tracks; Goldfinch
33	Painted turtle; Bull frog; Green frog; Song sparrow; Robin; Catbird; Veery; Bank swallow nesting cavities
34	Spotted sandpiper

Table 4-14: Reach 5A Riverbank – MNHESP Rare Species and Core Area Habitat Designation¹

Bank Station	MNHESP Core Area	State-Listed Species Habitat²
1	Core Area 1 Core Area 2	American Bittern, Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
2	Core Area 1 Core Area 2	American Bittern, Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
3	Core Area 2	American Bittern, Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
4	Core Area 2	American Bittern, Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
5	Core Area 2	American Bittern, Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
6	Core Area 2	Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
7	Core Area 2	Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
8	Core Area 2	Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
9		Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
10		Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
11		Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
12		Brook Snaketail, Matted Spike-sedge, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
13	Core Area 2 Core Area 3	Brook Snaketail, Matted Spike-sedge, Mustard White, Ocellated Darner, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
14	Core Area 2 Core Area 3	Bristly Buttercup; Brook Snaketail, Matted Spike-sedge, Mustard White, Ocellated Darner, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
15	Core Area 2 Core Area 3	American Bittern, Bristly Buttercup; Brook Snaketail, Matted Spike-sedge, Mustard White, Ocellated Darner, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
16	Core Area 1; Core Area 2; Core Area 3	American Bittern, Bristly Buttercup; Brook Snaketail, Matted Spike-sedge, Mustard White, Ocellated Darner, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Table 4-14: Reach 5A Riverbank – MNHESP Rare Species and Core Area Habitat Designation¹ (continued)

Bank Station	MNHESP Core Area	State-Listed Species Habitat ²
17	Core Area 1; Core Area 2; Core Area 3	American Bittern, Bristly Buttercup; Brook Snaketail, Matted Spike-sedge, Mustard White, Ocellated Darner, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
18	Core Area 1; Core Area 2; Core Area 3	American Bittern, Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Ocellated Darner, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
19	Core Area 1; Core Area 2; Core Area 3	American Bittern, Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye; Matted Spike-sedge, Mustard White, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
20	Core Area 2 Core Area 3	Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
21	Core Area 2 Core Area 3	Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Ocellated Darner, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle
22	Core Area 2; Core Area 3; Core Area 4	Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Ocellated Darner, Spine-crowned Clubtail, Wapato, Wood Turtle
23	Core Area 2 Core Area 3	Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Ocellated Darner, Spine-crowned Clubtail, Wapato, Wood Turtle
24	Core Area 2 Core Area 3	Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Ocellated Darner, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
25	Core 3	Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Ocellated Darner, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
26		Brook Snaketail, Frank's Lovegrass, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
27		Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
28		Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Ocellated Darner, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
29		Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Ocellated Darner, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
30		Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Ocellated Darner, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
31		Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
32		Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle

Table 4-14: Reach 5A Riverbank – MNHESP Rare Species and Core Area Habitat Designation¹ (continued)

Bank Station	MNHESP Core Area	State-Listed Species Habitat ²
33		Brook Snaketail, Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail, Spine-crowned Clubtail, Wapato, Wood Turtle
34		Frank's Lovegrass, Matted Spike-sedge, Mustard White, Rapids Clubtail; Spine-crowned Clubtail, Wapato, Wood Turtle

¹Core Habitat Areas as designated by MNHESP, July 2012
²State-Listed Species habitats as mapped by MNHESP, provided October 2022

Table 4-15: Reach 5A 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 Priority Habitat and Core Area habitat and IPaC results); floodplain connectivity; invasive species; incidental wildlife observations

Table 4-16: Reach 5A Riverbank Restoration Opportunities

Bank Station	Potential Restoration Resources Present
1	Coarse woody debris; Cobbles
2	Coarse woody debris
3	Coarse woody debris; Large trees; Root wads
4	Coarse woody debris; Cobbles
5	Coarse woody debris; Large trees; Root wads
6	Coarse woody debris; Large trees; Cobbles
7	Coarse woody debris; Large trees; Cobbles
8	Coarse woody debris; Large trees; Cobble
9	Coarse woody debris; Root wads; Large trees; Cobbles
10	Coarse woody debris; Large trees; Cobbles
11	Coarse woody debris; Large trees; Cobbles
12	Coarse woody debris; Large trees; Cobbles; Boulders
13	Coarse woody debris; Large trees; Cobbles
14	Coarse woody debris; Large trees; Cobbles
15	Coarse woody debris; Large trees; Root wads; Cobbles
16	Coarse woody debris; Large trees; Root wads; Cobbles; Boulders
17	Coarse woody debris; Root wads; Boulders; Cobbles
18	Coarse woody debris; Large trees; Root wads; Cobbles
19	Coarse woody debris; Large trees; Cobbles
20	Coarse woody debris; Cobbles
21	Coarse woody debris; Large trees; Root wads; Cobbles; Boulders
22	Coarse woody debris; Cobbles
23	Coarse woody debris; Large trees; Root wads; Cobbles
24	Coarse woody; Large trees; Root wads; Cobbles; Boulders
25	Coarse woody debris; Large trees; Root wads; Boulders
26	Coarse woody debris; Large trees; Root wads; Cobbles
27	Coarse woody debris; Large trees; Root wads; Cobbles
28	Coarse woody debris; Large trees; Root wads; Cobbles
29	Coarse woody debris; Large trees; Cobbles
30	Coarse woody debris; Large trees; Root wads; Cobbles
31	Coarse woody debris; Large trees; Cobbles
32	Coarse woody debris; Large trees; Root wads; Cobbles
33	Coarse woody debris; Large trees; Root wads; Cobbles
34	Coarse woody debris; Large trees; Root wads

Table 5-1: Reach 5A Backwater Habitat Characterization

Parameter	Description of Parameter	Reach 5A 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; 2022 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); 2022 field surveys using Form BW-1
Sediment composition	Relative % clay/silt/sand/gravel/cobble; boulder/bedrock; organic matter	Consolidate existing information (from sources below); 2022 field surveys using Form BW-1
Aquatic plant community	Species composition and relative abundance; rare species habitat; invasive species	Consolidate existing information (from sources below); 2022 field surveys using Form BW-1
Bordering habitat types	Species composition and relative abundance; rare species habitat; standing dead timber	2022 field 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); 2022 field 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); 2022 field 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; 2022 field 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); 2022 field surveys using Form BW-1
Presence of special habitat features	Tree cavities; beaver/muskrat dens; otter slides	Consolidate existing information (from sources below); 2022 field surveys using Form BW-1
* The existing information used for the Reach 5A 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, and the 2019 Final Accessibility Report – all described and referenced in Section 2 of the Reach 5A BRA Work Plan.		

Table 5-2: Reach 5A Backwater Plant Species Summary Data

Layer	Common Name	Scientific Name	Status ¹	Backwaters Where Identified	Total Occurrences
Tree Species	Boxelder maple	<i>Acer negundo</i>	Native	BW3, BW4	2
	Red maple	<i>Acer rubrum</i>	Native	BW5	1
	Silver maple	<i>Acer saccharinum</i>	Native	BW1, BW3, BW4, BW5, BW6	5
	American sycamore	<i>Platanus occidentalis</i>	Native	BW3	1
Shrub Species	Silky dogwood	<i>Cornus amomum</i>	Native	BW1, BW3	2
Woody Vine Species	River grape	<i>Vitis riparia</i>	Native	BW3	1
Herbs, forbs, grasses and aquatic plants	Sweetflag	<i>Acorus calamus</i>	Native	BW5	1
	Northern water-plantain	<i>Alisma triviale</i>	Native	BW3, BW4	2
	Swamp milkweed	<i>Asclepias incarnata</i>	Native	BW2	1
	Nodding beggar-ticks	<i>Bidens cernua</i>	Native	BW1, BW2, BW3, BW4, BW5, BW6	6
	Devil's beggar-tick	<i>Bidens frondosa</i>	Native	BW2, BW4, BW5	3
	Small-spiked false nettle	<i>Boehmeria cylindrica</i>	Native	BW1, BW2, BW3	3
	Wild calla	<i>Calla palustris</i>	Native	BW6	1
	Water-starwort	<i>Callitriche palustris</i>	Native	BW2, BW3, BW4	3
	Hop sedge	<i>Carex lupulina</i>	Native	BW2	1
	Spotted water-hemlock	<i>Cicuta maculata</i>	Native	BW4	1
	Common dodder	<i>Cuscuta gronovii</i>	Native	BW2, BW3, BW4	3
	Needle spikesedge	<i>Eleocharis acicularis</i>	Native	BW2	1
	Spikerush	<i>Eleocharis sp.</i>	Native	BW6	1
	Willow-herb	<i>Epilobium coloratum</i>	Native	BW3, BW4	2
	Spotted joe-pye weed	<i>Eutrochium maculatum</i>	Native	BW2	1
	Marsh bedstraw	<i>Galium palustre</i>	Native	BW1, BW2, BW3	3
	Jewelweed	<i>Impatiens capensis</i>	Native	BW3, BW4, BW5	3
	Pale jewelweed	<i>Impatiens pallida</i>	Native	BW5	1
	Yellow iris	<i>Iris pseudacorus</i>	Invasive ^{A,B}	BW2, BW3, BW4	3
	Canada wood nettle	<i>Laportea canadensis</i>	Native	BW1, BW3	2

Table 5-2: Reach 5A Backwater Plant Species Summary Data (continued)

Layer	Common Name	Scientific Name	Status ¹	Backwaters Where Identified	Total Occurrences
	Rice cut-grass	<i>Leersia oryzoides</i>	Native	BW1, BW2, BW3, BW4, BW5, BW6	6
	False pimpernel	<i>Lindernia dubia</i>	Native	BW6	1
	Common water-primrose	<i>Ludwigia palustris</i>	Native	BW2	1
	Northern water-horehound	<i>Lycopus uniflorus</i>	Native	BW1, BW4	2
	Moneywort	<i>Lysimachia nummularia</i>	Invasive ^A	BW1, BW2	2
	Purple loosestrife	<i>Lythrum salicaria</i>	Invasive ^{ABC}	BW2, BW3, BW6	3
	Wild mint	<i>Mentha canadensis</i>	Native	BW3, BW4	2
	Monkey-flower	<i>Mimulus ringens</i>	Native	BW2, BW4	2
	Water forget-me-not	<i>Myosotis scorpioides</i>	Invasive ^D	BW2, BW3, BW4	3
	Eurasian water-milfoil	<i>Myriophyllum spicatum</i>	Invasive ^{ABC}	BW2	1
	Yellow pond-lily	<i>Nuphar variegata</i>	Native	BW1	1
	Sensitive fern	<i>Onoclea sensibilis</i>	Native	BW1, BW2, BW5	3
	Ditch-stonecrop	<i>Penthorum sedoides</i>	Native	BW2, BW3	2
	False water-pepper	<i>Persicaria hydropiperoides</i>	Native	BW3, BW4	2
	Dock-leaved smartweed	<i>Persicaria lapathifolia</i>	Native	BW3, BW6	2
	Dotted Smartweed	<i>Persicaria punctata</i>	Native	BW1, BW3, BW5, BW6	4
	Arrow-leaved tearthumb	<i>Persicaria sagittata</i>	Native	BW1, BW2, BW4	3
	Reed canary grass	<i>Phalaris arundinacea</i>	Invasive ^{ABC}	BW3, BW5	2
	Obedient false dragonhead	<i>Physostegia virginiana</i>	Non-native	BW2	1
	Pickerelweed	<i>Pontederia cordata</i>	Native	BW1	1
	Green-headed coneflower	<i>Rudbeckia laciniata</i>	Native	BW2, BW3, BW4	3
	Common arrowhead	<i>Sagittaria latifolia</i>	Native	BW2, BW5, BW6	3
	Woolgrass	<i>Scirpus cyperinus</i>	Native	BW1	1
	Water parsnip	<i>Sium suave</i>	Native	BW3, BW5	2

Table 5-2: Reach 5A Backwater Plant Species Summary Data (continued)

Layer	Common Name	Scientific Name	Status ¹	Backwaters Where Identified	Total Occurrences
	American bur-reed	<i>Sparganium americanum</i>	Native	BW1	1
	Water-chestnut	<i>Trapa natans</i>	Invasive ^{ABC}	BW1	1
	Stinging nettle	<i>Urtica dioica</i>	Native	BW6	1
	Blue vervain	<i>Verbena hastata</i>	Native	BW2, BW4	2
	Water speedwell	<i>Veronica catenata</i>	Native	BW2, BW4, BW6	3

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

Table 5-3: Reach 5A 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
BW-1	√	√	√	√	√	*	√	√	√	√	√	√	√	√	∅	∅	√
BW-2	√	∅	∅	√	√	*	√	√	√	√	√	∅	√	√	∅	∅	√
BW-3	*	√	√	√	∅	*	√	√	√	√	√	∅	√	√	∅	∅	√
BW-4	√	√	√	√	∅	*	√	√	√	√	√	∅	√	√	∅	∅	√
BW-5	√	√	√	√	√	*	*	√	√	√	√	√	√	√	∅	∅	√
BW-6	*	√	√	√	∅	*	√	√	√	√	√	∅	√	√	∅	∅	√

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

Table 5-4: Reach 5A Backwaters: Summary of Biotic Habitat Features (N=6)

Habitat Feature	Wildlife Use	% of Stations Abundant	% of Stations Present	% of Stations Absent
Wetland and Aquatic Food	Overall food	33	67	0
Live or Dead Trees >30" DBH	Cover/perching/nesting	0	83	17
Standing dead trees with cavities and perches	Cavities/perching/breeding/nesting/feeding	0	83	17
Cavities in trunks or limbs of Live Trees	Cavities/perching/breeding/nesting	0	100	0
Small mammal burrows on banks	Hibernation/breeding/nesting/escape/cover	0	50	50
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	17	83	0
Rocks, crevices, logs, roots, hummocks under water surface	Turtles, snakes, frogs, invertebrate emergence	0	100	0
Rock, crevices, logs, branches, hummocks at or within 1 m above water	Turtles, snakes, frogs, wading birds, wood duck, mink, raccoon	0	100	0
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	0	100	0
Flat rocks or logs on banks or in exposed areas of backwater	Cover and basking for herpetofauna	0	100	0
Underwater banks of fine silt and/or clay	Beaver, muskrat, otter	0	33	67
Undercut or overhanging banks	Small mammals, mink, weasels, turtles	0	100	0
Mud flats	Feeding sites for birds, small mammals, herps	0	100	0
Vertical Sandy Banks	Nesting bank swallows and kingfishers; Turtles	0	0	100
Open sandy to gravelly soils with sparse vegetation	Turtle nesting habitat	0	0	100
Emergent wetlands	Habitat for common snipe, spotted sandpiper, sedge wren, least bittern, common moorhen (Flooded > 5cm) and pied-billed grebe (Flooded > 25cm)	0	100	0

Table 5-5: State-Listed Rare Species Potentially Associated with Backwater Habitats of Reach 5A

Scientific Name	Common Name	State Status
<i>Botaurus lentiginosus</i>	American Bittern	Endangered
<i>Ophiogomphus aspersus</i>	Brook Snaketail	Special Concern
<i>Gallinula galeata</i>	Common Gallinule	Special Concern
<i>Eleocharis intermedia</i>	Matted Spike-Sedge	Threatened
<i>Boyeria grafiana</i>	Ocellated Darner	Special Concern
<i>Papaipema sp. 2</i>	Ostrich Fern Borer	Special Concern
<i>Phanogomphus quadricolor</i>	Rapids Clubtail	Endangered
<i>Ophiogomphus carolus</i>	Riffle Snaketail	Threatened
<i>Hylogomphus abbreviatus</i>	Spine-Crowned Clubtail	Endangered
<i>Sagittaria cuneata</i>	Wapato	Threatened
<i>Glyptemys insculpta</i>	Wood Turtle	Special Concern

Table 5-6: Reach 5A 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 5-7: Water Chemistry of Backwater Habitats of Reach 5A

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen		Chlorophyll-a mg/l
					%	mg/l	
BW R5A-1							
5/9/2023	1	7.63	20.7	458.3	105	9.44	3
	2	7.5	20.3	477	89.4	7.93	1
	3	7.51	19.1	487.8	87	7.88	1
6/6/2023	1	7.53	17.9	514	129.7	12.27	1
	2	7.71	18.	504	137	12.94	0.7
	3	7.81	18.8	513	145.9	13.55	1
6/14/2023	1	7.64	15.4	618	99.4	9.85	0.6
	2	7.72	15.7	518	106.4	10.55	1.2
	3	7.91	15.5	522	120.6	11.98	2
Total Average		7.66	17.9	512.5	113.4	10.71	1.3
BW R5A-2							
5/9/2023	1	7.72	11.6	432.8	134	14.62	1
	2	7.3	11.1	404	74.3	8.15	1.8
	3	8.28	16	413.3	158.6	15.46	1
6/6/2023	1	7.32	14.8	561	67.2	6.78	1.6
	2	7.4	12.1	476.5	96.9	10.4	4.7
	3	7.55	16.8	431.3	71.8	6.95	2.5
6/14/2023	1	7.47	14.8	499	81.2	8.25	1.5
	2	7.24	12.8	509	79.4	8.32	1.9
	3	7.5	19	449	60	5.53	2
Total Average		7.53	14.3	464.0	91.5	9.38	2.0

Table 5-7: Water Chemistry of Backwater Habitats of Reach 5A (continued)

Date	Sample Location ID	pH	Temperature °C	Specific Conductivity	Dissolved Oxygen		Chlorophyll-a mg/l
					%	mg/l	
BW R5A-3							
5/9/2023	1	7.23	22.4	393.5	74.5	6.47	1
	2	7.32	19.6	381.2	77.6	7.04	1
	3	7.38	17.5	412.9	86.9	8.13	1
6/6/2023	1	7.19	22	439.1	80.1	6.99	1.9
	2	7.47	19.9	469.2	112.1	10.2	1.5
	3	7.34	19.4	456.6	92.5	8.75	1
6/14/2023	1	7.21	21.9	524	51	4.45	1.6
	2	7.6	19.5	482.7	101.8	9.3	1
	3	7.81	19.6	465	116.6	10.6	1.1
Total Average		7.39	20.2	447.1	88.1	7.99	1.2
BW R5A-4							
5/9/2023	1	7.48	17.4	470.7	73.3	6.84	0.5
	2	7.38	18	482.4	58.6	5.48	0.5
	3	7.48	17	492.4	73.6	7.04	0.5
6/6/2023	1	7.85	17.9	449.4	119.8	11.5	1
	2	7.53	17.8	471.7	97.3	9.24	1
	3	7.72	18.3	457	83.2	7.8	1.3
6/14/2023	1	7.72	18.3	457	83.2	7.8	1.3
	2	8.29	17.5	423.7	148.7	14.17	2.2
	3	7.8	17.4	462	88	8.41	1.7
Total Average		7.69	17.7	462.9	91.7	8.70	1.1

Table 5-7: Water Chemistry of Backwater Habitats of Reach 5A (continued)

Date	Sample Location ID	pH	Temperature °C	Sp Conductivity	Dissolved Oxygen		Chlorophyll-a mg/l
					%	mg/l	
BW R5A-5							
5/9/2023	1	7.61	17.8	585	98.4	9.24	4
	2	7.47	17.0	572	84.8	8.09	2
	3	7.36	19.1	603	79.7	7.34	2
6/6/2023	1	7.74	20.5	676	107.5	9.33	2.5
	2	7.45	17.6	694	72.9	7.23	6
	3	7.49	18.7	709	100.5	9.36	2.2
6/14/2023	1	7.88	19.3	672	94.6	8.6	3.6
	2	7.66	18.3	686	71.8	6.7	2.3
	3	7.48	18.5	694	60.9	5.67	1.2
Total Average		7.57	18.5	654.6	85.7	7.95	2.9
BW R5A-6							
5/9/2023	1	8.01	18.4	478.2	193.4	15.07	40
	2	7.53	25.1	477.8	94.6	7.56	4
	3	7.46	25.1	472.7	83.2	6.86	3
Total Average		7.67	22.9	476.2	123.7	9.83	15.7

Table 6-1: Reach 5A Wetland Community Types*

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.
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.
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.
Moderately alkaline lake/pond	Ponds located in the central valley region with calcareous bedrock underneath.

* Adapted From Woodlot (2002a) Ecological Characterization

Table 6-2: Reach 5A Upland Community Types*

Community Type	Description
Successional Northern Hardwood Forests	Early successional forests growing on formerly disturbed sites (fire, silvicultural, agricultural) well drained upland mineral soils. Dominant plants include quaking aspen, white pine, white birch, gray birch, and black birch in the canopy with willows, goldenrods, clovers beneath.
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.
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.

* Adapted From Woodlot (2002a) Ecological Characterization

Table 6-3: Comparison of natural community cover types mapped between 2002 and 2023

Natural Community / Cover Type	Woodlot 2002 (Acres) ¹	Natural Community / Cover Type	AECOM 2023 (Acres) ²
Moderately alkaline lake/pond	14.3	Moderately alkaline lake/pond	8.5
Low gradient stream	35.4	Stream	48.3
Medium-gradient stream	8.3		
Wet meadow	14.7	Wet meadow	22.4
Shallow emergent marsh	23.2	Shallow emergent marsh	46.2
Deep emergent marsh	15.6	Deep emergent marsh	12.6
Shrub swamp	54.8	Shrub swamp	64.0
Red maple swamp	47.8	Red maple swamp	8.9
Transitional floodplain forest	121.8	Transitional floodplain forest	143.8
High-terrace floodplain forest	9.8	High-terrace floodplain forest	10.3
Successional northern hardwoods	4.1	Successional Northern Hardwoods	3.7
Red oak-sugar maple transition forest	2.2	Red oak-sugar maple transition forest	2.6
Northern hardwoods-hemlock-white pine forest	9.1	Northern hardwoods-hemlock-white pine forest	7.4
Agricultural Field	18.3	Agricultural Field	4.4
Cultural grasslands	25.4	Cultural grasslands	26.1
Riverine pointbar and beach	0.8	Riverine pointbar and beach	0.0
Developed / Disturbed	0.0	Developed / Disturbed	0.6
SUM:	405.5	SUM:	409.8

1. Natural community mapping based on Woodlot 2002 ecological characterization.

2. Natural community mapping based on AECOM 2022-2023 field surveys, and interpretation of available aerial photography and LiDAR data.

Table 6-4: Reach 5A Floodplain Wetland Habitat Characterization

Parameter	Description of Parameter	Reach 5A 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 Reach 5A (updated during 2018-2019 morphology surveys); aerial photograph interpretation and updated LiDAR mapping; 2022 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); 2022 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); 2022 field surveys to obtain data for Form FP-1
Plant community	Plant species by community type	Consolidate existing information (from sources below); 2022 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); 2022 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); 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; 2022 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); 2022 field surveys to map invasive species and obtain data for Form FP-1

* The existing information used for the Reach 5A 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 2012, the Reach 5A vernal pool investigations; and the Final Accessibility Report – all described and referenced in Section 2 of the Reach 5A BRA Work Plan – as well as the USDA NRCS soil surveys, USGS surficial geology mapping, and FEMA FIS.

Table 6-5: Reach 5A Floodplain Wetland Plant Species Summary Data

Layer	Common Name	Scientific Name	Status ¹	Occurrence (Number of Plots N=202)
Tree Species	Boxelder maple	<i>Acer negundo</i>	Native	65
	Norway maple	<i>Acer platanoides</i>	Invasive ^{A,B}	2
	Red maple	<i>Acer rubrum</i>	Native	24
	Silver maple	<i>Acer saccharinum</i>	Native	47
	Sugar maple	<i>Acer saccharum</i>	Native	10
	Yellow birch	<i>Betula alleghaniensis</i>	Native	3
	Sweet birch	<i>Betula lenta</i>	Native	3
	Paper birch	<i>Betula papyrifera</i>	Native	1
	Gray birch	<i>Betula populifolia</i>	Native	4
	American hornbeam	<i>Carpinus caroliniana</i>	Native	12
	Bitternut hickory	<i>Carya cordiformis</i>	Native	2
	Shagbark hickory	<i>Carya sp.</i>	Native	2
	Common hackberry	<i>Celtis occidentalis</i>	Native	3
	Dotted hawthorn	<i>Crataegus punctata</i>	Native	13
	American beech	<i>Fagus grandifolia</i>	Native	5
	White ash	<i>Fraxinus americana</i>	Native	10
	Black ash	<i>Fraxinus nigra</i>	Native	1
	Green ash	<i>Fraxinus pennsylvanica</i>	Native	6
	Butternut	<i>Juglans cinerea</i>	Native	1
	Hop-hornbeam	<i>Ostrya virginiana</i>	Native	5
	Red pine	<i>Pinus resinosa</i>	Native	1
	Eastern white pine	<i>Pinus strobus</i>	Native	10
	American sycamore	<i>Platanus occidentalis</i>	Native	4
	Eastern cottonwood	<i>Populus deltoides</i>	Native	21
	Quaking aspen	<i>Populus tremuloides</i>	Native	5
	Black cherry	<i>Prunus serotina</i>	Native	8
	Northern red oak	<i>Quercus rubra</i>	Native	4
	White willow	<i>Salix alba</i>	Non-native	1
	Black willow	<i>Salix nigra</i>	Native	19
	American bladdernut	<i>Staphylea trifolia</i>	Native	2
	American yew	<i>Taxus canadensis</i>	Native	1
	American linden	<i>Tilia americana</i>	Native	17
	Eastern hemlock	<i>Tsuga canadensis</i>	Native	4

Table 6-5: Reach 5A Floodplain Wetland Plant Species Summary Data (continued).

Shrub Species	American elm	<i>Ulmus americana</i>	Native	21
	Slippery elm	<i>Ulmus rubra</i>	Native	1
	Speckled alder	<i>Alnus incana</i>	Native	18
	Canada serviceberry	<i>Amelanchier canadensis</i>	Native	1
	Japanese barberry	<i>Berberis thunbergii</i>	Invasive ^{A,B,C}	9
	Buttonbush	<i>Cephalanthus occidentalis</i>	Native	4
	Silky dogwood	<i>Cornus amomum</i>	Native	80
	American hazelnut	<i>Corylus americana</i>	Native	1
	Autumn olive	<i>Elaeagnus umbellata</i>	Invasive ^{A,B,C}	3
	Burning bush	<i>Euonymus alatus</i>	Invasive ^{A,B,C}	7
	European spindle	<i>Euonymus europaeus</i>	Non-native	2
	Glossy buckthorn	<i>Frangula alnus</i>	Invasive ^{A,B,C}	1
	American witch hazel	<i>Hamamelis virginiana</i>	Native	2
	Winterberry	<i>Ilex verticillata</i>	Native	4
	Border privet	<i>Ligustrum obtusifolium</i>	Invasive ^D	7
	Spicebush	<i>Lindera bensoin</i>	Native	1
	Morrow's honeysuckle	<i>Lonicera morrowii</i>	Invasive ^{A,B}	51
	Maleberry	<i>Lyonia ligustrina</i>	Native	1
	European buckthorn	<i>Rhamnus cathartica</i>	Invasive ^{A,B,C}	53
	Eastern black current	<i>Ribes americanum</i>	Native	3
	Multiflora rose	<i>Rosa multiflora</i>	Invasive ^{A,B,C}	15
	Swamp rose	<i>Rosa palustris</i>	Native	4
	Blackberry	<i>Rubus allegheniensis</i>	Native	2
	Red raspberry	<i>Rubus idaeus</i>	Native	3
	Dwarf raspberry	<i>Rubus pubescens</i>	Native	1
	Pussy willow	<i>Salix disolor</i>	Native	8
	Willow	<i>Salix sp.</i>	Native	14
	Elderberry	<i>Sambucus canadensis</i>	Native	6
	White meadowsweet	<i>Spiraea alba</i>	Native	9
	Meadowsweet	<i>Spiraea latifolia</i>	Native	8
	Arrowwood	<i>Viburnum dentatum</i>	Native	7
	Nannyberry	<i>Viburnum lentago</i>	Native	2
Woody Vine Species	Asian bittersweet	<i>Celastrus orbiculatus</i>	Invasive ^{A,B,C}	30
	Virgin's-bower	<i>Clematis virginiana</i>	Native	7
	Virginia creeper	<i>Parthenocissus quinquefolia</i>	Native	14
	Poison ivy	<i>Toxicodendron radicans</i>	Native	12

Table 6-5: Reach 5A Floodplain Wetland Plant Species Summary Data (continued).

Herb, Forb and Grass Species	River grape	<i>Vitis riparia</i>	Native	41
	Sweetflag	<i>Acorus calamus</i>	Native	3
	Northern maidenhair fern	<i>Adiantum pedatum</i>	Native	1
	Bishop's goutweed	<i>Aegopodium podagraria</i>	Invasive ^{A,B}	14
	Northern water-plantain	<i>Alisma triviale</i>	Native	5
	Garlic mustard	<i>Alliaria petiolata</i>	Invasive ^{A,B}	8
	Ramps	<i>Allium tricoccum</i>	Native	1
	Hemp dogbane	<i>Apocynum cannabinum</i>	Native	1
	Jack-in-the-pulpit	<i>Arisaema triphyllum</i>	Native	1
	Swamp milkweed	<i>Asclepias incarnata</i>	Native	1
	Common milkweed	<i>Asclepias syriaca</i>	Native	2
	Aster	<i>Aster sp.</i>	Native	1
	Lady fern	<i>Athyrium angustum</i>	Native	1
	Nodding beggar-ticks	<i>Bidens cernua</i>	Native	12
	Devil's beggar-tick	<i>Bidens frondosa</i>	Native	12
	Small-spiked false nettle	<i>Boehmeria cylindrica</i>	Native	7
	Black mustard	<i>Brassica nigra</i>	Non-native	5
	Smooth brome	<i>Bromus inermis</i>	Non-native	1
	Wild calla	<i>Calla palustris</i>	Native	1
	Water-starwort	<i>Callitriche palustris</i>	Native	4
	Hedge bindweed	<i>Calystegia sepium</i>	Native	1
	Hairy bitter-cress	<i>Cardamine hirsuta</i>	Non-native	1
	Eastern woodland sedge	<i>Carex blanda</i>	Native	1
	Bearded sedge	<i>Carex comosa</i>	Native	1
	Fringed sedge	<i>Carex crinita</i>	Native	1
	Bladder sedge	<i>Carex intumescens</i>	Native	1
	Hop sedge	<i>Carex lupulina</i>	Native	1
	Pennsylvania sedge	<i>Carex pennsylvanica</i>	Native	2
	Sedge	<i>Carex sp.</i>	Native	7
	Tussock sedge	<i>Carex stricta</i>	Native	12
	Blue cohosh	<i>Caulophyllum thalictroides</i>	Native	4
	Brown knapweed	<i>Centaurea jacea</i>	Non-native	1
	Chickweed	<i>Cerastium arvense</i>	Non-native	1
	White turtlehead	<i>Chelone glabra</i>	Native	2
	Bulblet-bearing water-hemlock	<i>Cicuta bulbifera</i>	Native	10
	Spotted water-hemlock	<i>Cicuta maculata</i>	Native	1

Table 6-5: Reach 5A Floodplain Wetland Plant Species Summary Data (continued).

Sweet wood-reed	<i>Cinna arundinacea</i>	Native	3
Enchanter's-nightshade	<i>Circaea canadensis</i>	Native	3
Creeping thistle	<i>Cirsium arvense</i>	Non-native	1
Field bindweed	<i>Convolvulus arvensis</i>	Non-native	1
Three-leaved goldthread	<i>Coptis trifolia</i>	Native	1
Common dodder	<i>Cuscuta gronovii</i>	Native	7
Queen Anne's Lace	<i>Daucus carota</i>	Non-native	1
Swamp-loosestrife	<i>Decodon verticillatus</i>	Native	1
Tree-clubmoss	<i>Dendrolycopodium obscurum</i>	Native	1
Tufted hairgrass	<i>Deschampsia cespitosa</i>	Non-native	5
Woodfern	<i>Dryopteris carthusiana</i>	Native	5
Barnyard grass	<i>Echinochloa crus-galli</i>	Non-native	2
Wild cucumber	<i>Echinocystis lobata</i>	Native	1
Needle spikesedge	<i>Eleocharis acicularis</i>	Native	2
Spikerush	<i>Eleocharis sp.</i>	Native	7
Purple-leaved willowherb	<i>Epilobium ciliatum</i>	Native	4
Willow-herb	<i>Epilobium coloratum</i>	Native	3
Purple willow-herb	<i>Epilobium sp.</i>	Native	3
River horsetail	<i>Equisetum fluviatile</i>	Native	1
Tall scouring-rush	<i>Equisetum hyemale</i>	Native	3
Meadow horsetail	<i>Equisetum pratense</i>	Native	3
Branched scouring-rush	<i>Equisetum scirpoides</i>	Native	2
Burnweed	<i>Erechtites hieraciifolius</i>	Native	2
Boneset	<i>Eupatorium perfoliatum</i>	Native	1
Grass-leaved-goldenrod	<i>Euthamia graminifolia</i>	Native	3
Spotted joe-pye weed	<i>Eutrochium maculatum</i>	Native	15
Black bindweed	<i>Fallopia convolvulus</i>	Non-native	1
Japanese knotweed	<i>Fallopia japonica</i>	Invasive ^{A,B,C}	7
Climbing bindweed	<i>Fallopia scandens</i>	Native	2
Common Strawberry	<i>Fragaria virginiana</i>	Native	2
Hemp-nettle	<i>Galeopsis bifida</i>	Non-native	1
Bedstraw	<i>Galium aparine</i>	Native	3
Rough bedstraw	<i>Galium asprellum</i>	Native	2
Whorled bedstraw	<i>Galium mollugo</i>	Native	1
Marsh bedstraw	<i>Galium palustre</i>	Native	21
Yellow avens	<i>Geum aleppicum</i>	Native	5

Table 6-5: Reach 5A Floodplain Wetland Plant Species Summary Data (continued).

White avens	<i>Geum canadense</i>	Native	9
Avens	<i>Geum sp.</i>	Native	2
Rattlesnake grass	<i>Glyceria canadensis</i>	Native	1
Tuberous sunflower	<i>Helianthus tuberosus</i>	Non-native	1
American cow-parsnip	<i>Heracleum maximum</i>	Native	2
Dame's-rocket	<i>Hesperis matronalis</i>	Invasive ^{A,B}	5
Common St. John's-wort	<i>Hypericum perforatum</i>	Native	1
Jewelweed	<i>Impatiens capensis</i>	Native	52
Pale jewelweed	<i>Impatiens pallida</i>	Native	1
Morning-glory	<i>Ipomoea purpurea</i>	Non-native	1
Yellow iris	<i>Iris pseudacorus</i>	Invasive ^{A,B}	4
Soft rush	<i>Juncus effusus</i>	Native	9
Path rush	<i>Juncus tenuis</i>	Native	2
Canada wood nettle	<i>Laportea canadensis</i>	Native	22
Rice cut-grass	<i>Leersia oryzoides</i>	Native	12
Common duckweed	<i>Lemna minor</i>	Native	1
False pimpernel	<i>Lindernia dubia</i>	Native	1
Common water-primrose	<i>Ludwigia palustris</i>	Native	9
Northern water-horehound	<i>Lycopus uniflorus</i>	Native	4
Fringed yellow-loosestrife	<i>Lysimachia ciliata</i>	Native	7
Moneywort	<i>Lysimachia nummularia</i>	Invasive ^A	48
Whorled loosestrife	<i>Lysimachia quadrifolia</i>	Native	1
Swamp candle	<i>Lysimachia terrestris</i>	Native	1
Yellow loosestrife	<i>Lysimachia vulgaris</i>	Native	4
Purple loosestrife	<i>Lythrum salicaria</i>	Invasive ^{A,B,C}	58
False Solomon's seal	<i>Maianthemum racemosum</i>	Native	2
Ostrich fern	<i>Matteuccia struthiopteris</i>	Native	40
Wild mint	<i>Mentha canadensis</i>	Native	2
Monkey-flower	<i>Mimulus ringens</i>	Native	2
Partridge berry	<i>Mitchella repens</i>	Native	1
Water forget-me-not	<i>Myosotis scorpioides</i>	Invasive ^D	10
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>	Invasive ^{A,B}	1
Sensitive fern	<i>Onoclea sensibilis</i>	Native	57
Cinnamon fern	<i>Osmunda cinnamomea</i>	Native	2
Royal fern	<i>Osmunda regalis</i>	Native	4
Slender yellow wood sorrel	<i>Oxalis dillenii</i>	Native	1

Table 6-5: Reach 5A Floodplain Wetland Plant Species Summary Data (continued).

Common yellow wood sorrel	<i>Oxalis stricta</i>	Native	1
Japanese mountain-spurge	<i>Pachysandra terminalis</i>	Non-native	1
New York Fern	<i>Parathelypteris noveboracensis</i>	Native	1
Massachusetts fern	<i>Parathelypteris simulata</i>	Native	2
Green arrow-arum	<i>Peltandra virginica</i>	Native	1
Ditch-stonecrop	<i>Penthorum sedoides</i>	Native	4
Water-pepper smartweed	<i>Persicaria hydropiper</i>	Native	11
False water-pepper	<i>Persicaria hydropiperoides</i>	Native	7
Dock-leaved smartweed	<i>Persicaria lapathifolia</i>	Native	4
Pennsylvania smartweed	<i>Persicaria pennsylvanica</i>	Native	4
Dotted Smartweed	<i>Persicaria punctata</i>	Native	8
Arrow-leaved tearthumb	<i>Persicaria sagittata</i>	Native	25
Smartweed	<i>Persicaria sp.</i>	Native	3
Jumpseed	<i>Persicaria virginiana</i>	Native	18
Reed canary grass	<i>Phalaris arundinacea</i>	Invasive ^{A,B,C}	16
Common reed	<i>Phragmites australis</i>	Invasive ^{A,B,C}	3
Obedient false dragonhead	<i>Physostegia virginiana</i>	Non-native	1
Clearweed	<i>Pilea pumila</i>	Native	9
Narrow leaf plantain	<i>Plantago lanceolata</i>	Non-native	1
Fowl blue grass	<i>Poa palustris</i>	Native	1
Solomon's seal	<i>Polygonatum sp.</i>	Native	1
Christmas fern	<i>Polystichum acrostichoides</i>	Native	1
Pickernelweed	<i>Pontederia cordata</i>	Native	1
Floating pondweed	<i>Potamogeton natans</i>	Native	1
Creeping buttercup	<i>Ranunculus repens</i>	Non-native	1
Green-headed coneflower	<i>Rudbeckia laciniata</i>	Native	25
Curly dock	<i>Rumex crispus</i>	Non-native	6
Common arrowhead	<i>Sagittaria latifolia</i>	Native	9
Soapwort	<i>Saponaria officinalis</i>	Non-native	1
Soft-stemmed bulrush	<i>Schoenoplectus tabernaemontani</i>	Native	3
Woolgrass	<i>Scirpus cyperinus</i>	Native	15
Hooded skullcap	<i>Scutellaria galericulata</i>	Native	1
Purple crown-vetch	<i>Securigera varia</i>	Non-native	1
One-seeded burr-cucumber	<i>Sicyos angulatus</i>	Native	1

Table 6-5: Reach 5A Floodplain Wetland Plant Species Summary Data (continued).

	Bladder campion	<i>Silene vulgaris</i>	Non-native	1
	Water parsnip	<i>Sium suave</i>	Native	4
	Climbing nightshade	<i>Solanum dulcamara</i>	Non-native	1
	Canada goldenrod	<i>Solidago canadensis</i>	Native	20
	Smooth goldenrod	<i>Solidago gigantea</i>	Native	2
	Wrinkled-leaved goldenrod	<i>Solidago rugosa</i>	Native	8
	Goldenrod	<i>Solidago sp.</i>	Native	3
	American bur-reed	<i>Sparganium americanum</i>	Native	12
	Great bur-reed	<i>Sparganium eurycarpum</i>	Native	2
	American aster	<i>Symphyotrichum lateriflorum</i>	Native	2
	Purple-stemmed aster	<i>Symphyotrichum puniceum</i>	Native	3
	Skunk cabbage	<i>Symplocarpus foetidus</i>	Native	7
	Common dandelion	<i>Taraxacum officinale</i>	Non-native	1
	Tall meadow-rue	<i>Thalictrum pubescens</i>	Native	1
	Marsh fern	<i>Thelypteris palustris</i>	Native	4
	White clover	<i>Trifolium repens</i>	Non-native	1
	Narrow-leaved cattail	<i>Typha angustifolia</i>	Non-native	6
	Broad-leaved cattail	<i>Typha latifolia</i>	Native	7
	Stinging nettle	<i>Urtica dioica</i>	Native	12
	Blue vervain	<i>Verbena hastata</i>	Native	4
	White vervain	<i>Verbena urticifolia</i>	Native	1
	Water speedwell	<i>Veronica catenata</i>	Native	3
	Germander speedwell	<i>Veronica chamaedrys</i>	Non-native	1
	Violet	<i>Viola sp.</i>	Native	3
	Rough cocklebur	<i>Xanthium strumarium</i>	Non-native	2
Bryophytes	Mosses	<i>Bryophyta</i>	Native	1
	American ciamacium moss	<i>Climacium americanum</i>	Native	1
	Haircap moss	<i>Polytrichum commune</i>	Native	1

¹Invasive 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

		Deep emergent marsh	Shallow emergent marsh	Wet meadow	Shrub swamp	Red maple swamp	Transitional floodplain forest	High-terrace floodplain forest
Trees	Count	3	27	17	36	3	74	8
	Min	0.0	0.0	0.0	0.0	38.0	0.0	85.5
	Max	0.0	85.5	20.5	63.0	63.0	98.0	98.0
	Mean	0.0	11.2	3.7	9.9	46.3	64.2	93.3
	±SE	0.0	4.3	1.5	3.1	8.3	3.0	2.3
Shrubs	Min	0.0	0.0	0.0	3.0	20.5	0.0	3.0
	Max	3.0	85.5	63.0	98.0	98.0	98.0	85.5
	Mean	1.0	13.0	11.1	74.5	46.3	43.3	27.4
	±SE	1.0	3.8	4.5	4.7	25.8	4.0	9.6
Woody Vines	Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Max	0.0	10.5	20.5	38.0	10.5	98.0	20.5
	Mean	0.0	0.4	2.0	2.4	3.5	12.3	10.1
	±SE	0.0	0.4	1.3	1.2	3.5	2.3	3.2
Herbs	Min	85.5	63.0	63.0	0.0	10.5	3.0	10.5
	Max	98.0	98.0	98.0	98.0	98.0	98.0	63.0
	Mean	93.8	94.5	94.5	57.3	68.8	70.7	43.6
	±SE	4.2	1.9	2.2	6.1	29.2	3.4	8.2
Mosses	Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Max	0.0	98.0	10.5	98.0	0.0	85.5	0.0
	Mean	0.0	12.1	1.0	12.6	0.0	3.8	0.0
	±SE	0.0	5.6	0.6	4.5	0.0	1.5	0.0

Table 6-7: Reach 5A NRCS Soil Series Mapping

Code ¹	Series ²	Area (Acres)	Percent of Reach 5A
901E	Berkshire-Marlow association	0.15	0.0
267A,B,D	Copake fine sandy loam	7.44	1.8
632C	Copake-Urban land complex	3.92	1.0
34A	Fredon fine sandy loam	3.48	0.8
298E	Groton and Hinckley soils	1.10	0.3
269B,C,D	Groton gravelly sandy loam	23.89	5.8
96A	*Hadley silt loam	21.29	5.2
270A	Hero loam	0.04	0.0
242D	Hinckley loamy sand	0.28	0.1
272C	Hoosic gravelly fine sandy loam	0.59	0.1
8A	*Limerick silt loam	117.26	28.6
254A,B	Merrimac fine sandy loam	2.93	0.7
58A	*Natchaug and Catden mucks	23.77	5.8
273A,B	Oakville loamy sand	0.95	0.2
600	Pits, gravel	7.32	1.8
5A	*Saco silt loam	4.38	1.1
651	Udorthents, smoothed	9.98	2.4
602	Urban land	3.40	0.8
1	water	49.21	12.0
98A	*Winooski silt loam	128.47	31.3
		409.84	100.0

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: Reach 5A Floodplain Natural Communities –Biotic Habitat Features

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
1	√	N/A	*	∅	*	*	∅	√	∅	∅	√	*	∅	√	∅	∅	√	√	∅
2	√	√	√	√	N/A	∅	∅	√	∅	∅	*	√	∅	∅	∅	∅	∅	∅	∅
3	√	√	∅	√	√	∅	∅	∅	∅	∅	*	*	∅	*	∅	∅	∅	∅	∅
4	√	√	∅	∅	√	∅	∅	*	∅	∅	*	∅	∅	*	∅	∅	∅	√	∅
6	√	N/A	N/A	√	∅	√	∅	*	∅	∅	*	√	∅	*	Flooded >25cm	Flooded >25cm	√	*	∅
7	√	√	√	∅	∅	√	∅	√	∅	∅	√	∅	∅	*	∅	∅	∅	√	∅
8	√	√	N/A	∅	∅	√	√	√	∅	∅	∅	∅	∅	N/A	∅	∅	∅	√	∅
9	*	N/A	N/A	∅	∅	∅	∅	*	∅	∅	*	∅	√	√	Flooded >25cm	Flooded >25cm	∅	√	∅
10	√	√	N/A	∅	*	√	∅	∅	∅	∅	√	√	√	*	∅	∅	∅	*	∅
11	√	√	∅	∅	√	√	∅	*	∅	∅	√	√	∅	∅	∅	∅	∅	∅	∅
12	√	√	∅	√	√	*	∅	√	∅	√	∅	√	√	∅	∅	∅	∅	∅	∅
13	√	√	∅	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	∅	∅
14	√	√	∅	∅	∅	*	∅	*	∅	∅	√	*	√	∅	∅	∅	∅	√	∅
15	√	√	∅	∅	∅	∅	∅	√	∅	∅	∅	∅	∅	∅	∅	∅	∅	√	∅
16	√	√	∅	√	√	∅	∅	*	∅	∅	*	∅	∅	√	∅	∅	∅	√	∅
17	√	√	√	√	∅	√	∅	√	∅	∅	√	√	∅	√	∅	∅	∅	√	∅
19	√	√	∅	√	√	√	∅	*	∅	∅	√	∅	∅	√	∅	∅	∅	√	√
20	√	N/A	∅	∅	√	√	∅	*	∅	∅	*	√	∅	√	∅	∅	√	√	∅
21	√	√	∅	*	∅	√	∅	∅	∅	∅	∅	√	√	√	∅	∅	√	√	∅
22	√	√	√	∅	√	∅	∅	√	∅	∅	√	∅	∅	∅	∅	∅	∅	∅	∅
23	*	N/A	∅	∅	∅	∅	∅	*	∅	∅	√	√	∅	∅	∅	∅	∅	√	∅
24	√	√	√	∅	∅	∅	√	√	∅	∅	√	√	∅	∅	∅	∅	∅	∅	∅
25	√	√	√	∅	√	∅	∅	√	∅	∅	√	√	∅	∅	∅	∅	∅	∅	∅
26	√	√	√	√	√	√	∅	*	∅	√	√	∅	∅	∅	∅	∅	∅	∅	∅
27	*	√	√	√	√	∅	∅	√	∅	∅	√	∅	∅	∅	∅	∅	∅	∅	∅
28	√	√	√	∅	√	∅	∅	*	∅	∅	√	∅	∅	∅	∅	∅	∅	∅	∅
29	*	N/A	∅	∅	√	√	∅	*	∅	∅	*	√	√	√	Flooded >25cm	∅	√	√	∅
30	√	√	∅	*	√	√	∅	√	∅	√	∅	√	∅	*	∅	∅	∅	∅	∅
37	√	N/A	∅	∅	√	√	∅	*	∅	∅	√	∅	√	*	Flooded >25cm	∅	∅	√	∅
38	√	N/A	∅	∅	√	∅	∅	*	∅	∅	*	∅	*	*	Flooded >5cm	∅	∅	√	∅

Table 6-8: Reach 5A Floodplain Natural Communities –Biotic Habitat Features (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
39	*	N/A	∅	∅	√	∅	∅	*	∅	√	*	√	*	*	∅	∅	∅	√	∅
40	√	N/A	∅	∅	∅	∅	∅	*	∅	∅	*	∅	*	*	Flooded >5cm	Flooded >5cm	∅	√	∅
41	√	√	√	∅	√	∅	∅	√	∅	∅	∅	∅	∅	√	∅	∅	∅	∅	∅
42	√	√	∅	∅	∅	∅	∅	*	∅	√	*	∅	∅	*	Flooded >25cm	Flooded >25cm	∅	√	∅
43	√	√	√	√	√	√	∅	*	∅	∅	*	√	∅	*	∅	∅	∅	∅	∅
44	√	N/A	N/A	∅	*	∅	∅	*	∅	∅	*	∅	√	∅	Flooded >25cm	Flooded >25cm	∅	√	∅
45	√	N/A	N/A	∅	√	∅	∅	*	∅	∅	*	√	*	∅	∅	∅	∅	√	√
46	√	N/A	∅	∅	√	√	∅	*	∅	∅	*	√	∅	∅	∅	∅	∅	∅	∅
47	√	N/A	N/A	∅	√	∅	∅	*	∅	∅	*	√	∅	∅	∅	∅	∅	√	∅
48	√	N/A	∅	∅	√	∅	∅	*	∅	∅	*	∅	√	*	Flooded >25cm	Flooded >25cm	∅	*	∅
49	*	N/A	N/A	∅	√	∅	∅	*	∅	∅	*	√	∅	∅	∅	∅	∅	*	∅
50	√	N/A	N/A	∅	√	∅	∅	*	∅	∅	*	∅	√	∅	Flooded >25cm	Flooded >25cm	∅	*	∅
51	*	N/A	∅	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	Flooded >25cm	Flooded >25cm	∅	√	∅
52	*	N/A	N/A	∅	∅	∅	∅	*	∅	∅	*	∅	√	*	∅	∅	∅	√	∅
53	*	N/A	N/A	∅	√	∅	∅	*	∅	∅	∅	√	√	∅	∅	∅	∅	*	∅
54	*	N/A	N/A	∅	∅	∅	∅	*	∅	∅	∅	∅	*	∅	∅	∅	∅	*	∅
55	√	N/A	N/A	∅	∅	∅	∅	*	∅	∅	√	√	*	∅	∅	∅	∅	*	√
56	*	N/A	N/A	∅	∅	∅	∅	*	∅	√	*	∅	*	∅	Flooded >25cm	Flooded >25cm	∅	*	∅
57	√	N/A	N/A	∅	∅	∅	∅	*	∅	∅	*	∅	*	∅	Flooded >5cm	Flooded >5cm	∅	*	∅
58	*	N/A	N/A	∅	∅	∅	∅	*	∅	∅	*	∅	*	∅	Flooded >25cm	Flooded >25cm	∅	*	∅
59	√	√	√	√	∅	∅	∅	√	∅	∅	√	∅	∅	∅	∅	∅	∅	√	∅
60	√	N/A	N/A	∅	∅	∅	∅	*	∅	∅	*	∅	√	∅	Flooded >25cm	∅	∅	*	∅
61	√	N/A	N/A	∅	∅	∅	∅	*	∅	∅	*	∅	*	∅	Flooded >25cm	∅	∅	*	∅
62	√	N/A	N/A	√	√	∅	∅	∅	∅	∅	*	√	√	∅	∅	∅	*	*	∅
64	*	√	∅	∅	∅	∅	∅	√	∅	∅	*	∅	∅	*	∅	∅	√	∅	∅
65	√	√	√	√	∅	√	∅	*	∅	√	*	√	∅	∅	∅	∅	∅	∅	∅

Table 6-8: Reach 5A Floodplain Natural Communities –Biotic Habitat Features (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
66	*	N/A	∅	∅	√	∅	∅	*	∅	∅	*	√	∅	√	∅	∅	∅	*	∅
67	√	√	√	*	∅	√	∅	*	∅	∅	*	√	∅	∅	∅	∅	∅	∅	∅
68	√	√	√	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	∅	∅
69	√	√	√	∅	∅	∅	∅	*	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅
70	√	√	√	∅	√	√	∅	*	∅	∅	*	√	∅	*	∅	∅	∅	∅	∅
71	√	√	∅	∅	√	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	*	∅
72	√	√	∅	√	*	*	∅	*	∅	√	√	√	√	∅	∅	∅	∅	∅	∅
73	*	√	∅	√	∅	√	√	*	∅	∅	*	∅	√	∅	∅	∅	∅	√	∅
74	√	√	√	∅	∅	√	√	*	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
75	*	N/A	∅	∅	√	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	*	∅
79	√	√	√	√	√	√	∅	√	∅	∅	√	√	√	*	∅	∅	∅	∅	∅
81	*	N/A	∅	∅	∅	∅	∅	*	∅	∅	∅	∅	√	∅	∅	∅	√	*	∅
82	√	√	∅	∅	√	√	√	√	∅	√	√	√	*	√	Flooded >5cm	Flooded >5cm	√	*	√
83	*	N/A	∅	∅	∅	√	∅	*	∅	∅	√	√	*	∅	∅	∅	√	√	√
84	*	N/A	∅	∅	√	√	∅	*	∅	∅	√	√	√	∅	∅	∅	√	*	√
85	*	√	√	∅	∅	∅	√	√	∅	∅	∅	√	∅	*	∅	∅	∅	∅	∅
86	√	√	√	∅	∅	√	∅	√	∅	∅	∅	√	∅	∅	∅	∅	∅	∅	∅
87	√	N/A	√	∅	∅	∅	∅	*	∅	∅	√	∅	√	*	∅	∅	∅	√	∅
88	√	√	√	∅	√	√	∅	*	∅	∅	*	√	*	*	∅	∅	∅	√	∅
90	√	N/A	√	∅	∅	∅	√	*	∅	∅	*	∅	∅	*	Flooded >25cm	Flooded >25cm	∅	*	∅
91	√	√	∅	∅	∅	∅	∅	√	√	√	*	√	√	∅	∅	∅	∅	∅	∅
92	√	√	∅	∅	√	∅	√	*	∅	∅	*	√	√	∅	∅	∅	∅	∅	∅
94	√	√	√	∅	∅	∅	∅	√	∅	∅	*	∅	√	√	∅	∅	∅	∅	∅
95	√	√	∅	√	√	√	∅	∅	∅	∅	∅	*	√	∅	∅	∅	√	√	∅
96	√	√	√	√	∅	√	√	√	∅	∅	*	√	√	√	∅	∅	∅	∅	∅
97	√	√	√	√	∅	∅	∅	*	∅	∅	√	√	√	∅	∅	∅	∅	√	∅
99	√	√	√	√	√	√	∅	√	∅	∅	√	√	√	∅	∅	∅	∅	∅	∅
100	√	N/A	√	√	√	∅	∅	√	∅	∅	√	√	√	∅	∅	∅	∅	∅	∅
101	√	√	*	∅	∅	∅	√	√	∅	∅	∅	√	√	√	∅	∅	∅	∅	∅
102	√	√	√	√	√	√	∅	√	∅	∅	√	√	√	∅	∅	∅	∅	∅	∅
103	√	N/A	√	√	√	√	∅	√	∅	∅	√	√	√	∅	∅	∅	∅	√	∅
104	√	√	*	√	√	√	∅	*	∅	∅	√	√	√	∅	∅	∅	∅	∅	∅

Table 6-8: Reach 5A Floodplain Natural Communities –Biotic Habitat Features (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
105	√	√	∅	√	√	√	∅	√	∅	∅	*	√	√	√	∅	∅	∅	∅	∅
106	√	√	∅	√	∅	√	∅	∅	√	∅	*	√	√	√	∅	∅	√	√	∅
107	√	√	∅	∅	∅	√	∅	√	∅	∅	√	*	√	N/A	∅	∅	∅	√	∅
108	*	√	∅	∅	√	√	∅	*	∅	∅	√	√	√	N/A	Flooded >5cm	Flooded >5cm	∅	√	∅
109	√	√	√	√	∅	√	√	√	∅	∅	*	√	√	*	∅	∅	∅	∅	∅
110	√	N/A	√	∅	√	√	∅	√	∅	∅	√	∅	∅	∅	Flooded >25cm	Flooded >25cm	*	√	∅
111	√	√	∅	∅	∅	∅	∅	∅	∅	∅	*	∅	∅	√	Flooded > 5cm	Flooded >5cm	∅	√	∅
112	√	√	∅	√	∅	∅	∅	N/A	∅	∅	√	√	∅	∅	∅	∅	∅	√	∅
113	√	√	∅	√	∅	∅	∅	√	∅	∅	√	∅	∅	√	∅	∅	∅	∅	∅
114	√	√	√	√	√	√	∅	√	∅	∅	∅	√	∅	∅	∅	∅	∅	∅	∅
115	√	*	*	∅	√	∅	∅	√	∅	∅	√	∅	∅	N/A	∅	∅	N/A	N/A	∅
116	√	√	√	∅	∅	∅	∅	√	∅	∅	√	∅	∅	N/A	∅	∅	N/A	√	∅
117	N/A	∅	∅	√	√	∅	∅	∅	∅	∅	∅	√	∅	∅	∅	∅	∅	N/A	N/A
118	√	√	√	∅	∅	∅	∅	√	∅	∅	√	∅	∅	∅	∅	∅	√	√	∅
119	√	√	*	√	√	√	∅	√	∅	∅	*	∅	∅	∅	∅	∅	∅	∅	∅
120	√	√	√	√	√	√	∅	√	∅	∅	∅	√	√	∅	∅	∅	∅	∅	∅
121	√	√	*	√	∅	√	∅	√	∅	∅	*	∅	√	∅	∅	∅	∅	∅	∅
122	√	√	*	∅	√	∅	∅	√	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
123	√	√	√	√	∅	∅	∅	√	∅	∅	*	∅	√	∅	∅	∅	√	∅	∅
124	√	√	√	∅	√	√	∅	√	∅	∅	*	√	√	∅	∅	∅	∅	∅	∅
125	√	N/A	*	√	√	√	∅	*	∅	∅	*	√	√	∅	∅	∅	√	∅	∅
126	√	√	√	∅	√	√	∅	√	∅	∅	∅	√	∅	∅	∅	∅	∅	∅	∅
127	√	N/A	∅	∅	∅	∅	∅	∅	∅	∅	*	∅	∅	∅	∅	∅	*	√	∅
128	√	N/A	*	∅	∅	∅	∅	√	∅	∅	*	∅	√	∅	∅	∅	√	∅	∅
129	√	√	√	∅	∅	∅	∅	∅	∅	∅	*	∅	√	∅	∅	∅	∅	∅	∅
130	√	√	√	∅	∅	∅	∅	√	∅	∅	√	√	√	∅	∅	∅	∅	∅	∅
131	√	N/A	∅	∅	∅	∅	∅	∅	∅	∅	*	√	√	∅	∅	∅	∅	√	N/A
132	√	N/A	*	∅	∅	∅	∅	*	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
134	√	√	√	√	√	√	√	√	∅	∅	√	√	√	∅	∅	∅	∅	∅	∅
136	√	N/A	*	∅	√	√	∅	√	∅	∅	√	∅	√	√	∅	∅	√	√	∅
137	*	N/A	*	∅	√	√	√	*	∅	√	*	∅	√	√	Flooded >25cm	Flooded >25cm	√	*	∅

Table 6-8: Reach 5A Floodplain Natural Communities –Biotic Habitat Features (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 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
138	√	N/A	*	∅	√	√	∅	*	∅	∅	√	∅	√	∅	∅	∅	∅	√	∅
139	√	N/A	∅	∅	∅	∅	∅	∅	∅	√	√	∅	√	√	Flooded >25cm	Flooded >25cm	∅	√	N/A
140	√	N/A	∅	∅	∅	√	√	√	∅	√	*	∅	√	√	Flooded >25cm	Flooded >25cm	∅	√	N/A
141	√	N/A	∅	∅	∅	∅	∅	∅	∅	∅	*	∅	∅	∅	Flooded >25cm	Flooded >25cm	∅	√	∅
142	√	N/A	*	∅	∅	∅	∅	*	∅	∅	∅	∅	∅	∅	∅	∅	∅	√	∅
143	√	N/A	*	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	√	∅
144	√	N/A	∅	∅	∅	∅	∅	∅	∅	∅	*	∅	∅	∅	Flooded >25cm	Flooded >25cm	∅	√	N/A
146	√	√	√	∅	∅	√	∅	√	∅	∅	*	∅	√	√	∅	∅	∅	∅	∅
147	√	√	*	∅	∅	√	∅	√	∅	∅	√	∅	√	∅	∅	∅	∅	√	∅
148	√	√	√	√	√	√	∅	√	∅	∅	√	√	√	√	∅	∅	∅	√	∅
149	√	√	∅	√	√	√	∅	∅	∅	∅	*	√	√	∅	∅	∅	∅	∅	∅
150	√	√	∅	∅	√	√	∅	√	∅	∅	√	∅	√	∅	Flooded >25cm	Flooded >25cm	∅	√	∅
151	√	N/A	*	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	∅	∅
152	√	N/A	*	∅	√	√	∅	*	∅	∅	*	∅	√	∅	∅	∅	√	√	∅
153	√	N/A	*	∅	√	√	∅	*	∅	∅	*	∅	√	√	∅	∅	∅	√	∅
155	*	N/A	∅	∅	∅	∅	∅	∅	∅	∅	*	∅	∅	∅	Flooded >25cm	Flooded >25cm	∅	√	∅
156	*	N/A	∅	∅	∅	∅	∅	∅	∅	∅	*	∅	∅	∅	∅	Flooded >25cm	∅	∅	∅
157	√	N/A	√	∅	∅	∅	∅	√	∅	∅	*	√	√	∅	∅	Flooded >25cm	∅	√	∅
158	√	N/A	*	∅	∅	∅	∅	*	∅	∅	√	∅	∅	∅	Flooded >25cm	Flooded >25cm	∅	∅	∅
159	√	N/A	∅	∅	∅	∅	∅	∅	∅	∅	√	∅	∅	√	∅	∅	∅	√	√
160	√	N/A	∅	∅	∅	∅	∅	∅	∅	∅	*	∅	∅	∅	Flooded >25cm	Flooded >25cm	∅	√	∅
161	√	N/A	*	∅	∅	√	∅	*	∅	∅	∅	∅	√	∅	∅	∅	∅	√	∅
162	√	√	∅	√	∅	√	√	√	∅	∅	√	√	√	∅	∅	∅	∅	√	∅
163	√	√	√	√	√	√	√	√	∅	∅	√	√	√	∅	∅	∅	∅	√	∅
164	√	√	*	∅	√	√	√	√	∅	∅	*	√	√	∅	∅	∅	∅	∅	∅
165	√	√	√	√	√	√	√	√	∅	∅	√	√	√	√	∅	∅	∅	∅	∅
168	√	N/A	√	∅	√	√	√	√	∅	∅	√	√	√	√	∅	∅	∅	√	∅

Table 6-8: Reach 5A Floodplain Natural Communities –Biotic Habitat Features (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
169	√	N/A	*	∅	√	√	∅	√	∅	∅	*	√	√	∅	∅	∅	∅	√	∅
170	√	N/A	∅	∅	√	√	∅	∅	∅	∅	*	∅	√	√	∅	Flooded >25cm	√	√	∅

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

*=Abundant; √=Present; ∅=Absent

Table 6-9: Reach 5A Floodplain Natural Communities: Summary of Biotic Habitat Features

Habitat Feature	Wildlife Use	% of Stations Abundant	% of Stations Present	% of Stations Absent
Wetland and Aquatic Food	Overall food	16	83	0
Upland Food	Overall food	1	55	1
Shrub thickets with earthworm habitat	Game foraging habitat (e.g., American woodcock)	16	33	39
Live or Dead Trees >30" DBH	Cover/perching/nesting	2	28	70
Standing Dead Trees with Cavities and Perches	Cavities/perching/breeding/nesting/feeding	3	47	50
Cavities in trunks or limbs of Live Trees	Cavities/perching/breeding/nesting	3	44	53
Small Mammal Burrows	Hibernation/breeding/nesting/escape/cover	0	13	87
Shrub and/or herbaceous vegetation	Suitable for birds such as veery nesting	46	40	14
Open sandy to gravelly soils with sparse vegetation	Turtle nesting habitat	0	1	99
Other Wildlife Dens/Nests	Hibernation/breeding/nesting/escape/cover	0	9	91
Dense Herb Cover	Voles, small mammals, amphibians, reptiles	51	34	15
Large Woody Debris on the ground	Small mammals, amphibians, reptiles, invertebrate emergence	3	45	51
Rocks, Crevices, Logs, Roots at Water Edge	Turtles, snakes, frogs, invertebrate emergence	9	46	45
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	16	20	61
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.	14	7	80
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	11	8	81
Depressions serving as vernal pools	Turtles, snakes, frogs, invertebrate emergence	2	14	83
Standing water present at least part of the growing season	Amphibians, turtles, foraging waterfowl, non-breeding amphibians and reptiles (foraging, re-hydration)	15	44	40
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	92

Table 6-10. Wildlife Observations Made During the 2022 Floodplain Surveys

Common Name	Scientific Name	Common Name	Scientific Name
Amphibians and Reptiles		Birds (cont.)	
American toad	<i>Anaxyrus americanus</i>	Northern cardinal	<i>Cardinalis cardinalis</i>
Bullfrog	<i>Lithobates catesbeiana</i>	Northern harrier	<i>Circus hudsonius</i>
Common snapping turtle	<i>Chelydra serpentina</i>	Marsh wren	<i>Cistothorus palustris</i>
Eastern garter snake	<i>Thamnophis sirtalis</i>	Yellow shafted flicker	<i>Colaptes auratus</i>
Greenfrog	<i>Lithobates clamitans</i>	Eastern wood-pewee	<i>Contopus virens</i>
Grey tree frog	<i>Dryophytes versicolor</i>	American crow	<i>Corvus brachyrhynchos</i>
Northern leopard frog	<i>Lithobates pipiens</i>	Fish crow	<i>Corvus ossifragus</i>
Painted turtle	<i>Chrysemys picta</i>	Blue Jay	<i>Cyanocitta cristata</i>
Pickerel frog	<i>Lithobates palustris</i>	Downy woodpecker	<i>Dryobates pubescens</i>
Spring peeper	<i>Pseudacris crucifer</i>	Pileated woodpecker	<i>Dryocopus pileatus</i>
Wood frog	<i>Lithobates sylvaticus</i>	Gray catbird	<i>Dumetella carolinensis</i>
Spotted salamander	<i>Ambystoma maculatum</i>	American kestrel	<i>Falco sparverius</i>
Invertebrates		Common yellow throat	<i>Geothypis trichas</i>
Damselfly	<i>O: Odonata S: Zygoptera</i>	Bald eagle	<i>Haliaeetus leucocephalus</i>
Caddisfly	<i>F: Limnephilidae</i>	Baltimore oriole	<i>Icterus galbula</i>
Darners	<i>O: Odonata F: Aeshnidae</i>	Hairy woodpecker	<i>Leuconotopicus villosus</i>
Ruby Meadowhawk	<i>Sympetrum rubicundulum</i>	Belted kingfisher	<i>Megaceryle alcyon</i>
Isopods	<i>O: Isopoda</i>	Red bellied woodpecker	<i>Melanerpes carolinus</i>
Monarch butterfly	<i>Danaus plexippus</i>	Wild turkey	<i>Meleagris gallopave</i>
Stonefly	<i>O: Plecoptera</i>	Song sparrow	<i>Melospiza melodia</i>
Tiger swallowtail	<i>Papilio glaucus</i>	Great-crested Flycatcher	<i>Myiarchus crinitus</i>
Mammals		Osprey	<i>Pandion haliaetus</i>
Beaver	<i>Castor canadensis</i>	Small sparrow	<i>Passer domesticus</i>
Black bear	<i>Ursus americanus</i>	Chestnut warbler	<i>Phylloscopus castaniceps</i>
Chipmunk	<i>Tamias striatus</i>	Eastern towhee	<i>Pipilo erythrophthalmus</i>
Coyote	<i>Canis latrans</i>	Black capped chickadee	<i>Poecile atricapillus</i>

Table 6-10. Wildlife Observations Made During the 2022 Floodplain Surveys (continued)

Common Name	Scientific Name	Common Name	Scientific Name
Eastern cottontail	<i>Sylvilagus floridanus</i>	Common grackle	<i>Quiscalus quiscula</i>
Muskrat	<i>Ondatra zibethicus</i>	American Woodcock	<i>Scolopax minor</i>
Raccoon	<i>Procyon lotor</i>	Yellow warbler	<i>Setophaga petechia</i>
White-tailed deer	<i>Odocoileus virginianus</i>	American redstart	<i>Setophaga ruticilla</i>
Birds		Eastern bluebird	<i>Sialia sialis</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>	American goldfinch	<i>Spinus tristis</i>
Wood duck	<i>Aix sponsa</i>	Field sparrow	<i>Spizella pusilla</i>
Mallard	<i>Anas platyrhynchos</i>	House wren	<i>Troglodytes aedon</i>
Ruby-throated hummingbird	<i>Archilochus colubris</i>	American robin	<i>Turdus migratorius</i>
Great blue heron	<i>Ardea herodias</i>	Red-eyed vireo	<i>Vireo olivaceus</i>
Tufted titmouse	<i>Baeolophus bicolor</i>	Mourning dove	<i>Zenaida macroura</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>	Veery	<i>Catharus fuscescens</i>
Cedar waxwing	<i>Bombycilla cedrorum</i>	Wood thrush	<i>Hylocichla mustelina</i>
Ruffed grouse	<i>Bonasa umbellus</i>	Common moorhen	<i>Gallinula chloropus</i>
Canada geese	<i>Branta canadensis</i>	Northern waterthrush	<i>Parkesia noveboracensis</i>
Green heron	<i>Butorides virescens</i>		

Table 6-11: State-Listed Rare Species Potentially Associated with Floodplain Wetland Habitats in Reach 5A

Scientific Name	Common Name	State Status
<i>Botaurus lentiginosus</i>	American Bittern	Endangered
<i>Ranunculus pensylvanicus</i>	Bristly Buttercup	Special Concern
<i>Ophiogomphus aspersus</i>	Brook Snaketail	Special Concern
<i>Gallinula galeata</i>	Common Gallinule	Special Concern
<i>Veronicastrum virginicum</i>	Culver's-root	Threatened
<i>Eragrostis frankii</i>	Frank's Lovegrass	Special Concern
<i>Carex grayi</i>	Gray's Sedge	Threatened
<i>Rhododendron maximum</i>	Great Laurel	Threatened
<i>Elymus villosus</i>	Hairy Wild Rye	Endangered
<i>Eleocharis intermedia</i>	Matted Spike-sedge	Threatened
<i>Pieris oleracea</i>	Mustard White	Threatened
<i>Boyeria grafiana</i>	Ocellated Darner	Special Concern
<i>Papaipema sp. 2</i>	Ostrich Fern Borer	Special Concern
<i>Phanogomphus quadricolor</i>	Rapids Clubtail	Endangered
<i>Ophiogomphus carolus</i>	Riffle Snaketail	Threatened
<i>Hylogomphus abbreviatus</i>	Spine-crowned Clubtail	Endangered
<i>Carex tuckermanii</i>	Tuckerman's Sedge	Endangered
<i>Sagittaria cuneata</i>	Wapato	Threatened
<i>Malaxis monophyllos ssp. brachypoda</i>	White Adder's-mouth	Endangered
<i>Myotis septentrionalis</i>	Northern Long-eared Bat	Endangered
<i>Glyptemys insculpta</i>	Wood Turtle	Special Concern

Table 6-12: Reach 5A 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 6-13: Reach 5A Floodplain Upland Habitat Characterization

Parameter	Description of Parameter	Reach 5A 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 Reach 5A; aerial photograph interpretation and updated LiDAR mapping; 2022 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); 2022 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); 2022 field surveys to obtain data for Form FP-1
Plant community	Plant species by community type; density/diversity and interspersions of plant community cover types	Consolidate existing information (from sources below); 2022 field surveys to obtain data for Form FP-1
Overall wildlife habitat/use	Wildlife use; habitat suitability	Consolidate existing information (from sources below); 2022 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; 2022 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); 2022 field surveys to map invasive species and obtain data for Form FP-1

* The existing information used for the Reach 5A 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, the MNHESP investigations of state-listed species through 2012, the Reach 5A vernal pool investigations; and the Final Accessibility Report – all described and referenced in Section 2 of the Reach 5A BRA Work Plan – as well as the USDA NRCS soil surveys, USGS surficial geology mapping, and; FEMA FIS.

Table 6-14: Reach 5A Plant Species in Upland Natural Communities Summary Data

Layer	Common Name	Scientific Name	Status ¹	Occurrence (Number of Plots N=26)
Tree Species	American beech	<i>Fagus grandifolia</i>	Native	3
	American bladdernut	<i>Staphylea trifolia</i>	Native	1
	American elm	<i>Ulmus americana</i>	Native	2
	American hornbeam	<i>Carpinus caroliniana</i>	Native	10
	American linden	<i>Tilia americana</i>	Native	8
	American yew	<i>Taxus canadensis</i>	Native	1
	Bitternut hickory	<i>Carya cordiformis</i>	Native	1
	Black cherry	<i>Prunus serotina</i>	Native	5
	Boxelder maple	<i>Acer negundo</i>	Native	2
	Butternut	<i>Juglans cinerea</i>	Native	1
	Common hackberry	<i>Celtis occidentalis</i>	Native	1
	Eastern cottonwood	<i>Populus deltoides</i>	Native	3
	Eastern hemlock	<i>Tsuga canadensis</i>	Native	2
	Eastern white pine	<i>Pinus strobus</i>	Native	6
	Gray birch	<i>Betula populifolia</i>	Native	1
	Green ash	<i>Fraxinus pennsylvanica</i>	Native	1
	Hickory	<i>Carya sp.</i>	Native	2
	Hop-hornbeam	<i>Ostrya virginiana</i>	Native	4
	Northern red oak	<i>Quercus rubra</i>	Native	4
	Paper birch	<i>Betula papyrifera</i>	Native	1
	Quaking aspen	<i>Populus tremuloides</i>	Native	2
	Red maple	<i>Acer rubrum</i>	Native	3
	Silver maple	<i>Acer saccharinum</i>	Native	1
	Slippery elm	<i>Ulmus rubra</i>	Native	1
	Sugar maple	<i>Acer saccharum</i>	Native	5
	Sweet birch	<i>Betula lenta</i>	Native	3
	White ash	<i>Fraxinus americana</i>	Native	4
	Yellow birch	<i>Betula alleghaniensis</i>	Native	1
Shrub Species	American hazelnut	<i>Corylus americana</i>	Native	1
	American witch hazel	<i>Hamamelis virginiana</i>	Native	2
	Autumn olive	<i>Elaeagnus umbellata</i>	Invasive ^{A,B,C}	3
	Blackberry	<i>Rubus allegheniensis</i>	Native	1
	Burning bush	<i>Euonymus alatus</i>	Invasive ^{A,B,C}	3
	Canada serviceberry	<i>Amelanchier canadensis</i>	Native	1
	European buckthorn	<i>Rhamnus cathartica</i>	Invasive ^{A,B,C}	7
	Japanese barberry	<i>Berberis thunbergii</i>	Invasive ^{A,B,C}	2
	Morrow's honeysuckle	<i>Lonicera morrowii</i>	Invasive ^{A,B}	10

Table 6-14: Reach 5A Plant Species in Upland Natural Communities Summary Data (continued)

Layer	Common Name	Scientific Name	Status ¹	Occurrence (Number of Plots N=26)
Woody Vine Species	Multiflora rose	<i>Rosa multiflora</i>	Invasive ^{A,B,C}	1
	Pussy willow	<i>Salix disolor</i>	Native	2
	Red raspberry	<i>Rubus idaeus</i>	Native	1
	Silky dogwood	<i>Cornus amomum</i>	Native	6
	Speckled alder	<i>Alnus incana</i>	Native	1
	Spicebush	<i>Lindera bensoin</i>	Native	1
	Swamp rose	<i>Rosa palustris</i>	Native	1
	Asian bittersweet	<i>Celastrus orbiculatus</i>	Invasive ^{A,B,C}	9
	Poison ivy	<i>Toxicodendron radicans</i>	Native	6
	River grape	<i>Vitis riparia</i>	Native	8
Herb, Forb and Grass Species	Virginia creeper	<i>Parthenocissus quinquefolia</i>	Native	5
	Virgin's-bower	<i>Clematis virginiana</i>	Native	2
	Avens	<i>Geum sp.</i>	Native	1
	Bedstraw	<i>Galium aparine</i>	Native	3
	Bedstraw	<i>Galium sp.</i>	Native	1
	Bladder campion	<i>Silene vulgaris</i>	Non-native	1
	Bladder sedge	<i>Carex intumescens</i>	Native	1
	Blue cohosh	<i>Caulophyllum thalictroides</i>	Native	4
	Branched scouring-rush	<i>Equisetum scirpoides</i>	Native	1
	Brown knapweed	<i>Centaurea jacea</i>	Non-native	1
	Canada goldenrod	<i>Solidago canadensis</i>	Native	9
	Canada wood nettle	<i>Laportea canadensis</i>	Native	1
	Chickweed	<i>Cerastium arvense</i>	Non-native	1
	Christmas fern	<i>Polystichum acrostichoides</i>	Native	1
	Common dandelion	<i>Taraxacum officinale</i>	Non-native	1
	Common milkweed	<i>Asclepias syriaca</i>	Native	2
	Common St. John's-wort	<i>Hypericum perforatum</i>	Native	1
	Common Strawberry	<i>Fragaria virginiana</i>	Native	2
	Eastern woodland sedge	<i>Carex blanda</i>	Native	1
	Enchanter's-nightshade	<i>Circaea canadensis</i>	Native	1
	Germander speedwell	<i>Veronica chamaedrys</i>	Non-native	1
	Grass-leaved-goldenrod	<i>Euthamia graminifolia</i>	Native	1
	Green-headed coneflower	<i>Rudbeckia laciniata</i>	Native	1
	Hedge bindweed	<i>Calystegia sepium</i>	Native	1
	Hemp dogbane	<i>Apocynum cannabinum</i>	Native	1
	Hemp-nettle	<i>Galeopsis bifida</i>	Non-native	1
	Jewelweed	<i>Impatiens capensis</i>	Native	3

Table 6-14: Reach 5A Plant Species in Upland Natural Communities Summary Data (continued)

Layer	Common Name	Scientific Name	Status ¹	Occurrence (Number of Plots N=26)
	Jumpseed	<i>Persicaria virginiana</i>	Native	3
	Marsh bedstraw	<i>Galium palustre</i>	Native	2
	Meadow horsetail	<i>Equisetum pratense</i>	Native	2
	Moneywort	<i>Lysimachia nummularia</i>	Invasive ^A	1
	Morning-glory	<i>Ipomoea purpurea</i>	Non-native	1
	Narrow leaf plantain	<i>Plantago lanceolata</i>	Non-native	1
	New York Fern	<i>Parathelypteris noveboracensis</i>	Native	1
	Northern maidenhair fern	<i>Adiantum pedatum</i>	Native	1
	Ostrich fern	<i>Matteuccia struthiopteris</i>	Native	4
	Partridge berry	<i>Mitchella repens</i>	Native	1
	Path rush	<i>Juncus tenuis</i>	Native	2
	Pennsylvania sedge	<i>Carex pensylvanica</i>	Native	2
	Purple loosestrife	<i>Lythrum salicaria</i>	Invasive ^{A,B,C}	1
	Purple-stemmed aster	<i>Symphyotrichum puniceum</i>	Native	1
	Queen Anne's Lace	<i>Daucus carota</i>	Non-native	1
	Reed canary grass	<i>Phalaris arundinacea</i>	Invasive ^{A,B,C}	2
	Rough bedstraw	<i>Galium asprellum</i>	Native	2
	Sensitive fern	<i>Onoclea sensibilis</i>	Native	6
	Skunk cabbage	<i>Symplocarpus foetidus</i>	Native	2
	Slender yellow wood sorrel	<i>Oxalis dillenii</i>	Native	1
	Soapwort	<i>Saponaria officinalis</i>	Non-native	1
	Solomon's seal	<i>Polygonatum sp.</i>	Native	1
	Stinging nettle	<i>Urtica dioica</i>	Native	1
	Sweet wood-reed	<i>Cinna arundinacea</i>	Native	1
	Three-leaved goldthread	<i>Coptis trifolia</i>	Native	1
	Tree-clubmoss	<i>Dendrolycopodium obscurum</i>	Native	1
	Violet	<i>Viola sp.</i>	Native	1
	White avens	<i>Geum canadense</i>	Native	1
	Whorled bedstraw	<i>Galium mollugo</i>	Native	1
	Woodfern	<i>Dryopteris carthusiana</i>	Native	1
	Wrinkled-leaved goldenrod	<i>Solidago rugosa</i>	Native	2
Bryophytes	Haircap moss	<i>Polytrichum commune</i>	Native	1

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

Table 6-15: Percent Cover of Trees, Shrubs, Woody Vines, Herbs, and Mosses Estimated within Upland Natural Community Cover Types

		Northern hardwoods- hemlock-white pine forest	Red oak-sugar maple transition forest	Successional Northern Hardwoods	Cultural grasslands/ Agriculture
	Count	3	2	3	10
Trees	Min	63.0	38.0	63.0	0.0
	Max	98.0	38.0	85.5	20.5
	Mean	86.3	38.0	78.0	5.2
	±SE	11.7	0.0	7.5	2.8
Shrubs	Min	10.5	20.5	10.5	0.0
	Max	20.5	85.5	63.0	85.5
	Mean	13.8	53.0	45.5	22.4
	±SE	3.3	32.5	17.5	9.6
Woody Vines	Min	0.0	3.0	20.5	0.0
	Max	63.0	3.0	20.5	38.0
	Mean	21.0	3.0	20.5	7.8
	±SE	21.0	0.0	0.0	3.9
Herbs	Min	3.0	20.5	0.0	10.5
	Max	38.0	63.0	10.5	98.0
	Mean	20.5	41.8	4.5	84.3
	±SE	10.1	21.3	3.1	8.4
Mosses	Min	0.0	0.0	0.0	0.0
	Max	38.0	0.0	10.5	3.0
	Mean	12.7	0.0	3.5	0.6
	±SE	12.7	0.0	3.5	0.4

Table 6-16: Reach 5A Upland Natural Communities –Biotic Habitat Features

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
5	N/A	√	∅	√	√	√	∅	∅	∅	∅	∅	√	∅	N/A	∅	∅	N/A	N/A	N/A
18	N/A	*	∅	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	N/A	N/A
31	N/A	√	∅	∅	∅	∅	∅	√	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	N/A
32	N/A	√	√	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	N/A	N/A
33	N/A	√	√	∅	∅	∅	√	√	∅	√	*	∅	∅	∅	∅	∅	∅	N/A	N/A
34	N/A	*	√	∅	√	√	√	√	∅	√	√	√	∅	√	∅	∅	∅	N/A	N/A
35	N/A	√	√	∅	√	√	√	√	∅	∅	∅	√	√	√	∅	∅	∅	N/A	N/A
36	N/A	√	√	∅	∅	∅	∅	√	∅	∅	√	∅	∅	∅	∅	∅	∅	N/A	N/A
63	N/A	√	√	∅	∅	√	√	√	∅	∅	√	√	∅	∅	∅	∅	∅	N/A	N/A
76	N/A	√	∅	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	N/A	N/A
77	N/A	∅	∅	∅	∅	∅	∅	*	∅	∅	*	∅	∅	∅	∅	∅	∅	N/A	N/A
78	N/A	√	∅	∅	∅	∅	∅	*	∅	∅	*	∅	∅	*	∅	∅	∅	N/A	N/A
80	N/A	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	N/A	N/A
89	N/A	√	√	∅	√	√	∅	∅	∅	∅	∅	√	√	∅	∅	∅	∅	∅	N/A
93	N/A	√	√	∅	∅	∅	∅	*	∅	∅	*	√	√	∅	∅	∅	∅	N/A	N/A
98	N/A	√	√	∅	√	∅	∅	√	∅	∅	∅	√	√	∅	∅	∅	√	√	N/A
133	N/A	√	∅	∅	√	√	∅	√	∅	∅	∅	√	√	∅	∅	∅	∅	N/A	N/A
135	N/A	√	√	∅	√	√	√	√	∅	∅	√	∅	√	√	∅	∅	∅	N/A	N/A
145	N/A	√	∅	∅	∅	∅	∅	√	∅	∅	*	∅	∅	∅	∅	∅	∅	N/A	N/A
154	N/A	√	∅	√	√	√	∅	√	∅	∅	∅	√	√	√	∅	∅	∅	N/A	N/A
166	N/A	√	√	∅	∅	∅	∅	√	∅	∅	*	∅	∅	∅	∅	∅	∅	N/A	N/A
167	N/A	√	√	∅	∅	√	√	√	∅	∅	*	√	√	∅	∅	∅	∅	N/A	N/A

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

*=Abundant; √=Present; ∅=Absent

Table 6-17: Reach 5A Upland Natural Communities: Summary of Biotic Habitat Features

Habitat Feature	Wildlife Use	% of Stations Abundant	% of Stations Present	% of Stations Absent
Wetland and Aquatic Food	Overall food	0	0	0
Upland Food	Overall food	9	82	9
Shrub thickets with earthworm habitat	Game foraging habitat (e.g., American woodcock)	0	55	45
Live or Dead Trees >30" DBH	Cover/perching/nesting	0	9	91
Standing Dead Trees with Cavities and Perches	Cavities/perching/breeding/nesting/feeding	0	36	64
Cavities in trunks or limbs of Live Trees	Cavities/perching/breeding/nesting	0	41	59
Small Mammal Burrows	Hibernation/breeding/nesting/escape/cover	0	27	73
Shrub and/or herbaceous vegetation	Suitable for birds such as veery nesting	27	59	14
Open sandy to gravelly soils with sparse vegetation	Turtle nesting habitat	0	0	100
Other Wildlife Dens/Nests	Hibernation/breeding/nesting/escape/cover	0	9	91
Dense Herb Cover	Voles, small mammals, amphibians, reptiles	45	18	36
Large Woody Debris on the ground	Small mammals, amphibians, reptiles, invertebrate emergence	0	45	55
Rocks, Crevices, Logs, Roots at Water Edge	Turtles, snakes, frogs, invertebrate emergence	0	36	64
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	5	18	73
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	100
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	100
Depressions serving as vernal pools	Turtles, snakes, frogs, invertebrate emergence	0	5	91
Standing water present at least part of the growing season	Amphibians, turtles, foraging waterfowl, non-breeding amphibians and reptiles (foraging, re-hydration)	0	5	9
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	0

Table 6-18: State-Listed Rare Species Potentially Associated with Floodplain Upland Habitats in Reach 5A

Scientific Name	Common Name	State Status
<i>Ranunculus pensylvanicus</i>	Bristly Buttercup	Special Concern
<i>Veronicastrum virginicum</i>	Culver's-Root	Threatened
<i>Eragrostis frankii</i>	Frank's Lovegrass	Special Concern
<i>Carex grayi</i>	Gray's Sedge	Threatened
<i>Rhododendron maximum</i>	Great Laurel	Threatened
<i>Elymus villosus</i>	Hairy Wild Rye	Endangered
<i>Pieris oleracea</i>	Mustard White	Threatened
<i>Papaipema sp. 2</i>	Ostrich Fern Borer	Special Concern
<i>Malaxis monophyllos ssp. brachypoda</i>	White Adder's-Mouth	Endangered
<i>Glyptemys insculpta</i>	Wood Turtle	Special Concern
<i>Myotis septentrionalis</i>	Northern Long-Eared Bat	Endangered

Table 6-19: Reach 5A 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 6-20: Canoe Meadows Bird Observations

This list has been generated from Canoe Meadows information provided on the MAS website as well as the listing for Canoe Meadows observations provided at “ebird.org”: [Canoe Meadows Wildlife Sanctuary, Pittsfield, Berkshire County, MA, US - eBird Hotspot](#). This listing indicates over 180 species of birds that have directly been observed within Canoe Meadows, much of which is located within Reach 5A.

Scientific Name	Common Name
<i>Scolopax minor</i>	American woodcock
<i>Haliaeetus leucocephalus</i>	Bald eagle
<i>Icterus galbula</i>	Baltimore oriole
<i>Riparia riparia</i>	Bank swallow
<i>Hirundo rustica</i>	Barn swallow
<i>Strix varia</i>	Barred owl
<i>Megaceryle alcyon</i>	Belted kingfisher
<i>Mniotilta varia</i>	Black-and-white warbler
<i>Coccyzus erythrophthalmus</i>	Black-billed cuckoo
<i>Setophaga fusca</i>	Blackburnian warbler
<i>Poecile atricapillus</i>	Black-capped chickadee
<i>Nycticorax nycticorax</i>	Black-crowned night heron
<i>Setophaga striata</i>	Blackpoll warbler
<i>Setophaga caerulescens</i>	Black-throated blue warbler
<i>Setophaga virens</i>	Black-throated green warbler
<i>Cyanocitta cristata</i>	Blue jay
<i>Poliophtila caerulea</i>	Blue-gray gnatcatcher
<i>Vireo solitarius</i>	Blue-headed vireo
<i>Spatula discors</i>	Blue-winged teal
<i>Vermivora cyanoptera</i>	Blue-winged warbler
<i>Dolichonyx oryzivorus</i>	Bobolink
<i>Buteo platypterus</i>	Broad-winged hawk
<i>Certhia americana</i>	Brown creeper
<i>Toxostoma rufum</i>	Brown thrasher
<i>Molothrus ater</i>	Brown-headed cowbird
<i>Branta canadensis</i>	Canada goose
<i>Cardellina canadensis</i>	Canada warbler
<i>Bombycilla cedrorum</i>	Cedar waxwing
<i>Setophaga cerulea</i>	Cerulean warbler
<i>Setophaga pensylvanica</i>	Chestnut-sided warbler
<i>Chaetura pelagica</i>	Chimney swift
<i>Spizella passerina</i>	Chipping sparrow
<i>Petrochelidon pyrrhonota</i>	Cliff swallow
<i>Tyto alba</i>	Common barn owl
<i>Bucephala clangula</i>	Common goldeneye
<i>Quiscalus quiscula</i>	Common grackle

Table 6-20: Canoe Meadows Bird Observations (continued)

Scientific Name	Common Name
<i>Mergus merganser</i>	Common merganser
<i>Gallinula chloropus</i>	Common moorhen
<i>Chordeiles minor</i>	Common nighthawk
<i>Corvus corax</i>	Common raven
<i>Acanthis flammea</i>	Common redpoll
<i>Gallinago gallinago</i>	Common snipe
<i>Geothlypis trichas</i>	Common yellowthroat
<i>Accipiter cooperii</i>	Cooper's hawk
<i>Junco hyemalis</i>	Dark-eyed junco
<i>Phalacrocorax auritus</i>	Double-crested cormorant
<i>Dryobates pubescens</i>	Downy woodpecker
<i>Sialia sialis</i>	Eastern bluebird
<i>Tyrannus tyrannus</i>	Eastern kingbird
<i>Sturnella magna</i>	Eastern meadowlark
<i>Sayornis phoebe</i>	Eastern phoebe
<i>Megascops asio</i>	Eastern screech owl
<i>Pipilo erythrophthalmus</i>	Eastern towhee
<i>Contopus virens</i>	Eastern wood-pewee
<i>Sturnus vulgaris</i>	European starling
<i>Hesperiphona vespertinus</i>	Evening grosbeak
<i>Spizella pusilla</i>	Field sparrow
<i>Regulus satrapa</i>	Golden-crowned kinglet
<i>Vermivora chrysoptera</i>	Golden-winged warbler
<i>Dumetella carolinensis</i>	Gray catbird
<i>Ardea herodias</i>	Great blue heron
<i>Myiarchus crinitus</i>	Great crested flycatcher
<i>Bubo virginianus</i>	Great horned owl
<i>Butorides virescens</i>	Green heron
<i>Anas carolinensis</i>	Green-winged teal
<i>Leuconotopicus villosus</i>	Hairy woodpecker
<i>Ammodramus henslowii</i>	Henslow's sparrow
<i>Catharus guttatus</i>	Hermit thrush
<i>Larus argentatus</i>	Herring gull
<i>Lophodytes cucullatus</i>	Hooded merganser
<i>Eremophila alpestris</i>	Horned lark
<i>Haemorhous mexicanus</i>	House finch
<i>Passer domesticus</i>	House sparrow
<i>Troglodytes aedon</i>	House wren
<i>Passerina cyanea</i>	Indigo bunting
<i>Charadrius vociferus</i>	Killdeer
<i>Rallus elegans</i>	King rail

Table 6-20: Canoe Meadows Bird Observations (continued)

Scientific Name	Common Name
<i>Calcarius lapponicus</i>	Lapland longspur
<i>Ixobrychus exilis</i>	Least bittern
<i>Empidonax minimus</i>	Least flycatcher
<i>Calidris minutilla</i>	Least sandpiper
<i>Asio otus</i>	Long-eared owl
<i>Parkesia motacilla</i>	Louisiana waterthrush
<i>Setophaga magnolia</i>	Magnolia warbler
<i>Anas platyrhynchos</i>	Mallard
<i>Cistothorus palustris</i>	Marsh wren
<i>Zenaida macroura</i>	Mourning dove
<i>Geothlypis philadelphia</i>	Mourning warbler
<i>Leiothlypis ruficapilla</i>	Nashville warbler
<i>Colinus virginianus</i>	Northern bobwhite
<i>Cardinalis cardinalis</i>	Northern cardinal
<i>Colaptes auratus</i>	Northern flicker
<i>Accipiter gentilis</i>	Northern goshawk
<i>Circus hudsonius</i>	Northern harrier
<i>Mimus polyglottos</i>	Northern mockingbird
<i>Setophaga americana</i>	Northern parula
<i>Stelgidopteryx serripennis</i>	Northern rough-winged swallow
<i>Aegolius acadicus</i>	Northern saw-whet owl
<i>Lanius borealis</i>	Northern shrike
<i>Parkesia noveboracensis</i>	Northern waterthrush
<i>Contopus cooperi</i>	Olive-sided flycatcher
<i>Pandion haliaetus</i>	Osprey
<i>Seiurus aurocapillus</i>	Ovenbird
<i>Setophaga palmarum</i>	Palm warbler
<i>Falco peregrinus</i>	Peregrine falcon
<i>Podilymbus podiceps</i>	Pied-billed grebe
<i>Dryocopus pileatus</i>	Pileated woodpecker
<i>Pinicola enucleator</i>	Pine grosbeak
<i>Spinus pinus</i>	Pine siskin
<i>Setophaga pinus</i>	Pine warbler
<i>Setophaga discolor</i>	Prairie warbler
<i>Haemorhous purpureus</i>	Purple finch
<i>Progne subis</i>	Purple martin
<i>Melanerpes carolinus</i>	Red-bellied woodpecker
<i>Sitta canadensis</i>	Red-breasted nuthatch
<i>Vireo olivaceus</i>	Red-eyed vireo
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker
<i>Buteo lineatus</i>	Red-shouldered hawk

Table 6-20: Canoe Meadows Bird Observations (continued)

Scientific Name	Common Name
<i>Buteo jamaicensis</i>	Red-tailed hawk
<i>Agelaius phoeniceus</i>	Red-winged blackbird
<i>Larus delawarensis</i>	Ring-billed gull
<i>Aythya collaris</i>	Ring-necked duck
<i>Phasianus colchicus</i>	Ring-necked pheasant
<i>Columba livia</i>	Rock dove
<i>Pheucticus ludovicianus</i>	Rose-breasted grosbeak
<i>Buteo lagopus</i>	Rough-legged hawk
<i>Regulus calendula</i>	Ruby-crowned kinglet
<i>Archilochus colubris</i>	Ruby-throated hummingbird
<i>Bonasa umbellus</i>	Ruffed grouse
<i>Euphagus carolinus</i>	Rusty blackbird
<i>Passerculus sandwichensis</i>	Savannah sparrow
<i>Piranga olivacea</i>	Scarlet tanager
<i>Cistothorus stellaris</i>	Sedge wren
<i>Calidris pusilla</i>	Semipalmated sandpiper
<i>Accipiter striatus</i>	Sharp-shinned hawk
<i>Plectrophenax nivalis</i>	Snow bunting
<i>Anser caerulescens</i>	Snow goose
<i>Tringa solitaria</i>	Solitary sandpiper
<i>Melospiza melodia</i>	Song sparrow
<i>Porzana carolina</i>	Sora
<i>Actitis macularia</i>	Spotted sandpiper
<i>Melospiza georgiana</i>	Swamp sparrow
<i>Leiothlypis peregrina</i>	Tennessee warbler
<i>Tachycineta bicolor</i>	Tree swallow
<i>Baeolophus bicolor</i>	Tufted titmouse
<i>Cathartes aura</i>	Turkey vulture
<i>Catharus fuscescens</i>	Veery
<i>Rallus limicola</i>	Virginia rail
<i>Vireo gilvus</i>	Warbling vireo
<i>Antrostomus vociferus</i>	Whip-poor-will
<i>Sitta carolinensis</i>	White-breasted nuthatch
<i>Zonotrichia albicollis</i>	White-throated sparrow
<i>Meleagris gallopavo</i>	Wild turkey
<i>Empidonax traillii</i>	Willow flycatcher
<i>Troglodytes hiemalis</i>	Winter wren
<i>Aix sponsa</i>	Wood duck
<i>Hylocichla mustelina</i>	Wood thrush
<i>Setophaga coronata</i>	Yellow warbler
<i>Sphyrapicus varius</i>	Yellow-bellied sapsucker

Table 6-20: Canoe Meadows Bird Observations (continued)

<i>Scientific Name</i>	<i>Common Name</i>
<i>Coccyzus americanus</i>	Yellow-billed cuckoo
<i>Icteria virens</i>	Yellow-breasted chat
<i>Setophaga coronata</i>	Yellow-rumped warbler
<i>Vireo flavifrons</i>	Yellow-throated vireo

Table 7-1: Data Collected in 2018-2019 on Vernal Pool inspections in Reach 5A

Historical Data				2018 Biological Data				2019 Biological Data				Physical Data (2018-2019)	
Pool_ID	Obligate Species ^{1,3}	Facultative Species ¹	Permanency ²	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?
5A-VP-1A	FS		T	SS (1), WF (1)		GF, ST		WF (1), WF Larvae		ST, GF (adult)		T ^a	No
5A-VP-1B								SS(4), WF(3), WF Larvae				T ^a	No
5A-VP-1	None	ST, WT, AT, SP, NLF, GF	P	SS (13), WF (Adult)		WT, PT, ST, GF	Yes	SS(9), WF(1)		GF (larvae), PF GF, PT, ST		NA	No
5A-VP-2	None			SS (5), WF (1) Spermatophores	SP			SS(25), WF(13), Spermatophores			Yes	T ^a	No
5A-VP-3	None			WF (Adult)		GF		WF Larvae				T ^a	No
5A-VP-4	WF, FS		T	WF (2), FS				WF(10)				T ^a	No
5A-VP-5	SS, WF,FS		P	WF (250-300), FS					Not Subject to Inspection			T ^a	No
5A-VP-6	FS		T	WF (6), FS					Not Subject to Inspection			T ^a	No
5A-VP-7	WF ¹	GF	T	WF (35-40), FS, WF Chorusing				SS(2), WF(50+)				T ^a	No
5A-VP-8	None			FS				WF(15)				T ^a	No
5A-VP-9	WF, FS	ST, PT, SP, NLF, GF	T	WF (1), WF (Adult), FS, WF Chorusing				WF (30)				T ^a	No
5A-VP-10	None			WF (15-20), FS				WF (> 100)				T ^a	No
5A-VP-12	None			WF (23)				WF(2), SS(1)		ST, GF(larvae, adults)		NA	No
5A-VP-13	None			WF (9)			Yes	None		GF larvae		P	No
5A-VP-14	None			None				WF Larvae				T ^a	No
5A-VP-15	None			WF (20-25), FS				WF Larvae		GF larvae		T ^a	No
5A-VP-15A	None			FS				WF(3)				T ^a	No
5A-VP-16	None			FS				WF(25)				T ^a	No
5A-VP-18	None			None		GF		WF(9)				T ^a	No
5A-VP-18A	None			None		GF		WF Larvae			Yes	T ^a	No
5A-VP-19	None			None	GTF	GF, ST		WF (5)				T ^b	No
5A-VP-20	None			WF (4), FS	SP			WF(7)		GF (larvae)		T ^b	No
5A-VP-21	SS, WF, FS	RSN, SP,NLF, PF, GF	T	WF (250-300), FS	SP			None				T ^b	No
5A-VP-22	WF, FS	SP, NLF, GF	T	WF (170), FS				WF(4)	GTF (calling) SP (calling)			T ^b	No
5A-VP-24	None			WF (10), SS (14)					Not Subject to Inspection			NA	No
5A-VP-26	None			FS				None				T ^b	
5A-VP-27	None			FS				FS				T ^a	No
5A-VP-28A								WF (2, Larvae)	AT			T ^a	No
5A-VP-32	None		T	WF (1), FS				WF (4), FS				T ^a	No
5A-VP-33	WF, FS		T	WF (Adult), FS				WF (10), FS	AT (calling)			T ^a No	No
5A-VP-35	None			FS				WF (6)	AT (breeding/eggs)			T ^b	No
5A-VP-36	WF ¹		T	WF (6)	SP				Not Subject to Inspection			T ^b	
5A-VP-40	WF	PT, NLF, GF	P	WF (1), FS					Not Subject to Inspection			T ^b	
5A-VP-42	None			WF (Adult)				WF (5), WF Larvae				T ^b	
5A-VP-49A	None			None		GF, NLF		WF (1), WF Larvae		GF		T ^b	No
5A-VP-50	None			None		GF		WF Larvae	AT eggs			T ^b No	No
5A-VP-52	None			None	SP, GTF	NLF, GF		WF(1), WF larvae				T ^b No	No
												No	

Table 7-1: Data Collected in 2018-2019 on Vernal Pool inspections in Reach 5A (continued).

Historical Data				2018 Biological Data				2019 Biological Data				Physical Data (2018-2019)	
Pool_ID	Obligate Species ^{1,3}	Facultative Species ¹	Permanency ²	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?
5A-VP-54	None			None	SP, GTF	GF		WF(1), WF larvae		GF (larvae)		T ^a	No
5A-VP-55	None		T	WF (2)	SP, GTF	GF		WF(1), WF Larvae	SP larvae	GF (larvae)		T ^a	No
5A-VP-57	None		T	None	SP, GTF	ST		WF(20), WF Larvae				T ^a	No
5A-VP-59A	None			WF (adults)		NLF		WF(3), WF Larvae		GF		T ^a	No
5A-VP-60	WF	GF	T	WF (9), FS					Not Subject to Inspection			T ^a	No
5A-VP-61	FS, WF	GF	T	WF (70), FS					Not Subject to Inspection			T ^a	No
5A-VP-62	FS, WF	GF	T	WF (7), FS					Not Subject to Inspection			T ^a	No
5A-VP-63	FS	GTF, GF	T	WF (1), FS					Not Subject to Inspection			T ^a	No
5A-VP-64	None			None	GTF, AT	NLF, GF, ST,	Yes	WF (4)	AT Tadpoles	GF (larvae)		T ^a	No
5A-VP-65	None			WF (1)	GTF	ST	Yes	WF(6), WF Larvae				T ^a	No
5A-VP-69	WF, FS	ST, PT, SP, NLF,GF	T	WF (6)	SP				Not Subject to Inspection			T ^a	No
5A-VP-70	WF, FS	PT, SP, NLF, GF	T	WF (65), FS					Not Subject to Inspection			T ^a	No
5A-VP-71	None	ST, PT, GF	P	SS(2), WF(2)	GTF	GF, RSN, PT, carp, perch	Yes	WF (8)		PF (2), RSN, GF (larvae)		NA	No
5A-VP-72	WF	PT, NLF, GF	P	SS(6)	GTF	PF, dead carp and perch	Yes		Not Subject to Inspection			NA	No
5A-VP-73	SS, WF	RSN, SP,NLF	T	SS(13), WF(+200)		GF, BF, PT, ST	Yes		Not Subject to Inspection			NA	No
5A-VP-73A	None			FS, WF(5)		BF, GF, PT			Not Subject to Inspection			T ^b	No
5A-VP-74	SS, FS	GF	T	FS, WF(23)			Yes		Not Subject to Inspection			T ^a	No
5A-VP-77	None			WF (6), SS (18)	SP	GF, NLF	Yes		Not Subject to Inspection			NA	No
5A-VP-79	FS		T	FS		GF			Not Subject to Inspection			T ^b	
5A-VP-80	FS	SP	T	FS				None				T ^b	
5A-VP-81	None			FS				None				T ^a	No
5A-VP-83	None			None		GF		WF Larvae	AT (breeding/eggs)			T ^b No	No

Table 7-1: Data Collected in 2018-2019 on Vernal Pool inspections in Reach 5A (Keys to Table Abbreviations).

1. Species abbreviations:

Code	Meaning	Code	Meaning
<i>Obligate Species</i>		<i>Other Species</i>	
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
<i>Facultative Species</i>		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
NA	Not applicable because pool has already been determined to meet vernal pool criteria under obligate species method based on 2018 data

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 Reach 5A Vernal Pools and the Adjacent Landscape

Surrounding Land Use (Percent of total area from edge of pool) ⁵																												
General Vernal Pool Characteristics												Vegetation Cover (%) ⁴					In-Pool Physical Habitat Structure				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
5A-VP-1A	08/02/22		Y	4	SS / SEM	Mucky Mineral/SiL	0.15	13	5.0	Seasonally Flooded	N	59.7	28.6	56.8	0.0	7.5	10.5	3	0	0	27.8	61.3	0.0	0.2	72.2	36.7	0.0	1.8
5A-VP-1B	08/02/22		Y	4	SEM / SS	Mucky Mineral/SiL	0.13	8	4.1	Seasonally Flooded	N	9.4	52.6	94.1	0.0	0.0	0	0	0	63	27.8	63.4	0.0	0.0	72.2	34.6	0.0	2.0
5A-VP-1	08/02/22		Y	5	POW / DEM / SEM / SS	Mucky Mineral/SiL	0.82	33	15.6	Seasonally to Semi-Perm Flooded	Seasonal	21.1	21.7	23.9	0.0	0.0	3	0	0	10.5	65.8	75.3	0.0	0.3	34.2	23.0	0.0	1.3
5A-VP-2	08/02/22	Y		6	SEM / SS / TFF	Deep Organic Muck	0.23	Dry	0.0	Seasonally Flooded/Saturated	Seasonal	27.1	21.4	97.6	0.0	0.0	3	10.5	0	20.5	62.2	77.5	0.0	0.8	37.8	20.8	0.0	0.9
5A-VP-3	08/01/22	Y		8	SS / TFF	Mineral/VFSL	0.39	6	2.6	Seasonally Flooded	N	86.1	26.2	51.0	0.0	0.0	10.5	3	3	0	100.0	74.2	0.0	12.7	0.0	12.4	0.0	0.6
5A-VP-4	08/01/22	Y		7	SS / TFF	Mineral/SiL	0.23	18	7.6	Seasonally Flooded/Saturated	N	49.0	35.8	83.0	0.0	0.0	20.5	3	0	3	94.5	77.1	5.5	15.8	0.0	6.7	0.0	0.4
5A-VP-5	08/03/22		Y	8	SEM / SS	Mucky Mineral/VFSL	0.33	17	9.6	Seasonally Flooded/Saturated	N	49.2	49.5	54.1	8.5	3.6	3	0	0	0	100.0	70.5	0.0	24.6	0.0	3.8	0.0	1.1
5A-VP-6	08/03/22		Y	9	TFF	Mucky Mineral/VFSL	0.05	18	10.1	Seasonally Flooded	N	73.0	7.3	22.1	5.4	0.0	10.5	0	3	0	100.0	72.3	0.0	21.4	0.0	4.7	0.0	1.7
5A-VP-7	08/03/22	Y		9	SS / TFF	Mineral/VFSL	0.41	18	8.8	Seasonally Flooded	Temporary	77.0	27.2	36.8	0.0	10.4	10.5	3	3	0	81.9	84.8	0.0	0.7	18.1	13.4	0.0	1.1
5A-VP-8	08/03/22	Y		9	SS / TFF	Mineral/SiL	0.07	18	8.5	Seasonally Flooded	Temporary	17.5	74.5	55.9	0.0	10.9	0	3	0	0	100.0	87.9	0.0	1.4	0.0	9.1	0.0	1.6
5A-VP-9	08/03/22		Y	9	SEM / SS / TFF	Mineral/FSL	0.60	16	5.6	Seasonally Flooded	N	3.0	98.0	20.5	0.0	3.0	10.5	3	10.5	3	90.0	80.3	0.0	9.3	5.4	10.0	4.6	0.4
5A-VP-10	08/03/22		Y	11	SS / TFF	Mineral/VFSL	0.17	13	5.8	Seasonally Flooded	N	100.0	16.1	8.1	0.0	0.0	20.5	10.5	0	0	100.0	76.0	0.0	16.3	0.0	6.1	0.0	1.5
5A-VP-12	08/03/22	Y		8	DEM / TFF	Mucky Mineral/SiL	0.27	24	13.7	Seasonally Flooded/Saturated	Seasonal	44.6	15.4	95.1	0.0	0.0	3	10.5	0	0	90.6	77.8	0.8	6.8	8.6	13.8	0.0	1.5
5A-VP-13	08/02/22	Y		11	DEM / TFF	Mucky Mineral/VFSL	0.40	21	11.7	Semi-permanently Flooded	Seasonal	49.3	1.7	78.4	0.0	0.0	3	3	3	0	85.0	75.7	0.2	12.1	8.8	11.2	6.0	1.1
5A-VP-14	08/02/22	Y		9	SS / TFF	Mucky Mineral/VFSL	0.03	5	2.5	Seasonally Flooded/Saturated	N	21.9	0.0	100.0	0.0	0.0	3	0	0	0	66.6	69.8	0.0	17.5	33.4	12.3	0.0	0.5
5A-VP-15	08/02/22	Y		9	DEM / SEM / TFF	Mucky Mineral/FSL	0.37	18	7.8	Semi-permanently Flooded	Seasonal	52.7	0.6	100.0	0.0	0.0	3	10.5	0	0	93.1	65.6	0.5	22.4	6.4	11.1	0.0	0.9
5A-VP-15A	08/02/22	Y		6	TFF	Mucky Mineral/FSL	0.04	15	7.4	Seasonally Flooded/Saturated	N	100.0	0.0	41.5	0.0	0.0	10.5	10.5	0	0	83.9	63.8	0.0	26.6	16.1	9.3	0.0	0.3
5A-VP-16	08/03/22	Y		7	TFF	Mucky Mineral/FSL	0.04	23	10.3	Seasonally Flooded	N	54.8	50.6	68.3	0.0	0.0	20.5	10.5	0	3	100.0	62.2	0.0	29.1	0.0	8.3	0.0	0.5
5A-VP-18	08/03/22	Y		6	SEM / SS /TFF	Mucky Mineral/FSL	0.15			Seasonally Flooded	Temporary	68.6	30.2	29.4	0.0	0.0	20.5	3	0	3	76.8	55.3	23.2	39.0	0.0	5.5	0.0	0.1
5A-VP-18A	08/03/22	Y		6	DEM / TFF	Mucky Mineral/FSL	0.04	24	11.2	Seasonally Flooded/Saturated	Seasonal	22.5	42.5	92.5	0.0	0.0	10.5	0	0	0	96.9	61.9	0.0	31.9	3.1	6.1	0.0	0.1
5A-VP-19	08/05/22	Y		1	SEM	Mineral/SiL	0.14	9	4.5	Seasonally Flooded	N	3.0	3.0	98.0	0.0	0.0	3	0	0	3	38.6	31.5	0.0	11.7	42.8	50.0	18.5	6.7
5A-VP-20	08/04/22		Y	3	SEM / SS / TFF	Mucky Mineral/LS	0.33	16	6.2	Seasonally Flooded/Saturated	N	10.7	51.6	53.9	0.0	0.0	3	0	0	20.5	76.9	51.4	0.1	16.5	5.3	23.1	17.8	9.0
5A-VP-21	08/05/22		Y	4	DEM / SEM / SS	Deep Organic Muck	1.65	23	13.6	Seasonally Flooded/Saturated	N	3.0	85.5	38.0	3.0	10.5	10.5	10.5	3	0	56.4	58.7	8.1	22.5	18.6	13.7	16.9	5.0
5A-VP-22	08/05/22		Y	4	DEM / SS / TFF	Mucky Mineral/LS	0.82	27	12.6	Seasonally Flooded/Saturated	N	60.5	18.3	64.2	0.0	0.0	3	3	0	10.5	56.4	65.9	0.0	7.4	3.8	21.1	39.8	5.5
5A-VP-24	08/04/22	Y		1	RMS	Mucky Mineral/FSL	0.10	12	5.7	Seasonally Flooded	N	85.5	20.5	10.5	0.0	0.0	20.5	3	3	10.5	89.6	64.5	0.0	0.0	10.4	22.7	0.0	12.8

Table 7-2: Habitat Characteristics within Reach 5A Vernal Pools and the Adjacent Landscape (continued)

Surrounding Land Use (Percent of total area from edge of pool) ⁵																												
General Vernal Pool Characteristics												Vegetation Cover (%) ⁴					In-Pool Physical Habitat Structure				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
5A-VP-26	08/04/22	Y		4	SS / TFF	Mucky Mineral/FSL	0.08	15	7.5	Seasonally Flooded	Temporary	0.0	58.3	73.3	0.0	29.9	3	10.5	0	0	82.2	66.2	1.7	10.6	0.7	9.3	15.4	13.9
5A-VP-27	08/04/22	Y		6	TFF	Mineral/FSL	0.08	Dry	0.0	Seasonally Flooded	N	32.6	42.3	31.0	0.0	0.0	3	0	0	0	91.6	67.0	0.0	7.0	0.2	11.0	8.2	15.0
5A-VP-28A	08/04/22	Y		6	SS / TFF	Mucky Mineral/SL	0.03			Seasonally Flooded/Saturated	Temporary	0.0	4.5	100.0	0.0	0.0	20.5	10.5	10.5	0	96.6	62.7	0.0	0.0	3.4	17.8	0.0	19.6
5A-VP-32	08/08/22	Y		7	SS / RMS	Organic/VFSL	0.08	18	11.8	Seasonally Flooded/Saturated	Temporary	76.7	31.3	59.4	0.0	13.1	10.5	3	3	0	76.2	50.0	0.0	0.0	1.8	22.9	22.0	27.1
5A-VP-33	08/08/22	Y		7	DEM / SS / TFF	Mineral/VFSL	0.53	15	7.3	Seasonally Flooded/Saturated	Temporary	11.9	12.6	100.0	0.0	0.0	3	0	0	10.5	93.6	49.9	0.0	0.0	3.8	27.0	2.6	23.1
5A-VP-35	08/08/22	Y		6	SS / TFF	Mucky Mineral/FSL	0.30	4	1.8	Seasonally Flooded/Saturated	Temporary	19.8	31.7	82.3	0.0	0.0	3	3	10.5	3	68.5	47.7	0.0	0.0	3.1	33.0	28.4	19.3
5A-VP-36	08/08/22	Y		6	SEM / SS / TFF	Mineral/VFSL	0.30	12	6.4	Seasonally Flooded/Saturated	N	65.7	53.6	64.4	0.0	0.0	3	0	0	0	54.0	47.7	0.0	0.0	11.3	27.9	34.7	24.4
5A-VP-40	08/08/22	Y		5	SEM / TFF	Mucky Mineral/FSL	0.12	15	7.4	Seasonally Flooded/Saturated	Temporary	60.7	15.7	70.4	0.0	0.0	3	3	0	0	84.9	47.5	0.0	0.2	14.6	36.7	0.6	15.6
5A-VP-42	08/08/22	Y		5	SEM / TFF	Mucky Mineral/FSL	0.13	8	4.3	Seasonally Flooded/Saturated	Temporary	85.6	0.0	87.9	0.0	0.0	3	10.5	0	0	87.5	43.2	0.0	3.8	12.5	42.8	0.0	10.2
5A-VP-49A	08/08/22	Y		5	SS / TFF	Mineral/VFSL	0.03	28	13.6	Seasonally Flooded	N	93.8	18.8	100.0	0.0	0.0	3	0	0	0	64.9	29.6	0.0	6.2	35.1	55.6	0.0	8.5
5A-VP-50	08/25/22	Y		5	SEM / TFF	Mineral/VFSL	0.06	12	6.0	Seasonally Flooded/Saturated	Temporary	56.3	0.0	100.0	0.0	0.0	10.5	0	0	0	72.1	34.5	0.0	7.6	27.1	50.4	0.8	7.5
5A-VP-52	08/09/22	Y		7	SEM / SS	Mucky Mineral/VFSL	0.06	11	5.3	Seasonally Flooded	Temporary	30.0	8.6	100.0	0.0	0.0	3	0	0	3	16.2	38.3	0.0	13.8	27.6	39.4	56.2	8.6
5A-VP-54	08/09/22	Y		7	SEM / SS	Mucky Mineral/VFSL	0.09	5	2.9	Seasonally Flooded/Saturated	N	0.0	38.0	98.0	0.0	0.0	10.5	0	0	3	13.2	37.7	0.0	10.5	25.4	43.1	61.5	8.6
5A-VP-55	08/09/22	Y		7	SEM / SS	Organic/VFSL	0.25	17	8.8	Seasonally Flooded/Saturated	Temporary	0.0	13.6	98.5	0.0	0.0	3	10.5	0	0	41.5	36.2	0.0	8.3	24.1	44.6	34.4	11.0
5A-VP-57	08/09/22	Y		5	TFF	Mineral/VFSL	0.49	37	19.9	Seasonally Flooded	Temporary	85.5	3.0	10.5	0.0	10.5	20.5	10.5	10.5	0	57.7	31.0	0.0	4.8	30.7	47.6	11.5	16.6
5A-VP-59A	08/31/22	Y		6	TFF	Mucky Mineral/VFSL	0.06	12	5.2	Seasonally Flooded/Saturated	N	94.5	12.3	37.2	0.0	5.7	10.5	0	0	0	76.0	36.5	0.0	10.1	24.0	49.4	0.0	4.0
5A-VP-60	08/11/22	Y		6	TFF	Organic/LFS	0.08	16	9.1	Seasonally Flooded	N	81.9	5.5	59.2	0.0	0.0	3	10.5	0	0	99.7	46.8	0.0	20.0	0.3	31.4	0.0	1.9
5A-VP-61	08/11/22	Y		9	TFF	Mineral/VFSL	0.26	17	9.1	Seasonally Flooded	N	66.9	21.2	76.6	0.0	0.0	20.5	10.5	3	0	97.1	47.3	0.0	14.4	2.9	34.8	0.0	3.4
5A-VP-62	08/11/22	Y		9	TFF	Organic/VFSL	0.22	20	9.7	Seasonally Flooded	N	86.7	1.5	23.9	0.0	0.0	10.5	3	0	0	80.4	51.5	0.0	10.8	19.6	34.7	0.0	2.9
5A-VP-63	08/10/22	Y		9	TFF	Mineral/VFSL	0.09	17	10.2	Seasonally Flooded	N	45.5	0.0	43.2	0.0	5.5	10.5	0	0	0	75.4	55.2	0.0	2.5	24.6	37.4	0.0	4.8
5A-VP-64	08/10/22	Y		6	SEM / SS / WM	Mucky Mineral/VFSL	1.00	36	19.8	Seasonally Flooded/Saturated	Temporary	0.0	2.1	98.6	0.0	0.0	10.5	0	0	20.5	38.8	38.8	0.0	0.5	39.6	46.4	21.6	14.3
5A-VP-65	08/10/22	Y		7	SEM	Mineral/VFSL	0.11	28	13.5	Seasonally Flooded/Saturated	Temporary	50.0	25.8	100.0	0.0	0.0	3	3	0	0	54.9	41.5	0.0	0.5	32.5	40.6	12.6	17.4
5A-VP-69	08/10/22	Y		8	SEM / SS	Organic/LS	0.34	14	6.4	Seasonally Flooded	N	48.2	22.3	57.6	12.5	0.0	10.5	0	0	0	89.9	48.5	1.1	4.4	8.4	39.5	0.6	7.5
5A-VP-70	08/10/22	Y		11	SEM / SS	Organic/LS	0.78	27	10.6	Seasonally Flooded	N	60.3	56.0	52.8	19.7	2.0	20.5	0	0	3	86.0	42.7	3.9	4.0	10.0	44.9	0.0	8.4
5A-VP-71	08/11/22		Y	10	DEM / SEM / SS	Organic/FSL	0.47	19	14.0	Seasonally Flooded/Saturated	Temporary	0.0	20.5	100.0	0.0	0.0	3	0	0	10.5	17.2	50.4	0.0	0.5	44.7	42.6	38.0	6.6
5A-VP-72	08/11/22		Y	9	DEM / SEM / SS	Organic/FSL	1.26			Semi-permanently Flooded	Temporary	0.0	38.0	98.0	0.0	0.0	3	0	0	20.5	17.8	47.1	0.0	5.0	28.7	44.0	53.4	3.9
5A-VP-73	08/11/22		Y	5	SS / TFF	Organic/FSL	0.48	19	9.7	Seasonally Flooded/Saturated	Temporary	22.3	30.7	91.8	1.3	0.0	3	0	0	10.5	58.8	41.5	0.0	10.9	13.6	42.5	27.6	5.1

Table 7-2: Habitat Characteristics within Reach 5A Vernal Pools and the Adjacent Landscape (continued)

Surrounding Land Use (Percent of total area from edge of pool) ⁵																												
General Vernal Pool Characteristics												Vegetation Cover (%) ⁴					In-Pool Physical Habitat Structure				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
5A-VP-73A	08/11/22	Y		4	SS / TFF	Mucky Mineral/FSL	0.15	11	5.2	Seasonally Flooded	N	100.0	39.6	66.6	0.0	6.3	10.5	0	0	0	64.7	38.0	0.0	5.3	35.3	50.2	0.0	6.4
5A-VP-74	08/11/22	Y		7	TFF	Organic/LFS	0.26	24	9.6	Seasonally Flooded	N	76.6	10.4	32.1	0.0	8.6	10.5	10.5	0	0	93.5	42.1	0.0	6.5	6.5	43.5	0.0	7.8
5A-VP-77	09/15/22		Y	1	SEM / SS / TFF	Deep Organic Muck	3.93	Dry	0.0	Seasonally Flooded	Seasonal	3.0	85.5	63.0	20.5	0.0	10.5	3	3	38	85.2	58.0	9.4	9.7	5.0	31.9	0.4	0.4
5A-VP-79	08/24/22	Y		3	SS / TFF	Organic/VFSL	0.08	12	6.9	Seasonally Flooded	N	49.0	18.9	93.0	0.0	18.3	10.5	0	0	0	92.3	46.4	0.0	1.1	4.6	49.7	3.1	2.9
5A-VP-80	08/24/22	Y		3	SS / TFF	Mucky Mineral/FSL	0.83	15	8.8	Seasonally Flooded/Saturated	Temporary	50.4	20.1	100.0	0.0	0.0	10.5	0	0	0	94.6	39.2	0.0	2.8	5.4	55.7	0.0	2.3
5A-VP-81	08/24/22	Y		3	TFF	Mucky Mineral/SL	0.09	16	9.7	Seasonally Flooded	N	80.8	0.0	79.2	0.0	0.0	3	10.5	0	0	92.4	48.8	0.0	0.2	3.7	48.4	3.9	2.5
5A-VP-83	08/25/22	Y		3	SEM	Mineral/SL	0.05	17	10.4	Seasonally Flooded	N	3.0	0.0	98.0	0.0	0.0	3	0	0	0	25.7	39.8	1.7	0.1	72.7	58.6	0.0	1.5

1. SS = Shrub Swamp, SEM = Shallow Emergent Marsh, DEM = Deep Emergent Marsh, TFF = Transitional Floodplain Forest, RMS = Red Maple Swamp, POW = Palustrine Open Water

2. Surface horizon / sub-surface soil textures

3. Hydrologic Regimes from FGDC (2013)

4. Percent cover of vegetation layers as measured from line-intercept transects across each vernal pool (n = 49) or as estimated in pools larger than one acre or pools with high shrub densities and/or deep water that restricted access across the pool (n = 10).

5. Percent cover of select habitats within the VPE = Vernal Pool Envelope (0-100 feet) and CTH = Critical Terrestrial Habitat (100-750 feet) from the edge of the pool. Landscape cover metrics based on MassGIS Land Cover/Land Use data (2016).

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

Surrounding Land Use (Percent of total area from edge of pool) ¹																		
Vegetation Cover (%)						In-Pool Physical Habitat Structure				All Forest		Developed		Open Space		Scrub/Shrub		Number of Pools within 1000 feet
	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	
Min	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	0.0	13.2	29.6	0.0	0.0	0.0	3.8	0.0	0.1	1
Max	100.0	98.0	100.0	20.5	29.9	20.5	10.5	10.5	63.0	100.0	87.9	23.2	39.0	72.7	58.6	61.5	27.1	11
Mean	45.5	25.8	68.1	1.2	2.5	8.2	3.7	1.2	4.6	72.9	55.2	1.0	9.0	17.0	29.2	9.2	6.6	6.3
Count	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
SE	4.3	3.1	3.8	0.5	0.7	0.8	0.6	0.4	1.4	3.3	2.0	0.4	1.2	2.4	2.1	2.1	0.9	0.3

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. Reach 5A Plant Species Summary Data for Certified Vernal Pools

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=59)
Tree Species	Boxelder maple	<i>Acer negundo</i>	Native	19
	Red maple	<i>Acer rubrum</i>	Native	13
	Silver maple	<i>Acer saccharinum</i>	Native	33
	Sugar maple	<i>Acer saccharum</i>	Native	3
	Yellow birch	<i>Betula alleghaniensis</i>	Native	2
	American hornbeam	<i>Carpinus caroliniana</i>	Native	7
	Common hackberry	<i>Celtis occidentalis</i>	Native	1
	Dotted hawthorn	<i>Crataegus punctata</i>	Native	7
	American beech	<i>Fagus grandifolia</i>	Native	1
	Green ash	<i>Fraxinus pennsylvanica</i>	Native	2
	Butternut	<i>Juglans cinerea</i>	Native	2
	Quaking aspen	<i>Populus tremuloides</i>	Native	2
	Pin cherry	<i>Prunus pensylvanica</i>	Native	1
	Black cherry	<i>Prunus serotina</i>	Native	3
	Eastern cottonwood	<i>Pupulus deltoides</i>	Native	6
	Black willow	<i>Salix nigra</i>	Native	8
	American linden	<i>Tilia americana</i>	Native	4
	Eastern hemlock	<i>Tsuga canadensis</i>	Native	2
	American elm	<i>Ulmus americana</i>	Native	13

Table 7-4. Reach 5A Plant Species Summary Data for Certified Vernal Pools (continued)

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=59)
Shrub Species	Speckled alder	<i>Alnus incana</i>	Native	3
	Japanese barberry	<i>Berberis thunbergii</i>	Invasive ^{A,B,C}	1
	Buttonbush	<i>Cephalanthus occidentalis</i>	Native	3
	Silky dogwood	<i>Cornus amomum</i>	Native	39
	American hazelnut	<i>Corylus americana</i>	Native	1
	Burning bush	<i>Euonymus alatus</i>	Invasive ^{A,B,C}	1
	Glossy buckthorn	<i>Frangula alnus</i>	Invasive ^{A,B,C}	1
	Winterberry	<i>Ilex verticillata</i>	Native	2
	Border privet	<i>Ligustrum obtusifolium</i>	Invasive ^D	2
	Morrow's honeysuckle	<i>Lonicera morrowii</i>	Invasive ^{A,B}	12
	Dock-leaved smartweed	<i>Persicaria lapathifolia</i>	Native	1
	European buckthorn	<i>Rhamnus cathartica</i>	Invasive ^{A,B,C}	9
	Multiflora rose	<i>Rosa multiflora</i>	ABC	8
	Pussy willow	<i>Salix discolor</i>	Native	3
	Willow	<i>Salix sp.</i>	Native	6
	Elderberry	<i>Sambucus canadensis</i>	Native	2
	White Meadowsweet	<i>Spiraea alba</i>	Native	3
	Arrowwood	<i>Viburnum dentatum</i>	Native	2
Woody Vines	Asian bittersweet	<i>Celastrus orbiculatus</i>	Invasive ^{A,B,C}	2
	Virginia creeper	<i>Parthenocissus quiquefolia</i>	Native	1
	Poison ivy	<i>Toxicodendron radicans</i>	Native	5
	River grape	<i>Vitis riparia</i>	Native	17

Table 7-4. Reach 5A Plant Species Summary Data for Certified Vernal Pools (continued)

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=59)
Herb, Forb and Grass Species	Sweet flag	<i>Acorus americanus</i>	Native	1
	Snakeroot	<i>Ageratina altissima</i>	Native	
	Northern water-plantain	<i>Alisma triviale</i>	Native	
	Hemp dogbane	<i>Apocynum cannabinum</i>	Native	1
	Swamp milkweed	<i>Asclepias incarnata</i>	Native	1
	Lady fern	<i>Athyrium angustum</i>	Native ₁	1
	Nodding beggar-ticks	<i>Bidens cernua</i>	Native ₁₇	3
	Devil's beggar-tick	<i>Bidens frondosa</i>	Native	14
	Small-spiked false nettle	<i>Boehmeria cylindrica</i>	Native	5
	Black mustard	<i>Brassica nigra</i>	Non-native	4
	Water starwort	<i>Callitriche palustris</i>	Native	2
	Fringed sedge	<i>Carex crinita</i>	Native	5
	Greater bladder sedge	<i>Carex intumescens</i>	Native	1
	Hop sedge	<i>Carex lupulina</i>	Native	3
	Lurid sedge	<i>Carex lurida</i>	Native	1
	Sedge	<i>Carex sp.</i>	Native	11
	Tussock sedge	<i>Carex stricta</i>	Native	2
	Fireweed	<i>Chamerion angustifolium</i>	Native	3
	White turtlehead	<i>Chelone glabra</i>	Native	1
	Bulblet-bearing water-hemlock	<i>Cicuta bulbifera</i>	Native	2
	Sweet wood-reed	<i>Cinna arundinacea</i>	Native	1
	Enchanter's-nightshade	<i>Circaea canadensis</i>	Native	1
	Common dodder	<i>Cuscuta gronovii</i>	Native	8

Table 7-4. Reach 5A Plant Species Summary Data for Certified Vernal Pools (continued)

Layer	Common Name	Scientific Name	Status ¹	Occurrence (Number of Pools N=59)
	Tufted hairgrass	<i>Deschampsia cespitosa</i>	Non-native	1
	Barnyard grass	<i>Echinochloa crus-galli</i>	Non-native	2
	Needle spikeweed	<i>Eleocharis acicularis</i>	Native	2
	Spikerush	<i>Eleocharis sp.</i>	Native	6
	Purple-leaved willowherb	<i>Epilobium ciliatum</i>	Native	1
	Tall scouring-rush	<i>Equisetum hyemale</i>	Native	2
	Burnweed	<i>Erechtites hieraciifolius</i>	Native	4
	Spotted joe-pye weed	<i>Eutrochium maculatum</i>	Native	3
	Marsh bedstraw	<i>Galium palustre</i>	Native	12
	White avens	<i>Geum canadense</i>	Native	2
	Rattlesnake grass	<i>Glyceria canadensis</i>	Native	2
	Jewelweed	<i>Impatiens capensis</i>	Native	23
	Yellow iris	<i>Iris pseudacorus</i>	Invasive ^{A,B}	8
	Blueflag	<i>Iris versicolor</i>	Native	1
	Canadian rush	<i>Juncus canadensis</i>	Native	1
	Soft rush	<i>Juncus effusus</i>	Native	1
	Canada wood nettle	<i>Laportea canadensis</i>	Native	3
	Rice cut-grass	<i>Leersia oryzoides</i>	Native	8
	Common duckweed	<i>Lemna minor</i>	Native	1
	Common water-primrose	<i>Ludwigia palustris</i>	Native	4
	Northern water-horehound	<i>Lycopus uniflorus</i>	Native	3
	Fringed yellow-loosestrife	<i>Lysimachia ciliata</i>	Native	2
	Moneywort	<i>Lysimachia nummularia</i>	Invasive ^{A,C}	31

Table 7-4. Reach 5A Plant Species Summary Data for Certified Vernal Pools (continued)

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=59)
	Swamp candles	<i>Lysimachia terrestris</i>	Native	1
	Yellow loosestrife	<i>Lysimachia vulgaris</i>	Native	1
	Purple loosestrife	<i>Lythrum salicaria</i>	Invasive ^{A,B,C}	29
	Ostrich fern	<i>Matteuccia struthiopteris</i>	Native	2
	Wild mint	<i>Mentha canadensis</i>	Native	1
	Monkey-flower	<i>Mimulus ringens</i>	Native	1
	Water forget-me-not	<i>Myosotis scorpioides</i>	Invasive ^D	15
	Sensitive fern	<i>Onoclea sensibilis</i>	Native	34
	Interrupted fern	<i>Osmunda claytoniana</i>	Native	2
	Royal fern	<i>Osmunda regalis</i>	Native	2
	Royal fern	<i>Osumnda regalis</i>	Native	2
	New York fern	<i>Parathelypteris noveboracensis</i>	Native	1
	Ditch-stonecrop	<i>Penthorum sedoides</i>	Native	9
	Halberd-leaved tearthumb	<i>Persicaria arifolia</i>	Native	1
	Water-pepper smartweed	<i>Persicaria hydropiper</i>	Native	6
	False water-pepper	<i>Persicaria hydropiperoides</i>	Native	8
	Pennsylvania smartweed	<i>Persicaria pensylvanica</i>	Native	8
	Dotted smartweed	<i>Persicaria punctata</i>	Native	10
	Arrow-leaved tearthumb	<i>Persicaria sagittata</i>	Native	11
	Smartweed	<i>Persicaria sp.</i>	Native	9
	Jumpseed	<i>Persicaria virginiana</i>	Native	4
	Reed canary grass	<i>Phalaris arundinacea</i>	Invasive ^{A,B,C}	14
	Common reed	<i>Phragmites australis</i>	Invasive ^{A,B,C}	3

Table 7-4. Reach 5A Plant Species Summary Data for Certified Vernal Pools (continued)

Layer	Common Name	Scientific Name	Status	Occurrence (Number of Pools N=59)
	Clearweed	<i>Pilea pumila</i>	Native	7
	Pickernelweed	<i>Pontederia cordata</i>	Native	1
	Bristly buttercup	<i>Ranunculus hispidus</i>	Native	1
	Blisterwort	<i>Ranunculus recurvatus</i>	Native	1
	Green-headed coneflower	<i>Rudbeckia laciniata</i>	Native	6
	Common arrowhead	<i>Sagittaria latifolia</i>	Native	5
	Soft-stemmed bulrush	<i>Schoenoplectus tabernaemontani</i>	Native	1
	Woolgrass	<i>Scirpus cyperinus</i>	Native	10
	Mad dog skullcap	<i>Scutellaria lateriflora</i>	Native	1
	One-seeded burr-cucumber	<i>Sicyos angulatus</i>	Native	1
	Water parsnip	<i>Sium suave</i>	Native	5
	Climbing nightshade	<i>Solanum dulcamara</i>	Non-native	4
	American bur-reed	<i>Sparganium americanum</i>	Native	3
	Bur-reed	<i>Sparganium sp.</i>	Native	5
	Aster	<i>Symphyotrichum sp.</i>	Native	1
	Skunk cabbage	<i>Symplocarpus foetidus</i>	Native	4
	Marsh fern	<i>Thelypteris palustris</i>	Native	4
	Massachusetts fern	<i>Thelypteris simulata</i>	Native	1
	Stinging nettle	<i>Urtica dioica</i>	Native	2
	Blue vervain	<i>Verbena hastata</i>	Native	1
	Narrow-leaved speedwell	<i>Veronica scutellata</i>	Native	1
	Rough cocklebur	<i>Xanthium strumarium</i>	Non-native	6

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

Table 7-5: Soil and Water Chemistry within the 15 Randomly Selected Vernal Pools

Vernal Pool ID	Soil Depth 0-8"						Water Chemistry					
	Total Organic Carbon						Dissolved Oxygen					
	Organic Carbon mg/Kg ¹	% Organic Carbon Dry Weight ²	% Moisture	% Solids	pH (SU)	Date	Temperature °C	%	mg/L	Specific Conductivity	pH	Date
5AVP3	15000	1.5	31.8	68.2	6.1	5/17/23	13.9	33.6	3.47	143.2	6.45	4/26/23
5AVP5	33000	3.3	41.1	58.9	5.7	5/17/23	10.4	27.4	3.95	112.4	6.22	4/26/23
5AVP12	61000	6.1	56.9	43.1	6.1	5/17/23	11.1	57.3	6.31	225.2	6.96	4/26/23
5AVP16	33000	3.3	40.0	60.0	6.0	5/17/23	11.7	43.4	4.70	228.7	6.82	4/26/23
5AVP18	18000	1.8	28.3	71.7	6.3	5/17/23	18.0	153.9	14.51	1578	7.18	4/26/23
5AVP20	27000	2.7	31.6	68.4	6.1	5/18/23	11.4	70.3	7.33	421.7	6.52	4/26/23
5AVP22	24000	2.4	38.8	61.2	6.2	5/17/23	11.7	17.5	1.90	192.5	6.62	4/26/23
5AVP27	18000	1.8	32.6	67.4	5.9	5/17/23	Dry					4/26/23
5AVP40	51000	5.1	45.9	54.1	5.9	5/17/23	14.4	11.7	1.19	231.8	6.64	4/21/23
5AVP50	32000	3.2	41.4	58.6	6.9	5/17/23	14.8	76.3	7.72	287.0	7.32	4/25/23
5AVP63	50000	5	44.6	55.4	6.1	5/17/23	10.8	19.6	2.05	101.6	6.14	4/25/23
5AVP69	17000	1.7	36.6	63.4	6.3	5/17/23	7.3	57.6	6.92	309	7.27	4/25/23
5AVP72	110000	11	60.9	39.1	5.6	5/17/23	11.7	74.6	8.09	167.8	6.54	4/25/23
5AVP79	27000	2.7	42.4	57.6	5.7	5/18/23	7.7	29.5	3.52	100.6	6.02	4/26/23
5AVP80	91000	9.1	59.1	40.9	6.4	5/18/23	8.4	21.1	2.47	278.5	6.83	4/26/23

1. Method: EPA-Lloyd Kahn, 9045D, Prep type: Total/NA Soluble
2. Percent Organic Carbon Dry Weight of each sample was determined by dividing each Organic Carbon value by 10,000 (1% of the analysis unit where 1 ppm = 1 mg/K or 10,000).

Table 7-6: State-Listed Rare Species Potentially Associated with Vernal Pool Habitats in Reach 5A

Scientific Name	Common Name	State Status
<i>Botaurus lentiginosus</i>	American Bittern	Endangered
<i>Ranunculus pensylvanicus</i>	Bristly Buttercup	Special Concern
<i>Gallinula galeata</i>	Common Gallinule	Special Concern
<i>Veronicastrum virginicum</i>	Culver's-Root	Threatened
<i>Carex grayi</i>	Gray's Sedge	Threatened
<i>Eleocharis intermedia</i>	Matted Spike-Sedge	Threatened
<i>Pieris oleracea</i>	Mustard White	Threatened
<i>Papaipema sp. 2</i>	Ostrich Fern Borer	Special Concern
<i>Carex tuckermanii</i>	Tuckerman's Sedge	Endangered
<i>Sagittaria cuneata</i>	Wapato	Threatened
<i>Malaxis monophyllos ssp. brachypoda</i>	White Adder's-Mouth	Endangered
<i>Glyptemys insculpta</i>	Wood Turtle	Special Concern

Table 7-7: Reach 5A Vernal Pool Tier Ratings*

Pool_ID	Category A				Category B			
	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
5A-VP-1A	N	Y	N	1	Y	Y	2	Tier I
5A-VP-1B	N	N	N	0	Y	Y	2	Tier III
5A-VP-1	N	Y	N	1	Y	Y	2	Tier I
5A-VP-2	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-3	N	N	N	0	Y	Y	2	Tier III
5A-VP-4	N	Y	N	1	Y	Y	2	Tier I
5A-VP-5	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-6	N	Y	N	1	Y	Y	2	Tier I
5A-VP-7	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-8	N	N	N	0	Y	Y	2	Tier III
5A-VP-9	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-10	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-12	N	Y	N	1	Y	Y	2	Tier I
5A-VP-13	N	N	N	0	Y	Y	2	Tier III
5A-VP-14	N	N	N	0	Y	Y	2	Tier III
5A-VP-15	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-15A	N	Y	N	1	Y	Y	2	Tier I
5A-VP-16	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-18	N	N	N	0	Y	Y	2	Tier III
5A-VP-18A	N	N	N	0	Y	Y	2	Tier III
5A-VP-19	N	N	N	0	Y	Y	2	Tier III
5A-VP-20	N	Y	N	1	Y	Y	2	Tier I
5A-VP-21	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-22	N	Y	Y	2	Y	Y	2	Tier I

Table 7-7: Reach 5A Vernal Pool Tier Ratings (continued)*

Pool_ID	Category A				Category B			
	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
5A-VP-24	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-26	N	N	N	0	Y	Y	2	Tier III
5A-VP-27	N	N	N	0	Y	Y	2	Tier III
5A-VP-28A	N	N	N	0	Y	Y	2	Tier III
5A-VP-32	N	Y	N	1	Y	Y	2	Tier I
5A-VP-33	N	Y	N	1	Y	Y	2	Tier I
5A-VP-35	N	Y	N	1	Y	Y	2	Tier I
5A-VP-36	N	N	N	0	Y	Y	2	Tier III
5A-VP-40	N	Y	N	1	Y	Y	2	Tier I
5A-VP-42	N	N	N	0	Y	Y	2	Tier III
5A-VP-49A	N	N	N	0	Y	Y	2	Tier III
5A-VP-50	N	Y	N	1	Y	Y	2	Tier I
5A-VP-52	N	N	N	0	Y	Y	2	Tier III
5A-VP-54	N	N	N	0	Y	Y	2	Tier III
5A-VP-55	N	N	N	0	Y	Y	2	Tier III
5A-VP-57	N	N	N	0	Y	Y	2	Tier III
5A-VP-59A	N	N	N	0	Y	Y	2	Tier III
5A-VP-60	N	Y	N	1	Y	Y	2	Tier I
5A-VP-61	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-62	N	Y	N	1	Y	Y	2	Tier I
5A-VP-63	N	Y	N	1	Y	Y	2	Tier I
5A-VP-64	N	N	N	0	Y	Y	2	Tier III
5A-VP-65	N	N	N	0	Y	Y	2	Tier III
5A-VP-69	N	N	N	0	Y	Y	2	Tier III

Table 7-7: Reach 5A Vernal Pool Tier Ratings (continued)*

Pool_ID	Category A				Category B			
	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
5A-VP-70	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-71	N	Y	N	1	Y	Y	2	Tier I
5A-VP-72	N	N	N	0	Y	Y	2	Tier III
5A-VP-73	N	Y	Y	2	Y	Y	2	Tier I
5A-VP-73A	N	Y	N	1	Y	Y	2	Tier I
5A-VP-74	Y	Y	N	2	Y	Y	2	Tier I
5A-VP-77	N	Y	N	1	Y	Y	2	Tier I
5A-VP-79	N	N	N	0	Y	Y	2	Tier III
5A-VP-80	N	N	N	0	Y	Y	2	Tier III
5A-VP-81	N	N	N	0	Y	Y	2	Tier III
5A-VP-83	N	N	N	0	Y	Y	2	Tier III

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

Table 8-1: State-Listed Species with Species Habitat Mapping Overlapping Reach 5A as shown on MNHESP Data Provided in October 2022

Scientific Name	Common Name	State Status	Area in 5A (Acres)	Taxonomic Group
<i>Botaurus lentiginosus</i>	American Bittern	E	164.0	Bird
<i>Ranunculus pensylvanicus</i>	Bristly Buttercup	SC	29.4	Plant
<i>Ophiogomphus aspersus</i>	Brook Snaketail	SC	240.6	Invertebrate
<i>Gallinula galeata</i>	Common Gallinule	SC	16.2	Bird
<i>Veronicastrum virginicum</i>	Culver's-Root	T	0.1	Plant
<i>Eragrostis frankii</i>	Frank's Lovegrass	SC	25.9	Plant
<i>Carex grayi</i>	Gray's Sedge	T	27.5	Plant
<i>Rhododendron maximum</i>	Great Laurel	T	1.7	Plant
<i>Elymus villosus</i>	Hairy Wild Rye	E	18.9	Plant
<i>Eleocharis intermedia</i>	Matted Spike-Eedge	T	116.8	Plant
<i>Pieris oleracea</i>	Mustard White	T	327.4	Invertebrate
<i>Boyeria grafiana</i>	Ocellated Darner	SC	276.8	Invertebrate
<i>Papaipema sp. 2</i>	Ostrich Fern Borer	SC	171.3	Invertebrate
<i>Phanogomphus quadricolor</i>	Rapids Clubtail	E	55.0	Invertebrate
<i>Ophiogomphus carolus</i>	Riffle Snaketail	T	191.7	Invertebrate
<i>Hylogomphus abbreviatus</i>	Spine-Crowned Clubtail	S	256.2	Invertebrate
<i>Carex tuckermanii</i>	Tuckerman's Sedge	E	0.9	Plant
<i>Sagittaria cuneata</i>	Wapato	T	171.2	Plant
<i>Malaxis monophyllos ssp. brachypoda</i>	White Adder's-Mouth	E	1.6	Plant
<i>Glyptemys insculpta</i>	Wood Turtle	SC	396.3	Reptile
<i>Myotis septentrionalis</i>	Northern Long-eared Bat	E	409.8*	Mammal

*The acreage of the Northern Long-Eared Bat is derived from the IPaC data, since no Species Habitat Map for this species was provided by MNHESP.

Table 10-1: R5A BRA Form H: Site Degradation/Disturbance Evaluation Criteria

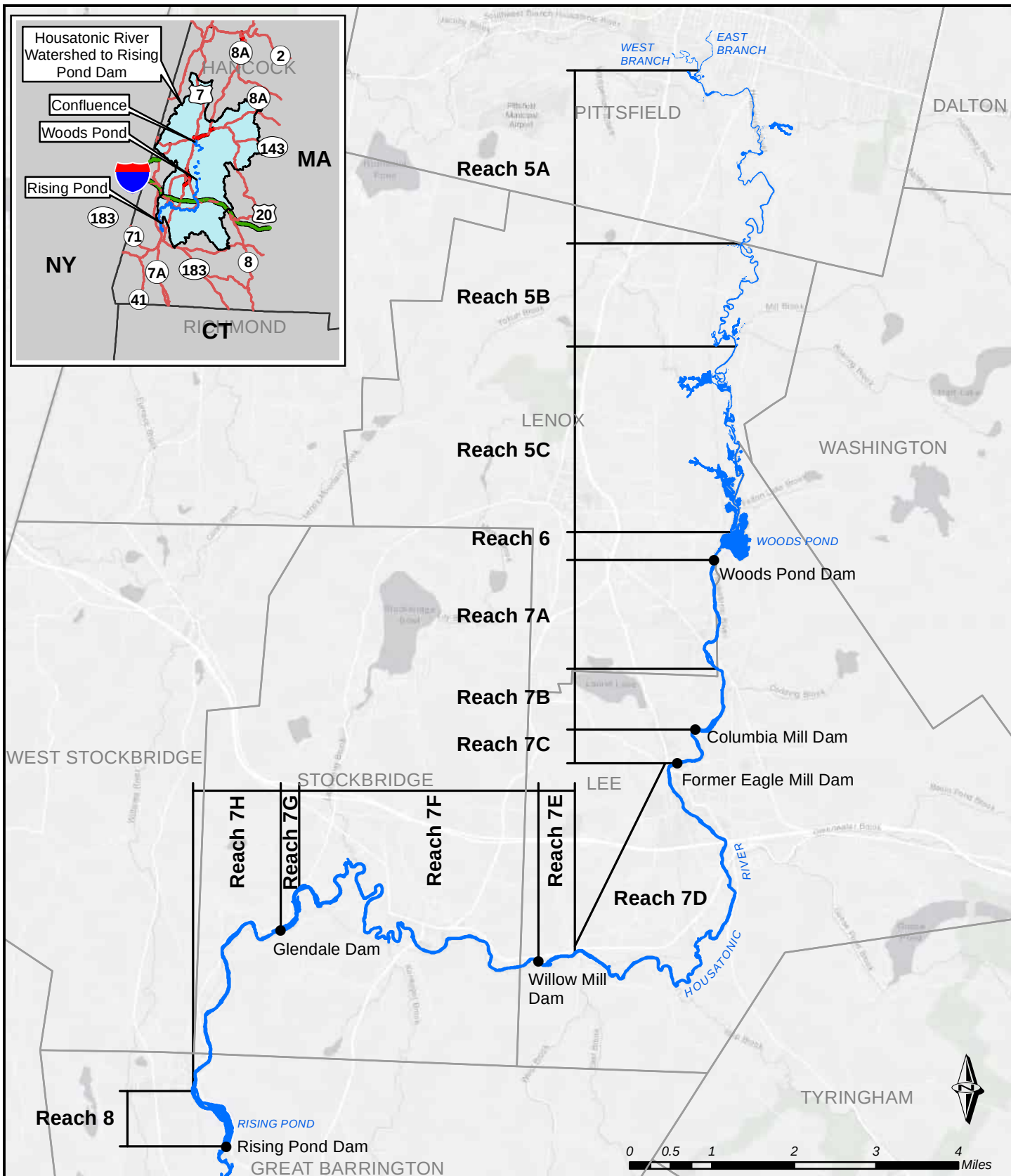
Area of Review ¹	Evaluation Criteria	SC*	Description/Rationale	Condition	Rating	Score
Area 5A-1 East Side of the River	invasive Species	3	Relative abundance of invasive plant species	Invasive species present but not dominant in most strata	3	9
	Site Stability	2	Level of erosion or sedimentation	Low level or none	1	2
	Soil Profile Integrity	2	Evidence of disturbed soil profile	Moderate	2	4
	Fill Disturbance	3	Evidence of filling	Moderate	2	6
	Surface Degradation	3	Evidence of dumping or other disturbance	Dumping or other physical disturbance evident	3	9
	Land Use Juxtaposition	1	Proximity and accessibility to land uses which may contribute to disturbance of the site.	Proximate and accessible to developed land use	3	3
	Size	1	Area of the evaluation unit	Large (>2 acres)	3	3
	Accessibility	1	Likelihood of the site being used for access or staging due to location	Highly likely	5	3
Total Score:						39
Area 5A-1 West Side of River	invasive Species	3	Relative abundance of invasive plant species	Minor presence of invasive plant species	1	3
	Site Stability	2	Level of erosion or sedimentation	Low level or none	1	2
	Soil Profile Integrity	2	Evidence of disturbed soil profile	Low level or none	1	2
	Fill Disturbance	3	Evidence of filling	Low level or none	1	3
	Surface Degradation	3	Evidence of dumping or other disturbance	Dumping or other physical disturbance evident	3	9
	Land Use Juxtaposition	1	Proximity and accessibility to land uses which may contribute to disturbance of the site.	Remote and isolated from developed land use	1	1
	Size	1	Area of the evaluation unit	Large (>2 acres)	3	3
	Accessibility	1	Likelihood of the site being used for access or staging due to location	Unlikely	1	1
Total Score:						24
Area 5A-2	invasive Species	3	Relative abundance of invasive plant species	Invasive species present but not dominant in most strata	3	9
	Site Stability	2	Level of erosion or sedimentation	Low level or none	1	2
	Soil Profile Integrity	2	Evidence of disturbed soil profile	Low level or none	1	2
	Fill Disturbance	3	Evidence of filling	Low level or none	1	3
	Surface Degradation	3	Evidence of dumping or other disturbance	Dumping or other physical disturbance evident	3	9
	Land Use Juxtaposition	1	Proximity and accessibility to land uses which may contribute to disturbance of the site.	Moderate juxtaposition	2	2
	Size	1	Area of the evaluation unit	Large (>2 acres)	3	3
	Accessibility	1	Likelihood of the site being used for access or staging due to location	Highly likely	5	3
Total Score:						33

Table 10-1: R5A BRA Form H: Site Degradation/Disturbance Evaluation Criteria (continued)

Area of Review ¹	Evaluation Criteria	SC*	Description/Rationale	Condition	Rating	Score
Area 5A-3	invasive Species	3	Relative abundance of invasive plant species	Invasive species present but not dominant in most strata	3	9
	Site Stability	2	Level of erosion or sedimentation	Low level or none	1	2
	Soil Profile Integrity	2	Evidence of disturbed soil profile	Moderate	2	4
	Fill Disturbance	3	Evidence of filling	Low level or none	1	3
	Surface Degradation	3	Evidence of dumping or other disturbance	Dumping or other physical disturbance evident	3	9
	Land Use Juxtaposition	1	Proximity and accessibility to land uses which may contribute to disturbance of the site.	Moderate juxtaposition	2	2
	Size	1	Area of the evaluation unit	Large (>2 acres)	3	3
	Accessibility	1	Likelihood of the site being used for access or staging due to location	Highly likely	5	3
Total Score:						35

1. Refer to Figure 6-3 for limits of Functional Units

Figures



Legend

- Dams
- Housatonic River Watershed
- Housatonic River

NOTE:
Basemap "Light Gray Canvas" from ESRI

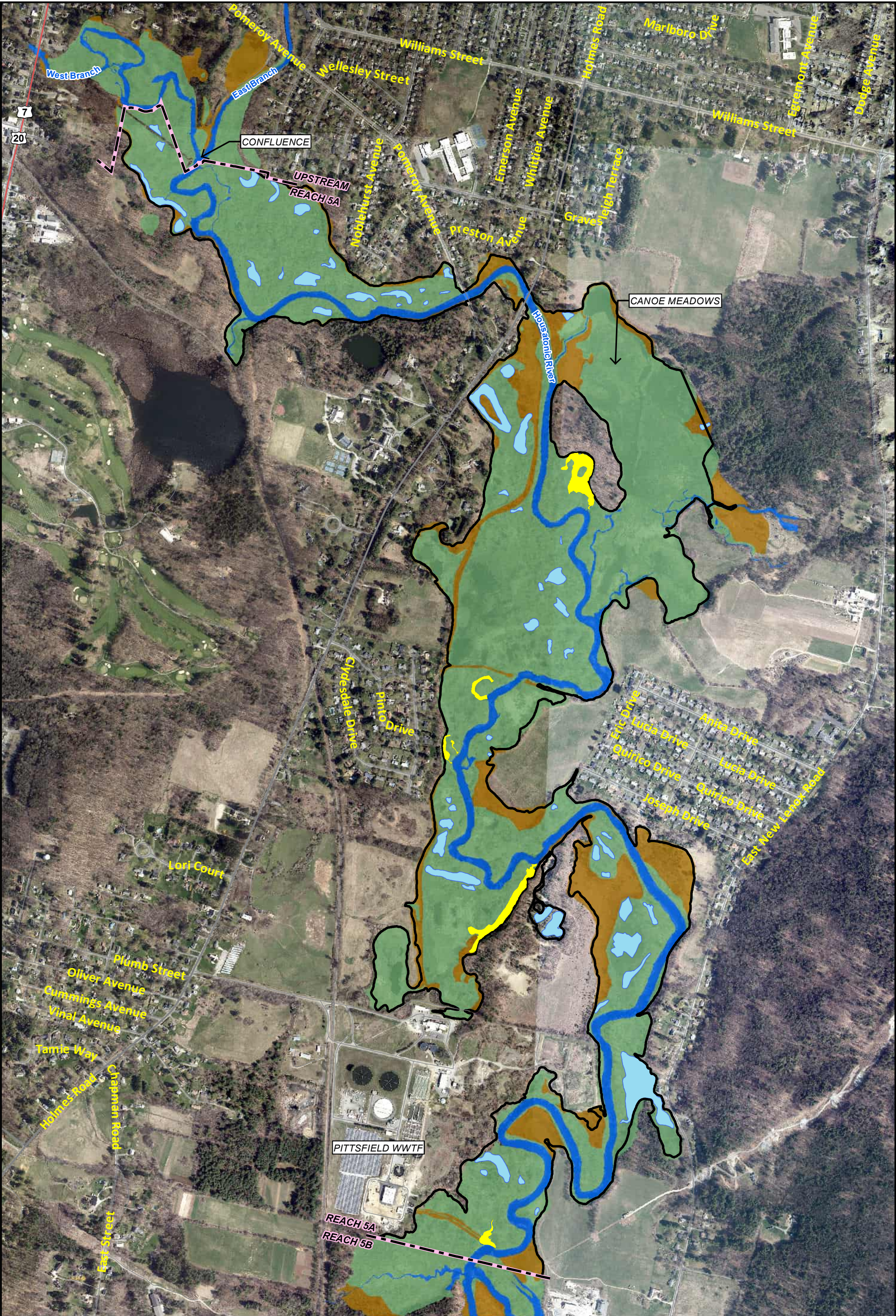
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Reaches 5B Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:104,000	1/18/2024	60670015

AECOM

Figure 1-1



Reach Boundaries

Reach 5A Isopleth

Backwater Areas

Certified Vernal Pools

Cover Types

Stream

Upland

Wetland

04509001,800

1 inch = 900 feet

Feet

Reach 5A

Reach 5A of the Rest of River

Housatonic River - Pittsfield, MA

SCALE

DATE

PROJECT NO.

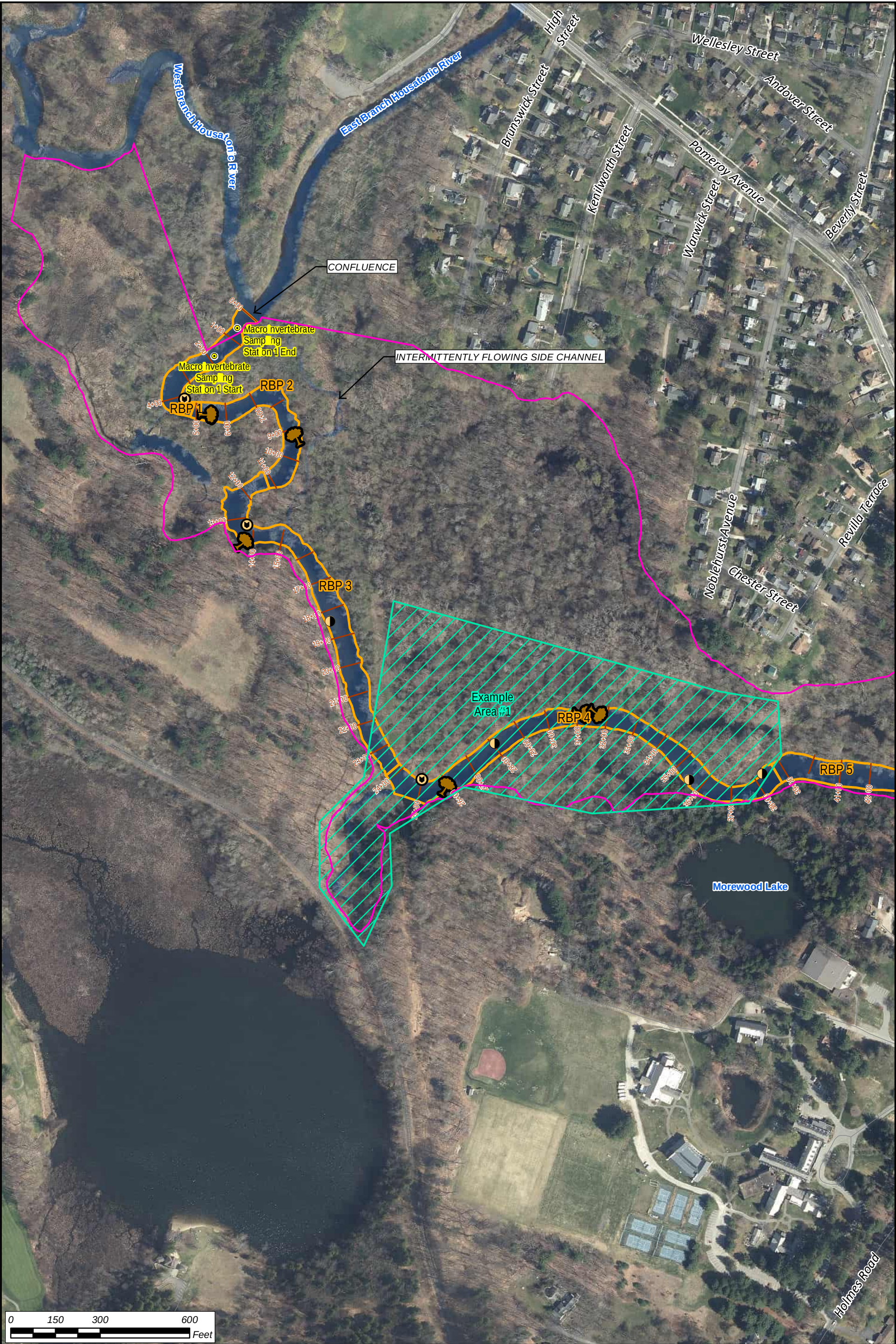
1:8,400

2/15/2024

60670015

AECOM

Figure 1-2



INDEX MAP

Legend

Cover Types

- Housatonic River
- Macroinvertebrate Sampling Station
- RBP

RBP-#: In-river assessment reach

- PCB Isopleth
- Example
- Side Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A

Riverine Habitat Investigations

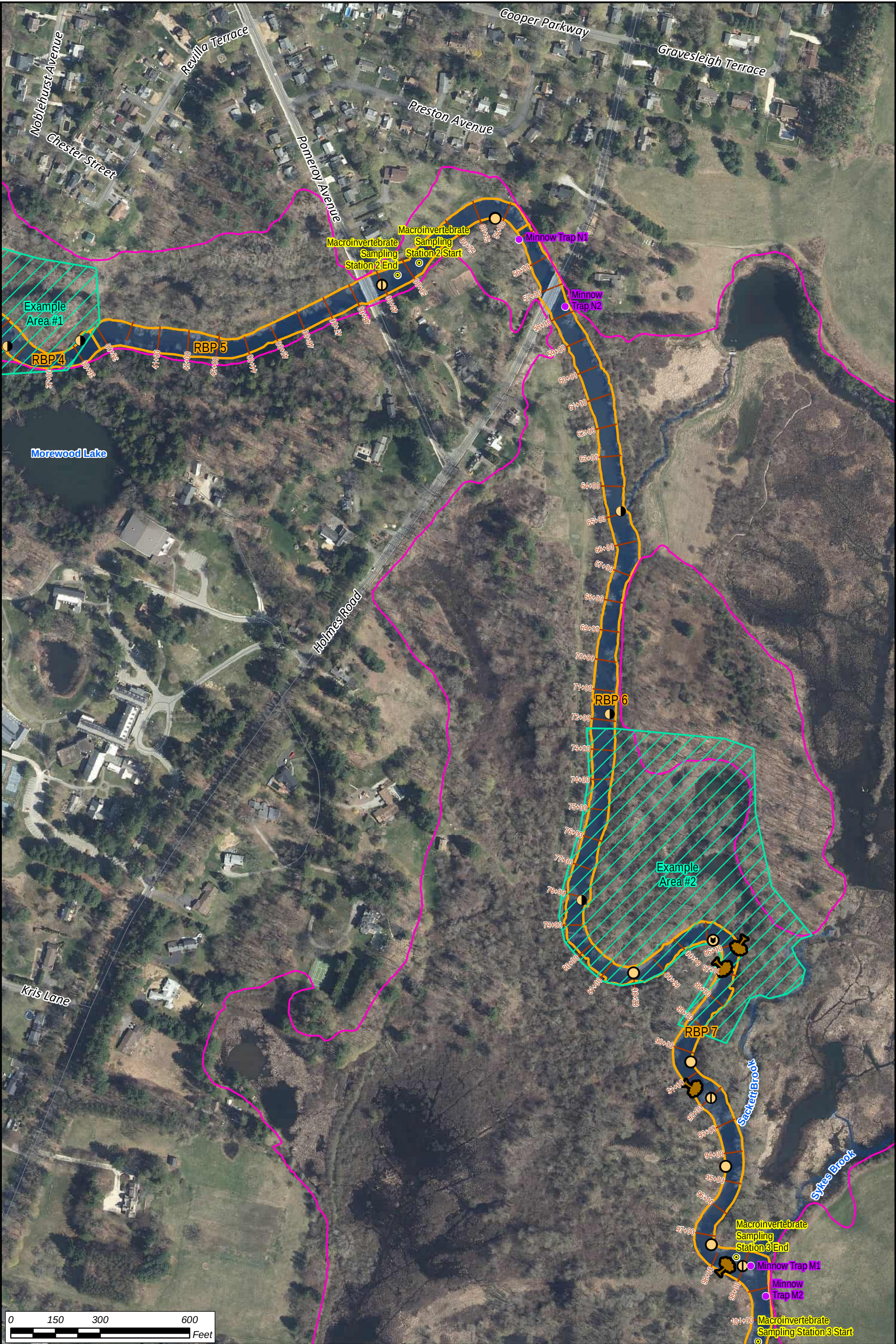
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60670015

AECOM

Figure 3-1a

Map Sheet 1 of 4



INDEX MAP

Legend

Cover Types

- Housatonic River
- Macroinvertebrate Sampling Station
- Minnow Trap Location
- RBP
- RBP-#: In-river assessment reach
- PCB Isopleth
- Example
- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A

Riverine Habitat Investigations

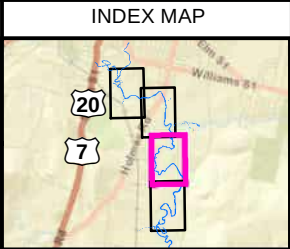
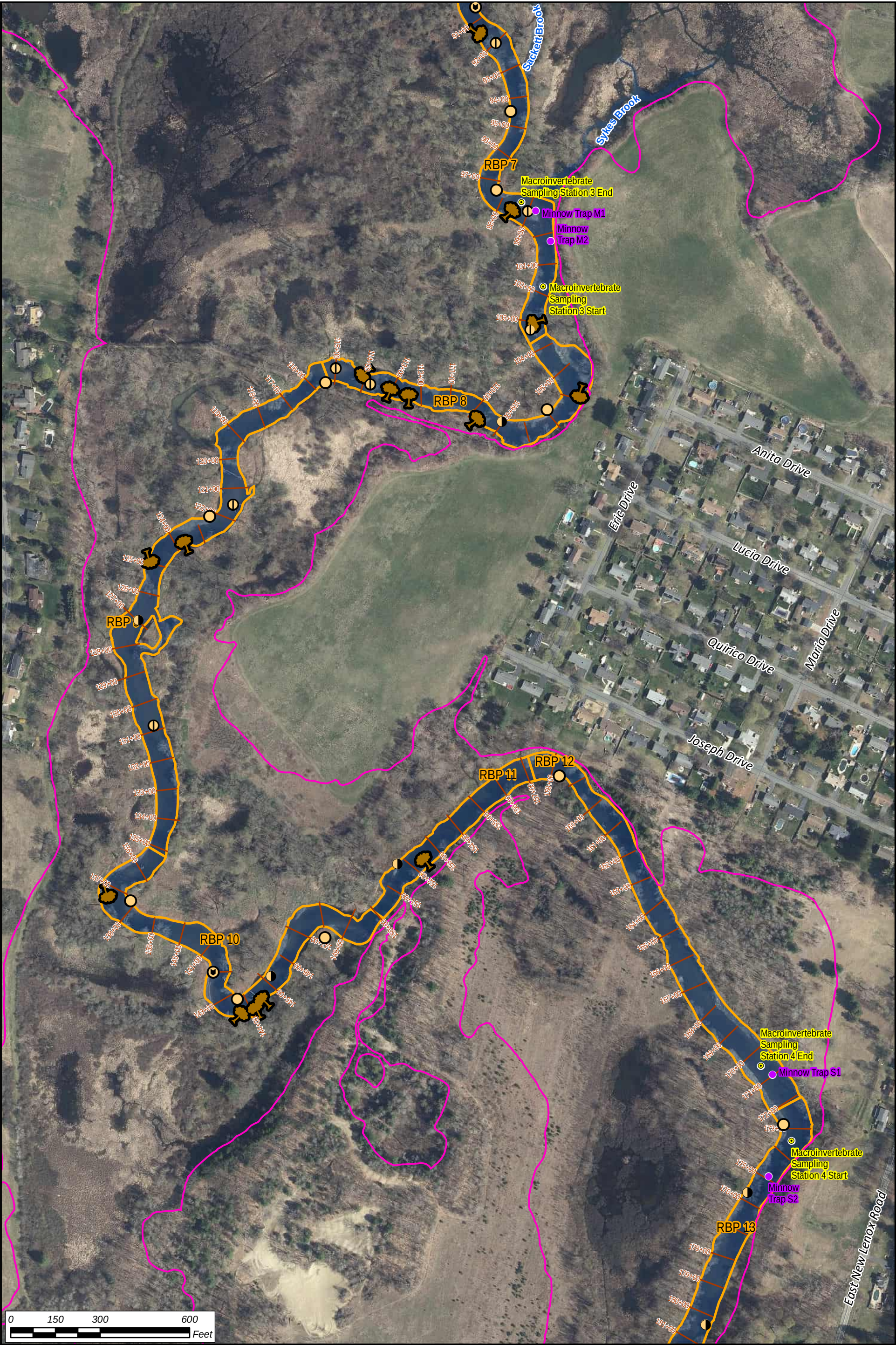
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60670015

AECOM

Figure 3-1b

Map Sheet 2 of 4



Legend

Cover Types

- Housatonic River
- Macroinvertebrate Sampling Station
- Minnow Trap Location
- RBP

RBP-#: In-river assessment reach

- PCB Isopleth
- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A

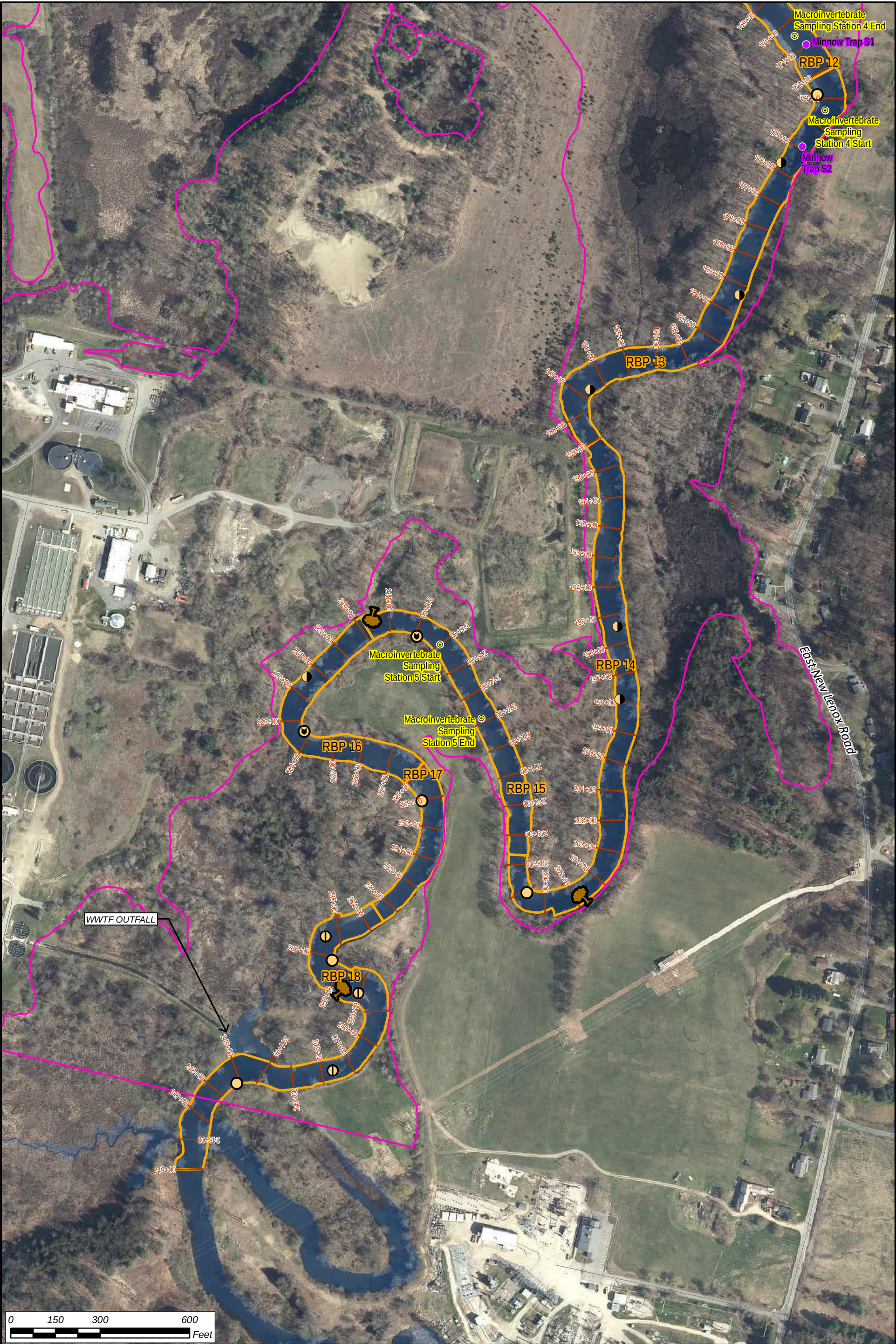
Riverine Habitat Investigations

Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60670015

Figure 3-1c

Map Sheet 3 of 4



INDEX MAP

Legend

Cover Types

- Housatonic River
- Macroinvertebrate Sampling Station
- Minnow Trap Location
- RBP
- RBP-#: In-river assessment reach

- PCB Isopleth
- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A Riverine Habitat Investigations		
Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60670015

Figure 3-1d
Map Sheet 4 of 4

Figure 3-2: Inorganic Substrate Components

Substrate Components for Overall Reach 5A

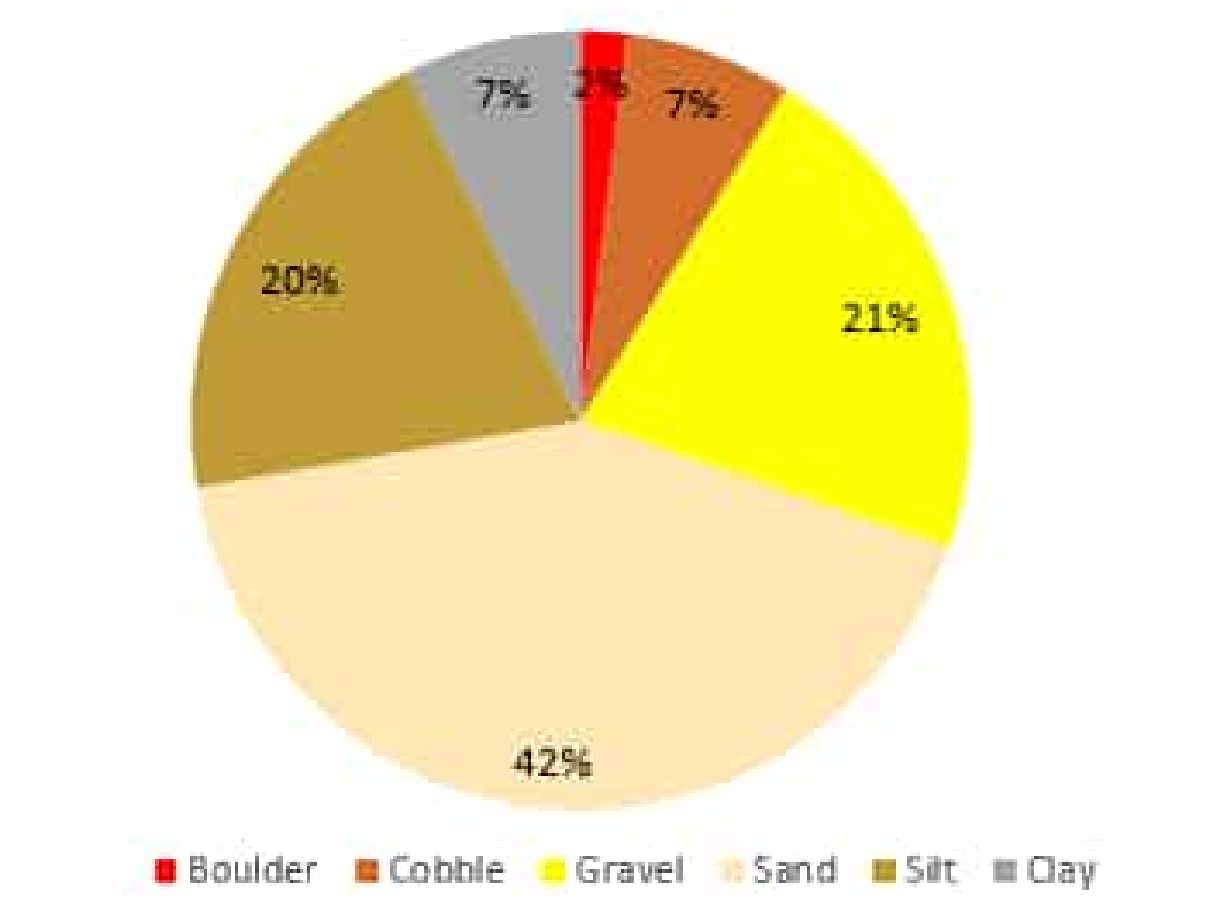
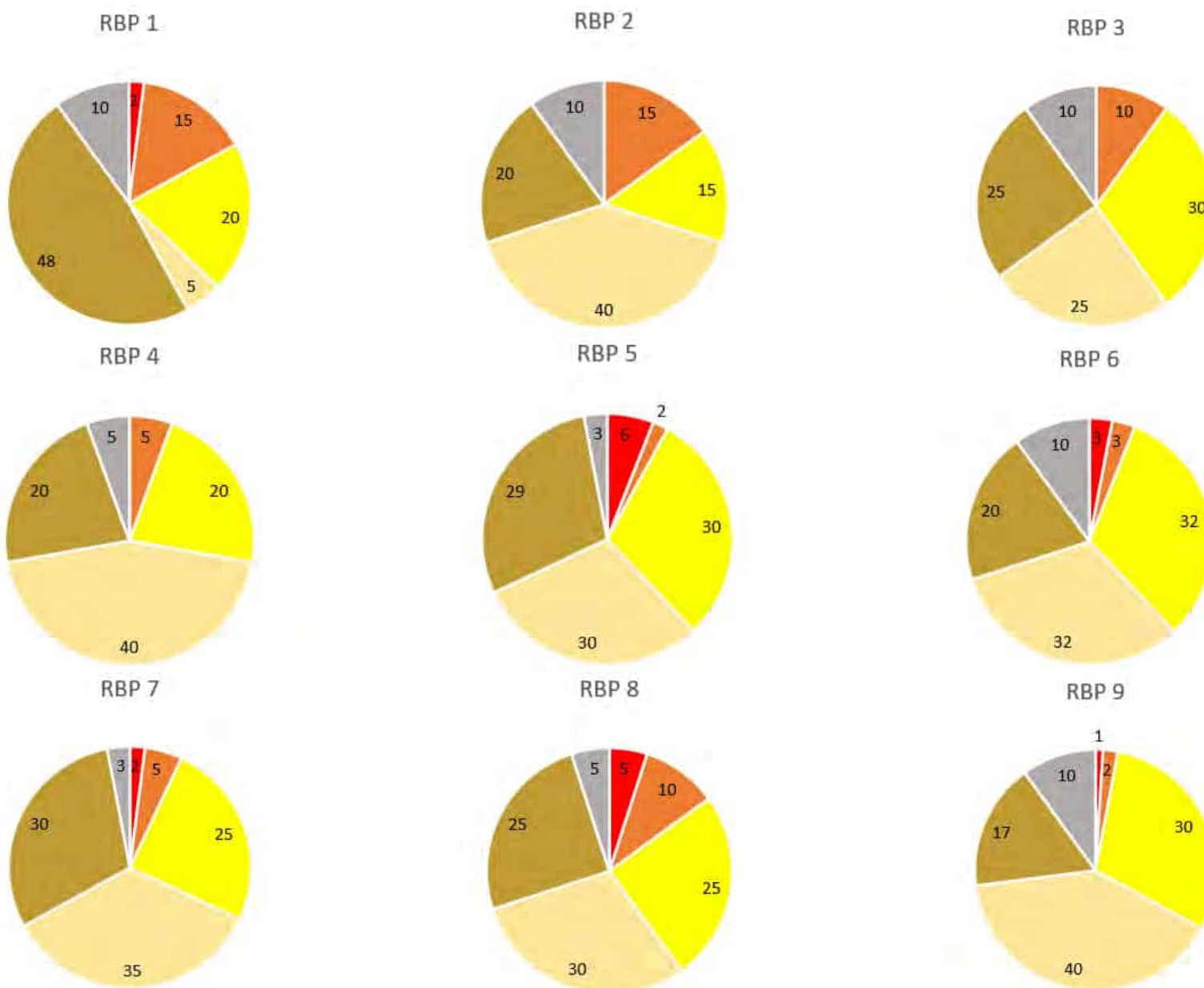


Figure 3-2: (Continued)

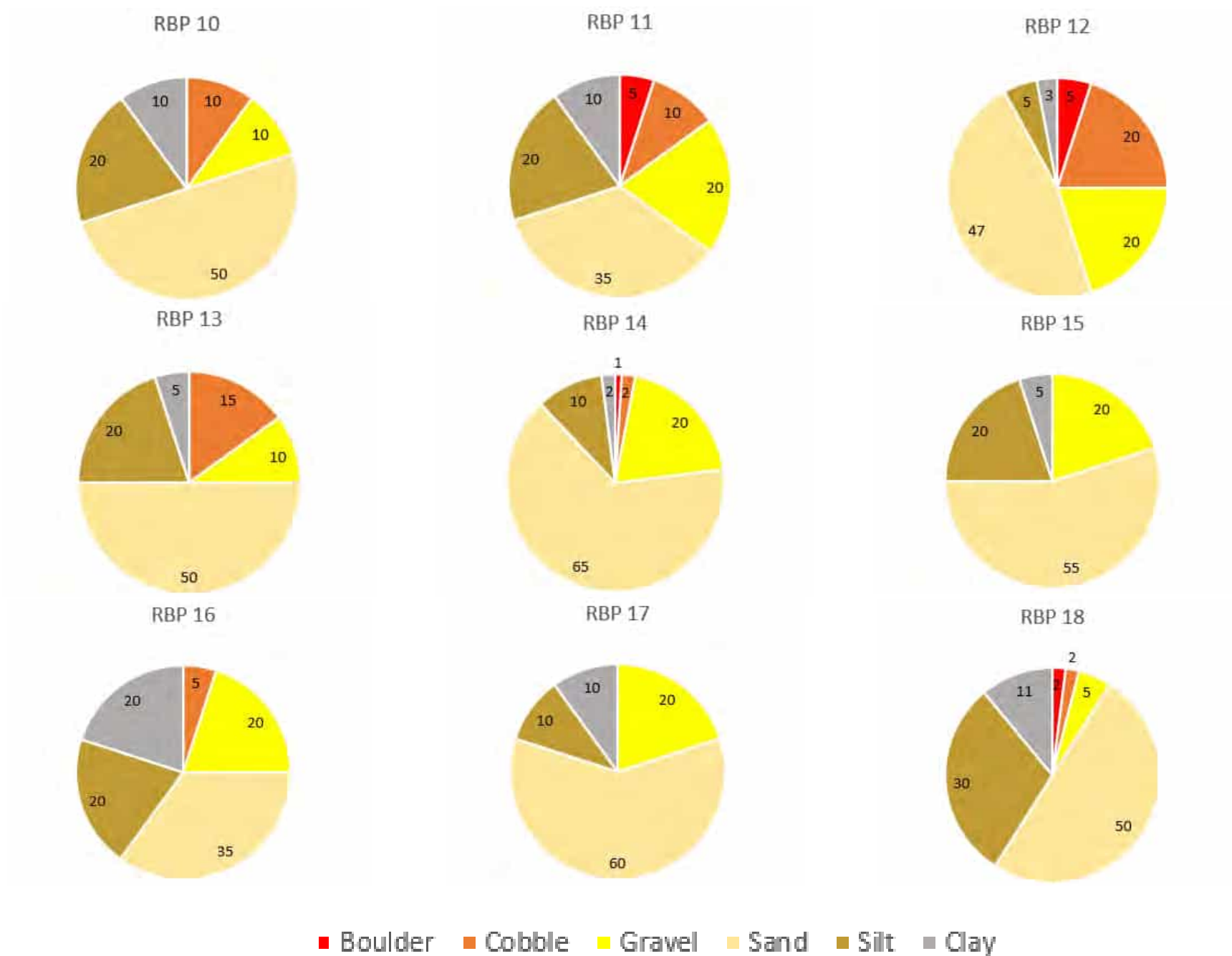
Inorganic Substrate Components by RBP (1-9)

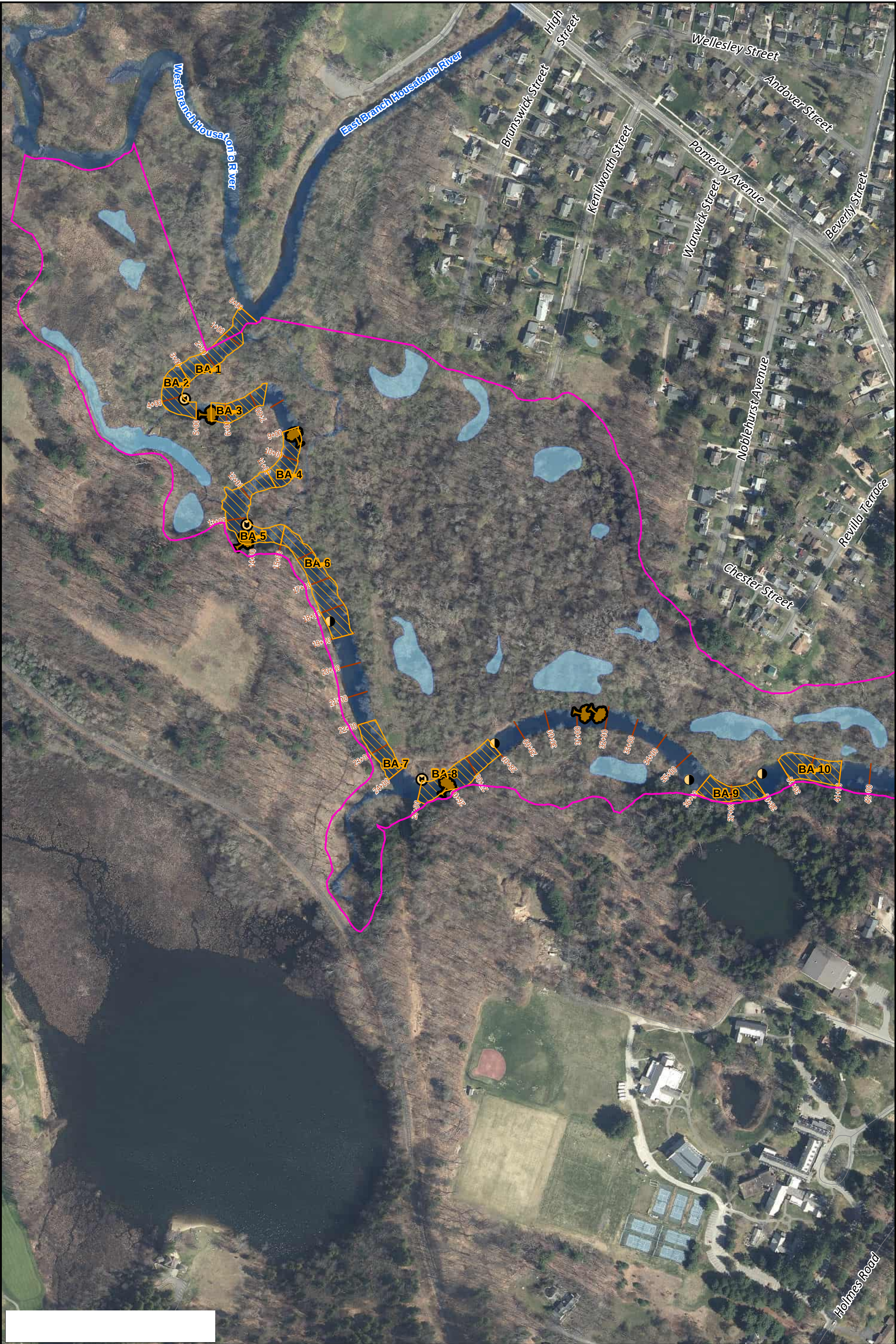


■ Boulder ■ Cobble ■ Gravel ■ Sand ■ Silt ■ Clay

Figure 3-2: (Continued)

Inorganic Substrate Components by RBP (10-18)





INDEX MAP

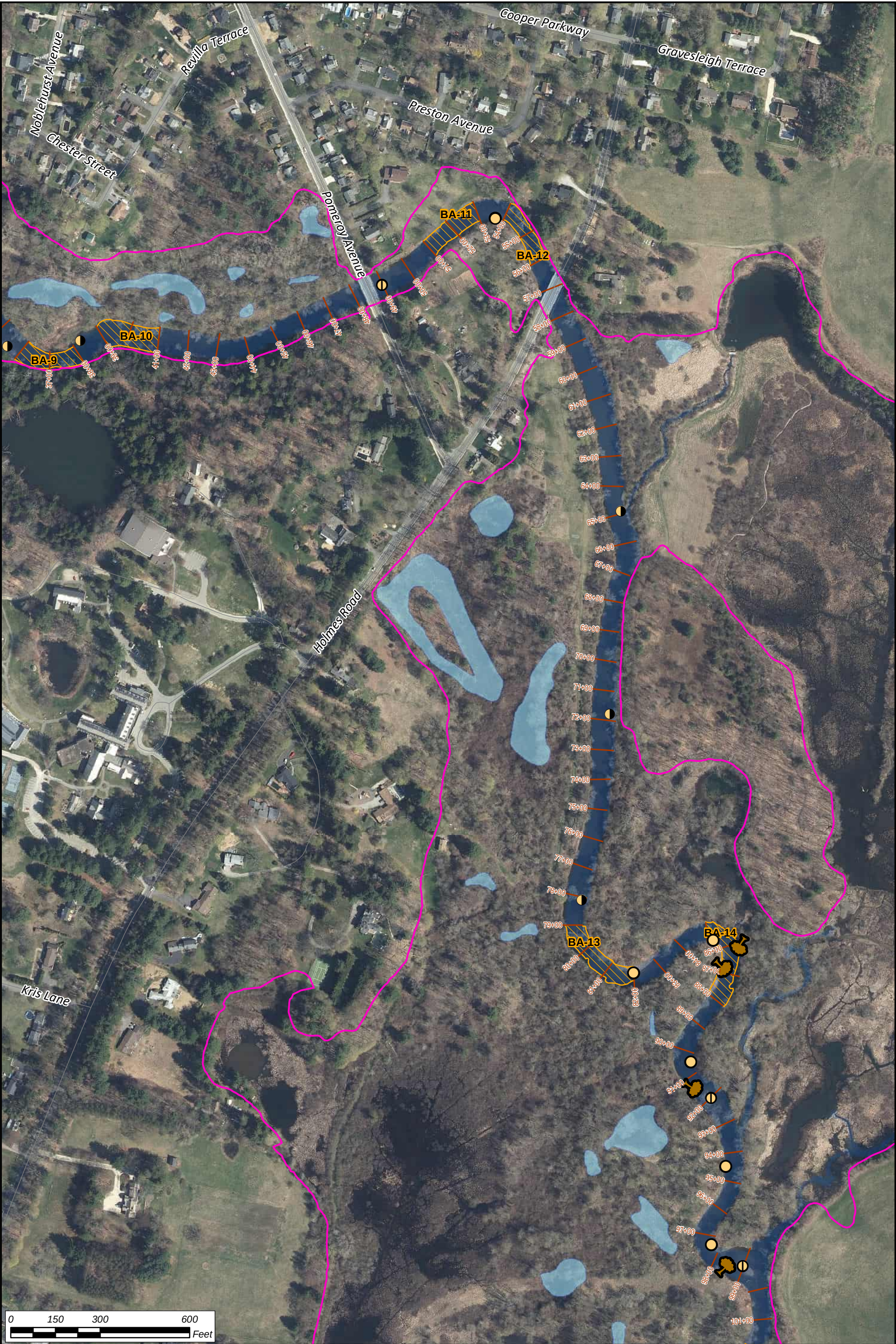
Legend

Cover Types

- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth
- Side Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A Riverbank Habitat Investigations		
Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60688342

Figure 4-1a
Map Sheet 1 of 4



INDEX MAP

Legend

Cover Types

- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth

- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A

Riverbank Habitat Investigations

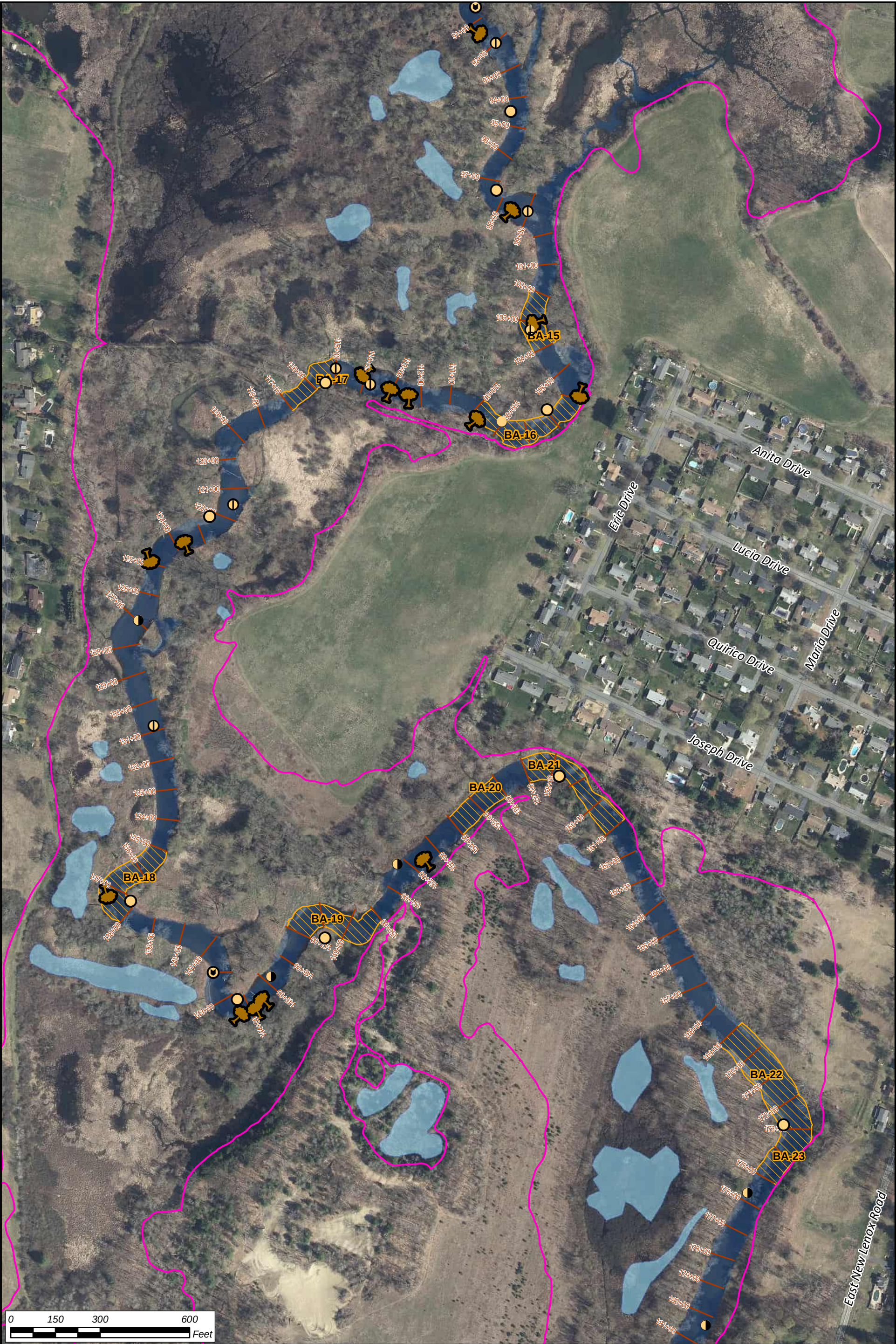
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60688342

AECOM

Figure 4-1b

Map Sheet 2 of 4



0 150 300 600 Feet

INDEX MAP

Legend

Cover Types

- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth

- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A

Riverbank Habitat Investigations

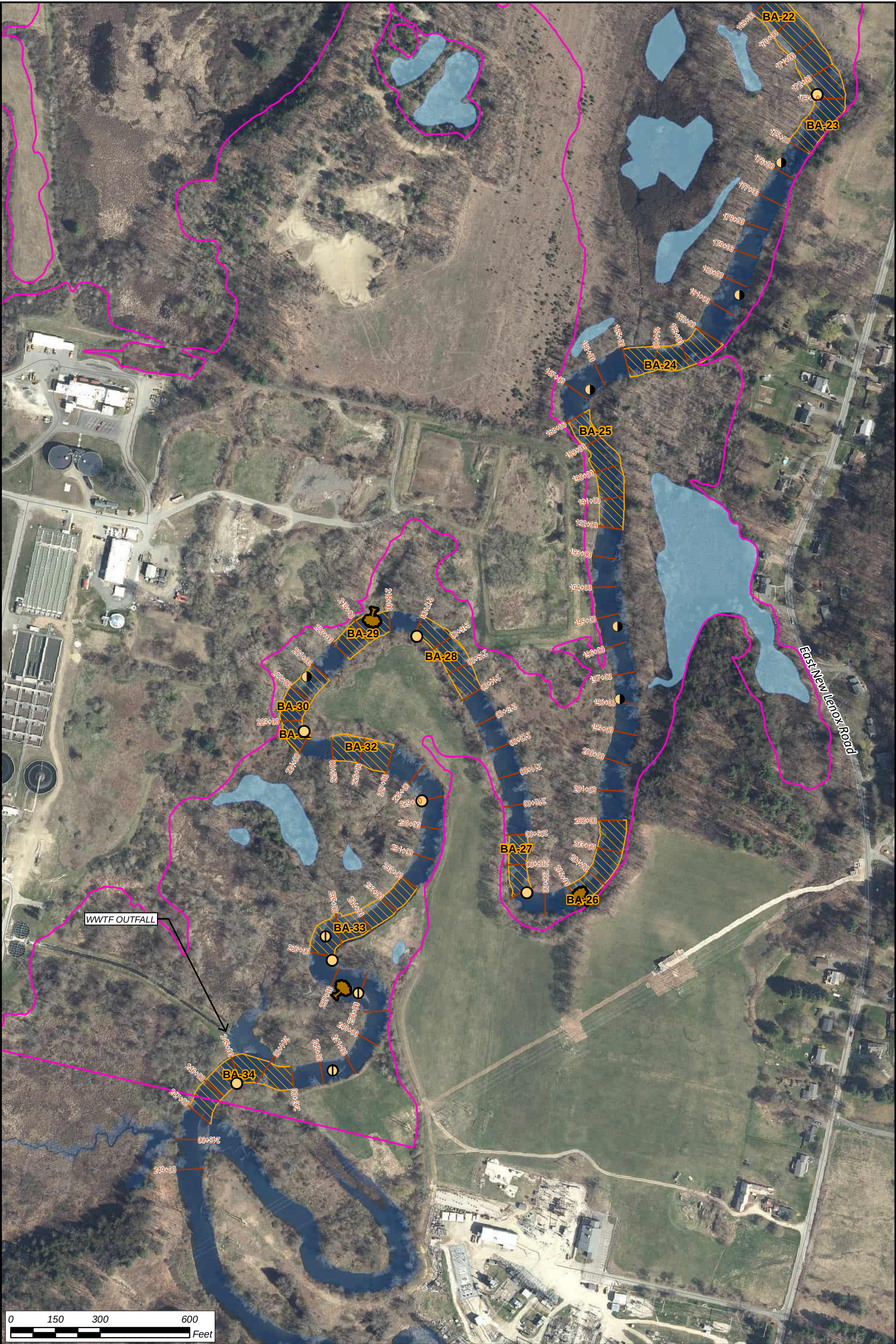
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60688342

AECOM

Figure 4-1c

Map Sheet 3 of 4



INDEX MAP

Legend

Cover Types

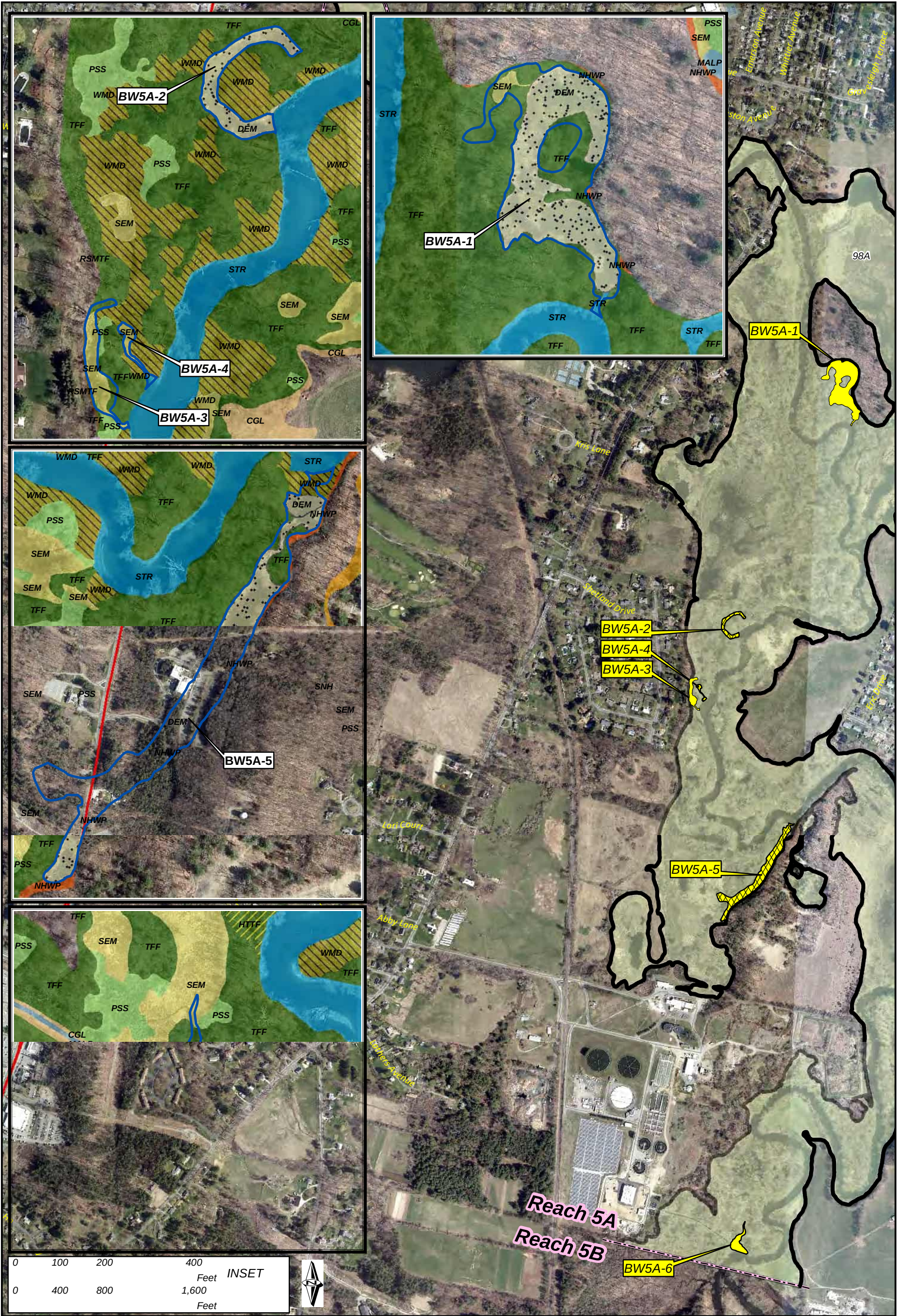
- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth

- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A Riverbank Habitat Investigations		
Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	1/19/2024	60688342

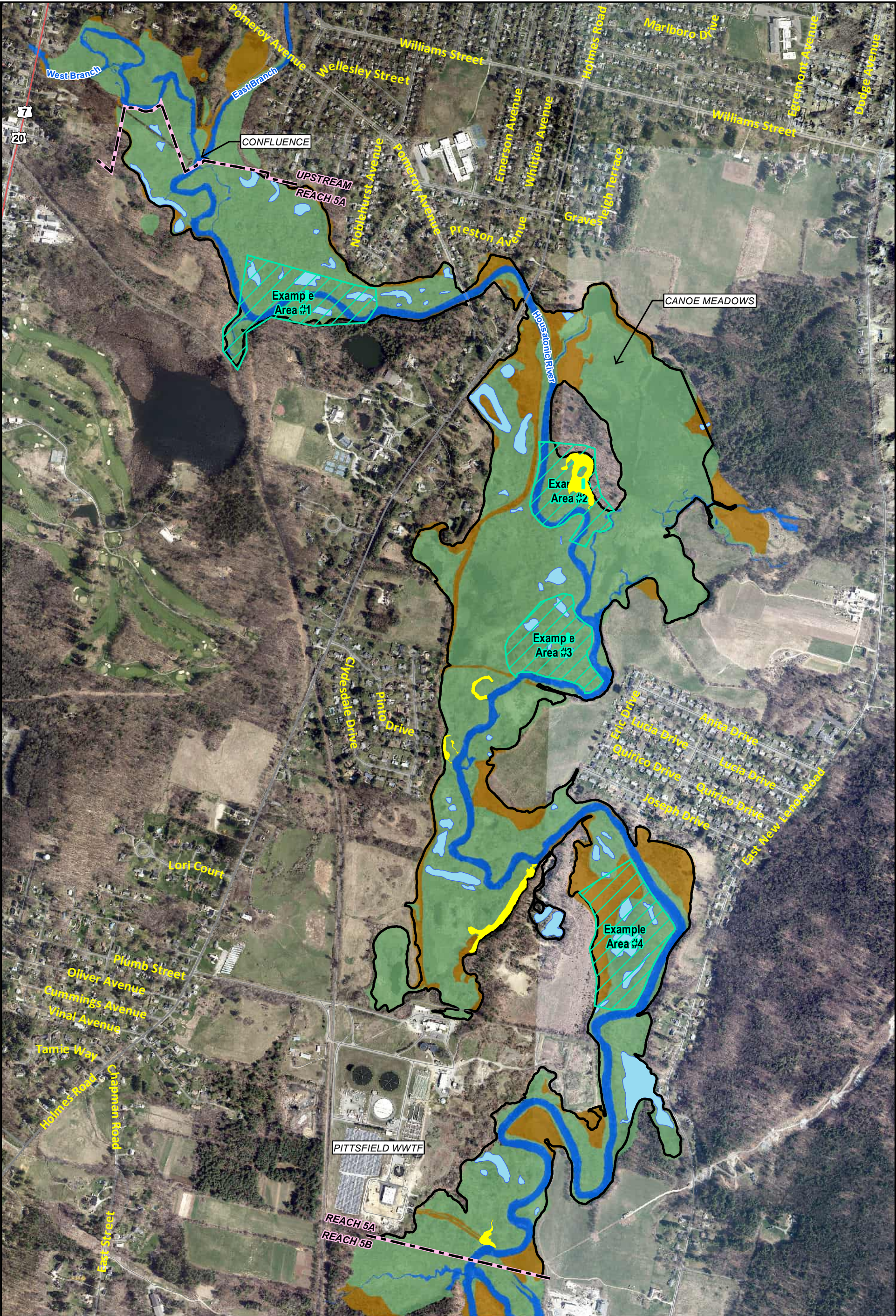
Figure 4-1d

Map Sheet 4 of 4



Reach 5A Backwaters and Natural Communities Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:9,600	8/21/2023	60670015

AECOM
Figure 5-1



Reach Boundaries

Reach 5A Isopleth

Backwater Areas

Certified Vernal Pools

Cover Types

Stream

Upland

Wetland

04509001,800

1 inch = 900 feet

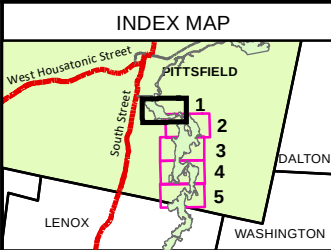
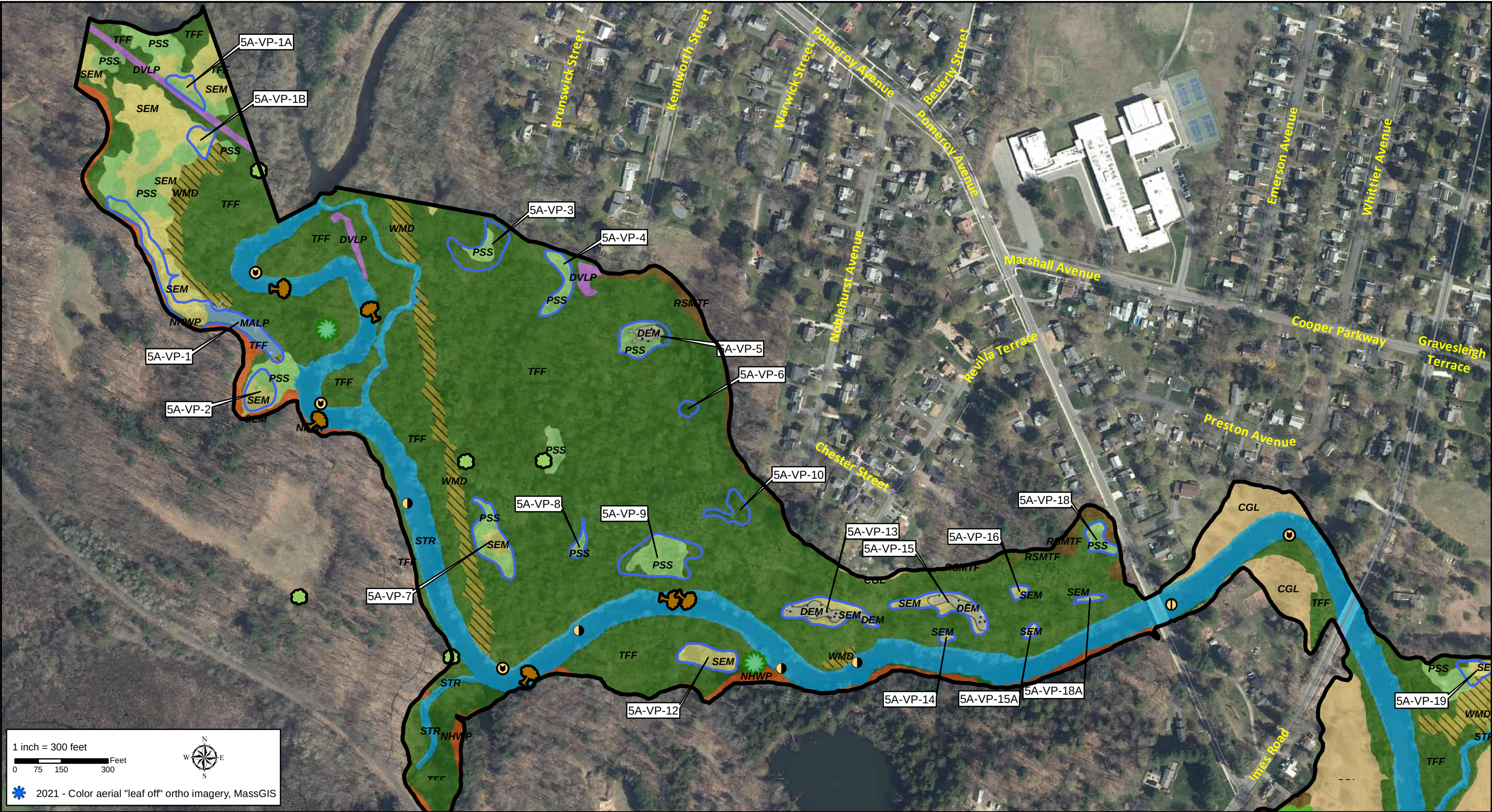
Feet

Reach 5A Example Areas
Within Floodplain Habitats
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:8,400	2/15/2024	60670015

AECOM

Figure 6-1



Natural Communities (2023)					
Developed / Disturbed (DVLP)	Shallow emergent marsh (SEM)	Cultural grasslands (CGL)	Mid-Channel Bar	Large Diameter Tree (>48 inches)	
Moderately alkaline lake/pond (MALP)	Wet meadow (WMD)	Northern hardwoods-hemlock-white pine forest (NHWP)	Point Bar	Large Diameter Tree (30-48 inches)	
Stream (STR)	Shrub swamp (PSS)	Red oak-sugar maple transition forest (RSMTF)	Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams		
Deep emergent marsh (DEM)	Red maple swamp (RMS)	Certified Vernal Pools			
	Transitional floodplain forest (TFF)	Side Bar			

Reach 5A Natural Communities

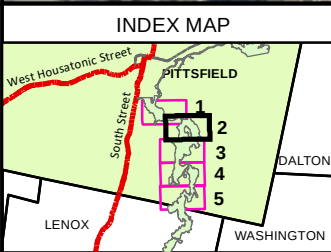
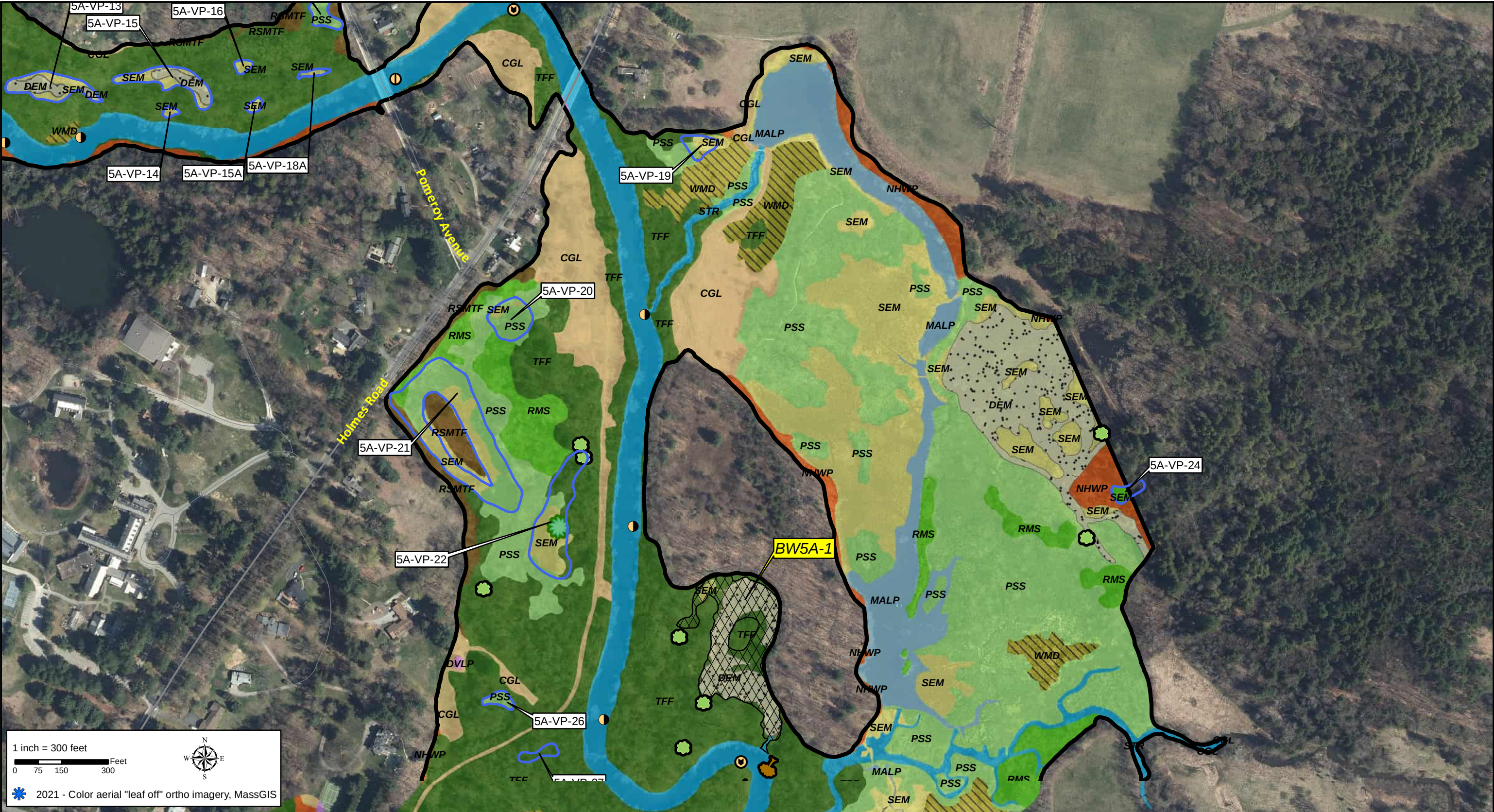
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	8/17/2023	60670015

AECOM

Figure 6-2a

Map Sheet 1 of 5



Natural Communities (2023)					
Developed / Disturbed (DVLP)	Shallow emergent marsh (SEM)	Cultural grasslands (CGL)	Mid-Channel Bar	Large Diameter Tree (>48 inches)	
Moderately alkaline lake/pond (MALP)	Wet meadow (WMD)	Northern hardwoods-hemlock-white pine forest (NHWP)	Point Bar		
Stream (STR)	Shrub swamp (PSS)	Red oak-sugar maple transition forest (RSMTF)	Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams	Large Diameter Tree (30-48 inches)	
Deep emergent marsh (DEM)	Red maple swamp (RMS)	Certified Vernal Pools	Large Diameter Tree (30-48 inches)		
	Transitional floodplain forest (TFF)	Side Bar			

Reach 5A Natural Communities Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/17/2023	60670015

AECOM

Figure 6-2b
Map Sheet 2 of 5



1 inch = 300 feet

0

75

150

300

Feet

N

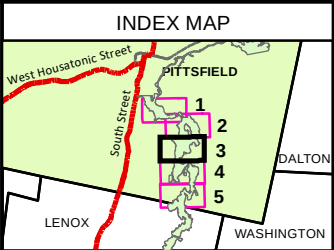
E

S

W

✳

 2021 - Color aerial "leaf off" ortho imagery, MassGIS



Natural Communities (2023)					
Developed / Disturbed (DVLN)	Shallow emergent marsh (SEM)	Cultural grasslands (CGL)	Certified Vernal Pools	Large Diameter Tree (30-48 inches)	
Moderately alkaline lake/pond (MALP)	Wet meadow (WMD)	Successional Northern Hardwoods (SNH)	Side Bar	Large Diameter Tree (>48 inches)	
Stream (STR)	Shrub swamp (PSS)	Northern hardwoods-hemlock-white pine forest (NHWP)	Mid-Channel Bar		
Deep emergent marsh (DEM)	Red maple swamp (RMS)	Red oak-sugar maple transition forest (RSMTF)	Point Bar		
	Transitional floodplain forest (TFF)		Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams		

Reach 5A Natural Communities

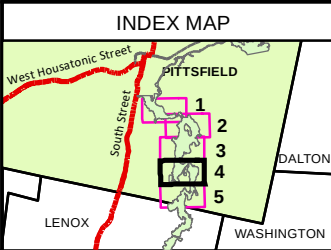
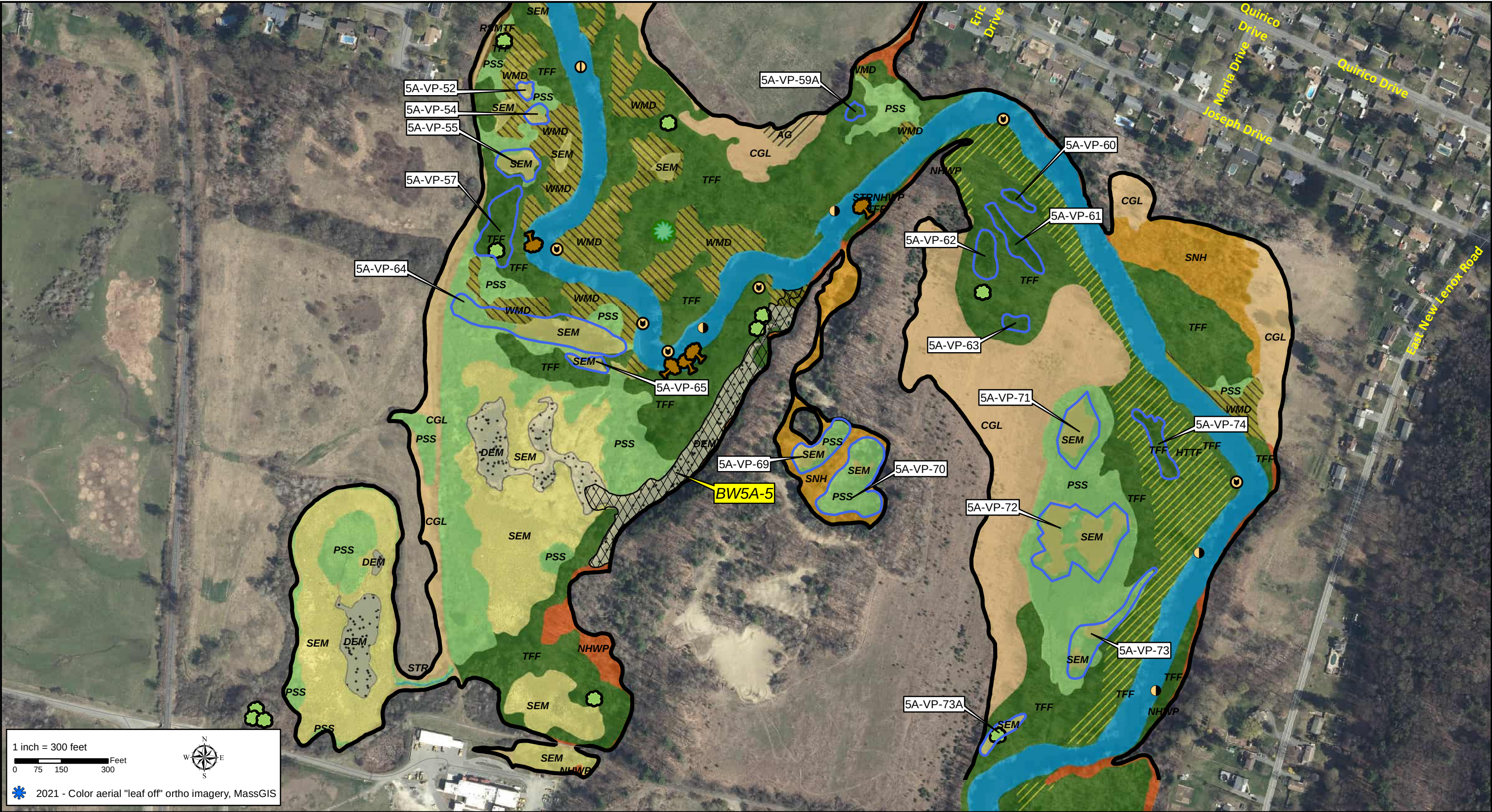
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	8/17/2023	60670015

AECOM

Figure 6-2c

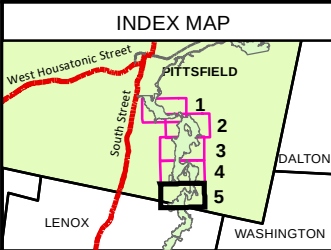
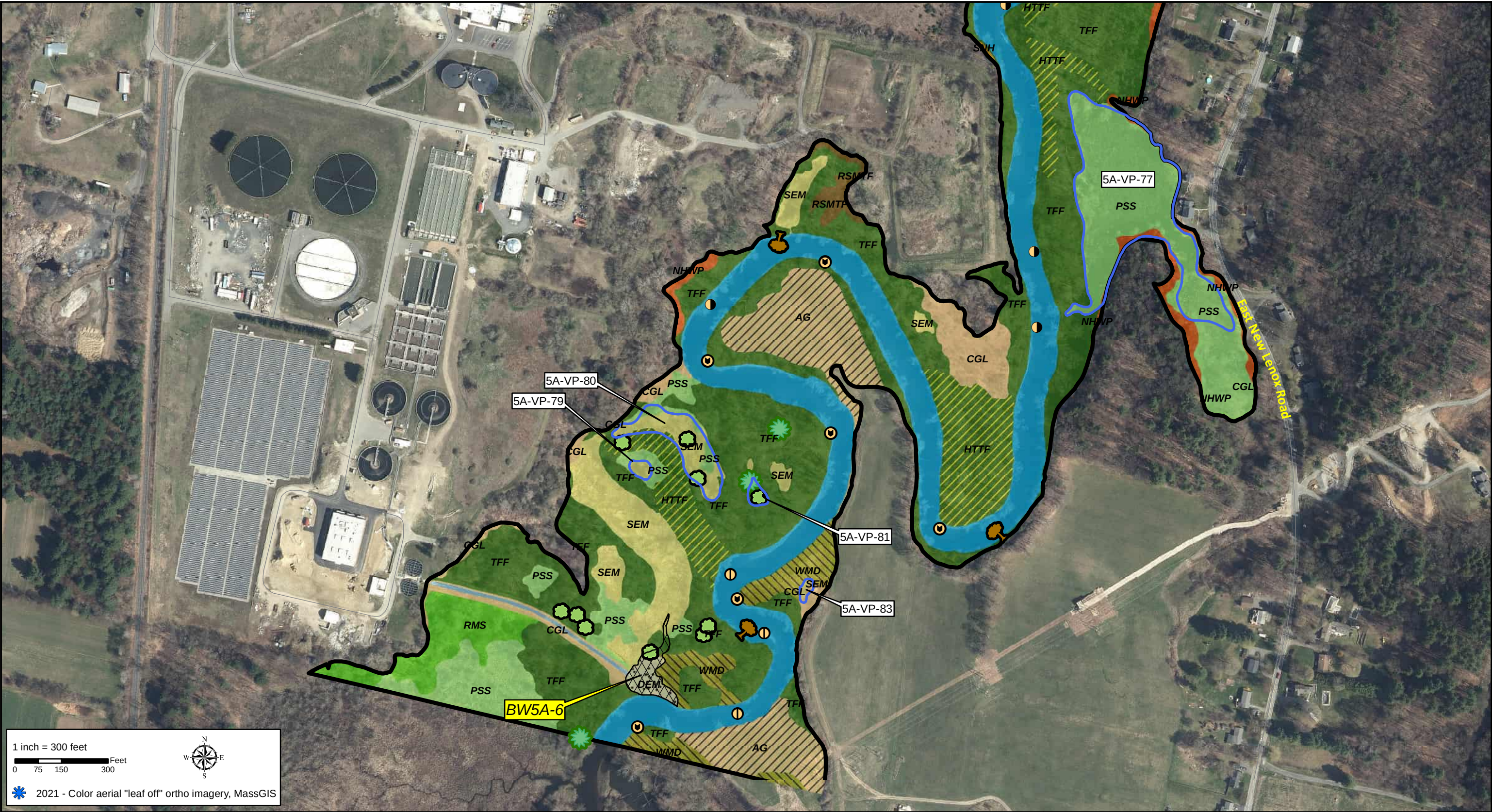
Map Sheet 3 of 5



Natural Communities (2023)			
Stream (STR)	Transitional floodplain forest (TFF)	Northern hardwoods-hemlock-white pine forest (NHWP)	Point Bar
Deep emergent marsh (DEM)	High-terrace floodplain forest (HTTF)	Red oak-sugar maple transition forest (RSMTF)	Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams
Shallow emergent marsh (SEM)	Cultural grasslands (CGL)	Certified Vernal Pools	Large Diameter Tree (30-48 inches)
Wet meadow (WMD)	Agricultural Field (AG)	Side Bar	Large Diameter Tree (>48 inches)
Shrub swamp (PSS)	Successional Northern Hardwoods (SNH)	Mid-Channel Bar	

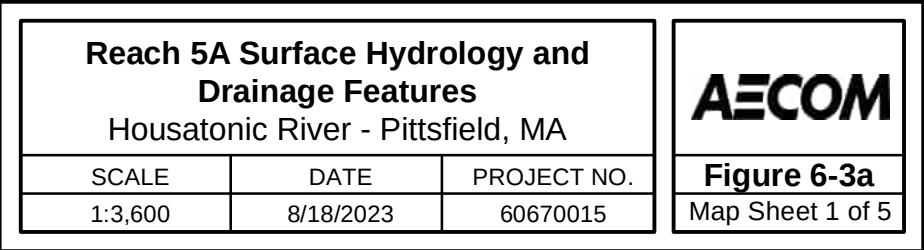
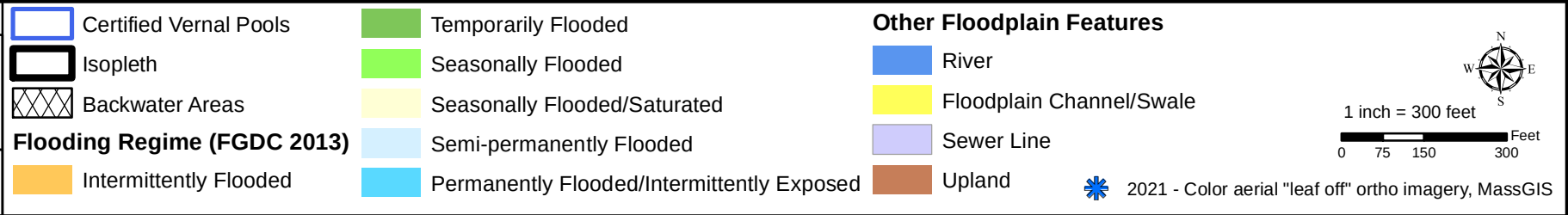
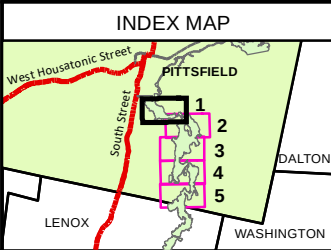
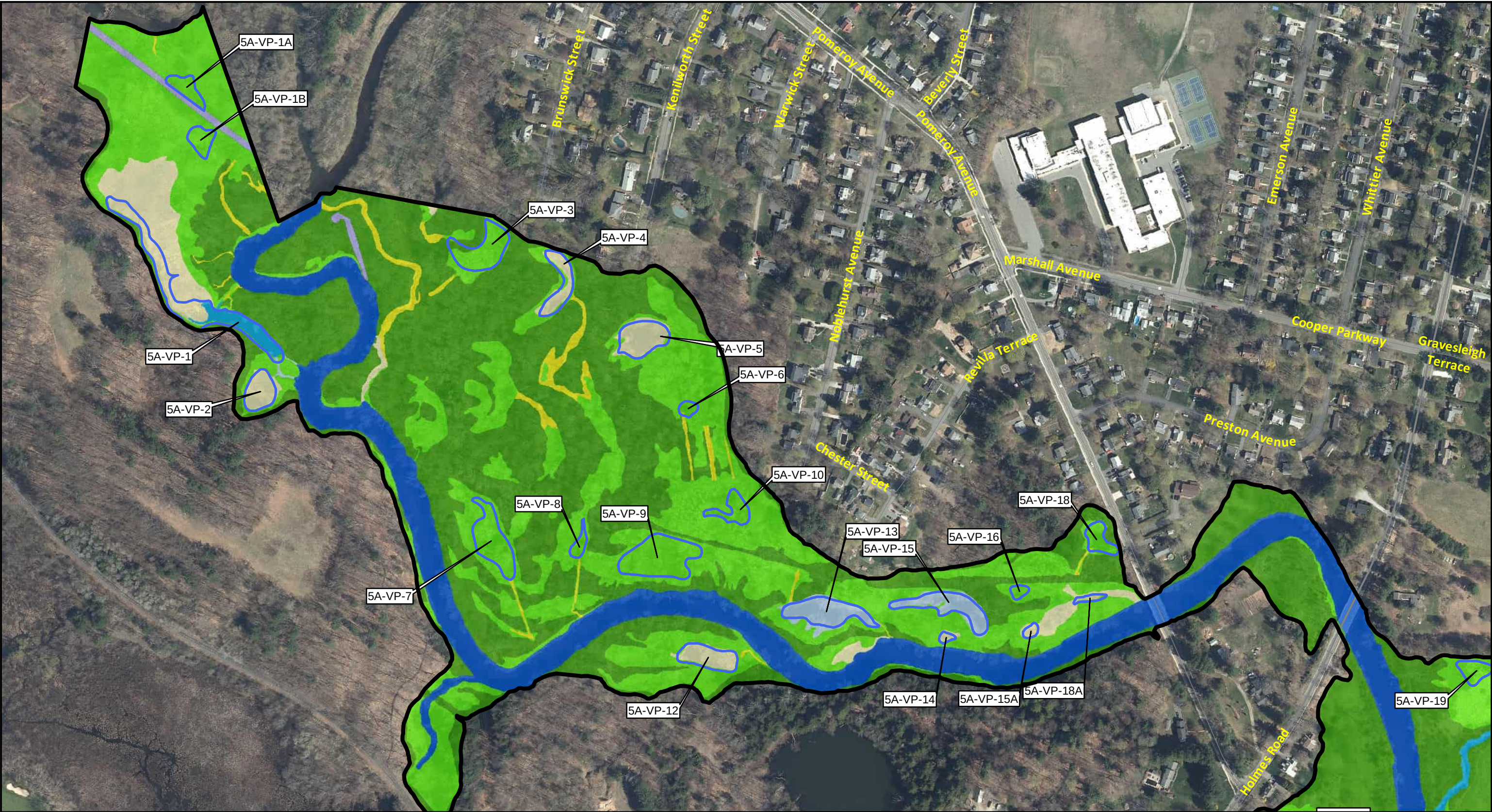
Reach 5A Natural Communities Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/17/2023	60670015

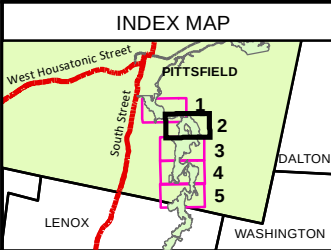
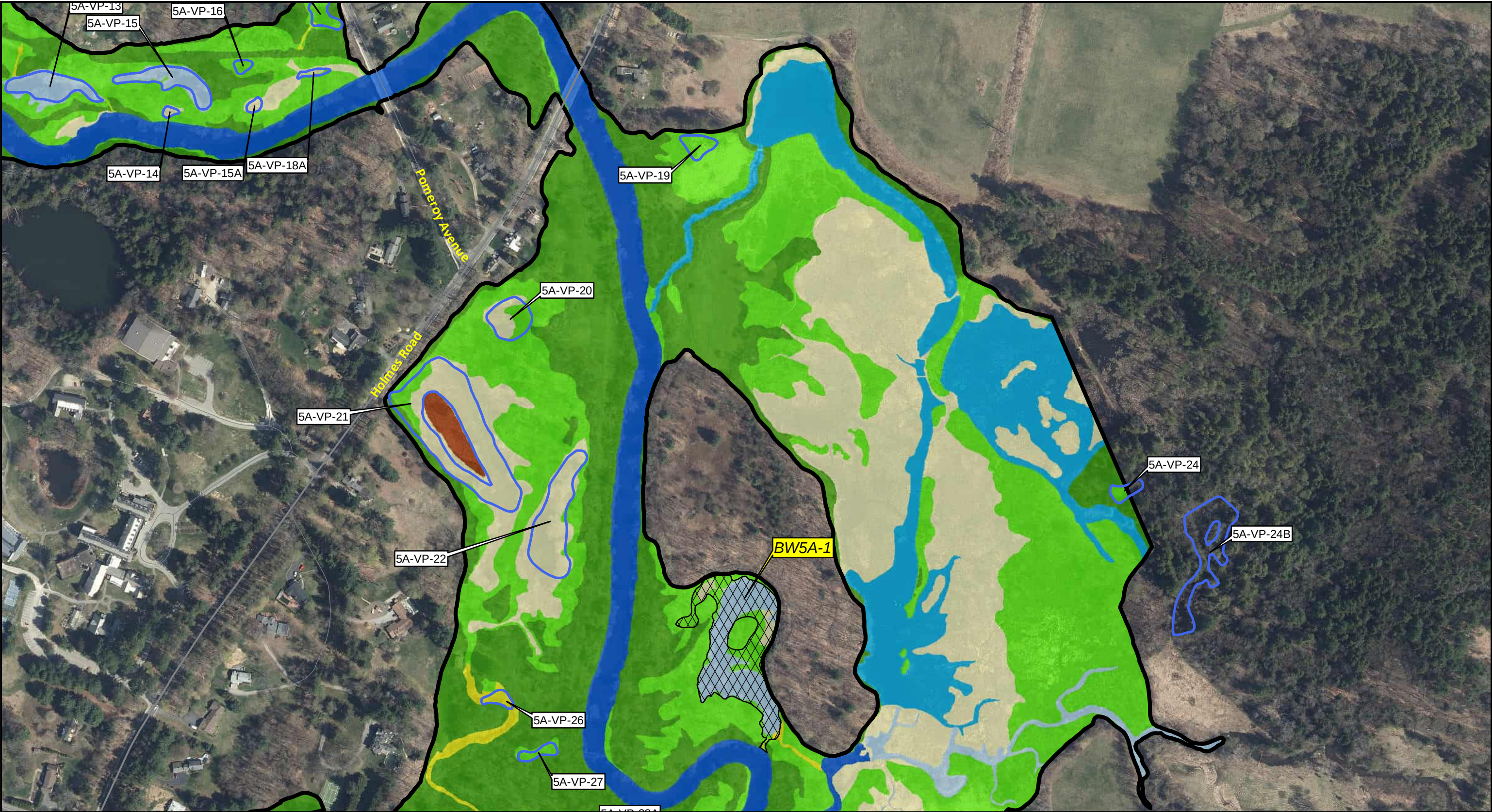
Figure 6-2d
Map Sheet 4 of 5



Natural Communities (2023)				
Moderately alkaline lake/pond (MALP)	Shrub swamp (PSS)	Cultural grasslands (CGL)	Red oak-sugar maple transition forest (RSMTF)	Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams
Stream (STR)	Red maple swamp (RMS)	Agricultural Field (AG)	Successional Northern Hardwoods (SNH)	Large Diameter Tree (30-48 inches)
Deep emergent marsh (DEM)	Transitional floodplain forest (TFF)	Northern hardwoods-hemlock-white pine forest (NHWP)	Certified Vernal Pools	Large Diameter Tree (>48 inches)
Shallow emergent marsh (SEM)	High-terrace floodplain forest (HTTF)		Side Bar	
			Mid-Channel Bar	
			Point Bar	

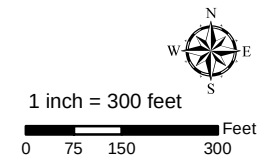
Reach 5A Natural Communities Housatonic River - Pittsfield, MA			AECOM
SCALE 1:3,600	DATE 8/17/2023	PROJECT NO. 60670015	
Figure 6-2e Map Sheet 5 of 5			





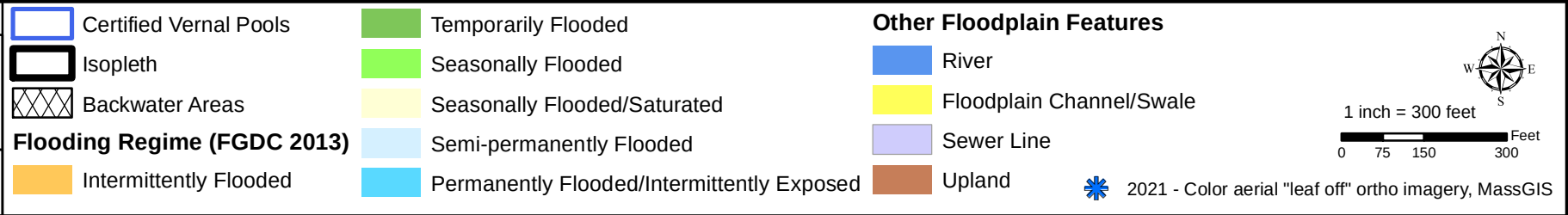
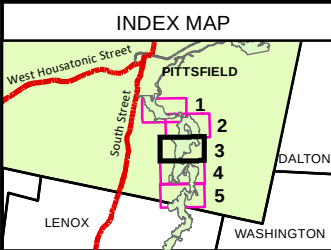
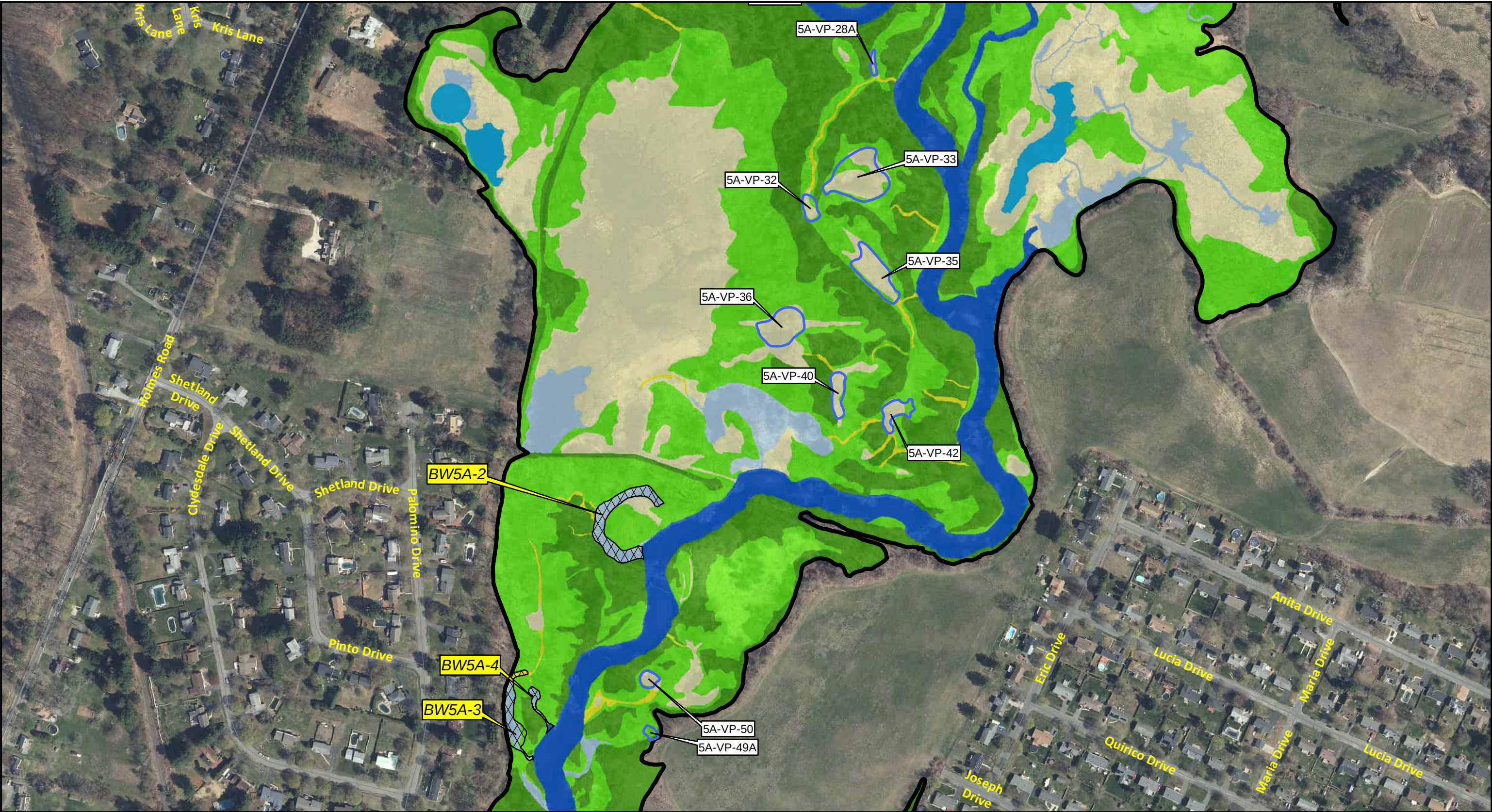
Certified Vernal Pools	Temporarily Flooded	Other Floodplain Features River Floodplain Channel/Swale Sewer Line Upland
Isopleth	Seasonally Flooded	
Backwater Areas	Seasonally Flooded/Saturated	
Flooding Regime (FGDC 2013)	Semi-permanently Flooded	
Intermittently Flooded	Permanently Flooded/Intermittently Exposed	

2021 - Color aerial "leaf off" ortho imagery, MassGIS



Reach 5A Surface Hydrology and Drainage Features Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

Figure 6-3b
Map Sheet 2 of 5

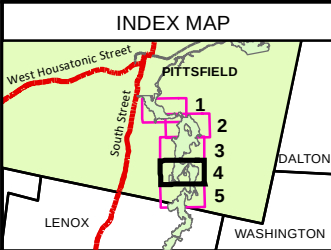
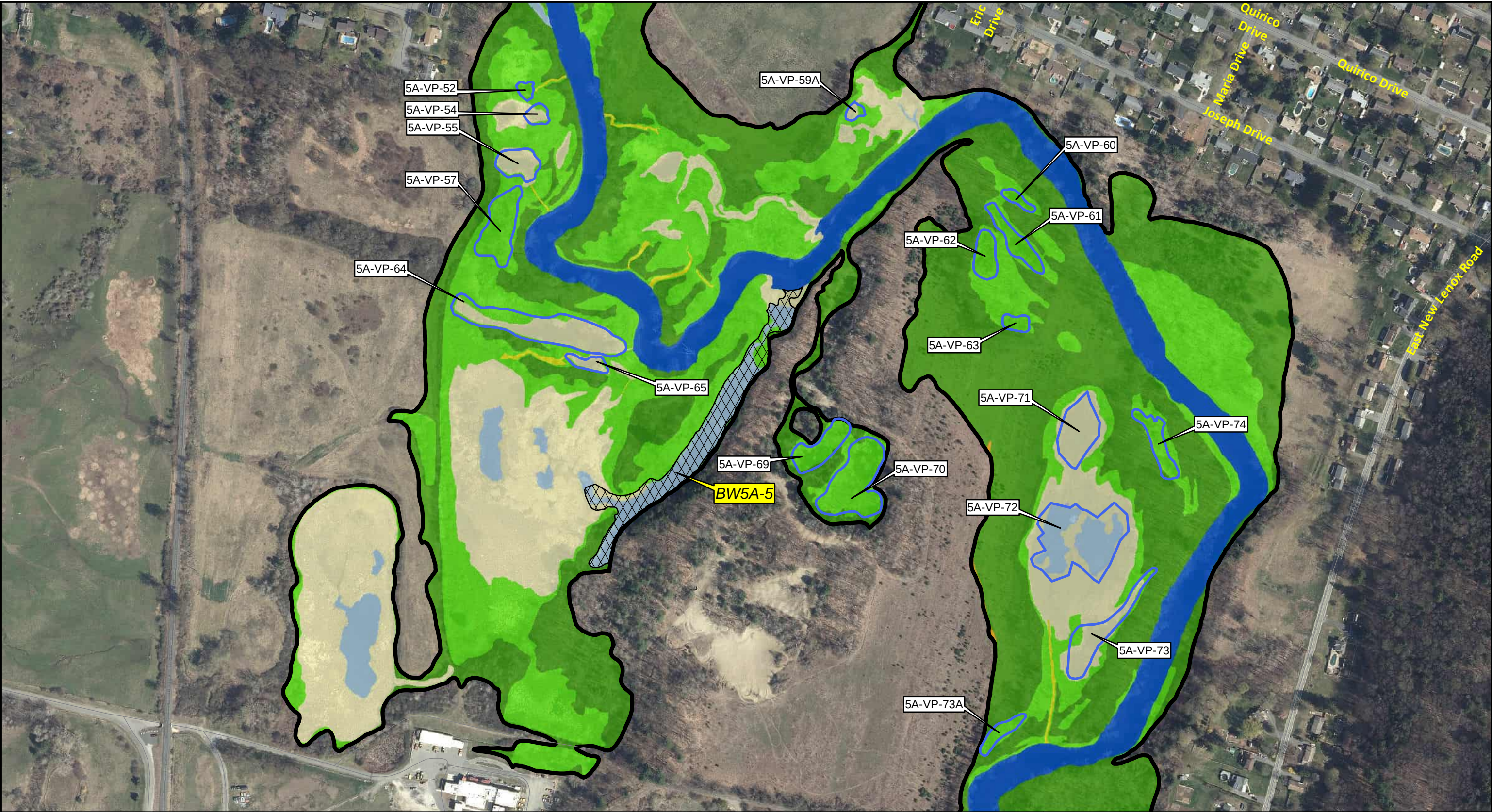


Reach 5A Surface Hydrology and Drainage Features

Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

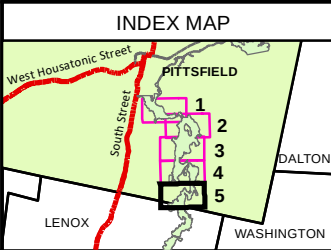
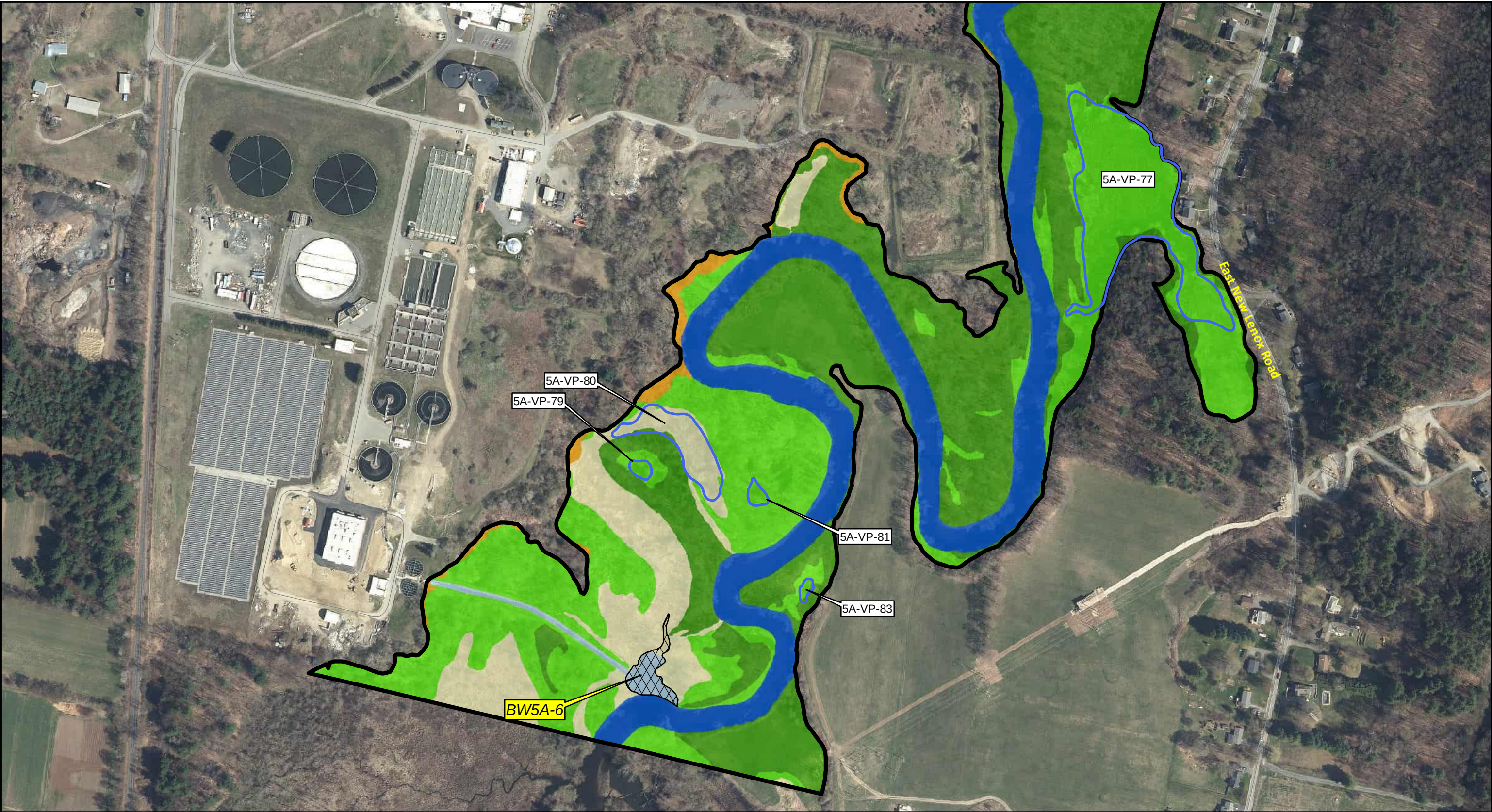
Figure 6-3c
Map Sheet 3 of 5



Certified Vernal Pools	Temporarily Flooded	Other Floodplain Features River Floodplain Channel/Swale Sewer Line Upland	
Isopleth	Seasonally Flooded		 1 inch = 300 feet 0 75 150 300 Feet 2021 - Color aerial "leaf off" ortho imagery, MassGIS
Backwater Areas	Seasonally Flooded/Saturated		
Flooding Regime (FGDC 2013)	Semi-permanently Flooded		
Intermittently Flooded	Permanently Flooded/Intermittently Exposed		

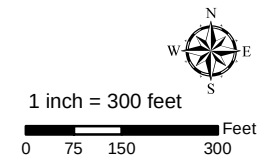
Reach 5A Surface Hydrology and Drainage Features Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

Figure 6-3d
Map Sheet 4 of 5



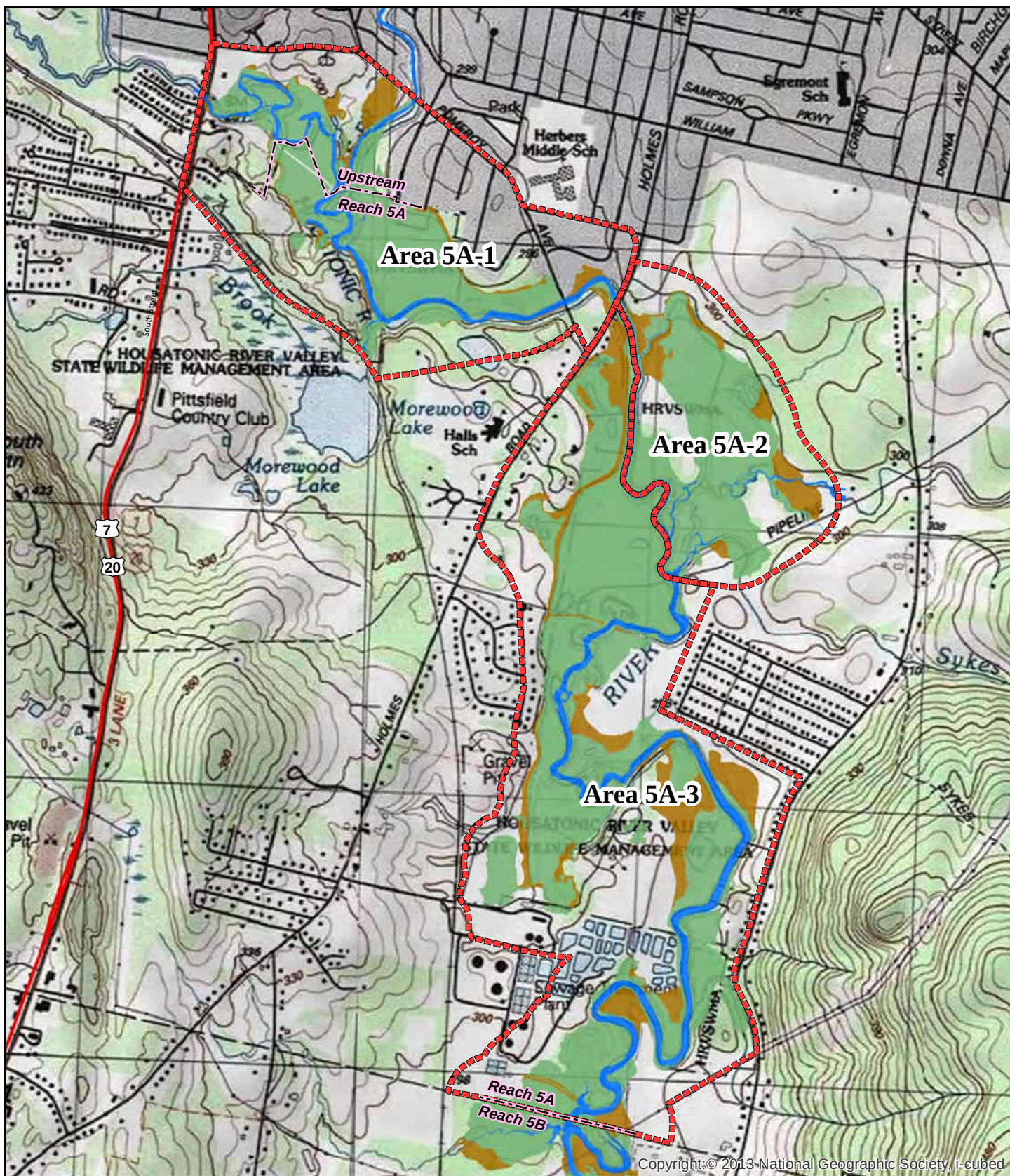
Certified Vernal Pools	Temporarily Flooded	Other Floodplain Features River Floodplain Channel/Swale Sewer Line Upland
Isopleth	Seasonally Flooded	
Backwater Areas	Seasonally Flooded/Saturated	
Flooding Regime (FGDC 2013)	Semi-permanently Flooded	
Intermittently Flooded	Permanently Flooded/Intermittently Exposed	

2021 - Color aerial "leaf off" ortho imagery, MassGIS



Reach 5A Surface Hydrology and Drainage Features Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

Figure 6-3e
Map Sheet 5 of 5



Legend

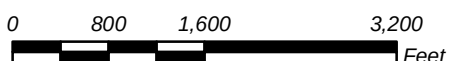
Cover Types

- Stream
- Upland
- Wetland

Reach Boundaries

Wetland Functional Units

1 inch = 1,600 feet



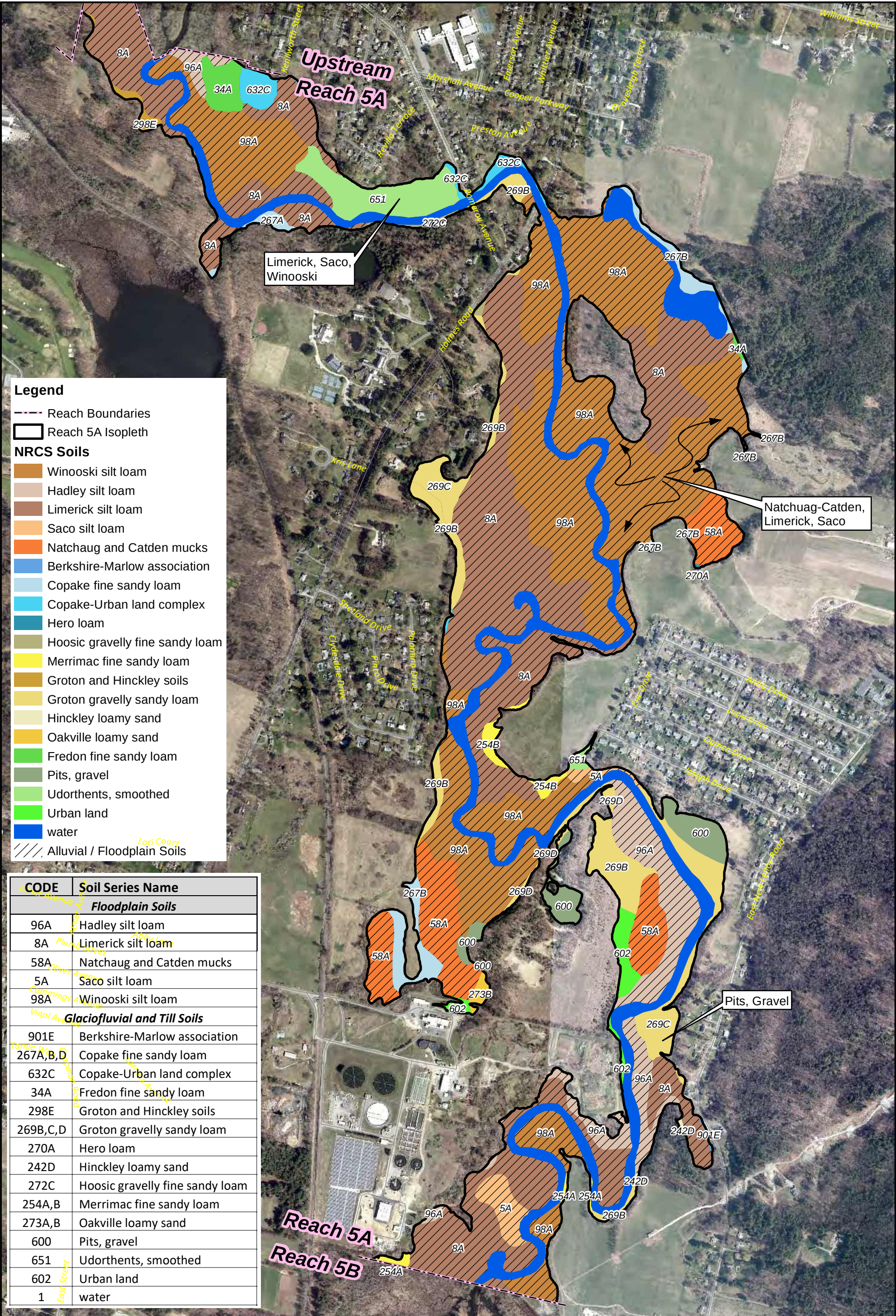
Reach 5A

Wetland Functional Units in Reach 5A
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:8,400	8/9/2023	60670015

AECOM

Figure 6-4



Legend

Reach Boundaries

Reach 5A Isopleth

NRCS Soils

Winooski silt loam

Hadley silt loam

Limerick silt loam

Saco silt loam

Natchaug and Catden mucks

Berkshire-Marlow association

Copake fine sandy loam

Copake-Urban land complex

Hero loam

Hoosic gravelly fine sandy loam

Merrimac fine sandy loam

Groton and Hinckley soils

Groton gravelly sandy loam

Hinckley loamy sand

Oakville loamy sand

Fredon fine sandy loam

Pits, gravel

Udorthents, smoothed

Urban land

water

Alluvial / Floodplain Soils

CODE	Soil Series Name
Floodplain Soils	
96A	Hadley silt loam
8A	Limerick silt loam
58A	Natchaug and Catden mucks
5A	Saco silt loam
98A	Winooski silt loam
Glaciofluvial and Till Soils	
901E	Berkshire-Marlow association
267A,B,D	Copake fine sandy loam
632C	Copake-Urban land complex
34A	Fredon fine sandy loam
298E	Groton and Hinckley soils
269B,C,D	Groton gravelly sandy loam
270A	Hero loam
242D	Hinckley loamy sand
272C	Hoosic gravelly fine sandy loam
254A,B	Merrimac fine sandy loam
273A,B	Oakville loamy sand
600	Pits, gravel
651	Udorthents, smoothed
602	Urban land
1	water

1 inch = 800 feet

0

400

800

1,600

Feet

Reach 5A

NRCS Mapped Soils in Reach 5A

Housatonic River - Pittsfield, MA

SCALE

DATE

PROJECT NO.

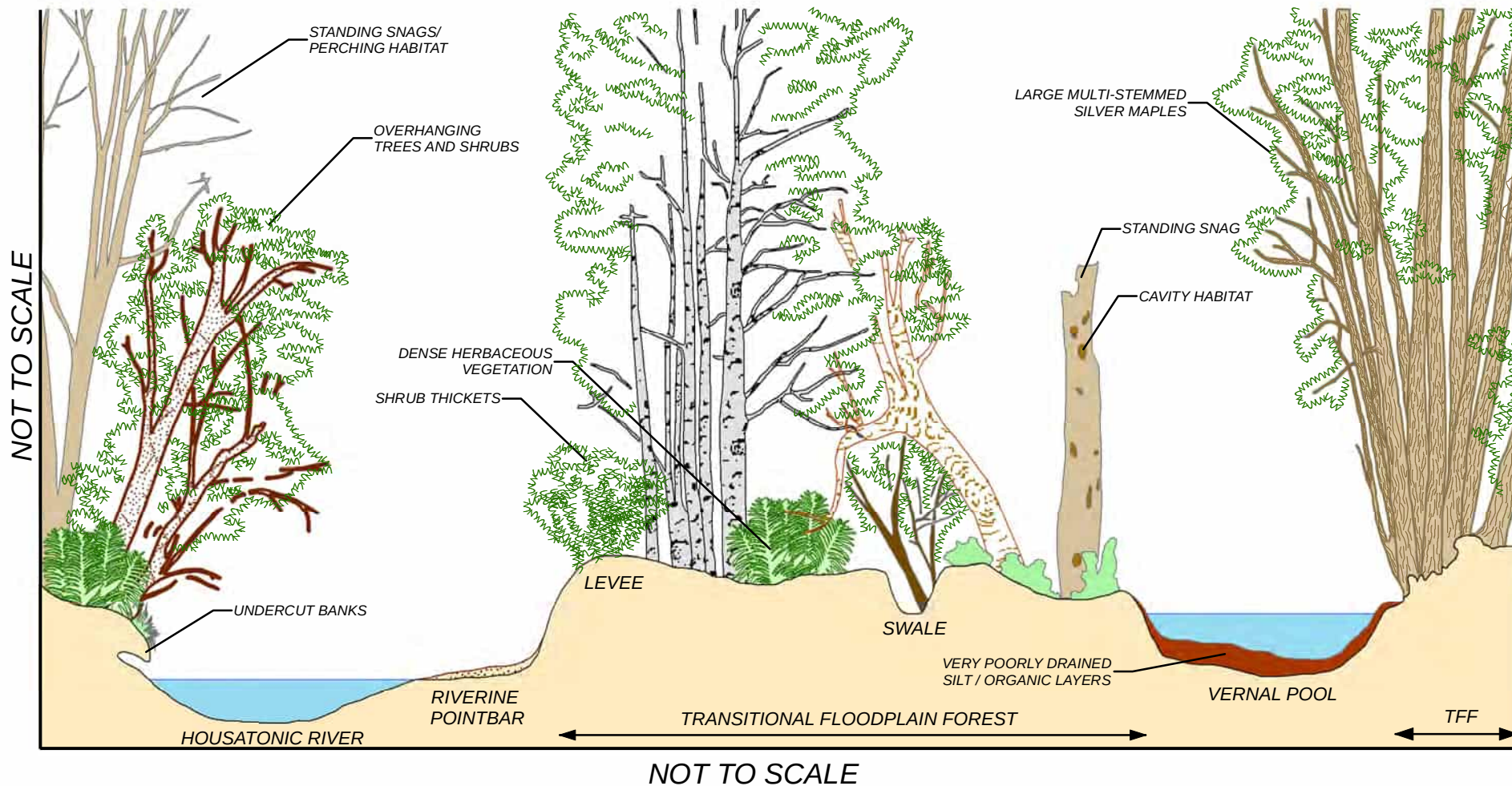
1:9,600

8/8/2023

60670015

AECOM

Figure 6-5

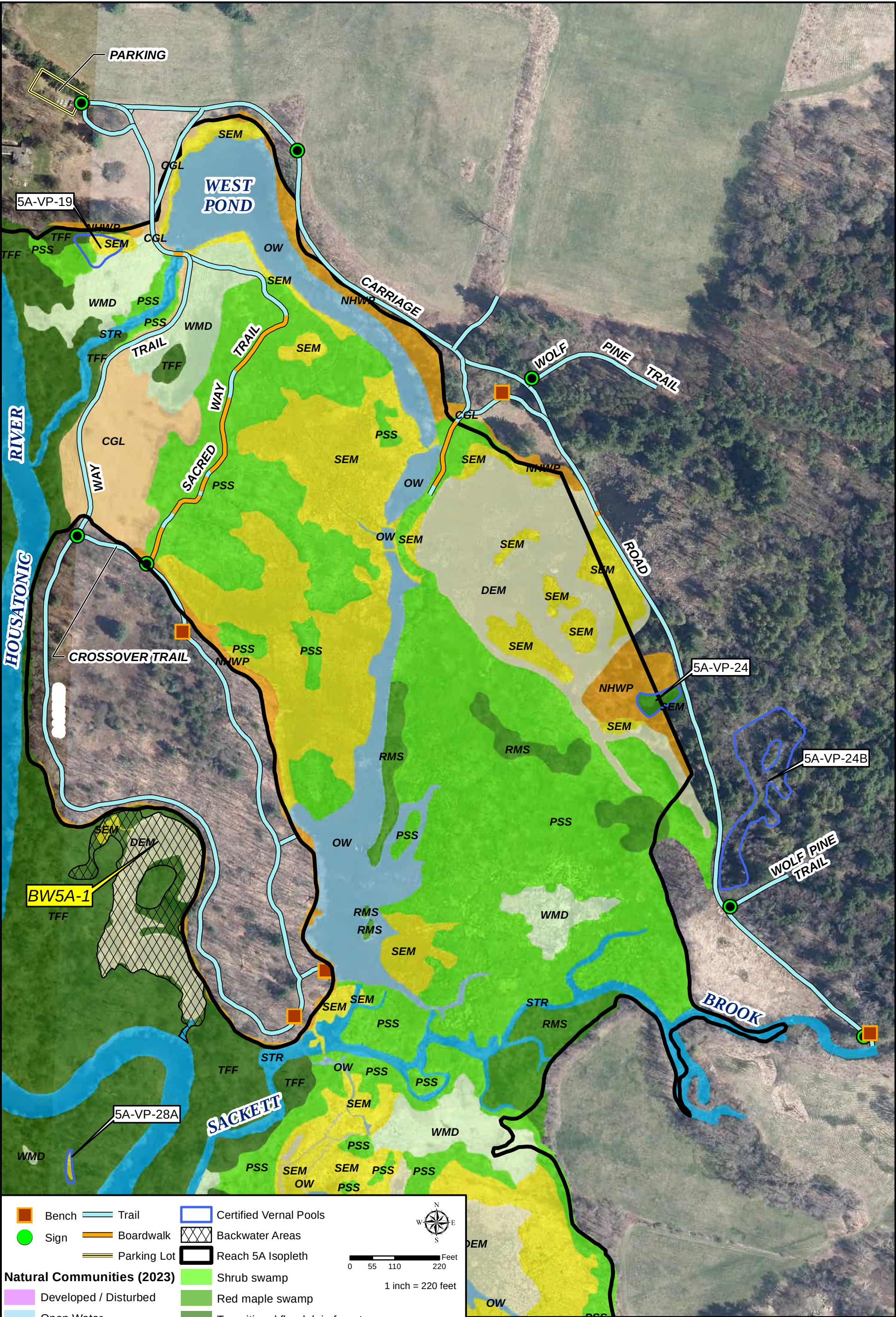


**Typical Cross-Section Through Riverine
and Floodplain Habitats in Reach 5A**
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
N/A	8/18/2023	60670015

AECOM

Figure 6-6



Bench

Sign

Trail

Boardwalk

Parking Lot

Certified Vernal Pools

Backwater Areas

Reach 5A Isopleth

Shrub swamp

Red maple swamp

Transitional floodplain forest

High-terrace floodplain forest

Cultural grasslands

Northern hardwoods-hemlock-white pine forest

Red oak-sugar maple transition forest

Developed / Disturbed

Open Water

Stream

Vernal Pool

Deep emergent marsh

Shallow emergent marsh

Wet meadow

0

55

110

220

Feet

1 inch = 220 feet

N

W

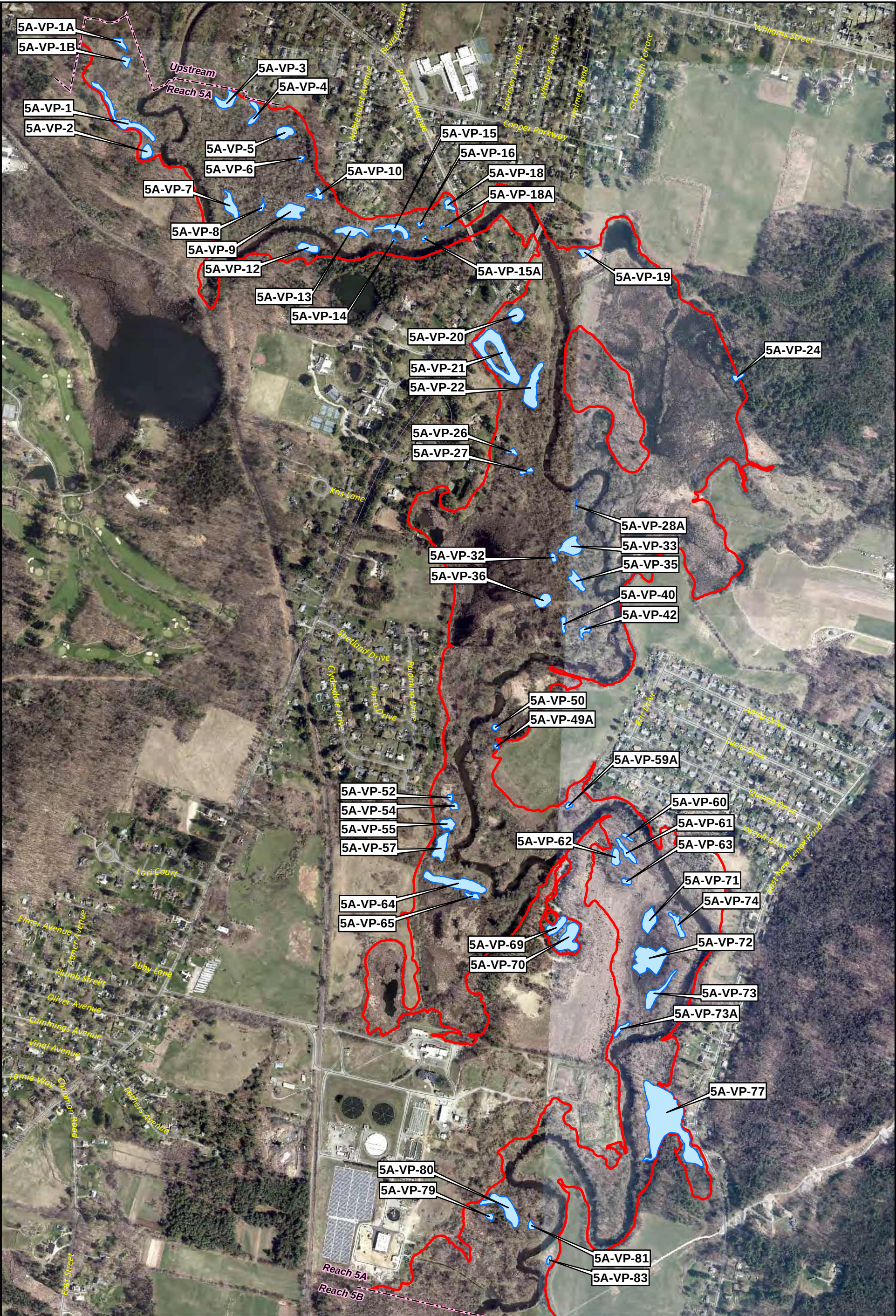
E

S

Canoe Meadows (EA 10) Existing Conditions Base Map Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:2,640	8/8/2023	60670015

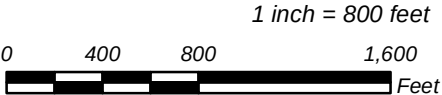
AECOM

Figure 6-7



Legend

- Reach Boundaries
- MNHESP Certifiable Vernal Pools
- Isopleth



Reach 5A		
MNHESP Certifiable Vernal Pools		
Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:9,600	8/3/2023	60670015

AECOM

Figure 7-1

Figure 7-2a. Percent organic carbon by dry weight.

Metric	% OC	
Min	1.5	
Max	11.0	VP-72
Mean	4.0	
SE	0.73	
IQR ¹	3.3	Includes 10 out of 15 Samples
Outlier Limit	10.1	Includes 1 out of 15 Samples

1. Interquartile Range, includes all samples from 25th to 75th percentile.

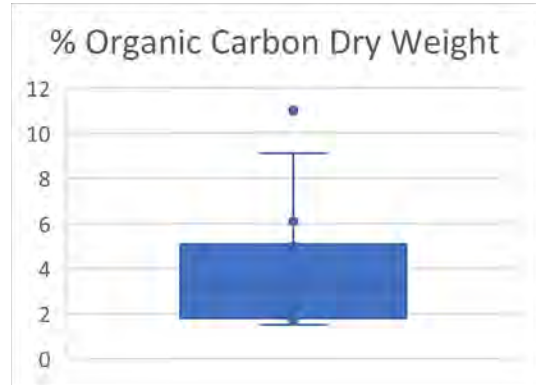


Figure 7-2b. Soil pH.

Metric	pH	
Min	5.6	
Max	6.9	VP-50
Mean	6.1	
SE	0.08	
IQR ¹	0.4	Includes 10 out of 15 Samples
Outlier Limit	6.9	Includes 1 out of 15 Samples

1. Interquartile Range, includes all samples from 25th to 75th percentile.

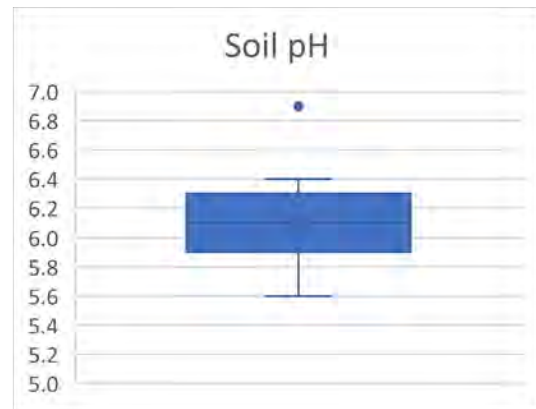


Figure 7-2c. Dissolved oxygen in water.

Metric	DO (mg/L)	
Min	1.2	
Max	14.5	
Mean	5.3	
SE	0.94	
IQR ¹	5.1	Includes 8 out of 14 Samples
Outlier Limit		No outliers in this dataset

1. Interquartile Range, includes all samples from 25th to 75th percentile.

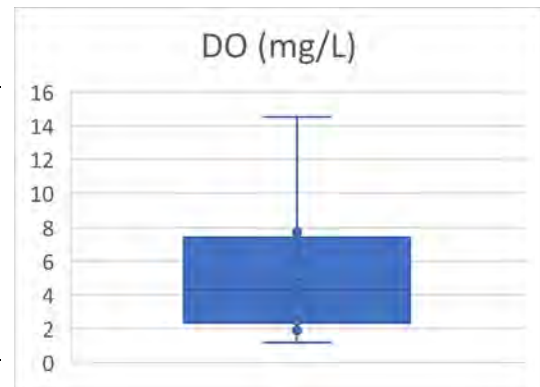


Figure 7-2d. Specific conductivity in water

Metric	Specific Conductivity	
Min	100.6	
Max	1578.0	VP-18
Mean	312.7	
SE	100.27	
IQR ¹	157.0	Includes 8 out of 14 Samples
Outlier Limit	528.0	Includes 1 out of 14 Samples

1. Interquartile Range, includes all samples from 25th to 75th percentile.

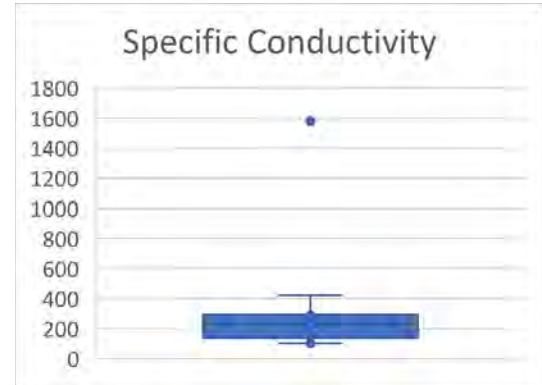
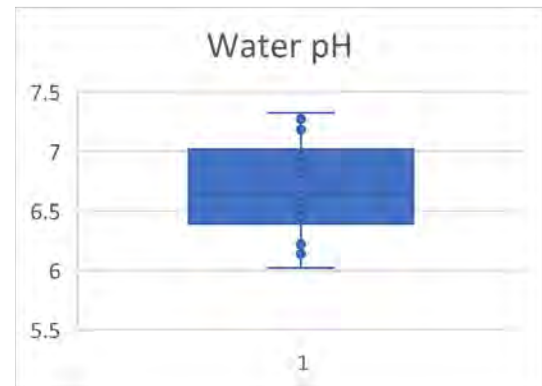
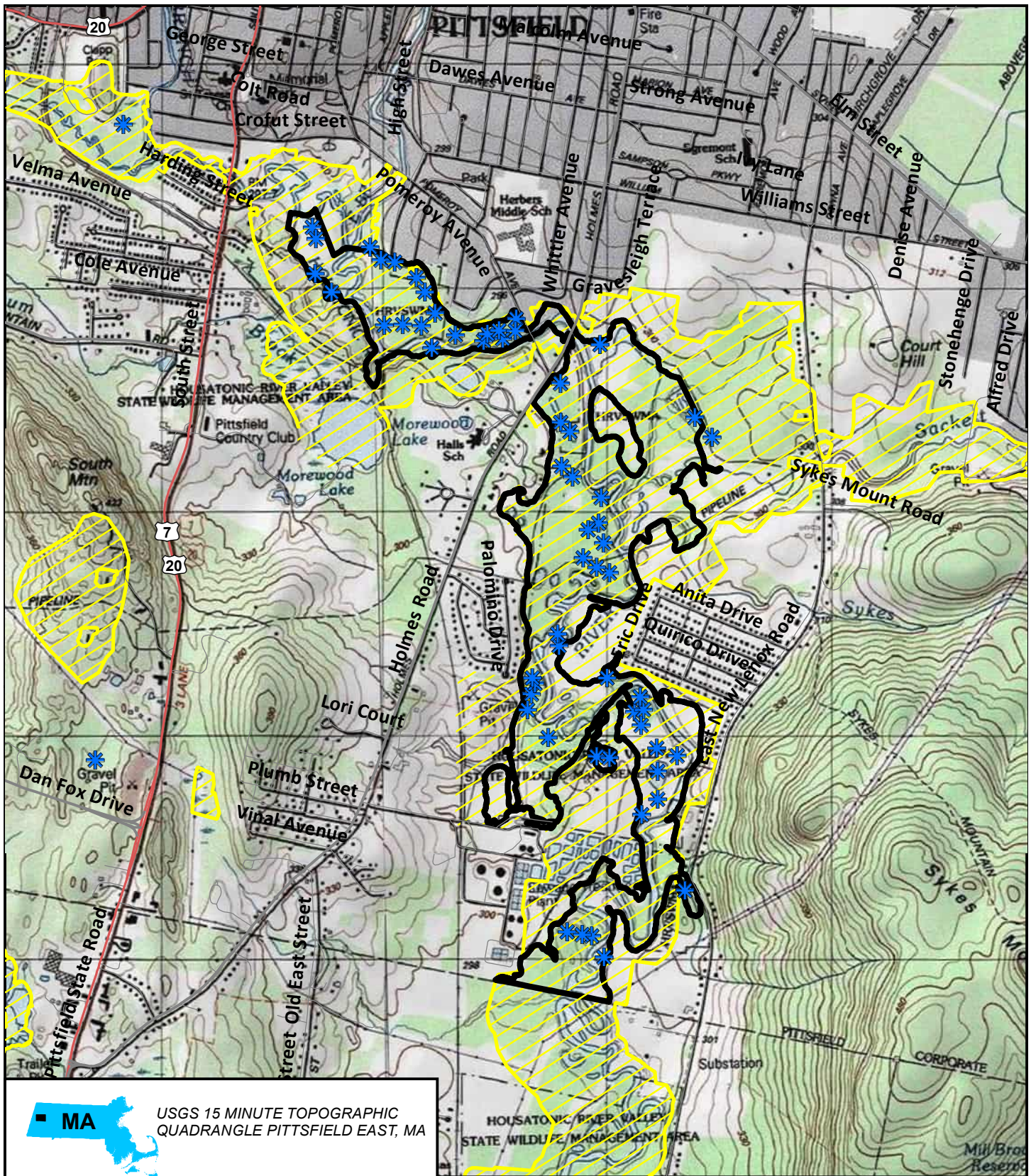


Figure 7-2e. Water pH.

Metric	Water pH	
Min	6.0	
Max	7.3	
Mean	6.7	
SE	0.11	
IQR ¹	0.6	Includes 8 out of 14 Samples
Outlier Limit		No outliers in this dataset

1. Interquartile Range, includes all samples from 25th to 75th percentile.





USGS 15 MINUTE TOPOGRAPHIC
QUADRANGLE PITTSFIELD EAST, MA

Legend

- Reach 5A Isopleth
- Priority Habitats 2021
- ★ NHESP CVPs

2,000 1,000 0 2,000
Feet



NHESP Priority Habitats

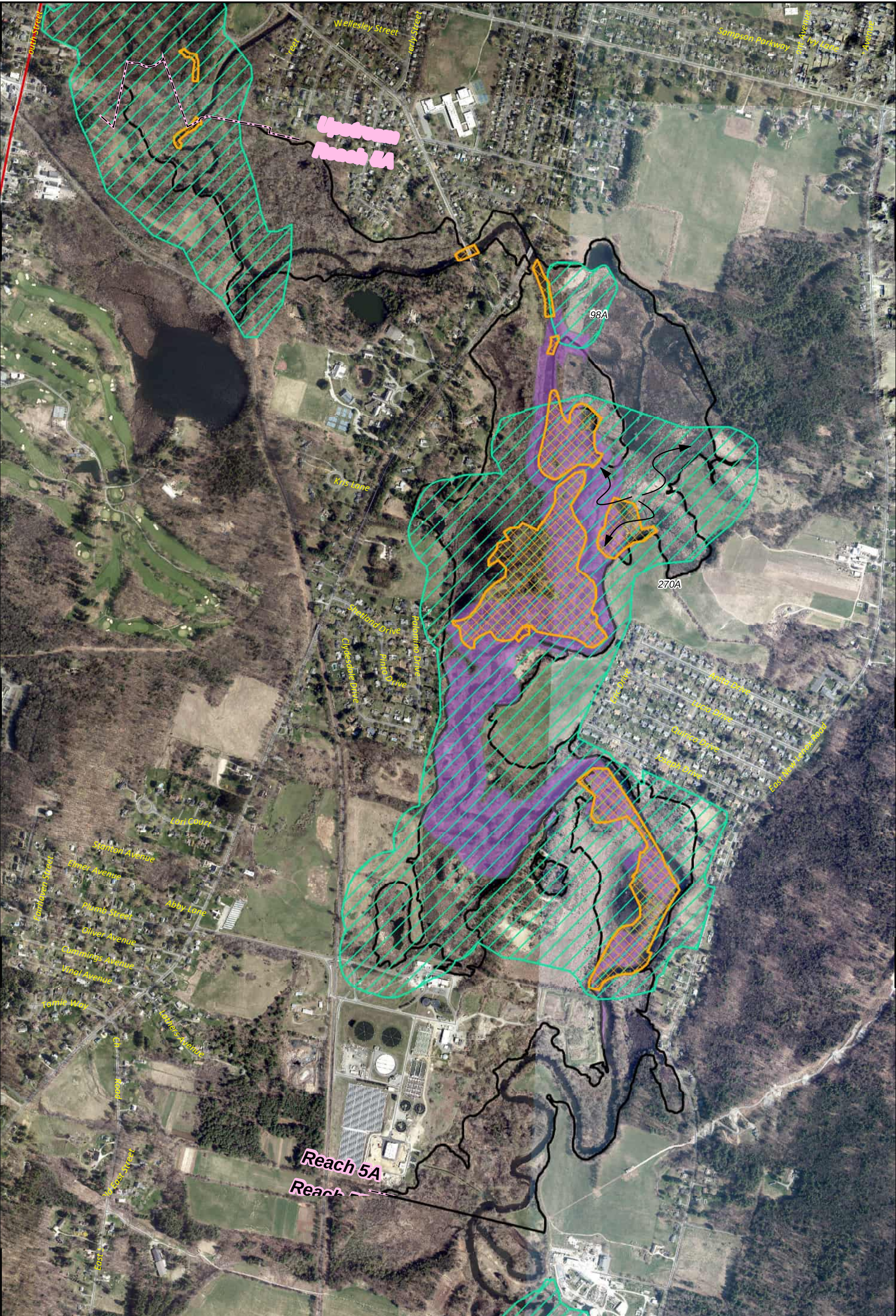
Reach 5A Floodplain Surveys
Pittsfield, Massachusetts

SCALE	DATE	PROJECT NO.
1:24,000	2/15/2024	04191406

AECOM

Figure Number

8-1



Legend

Reach Boundaries

Reach 5A Isopleth

NHESP Core Area 1*

NHESP Core Area 2

NHESP Core Area 3

0

450

900

1,800

Feet

1 inch = 900 feet

*NHESP Core Area 1 includes riverine areas that were designated for triangle floater mussels. This species has been delisted since these core areas were designated.

Reach 5A

Reach 5B

Reach 5A

NHESP Core Areas

Housatonic River - Pittsfield, MA

SCALE

DATE

PROJECT NO.

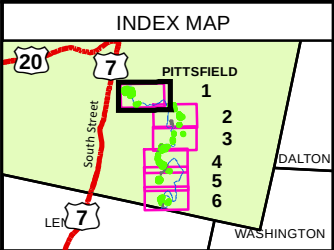
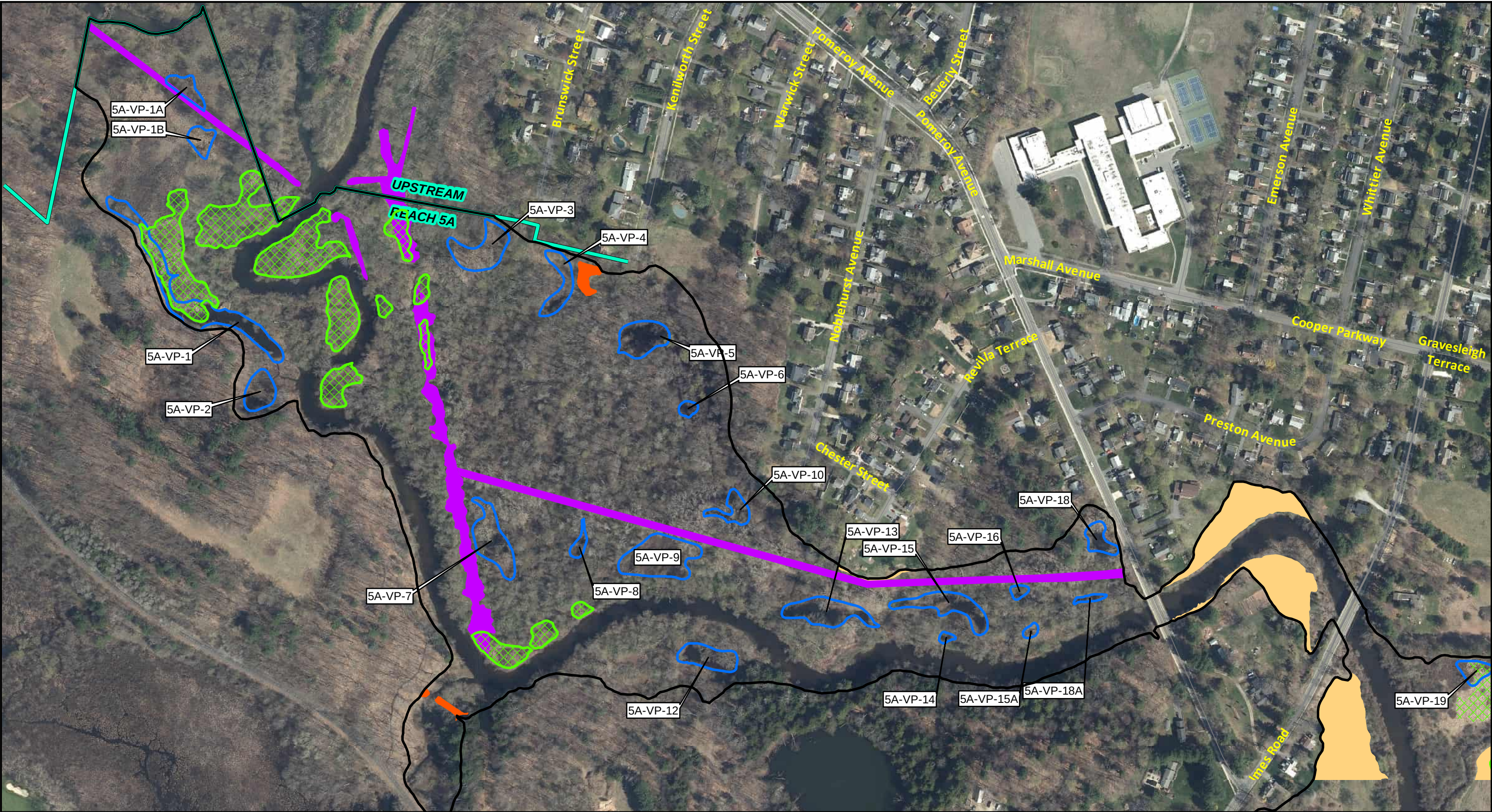
1:10,800

8/4/2023

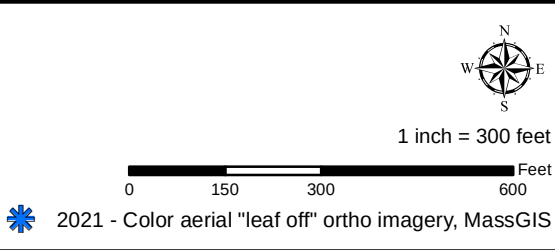
60670015

AECOM

Figure 8-2

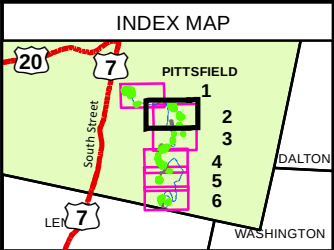
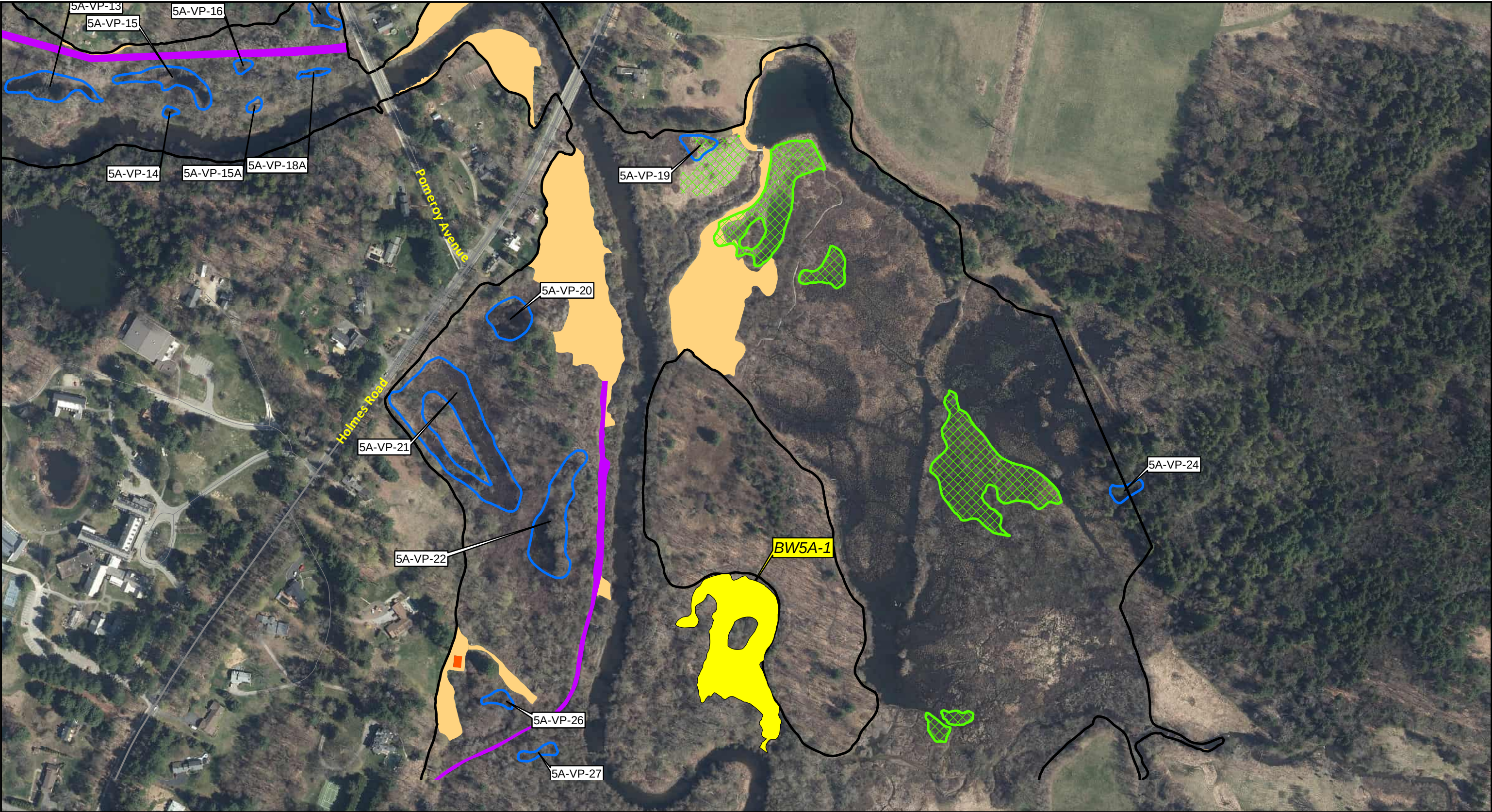


Disturbed / Degraded Areas		Other Features	
	Invasive Plants Dominant		Certified Vernal Pools
	Utility Lines		Isopleth
	Cultural grasslands		Reach Limits
	Agricultural Field		Backwater Areas
	Other Disturbed Areas		



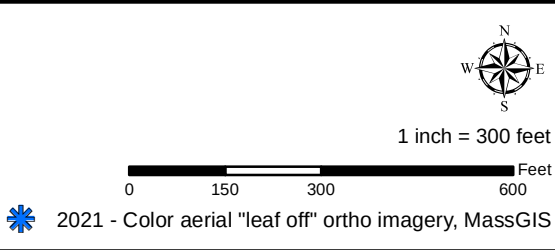
Reach 5A Disturbed Areas Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

Figure 10-1a
Map Sheet 1 of 5



- Disturbed / Degraded Areas**
- Invasive Plants Dominant
 - Utility Lines
 - Cultural grasslands
 - Agricultural Field
 - Other Disturbed Areas

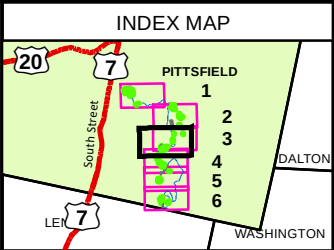
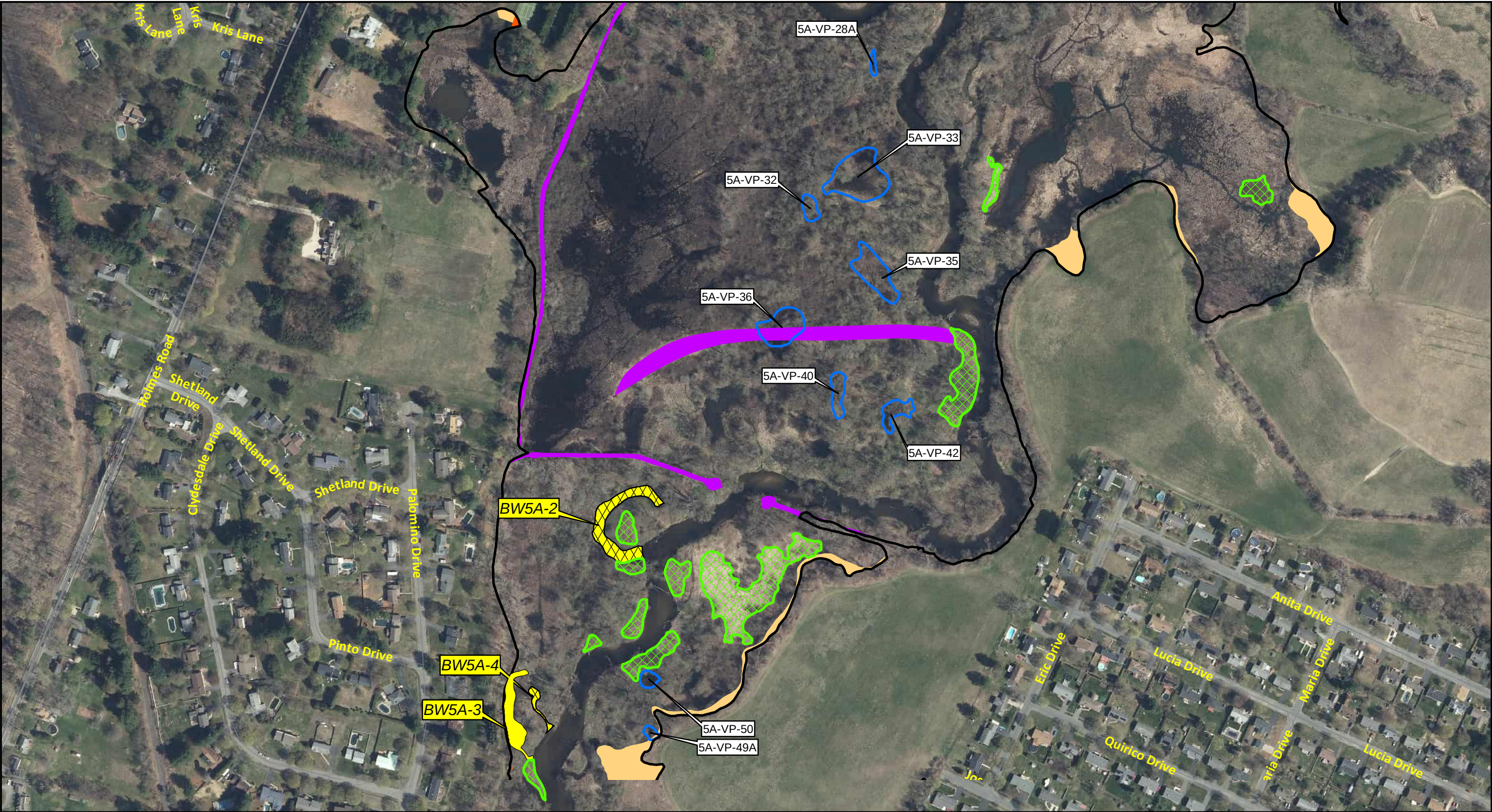
- Other Features**
- Certified Vernal Pools
 - Isopleth
 - Reach Limits
 - Backwater Areas



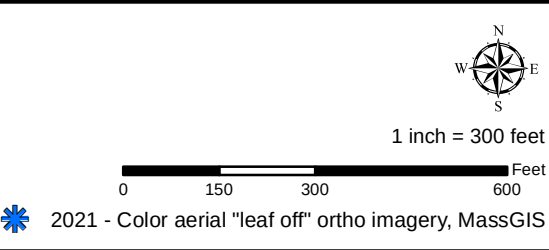
Reach 5A Disturbed Areas Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

AECOM

Figure 10-1b
Map Sheet 2 of 5

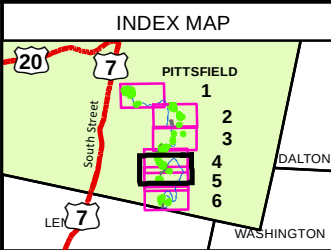
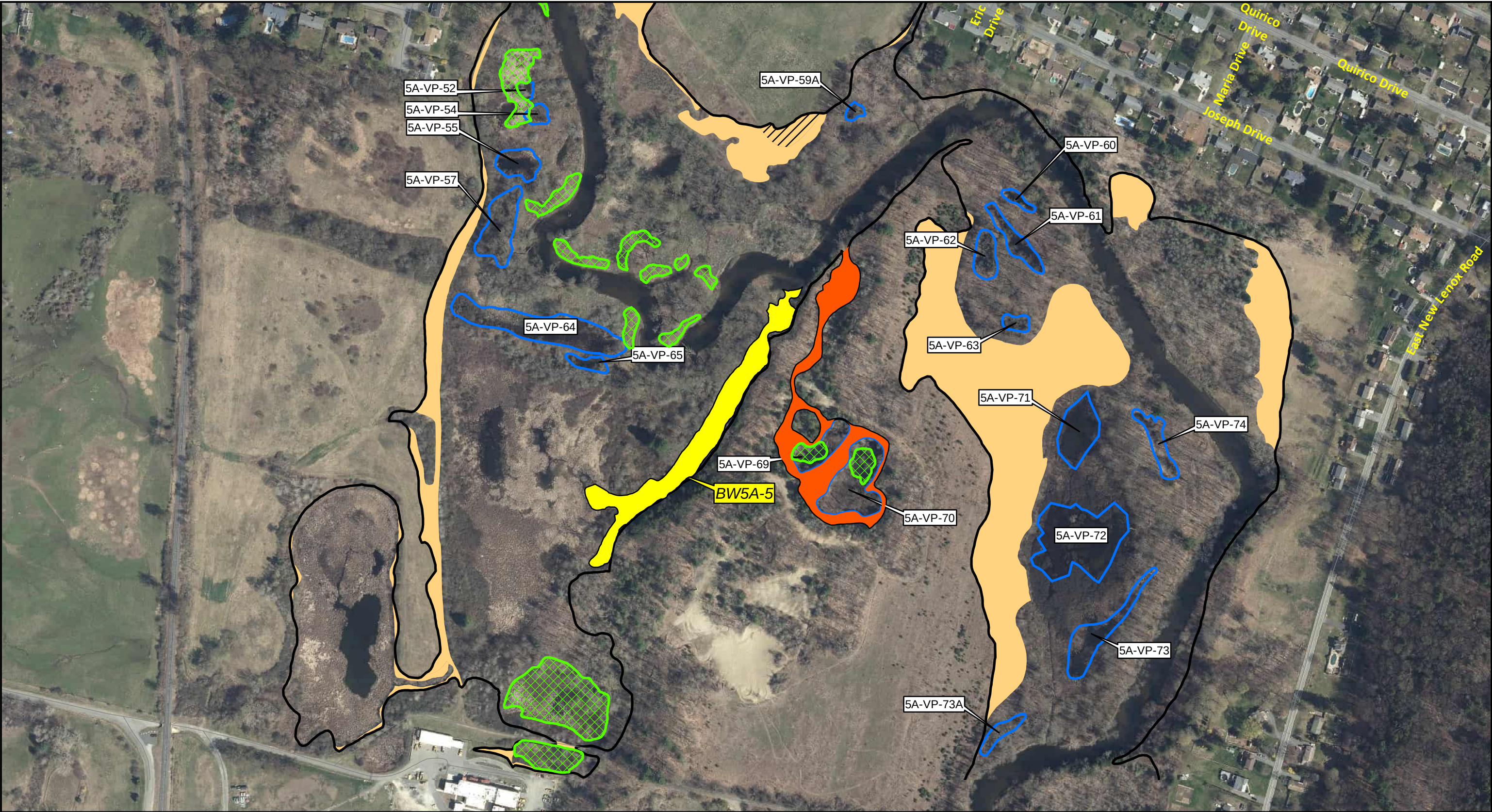


- | | |
|-----------------------------------|------------------------|
| Disturbed / Degraded Areas | Other Features |
| Invasive Plants Dominant | Certified Vernal Pools |
| Utility Lines | Isopleth |
| Cultural grasslands | Reach Limits |
| Agricultural Field | Backwater Areas |
| Other Disturbed Areas | |



Reach 5A Disturbed Areas Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

Figure 10-1c
Map Sheet 3 of 5



Disturbed / Degraded Areas

- Invasive Plants Dominant
- Utility Lines
- Cultural grasslands
- Agricultural Field
- Other Disturbed Areas

Other Features

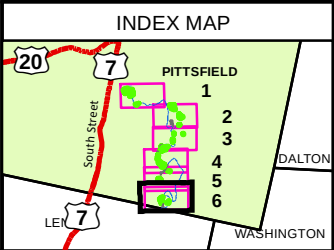
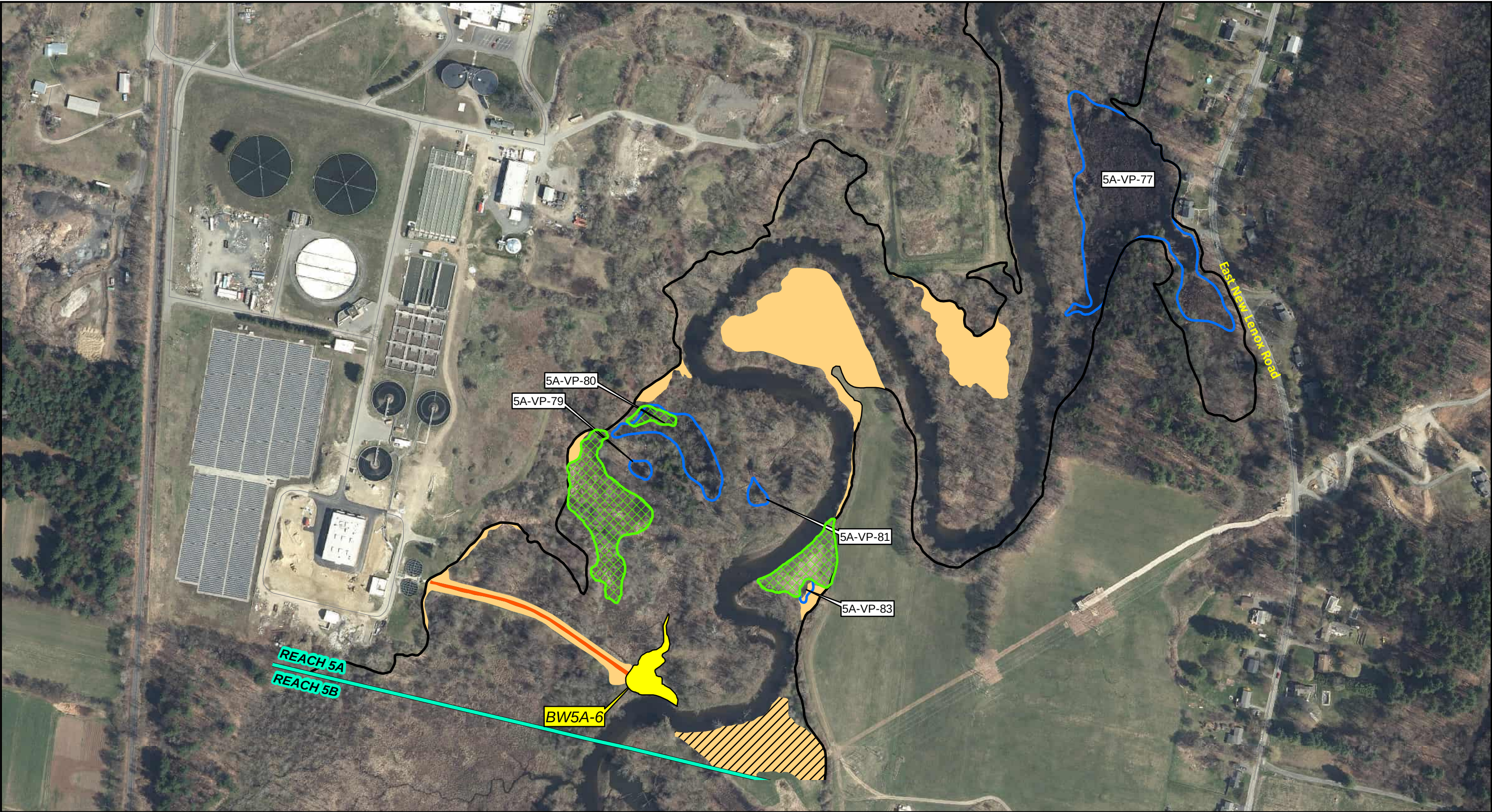
- Certified Vernal Pools
- Isopleth
- Reach Limits
- Backwater Areas

1 inch = 300 feet

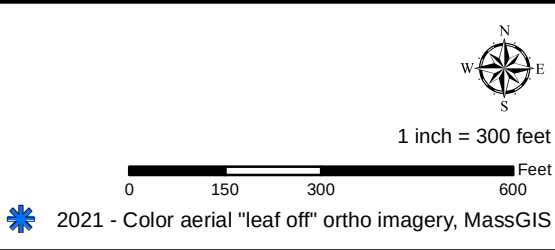
2021 - Color aerial "leaf off" ortho imagery, MassGIS

Reach 5A Disturbed Areas Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

Figure 10-1d
Map Sheet 4 of 5



- | Disturbed / Degraded Areas | Other Features |
|----------------------------|------------------------|
| Invasive Plants Dominant | Certified Vernal Pools |
| Utility Lines | Isopleth |
| Cultural grasslands | Reach Limits |
| Agricultural Field | Backwater Areas |
| Other Disturbed Areas | |



Reach 5A Disturbed Areas Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/18/2023	60670015

Figure 10-1e
Map Sheet 5 of 5

Appendix A

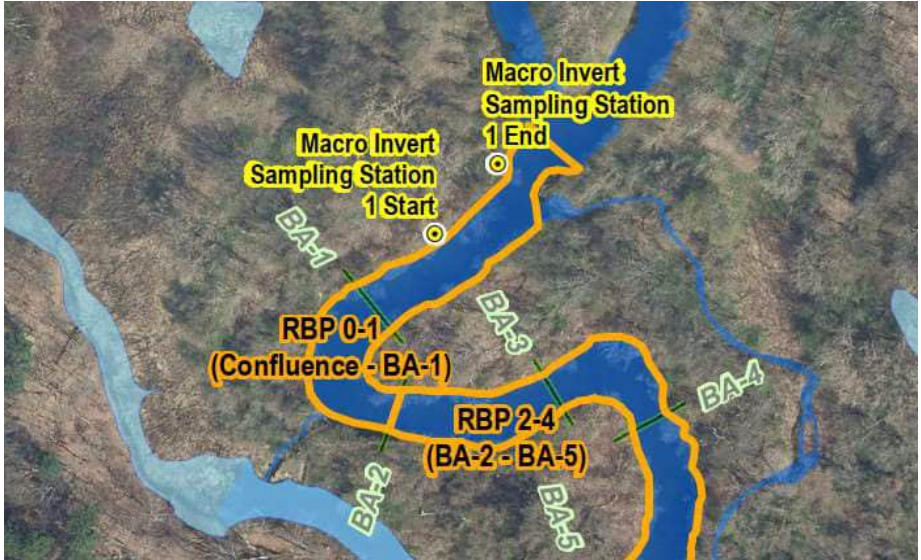
Riverine Habitat Information

- 1a. RBP Physical Data Sheets
- 1b. Incidental Wildlife Observations
- 2. Benthic Macroinvertebrate Results, Field Data Sheets and Notes
- 3. Fisheries Photo Log

A-1a RBP Physical Data Sheets (and Incidental Wildlife Observations)

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 0+00 - 5+00	
STATION # RBP 0-1 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.433205 LONG -73.251625		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/23/22 TIME 0920 ☒ AM ☐ PM	REASON FOR SURVEY Reach 5A BRA

WEATHER CONDITIONS	Now ☐ ☐ ☒ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover clear/sunny Past 24 hours ☐ ☒ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 <u>Silver Maple, Red Maple</u>			
INSTREAM FEATURES	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Estimated Reach Length <u>152.4</u> m Estimated Stream Width <u>27</u> m Sampling Reach Area <u>2753.4</u> m² Area in km² (m²x1000) <u>2.75</u> km² Estimated Stream Depth <u>1.5</u> m Surface Velocity (at thalweg) <u>0.5</u> m/sec </td><td style="width: 50%;"> Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>0.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>20</u> % ☒ Run <u>20</u> % ☒ Pool <u>60</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No </td></tr> </table>		Estimated Reach Length <u>152.4</u> m Estimated Stream Width <u>27</u> m Sampling Reach Area <u>2753.4</u> m ² Area in km² (m²x1000) <u>2.75</u> km ² Estimated Stream Depth <u>1.5</u> m Surface Velocity (at thalweg) <u>0.5</u> m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>0.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>20</u> % ☒ Run <u>20</u> % ☒ Pool <u>60</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No
Estimated Reach Length <u>152.4</u> m Estimated Stream Width <u>27</u> m Sampling Reach Area <u>2753.4</u> m ² Area in km² (m²x1000) <u>2.75</u> km ² Estimated Stream Depth <u>1.5</u> m Surface Velocity (at thalweg) <u>0.5</u> m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>0.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>20</u> % ☒ Run <u>20</u> % ☒ Pool <u>60</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No			
LARGE WOODY DEBRIS	LWD <u>50</u> m ² Density of LWD <u>12.15</u> m ² /km ² (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 <u>Potamogeton Crispis</u> Portion of the reach with aquatic vegetation <u>3</u> %			
WATER QUALITY	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Temperature <u>19.8</u> °C Specific Conductance <u>0.563</u> ms/cm Dissolved Oxygen <u>7.45</u> mg/L pH <u>8.18</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> </td><td style="width: 50%;"> 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 _____ </td></tr> </table>		Temperature <u>19.8</u> °C Specific Conductance <u>0.563</u> ms/cm Dissolved Oxygen <u>7.45</u> mg/L pH <u>8.18</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u>	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 _____
Temperature <u>19.8</u> °C Specific Conductance <u>0.563</u> ms/cm Dissolved Oxygen <u>7.45</u> mg/L pH <u>8.18</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u>	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	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse </td><td style="width: 50%;"> Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No </td></tr> </table>		Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No
Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>10</u>
Boulder	> 256 mm (10")	<u>2</u>			
Cobble	64-256 mm (2.5"-10")	<u>15</u>	Muck-Mud	black, very fine organic (FPOM)	<u>5</u>
Gravel	2-64 mm (0.1"-2.5")	<u>20</u>			
Sand	0.06-2mm (gritty)	<u>5</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>48</u>			
Clay	< 0.004 mm (slick)	<u>10</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	0+00 - 5+00
STATION #	RBP 0-1	RIVERMILE	N/A
LAT	42.433205	LONG	-73.251625
STORER #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	SM	DATE	08/23/22
		TIME	0920 ☒ AM ☐ PM
		REASON FOR SURVEY	Reach 5A BRA

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	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 <u>not</u> new fall and <u>not</u> 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 14	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 12	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 17	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 11	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 14	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)

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 19	20 ☒ 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 17	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 4 (LB)	Left Bank 10 9	8 7 6	5 ☒ 4 3	2 1 0
SCORE 4 (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 4 (LB)	Left Bank 10 9	8 7 6	5 ☒ 4 3	2 1 0
SCORE 5 (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

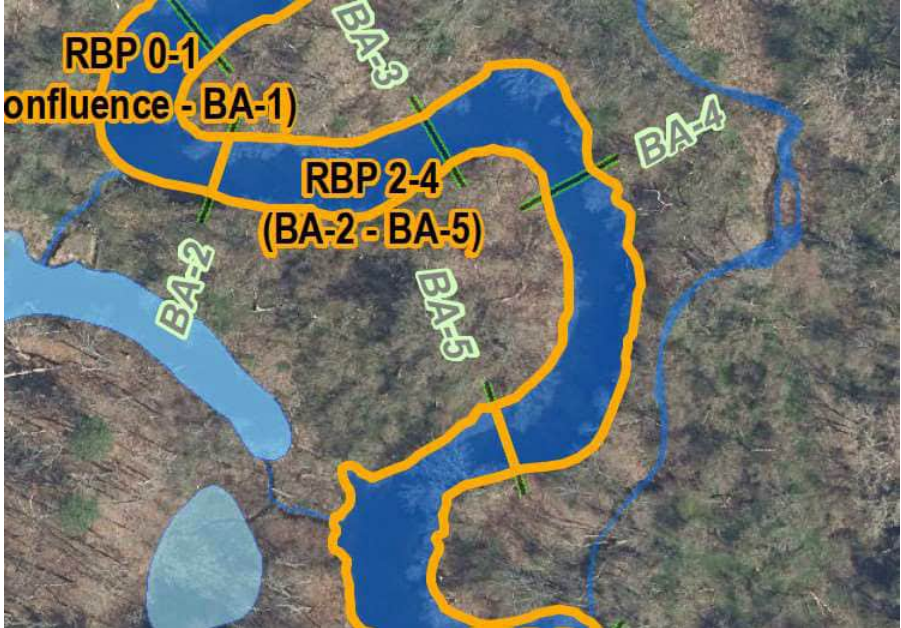
Client Name: GE		Site Location: Reach 5A Housatonic River		Project No. 60689453
Photo No. 1	Date: 08/23/22			
Direction Photo Taken: North				
Description: Station RBP 0-1 looking upstream contains a short run. The shoreline consists of grassy vegetation along with large bushes and trees. The banks have slight signs of erosion and bits of woody debris. Substrate is largely composed of silt with smaller percentages of gravel, cobble, and clay.				

Photo No. 2	Date: 8/23/22			
Direction Photo Taken: South				
Description: RBP 0-1 looking downstream. This section of the river consisted of a pool around five feet deep. There is little to no woody debris and the partly overhanging canopy is made up of silver and red maple trees.				

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/23/22		
Direction Photo Taken: Southeast			
Description: RBP 0-1 looking downstream. This section of RBP 0-1 was dominated by a pool environment with slight shoreline erosion. Similar to the previous image, the pool is around five feet deep and there is a partly overhanging canopy.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 5+00 - 11+00	
STATION # RBP 2-4 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.432825 LONG -73.250741		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/23/22 TIME 1024 ☒ AM ☐ PM	
		REASON FOR SURVEY Reach 5A BRA	

WEATHER CONDITIONS	Now ☐ ☐ ☒ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 90 % clear/sunny Past 24 hours ☒ ☒ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 90 % clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 21 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 Box Elder, Silver Maple, 1 Knotweed		
INSTREAM FEATURES	Estimated Reach Length 200 m Estimated Stream Width 17 m Sampling Reach Area 3535 m² Area in km² (m²x1000) 3.5 km² Estimated Stream Depth 1 m Surface Velocity (at thalweg) 0.5 m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 1 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 5 % ☒ Run 70 % ☒ Pool 25 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD 200 m ² Density of LWD 58.8 m ² /km ² (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 very sparse Portion of the reach with aquatic vegetation 0.5 %		
WATER QUALITY	Temperature 20.3 °C Specific Conductance 0.571 ms/cm Dissolved Oxygen 8.43 mg/L pH 8.4 Turbidity _____ WQ Instrument Used YSI 650 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 _____ 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)	20
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	15	Muck-Mud	black, very fine organic (FPOM)	5
Gravel	2-64 mm (0.1"-2.5")	15			
Sand	0.06-2mm (gritty)	40	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	20			
Clay	< 0.004 mm (slick)	10			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 5+00 - 11+00
STATION #	RBP 2-4	RIVERMILE	N/A
LAT	42.432825	LONG	-73.250741
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	KVN	DATE	08/23/22
		TIME	1024 ☒ AM ☐ PM
		REASON FOR SURVEY	Reach 5A 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 <u>not</u> new fall and <u>not</u> 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 13	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 16	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 16	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 12	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 15	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)

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 19	20 ☒ 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 14	20 19 18 17 16	15 ☒ 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 8 (LB)	Left Bank 10 9	☒ 7 6	5 4 3	2 1 0
SCORE 3 (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 5 (LB)	Left Bank 10 9	8 7 6	☒ 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	☒ 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 ☒ 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank ☒ 9	8 7 6	5 4 3	2 1 0

Total Score

Client Name: GE	Site Location: Reach 5A Housatonic River	Project No. 60689453
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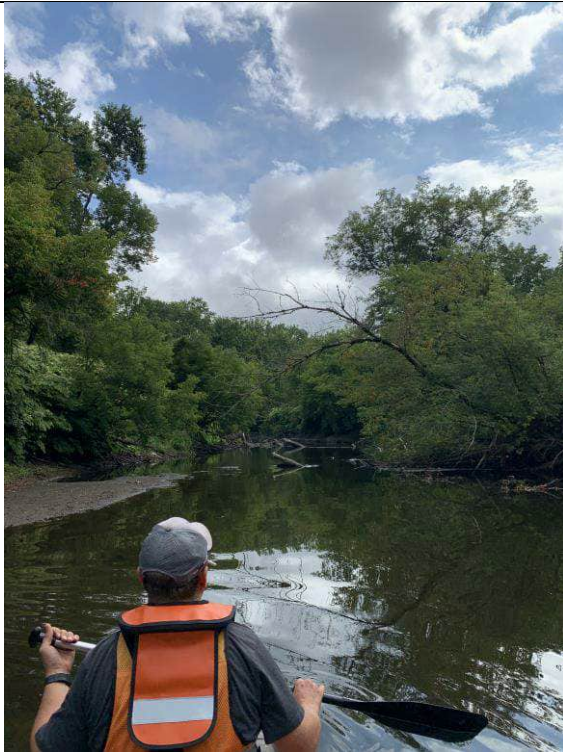
Photo No. 1	Date: 8/23/22	
Direction Photo Taken: East		
Description: RBP 2-4 looking downstream. This section of pool/run contained a moderate number of woody debris including fallen logs. A dead tree overhanging the river may provide another source of woody debris in the future. The shoreline consists of many trees.		

Photo No. 2	Date: 8/23/22	
Direction Photo Taken: West		
Description: RBP 2-4 looking upstream shows a run with large cluster of woody debris in the middle of the river and smaller clumps closer to the shoreline.		

Photo No. 3	Date: 8/23/22	
Direction Photo Taken: South		
Description: Further downstream in RBP 2-4 looking downstream. This section contains a shallow riffle/run with a sand/gravel bar and woody debris piled on top. The left side of the image shows erosion and slope failure, leading to multiple trees leaning over the river.		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 11+00 - 24+00	
STATION # RBP 5-6 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.430558 LONG -73.249828		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/23/22 TIME 1030 ☒ AM ☐ PM	
		REASON FOR SURVEY Reach 5A BRA	

WEATHER CONDITIONS	Now ☐ ☐ ☒ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 100 % clear/sunny ☐ Past 24 hours ☒ ☒ ☐ ☒ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 90 % clear/sunny ☐ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 22 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 <u>Red maple, Silver maple</u>			
INSTREAM FEATURES	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Estimated Reach Length <u>365</u> m Estimated Stream Width <u>25</u> m Sampling Reach Area <u>7701</u> m² Area in km² (m²x1000) <u>7.7</u> km² Estimated Stream Depth <u>1.5</u> m Surface Velocity (at thalweg) <u>0.5</u> m/sec </td><td style="width: 50%;"> Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>25</u> % ☒ Run <u>65</u> % ☒ Pool <u>10</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No </td></tr> </table>		Estimated Reach Length <u>365</u> m Estimated Stream Width <u>25</u> m Sampling Reach Area <u>7701</u> m ² Area in km² (m²x1000) <u>7.7</u> km ² Estimated Stream Depth <u>1.5</u> m Surface Velocity (at thalweg) <u>0.5</u> m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>25</u> % ☒ Run <u>65</u> % ☒ Pool <u>10</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No
Estimated Reach Length <u>365</u> m Estimated Stream Width <u>25</u> m Sampling Reach Area <u>7701</u> m ² Area in km² (m²x1000) <u>7.7</u> km ² Estimated Stream Depth <u>1.5</u> m Surface Velocity (at thalweg) <u>0.5</u> m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>25</u> % ☒ Run <u>65</u> % ☒ Pool <u>10</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No			
LARGE WOODY DEBRIS	LWD <u>150</u> m ² Density of LWD <u>16.44</u> m ² /km ² (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 <u>Potamogeton crispus</u> Portion of the reach with aquatic vegetation <u>2</u> %			
WATER QUALITY	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Temperature <u>19.6</u> °C Specific Conductance <u>0.597</u> ms/cm Dissolved Oxygen <u>6.53</u> mg/L pH <u>8.09</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> </td><td style="width: 50%;"> 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 _____ </td></tr> </table>		Temperature <u>19.6</u> °C Specific Conductance <u>0.597</u> ms/cm Dissolved Oxygen <u>6.53</u> mg/L pH <u>8.09</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u>	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 _____
Temperature <u>19.6</u> °C Specific Conductance <u>0.597</u> ms/cm Dissolved Oxygen <u>6.53</u> mg/L pH <u>8.09</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u>	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	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse </td><td style="width: 50%;"> Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No </td></tr> </table>		Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No
Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>7</u>
Boulder	> 256 mm (10")	<u>0</u>			
Cobble	64-256 mm (2.5"-10")	<u>10</u>	Muck-Mud	black, very fine organic (FPOM)	<u>1</u>
Gravel	2-64 mm (0.1"-2.5")	<u>30</u>			
Sand	0.06-2mm (gritty)	<u>25</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>25</u>			
Clay	< 0.004 mm (slick)	<u>10</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 11+00 - 24+00
STATION #	RBP 5-6	RIVERMILE	N/A
LAT	42.430558	LONG	-73.249828
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	SM	DATE	08/23/22
		TIME	1030 ☒ AM ☐ PM
		REASON FOR SURVEY	Reach 5A BRA

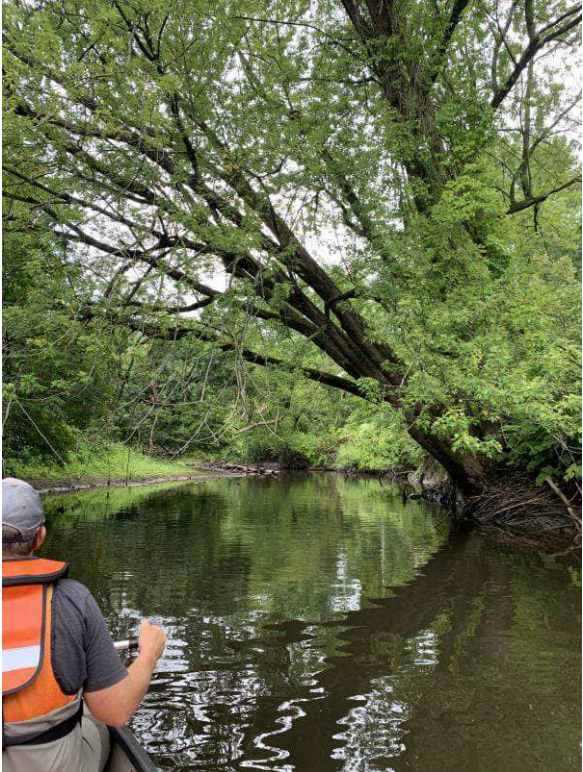
Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> 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 10	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 10	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 16	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 09	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 12	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)

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 17	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 6	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 6 (LB)	Left Bank 10 9	8 7 ☒ 6	5 4 3	2 1 0
SCORE 5 (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 6 (LB)	Left Bank 10 9	8 7 ☒ 6	5 4 3	2 1 0
SCORE 6 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/23/22		
Direction Photo Taken: Southwest			
Description: RBP 5-6 looking downstream. Maple trees provide a partial canopy over the river's run. Erosion is affecting the shoreline on the right side which is covered in shrubs and trees. Grassy vegetation and shrubs cover the left shoreline.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 24+00 - 38+00	
STATION # RBP 7-9	RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.429998	LONG -73.246600	RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/23/22 TIME 1510 ☐ AM ☒ PM	REASON FOR SURVEY Reach 5A BRA

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☒ showers (intermittent) ☐ 40 % ☒ %cloud cover ☐ clear/sunny Past 24 hours ☒ ☒ ☐ ☒ 100 % ☐ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 22 ° C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) Additional photographs attached below.
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 km²

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 <u>Silver maple, box elder</u>		
INSTREAM FEATURES	Estimated Reach Length <u>500</u> m Estimated Stream Width <u>25</u> m Sampling Reach Area <u>8872</u> m ² Area in km² (m²x1000) <u>8.8</u> km ² Estimated Stream Depth <u>1.5</u> m Surface Velocity (at thalweg) <u>0.5</u> m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>10</u> % ☒ Run <u>70</u> % ☒ Pool <u>20</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD <u>500</u> m ² Density of LWD <u>40</u> m ² /km ² (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 <u>Potamogeton crispus</u> Portion of the reach with aquatic vegetation <u>1</u> %		
WATER QUALITY	Temperature <u>21.2</u> °C Specific Conductance <u>0.571</u> ms/cm Dissolved Oxygen <u>8.88</u> mg/L pH <u>8.48</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> 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 _____ Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>10</u>
Boulder	> 256 mm (10")	<u>0</u>			
Cobble	64-256 mm (2.5"-10")	<u>5</u>	Muck-Mud	black, very fine organic (FPOM)	<u>0</u>
Gravel	2-64 mm (0.1"-2.5")	<u>20</u>			
Sand	0.06-2mm (gritty)	<u>45</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>25</u>			
Clay	< 0.004 mm (slick)	<u>5</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 24+00 - 38+00
STATION #	RBP 7-9	RIVERMILE	N/A
LAT	42.429998	LONG	-73.246600
STORER #	N/A	RIVER BASIN	Housatonic
AGENCY	N/A		
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	KVN	DATE	08/23/22
		TIME	1510 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A BRA

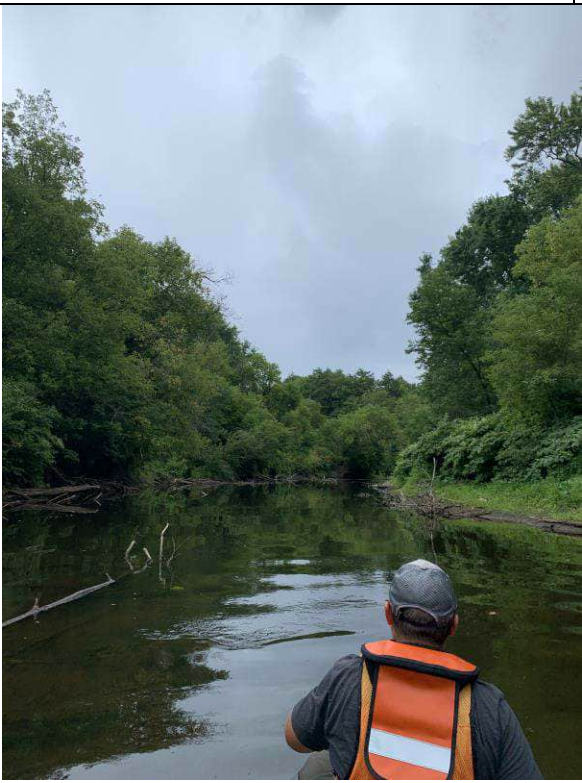
	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> 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 16	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 10	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 13	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 11	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 14	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)

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 17	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 12	20 19 18 12 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 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (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 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (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 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/23/22		
Direction Photo Taken: West			
Description: RBP 7-9 looking upstream. This run contains many groups of woody debris along both shorelines, resulting in good cover for epifaunal organisms and fish. This section of RBP 7-9 had slight erosion, but other parts had more moderate erosion issues.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 38+00 - 56+00	
STATION # RBP 10-11 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.429839 LONG -73.241568		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/23/22 TIME 1445 ☐ AM ☒ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☒ storm (heavy rain) ☒ rain (steady rain) ☐ showers (intermittent) 100 %cloud cover ☒ clear/sunny Past 24 hours ☒ storm (heavy rain) ☒ rain (steady rain) ☐ showers (intermittent) 90 %cloud cover ☐ clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 22 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☒ Mixture of origins ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 <u>Silver maple</u>		
INSTREAM FEATURES	Estimated Reach Length <u>490</u> m Estimated Stream Width <u>25</u> m Sampling Reach Area <u>10404</u> m² Area in km² (m²x1000) <u>10.4</u> km² Estimated Stream Depth <u>0.75</u> m Surface Velocity (at thalweg) <u>0.25</u> m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>2</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>15</u> % ☒ Run <u>55</u> % ☒ Pool <u>30</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD <u>200</u> m ² Density of LWD <u>16.33</u> m ² /km ² (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 <u>Potamogeton crispis</u> Portion of the reach with aquatic vegetation <u>2</u> %		
WATER QUALITY	Temperature <u>20.2</u> °C Specific Conductance <u>0.594</u> ms/cm Dissolved Oxygen <u>7.47</u> mg/L pH <u>8.36</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> 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 <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>5</u>
Boulder	> 256 mm (10")	<u>6</u>			
Cobble	64-256 mm (2.5"-10")	<u>2</u>	Muck-Mud	black, very fine organic (FPOM)	<u>3</u>
Gravel	2-64 mm (0.1"-2.5")	<u>30</u>			
Sand	0.06-2mm (gritty)	<u>30</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>29</u>			
Clay	< 0.004 mm (slick)	<u>3</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 38+00 - 56+00
STATION #	RBP 10-11	RIVERMILE	N/A
LAT	42.429839	LONG	-73.241568
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	SM	DATE	08/23/22
		TIME	1445 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A 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 <u>not</u> new fall and <u>not</u> 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 10	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 11	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 14	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 8	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 9	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)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	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 13	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 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 8	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) SCORE 4 (LB) SCORE 4 (RB)	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.
Left Bank	10 9	8 7 6	5 4 3	2 1 0
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.
Left Bank	10 9	8 7 6	5 4 3	2 1 0
Right Bank	10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE (LB) SCORE (RB)	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.
Left Bank	10 9	8 7 6	5 4 3	2 1 0
Right Bank	10 9	8 7 6	5 4 3	2 1 0

Total Score

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/23/22		
Direction Photo Taken: Southwest			
Description: RBP 10-11 looking upstream near Pomeroy Ave Bridge. A shallow run flows underneath the bridge and past a deposited sand bar on both sides. Litter is scattered on the riverbed.			
Photo No. 2	Date: 8/23/22		
Direction Photo Taken: East			
Description: RBP 10-11 looking downstream. This section contains a short riffle that cuts through the sand bar. The rest of the stream in this section is a shallow run. Dense vegetation on both shorelines. Cobble covers the slope on the right shoreline.			

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/23/22		
Direction Photo Taken: Northeast			
Description: RBP 11 outer bend. The outer bend of RBP 11 contains rip rap to prevent shoreline erosion near houses. The water also gets deeper on the outer bend and changes from a run to a pool.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 56+00 - 88+00	
STATION # RBP 12-13 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.426141 LONG -73.238070		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/23/22 TIME 1545 ☐ AM ☒ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☒ %cloud cover ☐ clear/sunny Past 24 hours ☒ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☒ %cloud cover ☐ clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 22 °C Other 		
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.		
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²		

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 <u>Silver maple</u>		
INSTREAM FEATURES	Estimated Reach Length <u>975</u> m Estimated Stream Width <u>25</u> m Sampling Reach Area <u>19568</u> m² Area in km² (m²x1000) <u>19.5</u> km² Estimated Stream Depth <u>1.5</u> m Surface Velocity <u>0.25</u> m/sec (at thalweg) Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>5</u> % ☒ Run <u>30</u> % ☒ Pool <u>65</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD <u>500</u> m ² Density of LWD <u>20.5</u> m ² /km ² (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 <u>Potamogeton crispus + algae</u> Portion of the reach with aquatic vegetation <u>20</u> %		
WATER QUALITY	Temperature <u>20.83</u> °C Specific Conductance <u>0.582</u> ms/cm Dissolved Oxygen <u>7.41</u> mg/L pH <u>8.57</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> 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 <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>5</u>
Boulder	> 256 mm (10")	<u>3</u>			
Cobble	64-256 mm (2.5"-10")	<u>3</u>	Muck-Mud	black, very fine organic (FPOM)	<u>0</u>
Gravel	2-64 mm (0.1"-2.5")	<u>32</u>			
Sand	0.06-2mm (gritty)	<u>32</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>20</u>			
Clay	< 0.004 mm (slick)	<u>10</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 56+00 - 88+00
STATION #	RBP 12-13	RIVERMILE	N/A
LAT	42.426141	LONG	-73.238070
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	SM	DATE	08/23/22
		TIME	1545 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A 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 <u>not</u> new fall and <u>not</u> 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 12	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 12	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 11	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 8	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 10	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)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	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 13	20 19 18 17 16	15 14 <input checked="" type="text" value="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 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 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 <input checked="" type="text" value="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.	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 5 (LB)	Left Bank 10 9	8 7 6	<input checked="" type="text" value="5"/> 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	<input checked="" type="text" value="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 6 (LB)	Left Bank 10 9	8 7 <input checked="" type="text" value="6"/>	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 <input checked="" type="text" value="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 <input checked="" type="text" value="7"/> 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 <input checked="" type="text" value="7"/> 6	5 4 3	2 1 0

Total Score

[illegible]

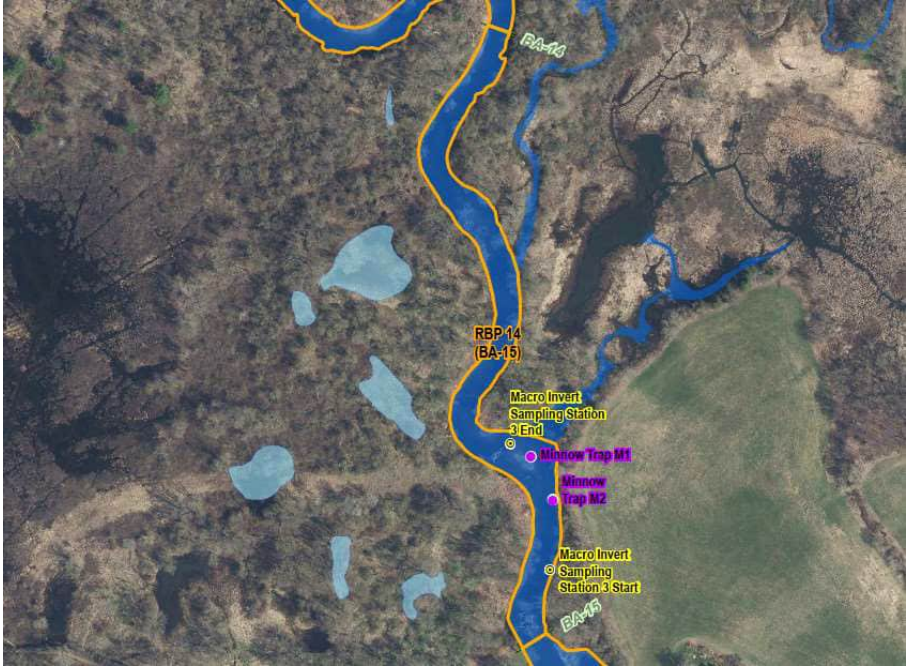
Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/23/22		
Direction Photo Taken: South			
Description: Beginning of RBP 12 looking downstream. Silver maple trees and shrubs cover the shorelines. This section contains many deep pools and sections of run. Woody debris piles can be found on the shorelines.			
Photo No. 2	Date: 8/23/22		
Direction Photo Taken: North			
Description: Lower half of RBP 12 looking upstream. Woody debris is scattered along the shorelines. In this section, there is a slight riffle, but mainly a run with a pool at the outer bend. Silver maple trees make up the majority of riparian vegetation.			

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/23/22		
Direction Photo Taken: South			
Description: Lower half of RBP 12 looking downstream. This shallow section of RBP 12 contains riffles near the sand bars and runs near the left shoreline.			
Photo No. 4	Date: 8/23/22		
Direction Photo Taken: North			
Description: Beginning of RBP 13 looking upstream. This section contains a large pool on the outer bend with overhanging maple trees. Erosion can also be seen on the outer bend's shoreline.			

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 5	Date: 8/23/22		
Direction Photo Taken: Southeast			
Description: RBP 13 has large woody debris that provides good cover/habitat for underwater organisms. Floating debris is also being caught on the branches in this pool area. The shoreline is experiencing moderate erosion.			
Photo No. 6	Date: 8/23/22		
Direction Photo Taken: East			
Description: Downstream of RBP 13 has branches and other woody debris. The shorelines have slight erosion in this pool area. Silver maples and shrubs make up the riparian vegetation.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 88+00 - 104+00	
STATION # RBP 14	RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.25222	LONG -73.14145	RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/23/22 TIME 1710 ☐ AM ☒ PM	REASON FOR SURVEY Reach 5A BRA

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ %cloud cover ☐ clear/sunny Past 24 hours ☒ ☒ ☒ ☒ 100 % ☐ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 22.7 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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, knotweed			
INSTREAM FEATURES	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Estimated Reach Length 550 m Estimated Stream Width 20 m Sampling Reach Area 10658 m² Area in km² (m²x1000) 11 km² Estimated Stream Depth 1.5 m Surface Velocity (at thalweg) 0.25 m/sec </td><td style="width: 50%;"> Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 2 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 10 % ☒ Run 45 % ☒ Pool 45 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No </td></tr> </table>		Estimated Reach Length 550 m Estimated Stream Width 20 m Sampling Reach Area 10658 m ² Area in km² (m²x1000) 11 km ² Estimated Stream Depth 1.5 m Surface Velocity (at thalweg) 0.25 m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 2 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 10 % ☒ Run 45 % ☒ Pool 45 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No
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LARGE WOODY DEBRIS	LWD 700 m ² Density of LWD 63.6 m ² /km ² (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 Potamogeton crispis, water celery, blue flag iris Portion of the reach with aquatic vegetation 1 %			
WATER QUALITY	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Temperature 21.4 °C Specific Conductance 0.500 ms/cm Dissolved Oxygen 8.88 mg/L pH 8.51 Turbidity _____ WQ Instrument Used YSI 650 </td><td style="width: 50%;"> 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 _____ </td></tr> </table>		Temperature 21.4 °C Specific Conductance 0.500 ms/cm Dissolved Oxygen 8.88 mg/L pH 8.51 Turbidity _____ WQ Instrument Used YSI 650	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 _____
Temperature 21.4 °C Specific Conductance 0.500 ms/cm Dissolved Oxygen 8.88 mg/L pH 8.51 Turbidity _____ WQ Instrument Used YSI 650	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	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse </td><td style="width: 50%;"> 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 </td></tr> </table>		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
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
Boulder	> 256 mm (10")	2			
Cobble	64-256 mm (2.5"-10")	5	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	35	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	30			
Clay	< 0.004 mm (slick)	3			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 88+00 - 104+00
STATION #	RBP 14	RIVERMILE	N/A
LAT	42.25222	LONG	-73.14145
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	KVN	DATE	08/23/22
		TIME	1710 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A 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 <u>not</u> new fall and <u>not</u> 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 15	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 12	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 12	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 9	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 13	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)

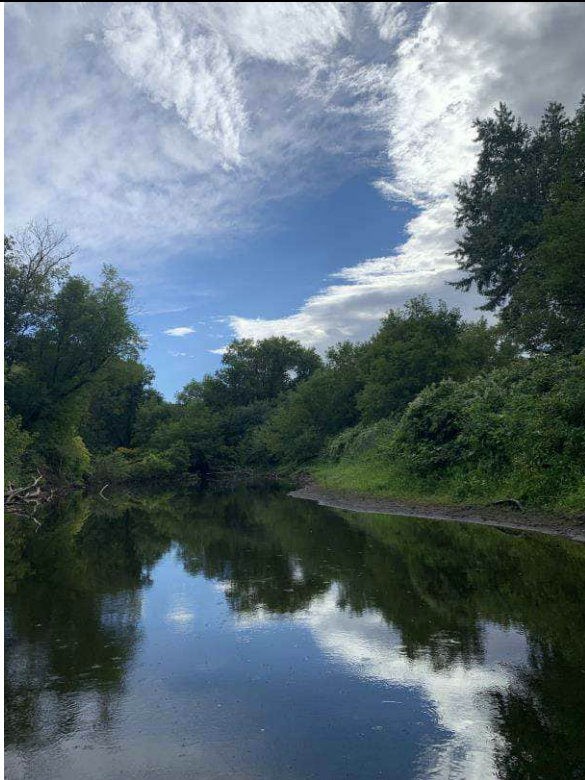
Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 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 19	20 ☒ 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 13	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 5 (LB)	Left Bank 10 9	8 7 6	☒ 5 4 3	2 1 0
SCORE 5 (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 6 (LB)	Left Bank 10 9	8 7 ☒ 6	5 4 3	2 1 0
SCORE 6 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/23/22		
Direction Photo Taken: East			
Description: Beginning of RBP 14 with woody debris. The far side of the image contains a pool and the left side is a run.			
Photo No. 2	Date: 8/24/22		
Direction Photo Taken: South			
Description: Beginning of RBP 14 looking downstream. On the outer bend, there are cobble deposits and woody debris. The sand bar on the inner part of the bend has grassy vegetation before a steep slope.			

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/23/22		
Direction Photo Taken: Southeast			
Description: RBP 14 looking downstream is a run. Woody debris stretches across the river, creating a blockage near the sand bar. Riparian trees hang over the river. A pile of cobble was deposited on the far right side.			

Photo No. 4	Date: 8/23/22		
Direction Photo Taken: Southeast			
Description: Further downstream of RBP 14, woody debris is collected on the shorelines. A small bar has formed on the right side. Shrubs and maple trees make up the riparian vegetation. There are also pools on the outer bends of the river.			

AECOM Imagine it. Delivered. PHOTOGRAPHIC LOG					
Client Name: GE		Site Location: Reach 5A Housatonic River		Project No. 60689453	
Photo No. 5	Date: 08/23/22				
Direction Photo Taken: North					
Description: Eroded bank in RBP 14. Vegetation's roots are exposed, and bank stability is low. This section has shallow areas and sunken woody debris.					

Photo No. 6	Date: 8/24/22				
Direction Photo Taken: Northwest					
Description: Looking upstream in RBP-14. Due to the drought during these pictures, some parts of this section appear as riffles. Woody debris around the sand bar dams part of the stream. More shrubs and grassy vegetation line these shores.					




PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 104+00 - 115+00	
STATION # RBP 15-16 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.25226 LONG -73.14156		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/24/22 TIME 1050 ☒ AM ☐ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ %cloud cover ☐ clear/sunny Past 24 hours ☒ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ %cloud cover ☐ clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 24 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☒ Mixture of origins ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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, knotweed			
INSTREAM FEATURES	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Estimated Reach Length 400 m Estimated Stream Width 18 m Sampling Reach Area 8180 m² Area in km² (m²x1000) 7.2 km² Estimated Stream Depth 1.5 m Surface Velocity (at thalweg) 0.3 m/sec </td><td style="width: 50%;"> Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 1 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 2 % ☒ Run 60 % ☒ Pool 28 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No </td></tr> </table>		Estimated Reach Length 400 m Estimated Stream Width 18 m Sampling Reach Area 8180 m ² Area in km² (m²x1000) 7.2 km ² Estimated Stream Depth 1.5 m Surface Velocity (at thalweg) 0.3 m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 1 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 2 % ☒ Run 60 % ☒ Pool 28 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No
Estimated Reach Length 400 m Estimated Stream Width 18 m Sampling Reach Area 8180 m ² Area in km² (m²x1000) 7.2 km ² Estimated Stream Depth 1.5 m Surface Velocity (at thalweg) 0.3 m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 1 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 2 % ☒ Run 60 % ☒ Pool 28 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No			
LARGE WOODY DEBRIS	LWD 350 m ² Density of LWD 48.6 m ² /km ² (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 Yellow flag iris, algae Portion of the reach with aquatic vegetation <1 %			
WATER QUALITY	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Temperature 20.27 °C Specific Conductance 0.535 ms/cm Dissolved Oxygen 7.15 mg/L pH 8.35 Turbidity _____ WQ Instrument Used YSI 650 </td><td style="width: 50%;"> 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 _____ </td></tr> </table>		Temperature 20.27 °C Specific Conductance 0.535 ms/cm Dissolved Oxygen 7.15 mg/L pH 8.35 Turbidity _____ WQ Instrument Used YSI 650	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 _____
Temperature 20.27 °C Specific Conductance 0.535 ms/cm Dissolved Oxygen 7.15 mg/L pH 8.35 Turbidity _____ WQ Instrument Used YSI 650	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	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☐ Absent ☒ Slight ☐ Moderate ☐ Profuse </td><td style="width: 50%;"> 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 </td></tr> </table>		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
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)	15
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	10	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	30	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	25			
Clay	< 0.004 mm (slick)	5			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 104+00 - 115+00
STATION #	RBP 15-16	RIVERMILE	N/A
LAT	42.25226	LONG	-73.14156
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	KVN	DATE	08/24/22
		TIME	1050 ☒ AM ☐ PM
		REASON FOR SURVEY	Reach 5A 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 <u>not</u> new fall and <u>not</u> 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 <u>11</u>	20 19 18 17 16	15 14 13 12 <u>11</u>	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 <u>13</u>	20 19 18 17 16	15 14 <u>13</u> 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 <u>15</u>	20 19 18 17 16	<u>15</u> 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 <u>9</u>	20 19 18 17 16	15 14 13 12 11	10 <u>9</u> 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 <u>15</u>	20 19 18 17 16	<u>15</u> 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

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	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 8	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 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) 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 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (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

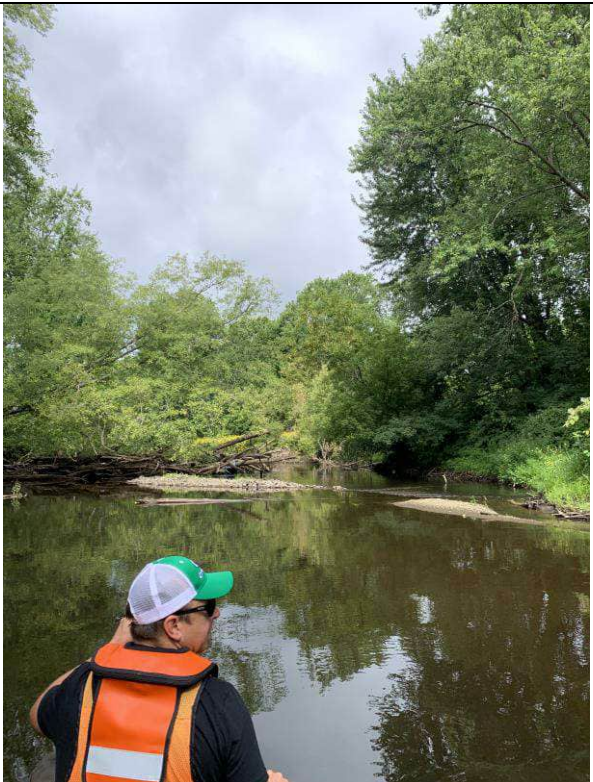
Total Score

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River		Project No. 60689453
Photo No. 1	Date: 8/24/22			
Direction Photo Taken: East				
Description: RBP 15-16 looking upstream. This section is a run with little woody debris.				

Photo No. 2	Date: 8/24/22			
Direction Photo Taken: South				
Description: RBP 15 looking downstream. This section of the river is a pool with woody debris. Houses and private property reside over the bank's slope. Erosion is visible on the slope in areas lacking vegetation.				

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/24/22		
Direction Photo Taken: North			
Description: RBP 15-16 looking upstream. In the middle of the stream is a deposited island with a fallen tree. This section of the stream is a run.			

Photo No. 4	Date: 8/24/22		
Direction Photo Taken: West			
Description: RBP 15-16 looking downstream. In this section, there is a cobble bar and sand bar. In between these two deposits is a riffle. A run leads to a pool on the left where a large collection of woody debris resides.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 115+00 - 135+00	
STATION # RBP 17 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.416992 LONG -73.240999		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/24/22 TIME 1217 ☐ AM ☒ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover ☐ 50 % ☒ 60 % clear/sunny Past 24 hours ☒ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover ☐ 50 % ☒ 60 % clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 23 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☒ Mixture of origins ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 <u>silver maple</u>		
INSTREAM FEATURES	Estimated Reach Length <u>579</u> m Estimated Stream Width <u>28</u> m Sampling Reach Area <u>14001</u> m² Area in km² (m²x1000) <u>14.0</u> km² Estimated Stream Depth <u>1</u> m Surface Velocity (at thalweg) <u>0.75</u> m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.5</u> m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle <u>16</u> % ☒ Run <u>52</u> % ☒ Pool <u>32</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD <u>1000</u> m ² Density of LWD <u>61.7</u> m ² /km ² (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 <u>Algae</u> Portion of the reach with aquatic vegetation <u>15</u> %		
WATER QUALITY	Temperature <u>21.1</u> °C Specific Conductance <u>0.563</u> ms/cm Dissolved Oxygen <u>7.04</u> mg/L pH <u>8.48</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> 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 <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>10</u>
Boulder	> 256 mm (10")	<u>1</u>			
Cobble	64-256 mm (2.5"-10")	<u>2</u>	Muck-Mud	black, very fine organic (FPOM)	<u>1</u>
Gravel	2-64 mm (0.1"-2.5")	<u>30</u>			
Sand	0.06-2mm (gritty)	<u>40</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>17</u>			
Clay	< 0.004 mm (slick)	<u>10</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 115+00 - 135+00
STATION #	RBP 17	RIVERMILE	N/A
LAT	42.416992	LONG	-73.240999
STORER #	N/A	RIVER BASIN	Housatonic
AGENCY	N/A		
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	SM	DATE	08/24/22
		TIME	1217 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A BRA

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	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 <u>not</u> new fall and <u>not</u> 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 8	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 15	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 16	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 7	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 13	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)

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 18	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 8	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 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (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 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/24/22		
Direction Photo Taken: Southwest			
Description: Beginning of RBP 17 looking downstream. The water depth is shallow in this area and a riffle is present. Large rocks/cobble deposits are near the riffle. The shoreline has contains gravel and a mix of shrubs.			
Photo No. 2	Date: 8/24/22		
Direction Photo Taken: South			
Description: RBP 17 looking downstream. This section is a run, and the left bank has slight erosion. There is a fallen log and other woody debris. A sand bar and riffle can be seen in the distance.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 135+00 - 150+00	
STATION # RBP 18	RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.414557	LONG -73.238682	RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/24/22 TIME 1235 ☐ AM ☒ PM	REASON FOR SURVEY Reach 5A BRA

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ %cloud cover ☐ clear/sunny Past 24 hours ☒ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ %cloud cover ☐ clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 23 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  RBP 18 (BA-19) BA-18 BA-19 Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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, sycamore, knotweed		
INSTREAM FEATURES	Estimated Reach Length 500 m Estimated Stream Width 20 m Sampling Reach Area 10429 m² Area in km² (m²x1000) 10.4 km² Estimated Stream Depth 1.5 m Surface Velocity 0.3 m/sec (at thalweg) Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 1.5 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 2 % ☒ Run 38 % ☒ Pool 60 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD 200 m ² Density of LWD 20 m ² /km ² (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 Potamogeton crispis, sparse macrophyte algae Portion of the reach with aquatic vegetation 15 %		
WATER QUALITY	Temperature 21.5 °C Specific Conductance 0.534 ms/cm Dissolved Oxygen 8.46 mg/L pH 8.25 Turbidity _____ WQ Instrument Used YSI 650 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 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)	10
Boulder	> 256 mm (10")	<1			
Cobble	64-256 mm (2.5"-10")	10	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	50	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	20			
Clay	< 0.004 mm (slick)	10			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 135+00 - 150+00
STATION #	RBP 18	RIVERMILE	N/A
LAT	42.414557	LONG	-73.238682
STORER #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	KVN	DATE	08/24/22
		TIME	1235 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A 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 <u>not</u> new fall and <u>not</u> 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 12	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 14	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 15	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 7	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 15	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)

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	(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 16	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 3 (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 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/24/22		
Direction Photo Taken: South			
Description: RBP 18 looking downstream. From this spot, wood debris is prevalent. A sand bar has formed on the inner bend of the river.			
Photo No. 2	Date: 8/24/22		
Direction Photo Taken: East			
Description: RBP 18 looking downstream, a small sand bar has formed around the bend of the river.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 150+00 - 156+00	
STATION # RBP 19	RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.415515	LONG -73.236849	RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/24/22 TIME 1430 ☐ AM ☒ PM	REASON FOR SURVEY Reach 5A BRA

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ 50 % ☒ %cloud cover ☐ clear/sunny Past 24 hours ☒ ☒ ☐ 100 % Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 25.8 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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, eastern white pine		
INSTREAM FEATURES	Estimated Reach Length 180 m Estimated Stream Width 25 m Sampling Reach Area 4985 m² Area in km² (m²x1000) 4.9 km² Estimated Stream Depth 0.5 m Surface Velocity (at thalweg) 0.25 m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 2 m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle 1 % ☒ Run 90 % ☒ Pool 10 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD 100 m ² Density of LWD 22.2 m ² /km ² (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 Vallisneria Portion of the reach with aquatic vegetation 1 %		
WATER QUALITY	Temperature 22 °C Specific Conductance 0.506 ms/cm Dissolved Oxygen 8.89 mg/L pH 8.35 Turbidity _____ WQ Instrument Used YSI 650 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 _____ 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)	10
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	10	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	35	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	20			
Clay	< 0.004 mm (slick)	10			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 150+00 - 156+00
STATION #	RBP 19	RIVERMILE	N/A
LAT	42.415515	LONG	-73.236849
STORER #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	KVN	DATE	08/24/22
		TIME	1430 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A BRA

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	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 <u>not</u> new fall and <u>not</u> 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 10	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 10	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 6	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 10	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 14	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)

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	(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 8	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 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 6 (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 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (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

[illegible]

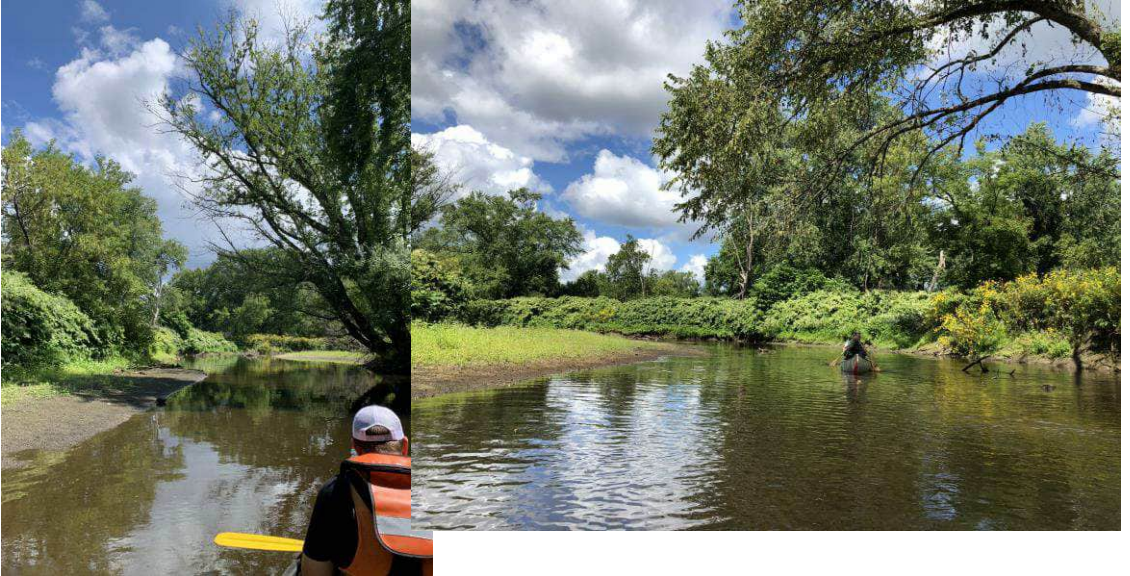
Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/24/22		
Direction Photo Taken: Northeast (Left) Northwest (Right)			
Description: RBP-19. First photo taken looking downstream, second photo taken after the bend looking back upstream. In both images, a run is present. The outer bend has moderate erosion, while the inner bend has a sand bar with grassy vegetation.			

Photo No. 2	Date: 8/24/22	
Direction Photo Taken: Northeast		
Description: RBP-19 looking downstream. This section is a pool with branches and underwater woody debris. It later converts into a run with a few small riffles for the rest of RBP 19.		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 156+00 - 172+00	
STATION # RBP 20-22 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.414430 LONG -73.234158		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/24/22 TIME 1520 ☐ AM ☒ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover clear/sunny 25 % ☒ Past 24 hours ☐ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover clear/sunny 80 % ☒ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 29 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 <u>Tulip poplar</u>		
INSTREAM FEATURES	Estimated Reach Length <u>518</u> m Estimated Stream Width <u>25</u> m Sampling Reach Area <u>12030</u> m² Area in km² (m²x1000) <u>12.0</u> km² Estimated Stream Depth <u>1</u> m Surface Velocity (at thalweg) <u>0.3</u> m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.5</u> m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle <u> </u> % ☒ Run <u>65</u> % ☒ Pool <u>35</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD <u>75</u> m ² Density of LWD <u>5.8</u> m ² /km ² (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 <u>Water celery + algae</u> Portion of the reach with aquatic vegetation <u>2</u> %		
WATER QUALITY	Temperature <u>21.1</u> °C Specific Conductance <u>0.563</u> ms/cm Dissolved Oxygen <u>7.04</u> mg/L pH <u>8.48</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> Water Odors ☒ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ Water Surface Oils ☐ Slick ☐ Sheen ☐ Globbs ☐ 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 <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>8</u>
Boulder	> 256 mm (10")	<u>5</u>			
Cobble	64-256 mm (2.5"-10")	<u>20</u>	Muck-Mud	black, very fine organic (FPOM)	<u>5</u>
Gravel	2-64 mm (0.1"-2.5")	<u>20</u>			
Sand	0.06-2mm (gritty)	<u>47</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>5</u>			
Clay	< 0.004 mm (slick)	<u>3</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 156+00 - 172+00
STATION #	RBP 20-22	RIVERMILE	N/A
LAT	42.414430	LONG	-73.234158
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	SM	DATE	08/24/22
		TIME	1520 ☐ AM ☒ PM
		REASON FOR SURVEY	
		Reach 5A BRA	

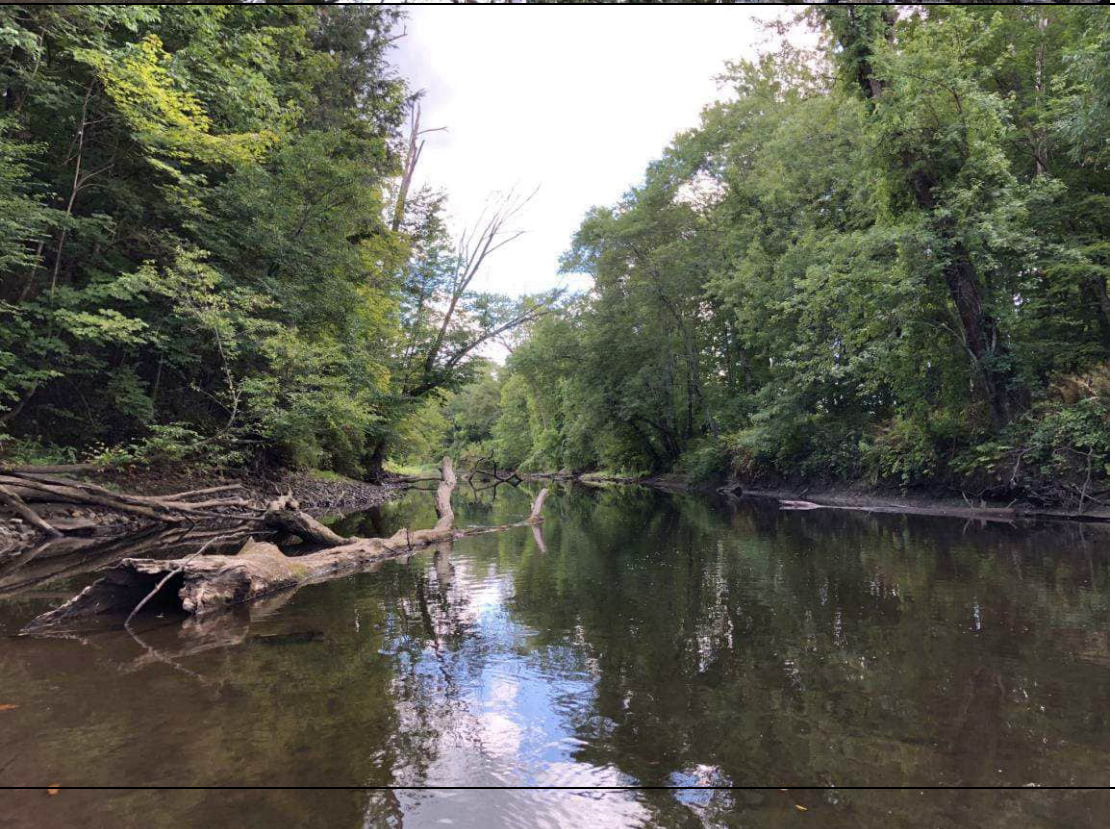
Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> 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 13	20 19 18 17 16	15 14 <input checked="" type="text" value="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 19	20 <input checked="" type="text" value="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 15	20 19 18 17 16	<input checked="" type="text" value="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 12	20 19 18 17 16	15 14 13 <input checked="" type="text" value="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 14	20 19 18 17 16	15 <input checked="" type="text" value="14"/> 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

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 19	20 ☒ 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 10	20 19 18 17 16	15 14 13 12 11	☒ 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 5 (LB)	Left Bank 10 9	8 7 6	☒ 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	☒ 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 6 (LB)	Left Bank 10 9	8 7 ☒ 6	5 4 3	2 1 0
SCORE 6 (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 ☒ 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank ☒ 9	8 7 6	5 4 3	2 1 0

Total Score

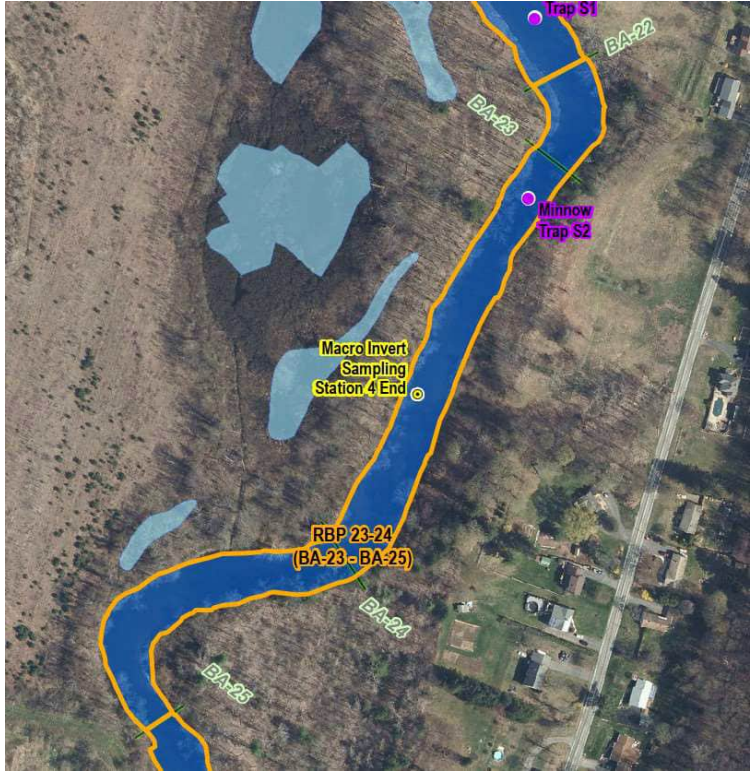
[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/24/22		
Direction Photo Taken: Northwest			
Description: End of RBP 20 looking upstream contains cobble bars and shoreline. A run reaches the cobble area and turns into a riffle.			
Photo No. 2	Date: 8/24/22		
Direction Photo Taken: Southeast			
Description: RBP 20-21 looking downstream. Large woody debris has fallen into the river. The bank is more stable on the left side and contains cobble, while the bank on the right is eroded and has lost stability. This section is a run.			

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/24/22		
Direction Photo Taken: Southeast			
Description: End of RBP 21 looking downstream. Coontail is the dominant aquatic vegetation. This area is a run with pockets of pool.			
Photo No. 4	Date: 8/24/22		
Direction Photo Taken: Southeast			
Description: RBP 22 looking downstream. This section also contains predominantly coontail. At the far bank, there is cobble/rip rap to prevent erosion.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 172+00 - 188+00	
STATION # RBP 23-24 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.411755 LONG -73.233352		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/24/22 TIME 1600 ☐ AM ☒ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 15 % clear/sunny ☒ Past 24 hours ☐ ☐ ☒ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 80 % clear/sunny ☐ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 29 °C Other		
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.		
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☒ Mixture of origins ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²		

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 _____		
INSTREAM FEATURES	Estimated Reach Length 450 m Estimated Stream Width 30 m Sampling Reach Area 14004 m² Area in km² (m²x1000) 14.0 km² Estimated Stream Depth 1.25 m Surface Velocity (at thalweg) 2 m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark .75 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 2 % ☒ Run 85 % ☒ Pool 13 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD 125 m ² Density of LWD 9.26 m ² /km ² (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 American burr-reed Portion of the reach with aquatic vegetation 5 %		
WATER QUALITY	Temperature 22.19 °C Specific Conductance 0.521 ms/cm Dissolved Oxygen 8.84 mg/L pH 8.42 Turbidity _____ WQ Instrument Used YSI 650 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 _____ 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)	15
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	15	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	50	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	20			
Clay	< 0.004 mm (slick)	5			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 172+00 - 188+00
STATION #	RBP 23-24	RIVERMILE	N/A
STREAM CLASS	E (Rosgen)		
LAT	42.411755	LONG	-73.233352
RIVER BASIN	Housatonic		
STORET #	N/A		
AGENCY	N/A		
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	SM	DATE	08/24/22
		TIME	1600 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A BRA

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	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 <u>not</u> new fall and <u>not</u> 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 13	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 14	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 18	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 12	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 13	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)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.	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 17	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 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 10	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.	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 8 (LB)	Left Bank 10 9	☒ 8 7 6	5 4 3	2 1 0
SCORE 8 (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 9 (LB)	Left Bank 10 ☒ 9	8 7 6	5 4 3	2 1 0
SCORE 9 (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

[illegible]

PHOTOGRAPHIC LOG

Client Name: GE		Site Location: Reach 5A Housatonic River		Project No. 60689453
Photo No. 1	Date: 8/24/22			
Direction Photo Taken: South				
Description: RPB 23-24 looking downstream at a run. Cobble is present on the left bank along with woody debris on both sides.				

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 188+00 - 209+00	
STATION # RBP 25-26 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.405314 LONG -73.235891		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/24/22 TIME 1622 ☐ AM ☒ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 50 % clear/sunny ☒ Past 24 hours ☒ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover 70 % clear/sunny ☐ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 29 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 <u>Maples, Sunflower</u>			
INSTREAM FEATURES	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Estimated Reach Length <u>610</u> m Estimated Stream Width <u>28</u> m Sampling Reach Area <u>14201</u> m² Area in km² (m²x1000) <u>14.2</u> km² Estimated Stream Depth <u>1.0</u> m Surface Velocity (at thalweg) <u>0.4</u> m/sec </td><td style="width: 50%;"> Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.0</u> m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle <u> </u> % ☒ Run <u>50</u> % ☒ Pool <u>50</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No </td></tr> </table>		Estimated Reach Length <u>610</u> m Estimated Stream Width <u>28</u> m Sampling Reach Area <u>14201</u> m ² Area in km² (m²x1000) <u>14.2</u> km ² Estimated Stream Depth <u>1.0</u> m Surface Velocity (at thalweg) <u>0.4</u> m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.0</u> m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle <u> </u> % ☒ Run <u>50</u> % ☒ Pool <u>50</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No
Estimated Reach Length <u>610</u> m Estimated Stream Width <u>28</u> m Sampling Reach Area <u>14201</u> m ² Area in km² (m²x1000) <u>14.2</u> km ² Estimated Stream Depth <u>1.0</u> m Surface Velocity (at thalweg) <u>0.4</u> m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.0</u> m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle <u> </u> % ☒ Run <u>50</u> % ☒ Pool <u>50</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No			
LARGE WOODY DEBRIS	LWD <u>100</u> m ² Density of LWD <u>5.85</u> m ² /km ² (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 <u>grasses</u> Portion of the reach with aquatic vegetation <u>4</u> %			
WATER QUALITY	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Temperature <u>21.5</u> °C Specific Conductance <u>0.551</u> ms/cm Dissolved Oxygen <u>6.29</u> mg/L pH <u>8.43</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> </td><td style="width: 50%;"> 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 _____ </td></tr> </table>		Temperature <u>21.5</u> °C Specific Conductance <u>0.551</u> ms/cm Dissolved Oxygen <u>6.29</u> mg/L pH <u>8.43</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u>	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 _____
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SEDIMENT/SUBSTRATE	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Odors ☒ Normal ☐ Sewage ☒ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse </td><td style="width: 50%;"> Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No </td></tr> </table>		Odors ☒ Normal ☐ Sewage ☒ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No
Odors ☒ Normal ☐ Sewage ☒ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>10</u>
Boulder	> 256 mm (10")	<u>1</u>			
Cobble	64-256 mm (2.5"-10")	<u>2</u>	Muck-Mud	black, very fine organic (FPOM)	<u>10</u>
Gravel	2-64 mm (0.1"-2.5")	<u>20</u>			
Sand	0.06-2mm (gritty)	<u>65</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>10</u>			
Clay	< 0.004 mm (slick)	<u>2</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 188+00 - 209+00
STATION #	RBP 25-26	RIVERMILE	N/A
LAT	42.405314	LONG	-73.235891
STORER #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	SM	DATE	08/24/22
		TIME	1622 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A BRA

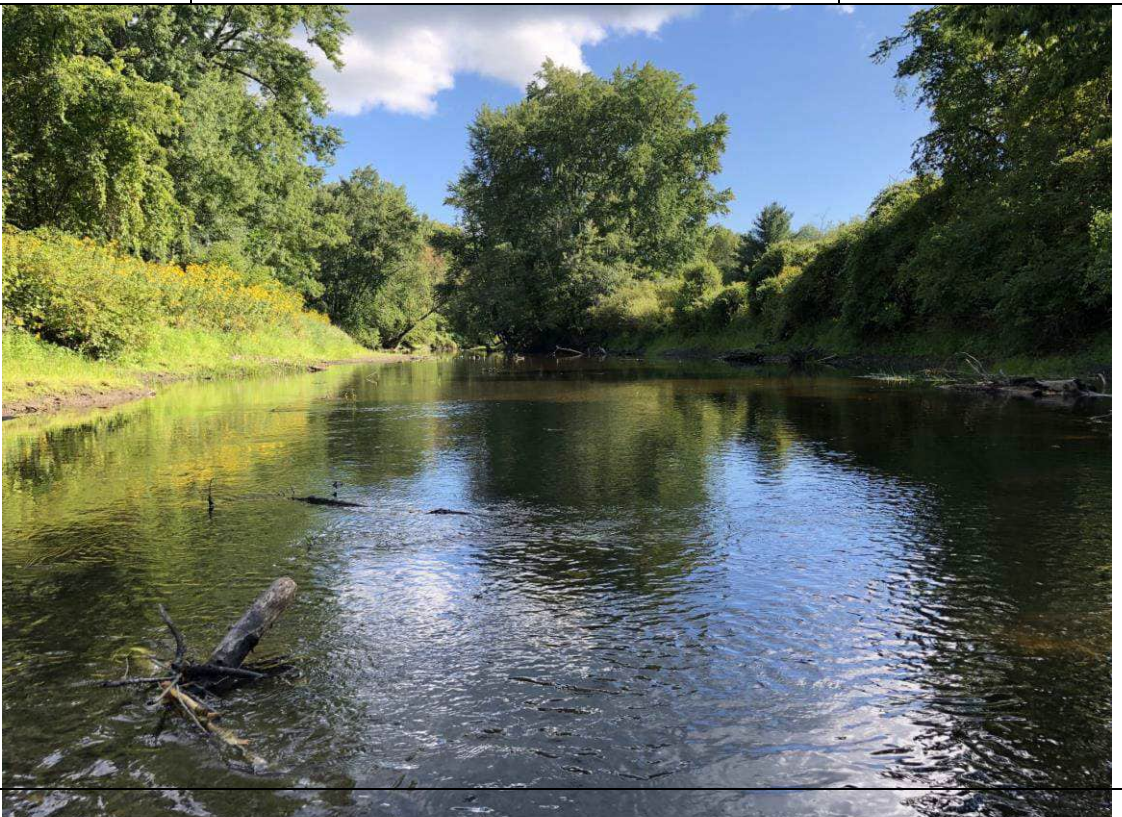
Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> 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 10	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 13	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 17	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 9	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 14	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)

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 18	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 15	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 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (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 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/24/22		
Direction Photo Taken: South			
Description: RBP 25 looking downstream. Maples and sunflowers occupy the banks. The water depth is shallow in this area and contains scattered pieces of woody debris. Some edges of the stream drop off into a pool.			
Photo No. 2	Date: 8/24/22		
Direction Photo Taken: Northwest			
Description: RBP 26 looking downstream. The river is predominantly a pool and contains waterlogged woody debris. Maples overhang the river and provide partial cover.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION Station 209+00 - 219+00	
STATION # RBP 27-28 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.40690 LONG -73.23662		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/25/22 TIME 1010 ☒ AM ☐ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☒ %cloud cover ☒ clear/sunny Past 24 hours ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☒ 60 % ☐ clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 22 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Type ☐ Coldwater ☒ Warmwater Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Catchment Area km²

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, box elder, knotweed		
INSTREAM FEATURES	Estimated Reach Length 300 m Estimated Stream Width 30 m Sampling Reach Area 7764 m² Area in km² (m²x1000) 7.8 km² Estimated Stream Depth 1.0 m Surface Velocity (at thalweg) 0.3 m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark 1.5 m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle 1 % ☒ Run 90 % ☒ Pool 10 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD 150 m ² Density of LWD 16.7 m ² /km ² (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 burr reed, macrophyte algae Portion of the reach with aquatic vegetation 2 %		
WATER QUALITY	Temperature 19.4 °C Specific Conductance 0.520 ms/cm Dissolved Oxygen 6.63 mg/L pH 8.13 Turbidity _____ WQ Instrument Used YSI 650 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 _____ 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)	15
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	0	Muck-Mud	black, very fine organic (FPOM)	5
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	55	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	20			
Clay	< 0.004 mm (slick)	5			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	Station 188+00 - 209+00
STATION #	RBP 27-28	RIVERMILE	N/A
LAT	42.40690	LONG	-73.23662
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	KVN	DATE	08/25/22
		TIME	1010 ☒ AM ☐ PM
		REASON FOR SURVEY	Reach 5A BRA

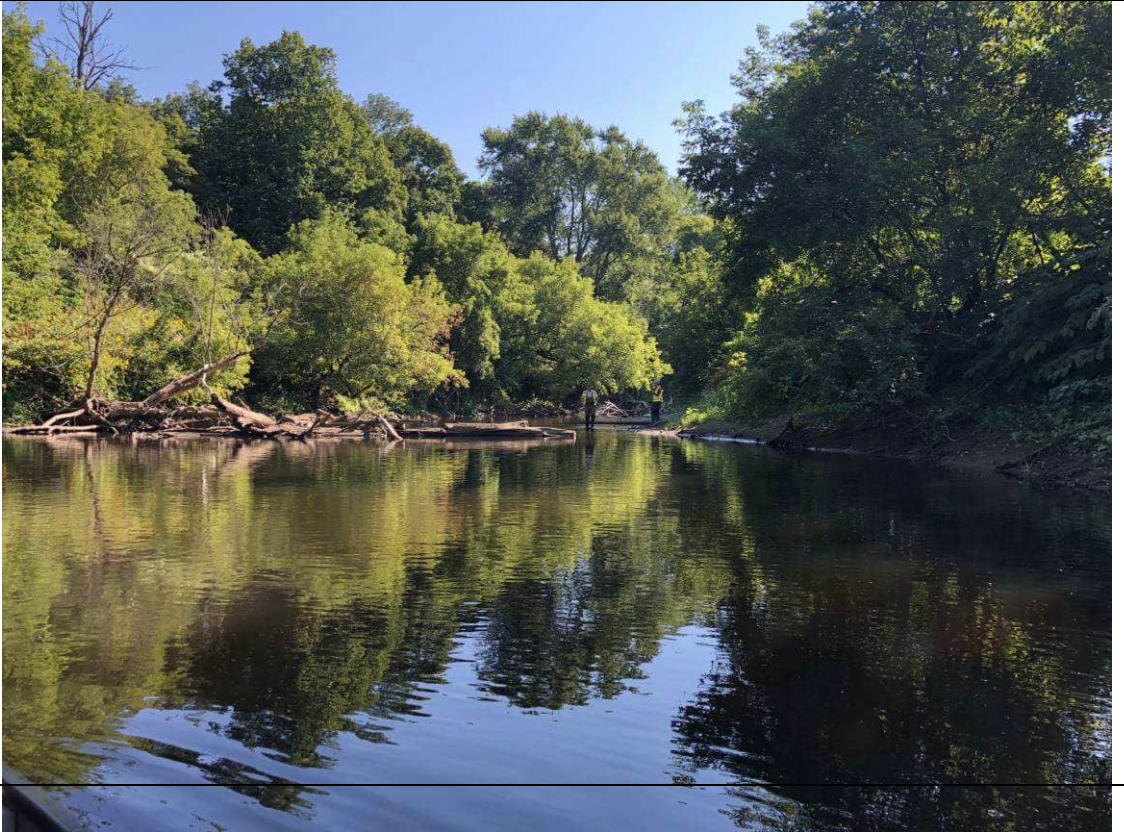
Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> 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 11	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 13	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 6	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 13	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 15	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)

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 18	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 13	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 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (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 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/25/22		
Direction Photo Taken: Northeast			
Description: RBP 28 looking upstream. A large pool with slight to moderate erosion on the right bank. Large logs have accumulated and dammed a part of the river.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION 209+00 - 219+00	
STATION # RBP 29-31 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.40734 LONG -73.23855		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/25/22 TIME 1115 ☒ AM ☐ PM	REASON FOR SURVEY Reach 5A BRA

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ %cloud cover ☐ % ☒ clear/sunny Past 24 hours ☐ ☐ ☒ ☒ 60 % ☐ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 26 ° C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☒ Mixture of origins ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 Box elder, Silver & Red maple, Knotweed			
INSTREAM FEATURES	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Estimated Reach Length 280 m Estimated Stream Width 25 m Sampling Reach Area 6899 m² Area in km² (m²x1000) 6.8 km² Estimated Stream Depth 1 m Surface Velocity (at thalweg) 0.5 m/sec </td><td style="width: 50%;"> Canopy Cover ☐ Partly open ☒ Partly shaded ☐ Shaded High Water Mark 1 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 15 % ☒ Run 35 % ☒ Pool 50 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No </td></tr> </table>		Estimated Reach Length 280 m Estimated Stream Width 25 m Sampling Reach Area 6899 m ² Area in km² (m²x1000) 6.8 km ² Estimated Stream Depth 1 m Surface Velocity (at thalweg) 0.5 m/sec	Canopy Cover ☐ Partly open ☒ Partly shaded ☐ Shaded High Water Mark 1 m Proportion of Reach Represented by Stream Morphology Types ☒ Riffle 15 % ☒ Run 35 % ☒ Pool 50 % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No
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LARGE WOODY DEBRIS	LWD 400 m ² Density of LWD 57.14 m ² /km ² (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, Burr reed Portion of the reach with aquatic vegetation <1 %			
WATER QUALITY	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Temperature 19.8 °C Specific Conductance 0.521 ms/cm Dissolved Oxygen 6.99 mg/L pH 8.18 Turbidity _____ WQ Instrument Used YSI 650 </td><td style="width: 50%;"> 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 </td></tr> </table>		Temperature 19.8 °C Specific Conductance 0.521 ms/cm Dissolved Oxygen 6.99 mg/L pH 8.18 Turbidity _____ WQ Instrument Used YSI 650	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
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SEDIMENT/SUBSTRATE	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse </td><td style="width: 50%;"> 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 </td></tr> </table>		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
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)	10
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	5	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	35	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	20			
Clay	< 0.004 mm (slick)	20			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	219+00 - 227+00
STATION #	RBP 29-31	RIVERMILE	N/A
LAT	42.40734	LONG	-73.23855
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	SM	DATE	08/25/22
		TIME	1115 ☒ AM ☐ PM
		REASON FOR SURVEY	Reach 5A BRA

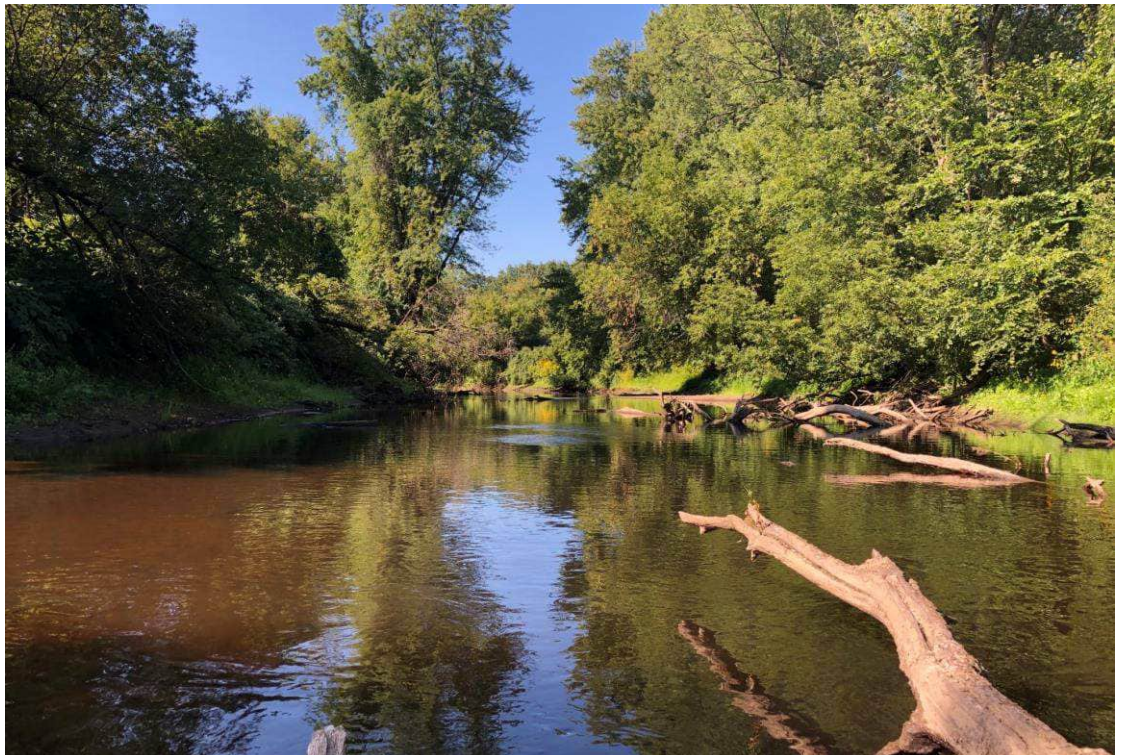
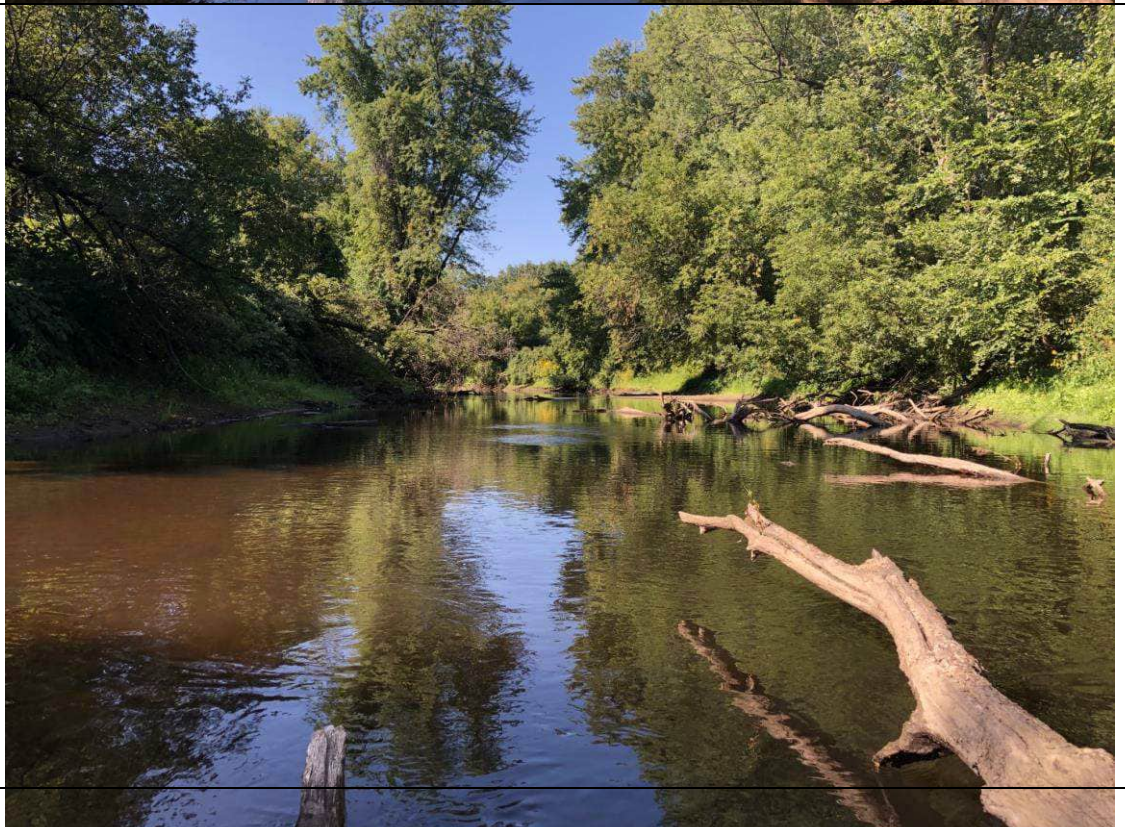
	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> 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 9	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 11	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 12	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 12	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 11	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)

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 16	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 15	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 7 (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE 7 (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 8 (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE 8 (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

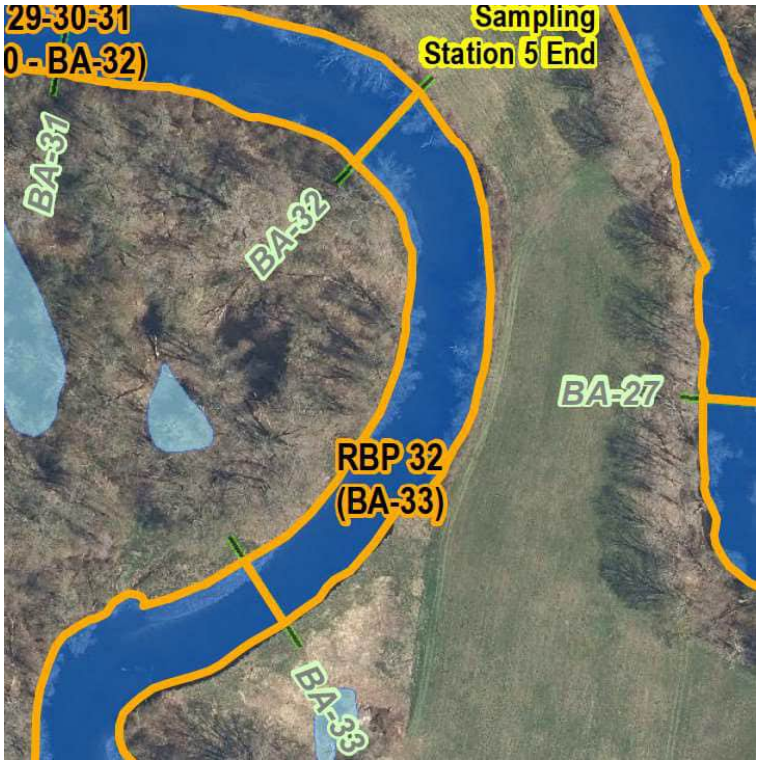
[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/25/22		
Direction Photo Taken: Southwest			
Description: RBP 29 looking downstream. The right side of the river is a large pool, while the left side is mainly a run. Woody debris has settled in the deep pool areas.			
Photo No. 2	Date: 8/25/22		
Direction Photo Taken: Southwest			
Description: RBP 29 looking downstream. The right side of the river is a large pool, while the left side is mainly a run. Woody debris has settled in the deep pool areas.			

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/25/22		
Direction Photo Taken: South/Southeast			
Description: RBP 30-31 looking downstream at bend. A large deep pool makes up this area. Mature silver and red maples line the right bank. Erosion is visible on the outer bend and woody debris is present.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION 227+00 - 234+00	
STATION # RBP 32 RIVERMILE N/A		STREAM CLASS E (Rosgen)	
LAT 42.40581 LONG -73.23732		RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY KVN		DATE 08/25/22 TIME 1330 ☐ AM ☒ PM	
REASON FOR SURVEY Reach 5A BRA			

WEATHER CONDITIONS	Now ☐ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover ☐ 5 ☐ 10 ☐ 20 ☐ 30 ☐ 40 ☐ 50 ☐ 60 ☐ 70 ☐ 80 ☐ 90 ☐ 100 clear/sunny Past 24 hours ☐ ☐ ☐ ☐ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover ☐ 5 ☐ 10 ☐ 20 ☐ 30 ☐ 40 ☐ 50 ☐ 60 ☐ 70 ☐ 80 ☐ 90 ☐ 100 clear/sunny Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 28 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Stream Type ☐ Coldwater ☒ Warmwater Catchment Area km²

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 <u>Knotweed, Milkweed, Coneflower</u>			
INSTREAM FEATURES	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Estimated Reach Length <u>200</u> m Estimated Stream Width <u>20</u> m Sampling Reach Area <u>4070</u> m² Area in km² (m²x1000) <u>4</u> km² Estimated Stream Depth <u>2</u> m Surface Velocity (at thalweg) <u>0.2</u> m/sec </td><td style="width: 50%;"> Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>2</u> m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle <u>1</u> % ☒ Run <u>35</u> % ☒ Pool <u>65</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No </td></tr> </table>		Estimated Reach Length <u>200</u> m Estimated Stream Width <u>20</u> m Sampling Reach Area <u>4070</u> m ² Area in km² (m²x1000) <u>4</u> km ² Estimated Stream Depth <u>2</u> m Surface Velocity (at thalweg) <u>0.2</u> m/sec	Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>2</u> m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle <u>1</u> % ☒ Run <u>35</u> % ☒ Pool <u>65</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No
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LARGE WOODY DEBRIS	LWD <u>500</u> m ² Density of LWD <u>125</u> m ² /km ² (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 <u>Burr reed, milfoil</u> Portion of the reach with aquatic vegetation <u>2</u> %			
WATER QUALITY	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Temperature <u>21.9</u> °C Specific Conductance <u>0.521</u> ms/cm Dissolved Oxygen <u>8.94</u> mg/L pH <u>8.38</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> </td><td style="width: 50%;"> 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 _____ </td></tr> </table>		Temperature <u>21.9</u> °C Specific Conductance <u>0.521</u> ms/cm Dissolved Oxygen <u>8.94</u> mg/L pH <u>8.38</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u>	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 _____
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SEDIMENT/SUBSTRATE	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse </td><td style="width: 50%;"> Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No </td></tr> </table>		Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No
Odors ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☒ None ☐ Other _____ Oils ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☒ Other <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>15</u>
Boulder	> 256 mm (10")	<u>0</u>			
Cobble	64-256 mm (2.5"-10")	<u>0</u>	Muck-Mud	black, very fine organic (FPOM)	<u>5</u>
Gravel	2-64 mm (0.1"-2.5")	<u>20</u>			
Sand	0.06-2mm (gritty)	<u>60</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>10</u>			
Clay	< 0.004 mm (slick)	<u>10</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	227+00- 234+00
STATION #	RBP 32	RIVERMILE	N/A
LAT	42.40581	LONG	-73.23732
STORET #	N/A	RIVER BASIN	Housatonic
INVESTIGATORS	SM, TW, KVN, NC	AGENCY	N/A
FORM COMPLETED BY	KVN	DATE	08/25/22
		TIME	1330 ☐ AM ☒ PM
		REASON FOR SURVEY	Reach 5A 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 <u>not</u> new fall and <u>not</u> 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 12	20 19 18 17 16	15 14 13 <input checked="" type="text" value="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 10	20 19 18 17 16	15 14 13 12 11	<input checked="" type="text" value="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 13	20 19 18 17 16	15 14 <input checked="" type="text" value="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 13	20 19 18 17 16	15 14 <input checked="" type="text" value="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 18	20 19 <input checked="" type="text" value="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)

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	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 18	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 8/25/22		
Direction Photo Taken: South			
Description: RBP 32 looking downstream. The outer bend is a pool with large clumps of woody debris and erosion. The inner bend is shallower and is a run. Moderate erosion has occurred at the outer bank and has shrubs growing on top of the slope.			

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Housatonic River		LOCATION 234+00 - 247+00	
STATION # RBP 33	RIVERMILE N/A	STREAM CLASS E (Rosgen)	
LAT 42.40385	LONG -73.23812	RIVER BASIN Housatonic	
STORET # N/A		AGENCY N/A	
INVESTIGATORS SM, TW, KVN, NC			
FORM COMPLETED BY SM		DATE 08/25/22 TIME 1341 ☐ AM ☒ PM	REASON FOR SURVEY Reach 5A BRA

WEATHER CONDITIONS	Now ☐ ☐ ☐ ☐ ☒ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover ☒ 25 % clear/sunny ☒ Past 24 hours ☐ ☐ ☐ ☒ ☐ storm (heavy rain) rain (steady rain) showers (intermittent) %cloud cover ☒ 50 % clear/sunny ☐ Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No Air Temperature 32 °C Other
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  Additional photographs attached below.
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal Stream Type ☐ Coldwater ☒ Warmwater Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other Catchment Area km²

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 <u>Knotweed, Box Elder</u>		
INSTREAM FEATURES	Estimated Reach Length <u>533</u> m Estimated Stream Width <u>30</u> m Sampling Reach Area <u>12122</u> m² Area in km² (m²x1000) <u>12.1</u> km² Estimated Stream Depth <u>2</u> m Surface Velocity (at thalweg) <u>0.125</u> m/sec Canopy Cover ☒ Partly open ☐ Partly shaded ☐ Shaded High Water Mark <u>1.5</u> m Proportion of Reach Represented by Stream Morphology Types ☐ Riffle <u>1</u> % ☒ Run <u>12</u> % ☒ Pool <u>88</u> % Channelized ☐ Yes ☒ No Dam Present ☐ Yes ☒ No		
LARGE WOODY DEBRIS	LWD <u>400</u> m ² Density of LWD <u>25</u> m ² /km ² (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 <u>Burr weed</u> Portion of the reach with aquatic vegetation <u>1</u> %		
WATER QUALITY	Temperature <u>21.6</u> °C Specific Conductance <u>0.522</u> ms/cm Dissolved Oxygen <u>8.6</u> mg/L pH <u>8.38</u> Turbidity _____ WQ Instrument Used <u>YSI 650</u> 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 <u>Sand/Mud</u> 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		<u>0</u>	Detritus	sticks, wood, coarse plant materials (CPOM)	<u>6</u>
Boulder	> 256 mm (10")	<u>2</u>			
Cobble	64-256 mm (2.5"-10")	<u>2</u>	Muck-Mud	black, very fine organic (FPOM)	<u>8</u>
Gravel	2-64 mm (0.1"-2.5")	<u>5</u>			
Sand	0.06-2mm (gritty)	<u>50</u>	Marl	grey, shell fragments	<u>0</u>
Silt	0.004-0.06 mm	<u>30</u>			
Clay	< 0.004 mm (slick)	<u>11</u>			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	Housatonic River	LOCATION	234+00 - 247+00
STATION #	RBP 33	RIVERMILE	N/A
STREAM CLASS	E (Rosgen)		
LAT	42.40385	LONG	-73.23812
RIVER BASIN	Housatonic		
STORET #	N/A		AGENCY
N/A			
INVESTIGATORS	SM, TW, KVN, NC		
FORM COMPLETED BY	DATE	REASON FOR SURVEY	
SM	08/25/22	Reach 5A BRA	
	TIME		
	1341		
	☐ AM ☒ PM		

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	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 <u>not</u> new fall and <u>not</u> 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 8	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 9	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 12	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 6	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 13	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)

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 17	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 18	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (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 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (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

[illegible]

Client Name: GE		Site Location: Reach 5A Housatonic River		Project No. 60689453
Photo No. 1	Date: 8/25/22			
Direction Photo Taken: South				
Description: RBP 33-34 looking downstream. One of the deeper RBPs in our survey. The large pool's water depth is approximately six and a half feet. Woody debris clusters can be seen in the distance.				

Photo No. 2	Date: 8/25/22			
Direction Photo Taken: North				
Description: RBP 33-34 looking upstream. Most of this section is a pool with large amounts of woody debris. The substrate is predominantly sand with some silt.				

A-1b Wildlife Forms

Appendix A-1 (continued). Incidental Direct Wildlife Observations during in-river habitat surveys.

WILDLIFE FIELD OBSERVATIONS

Date: 08/23/2022							
Time: 0920							
Weather: Showers							
Team member(s): SM, TW, KVN, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0920	Amphibian	No	American Toad <i>Anaxyrus americanus</i>	RBP 0-1 42.433205, -73.251625	Amphibian	Animal	Individual
0920	Small mammal	No	American Beaver <i>Castor canadensis</i>	RBP 0-1 42.433205, -73.251625	Small mammal	Track	

WILDLIFE FIELD OBSERVATIONS

Date: 08/23/2022							
Time: 1024							
Weather: Showers							
Team member(s): SM, TW, KV, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1024	Reptile	No	Painted turtle <i>Chrysemys picta</i>	RBP 2-4 42.432825, -73.250741	Reptile	Animal	Individual Adult
1024	Amphibian	No	Green frog <i>Lithobates clamitans</i>	RBP 2-4 42.432825, -73.250741	Amphibian	Animal	Individual Adult
1024	Fish	No	Unknown	RBP 2-4 42.432825, -73.250741	Fish	Animal	2 individuals approximately 12" in length
1024	Bird	No	Hummingbird <i>Trochilidae</i>	RBP 2-4 42.432825, -73.250741	Bird	Animal	Individual
1024	Invertebrate	No	Common water strider <i>Aquarius remigis</i>	RBP 2-4 42.432825, -73.250741	Invertebrate	Animal	Multiple individuals
1024	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	RBP 2-4 42.432825, -73.250741	Bird	Animal	1 individual

WILDLIFE FIELD OBSERVATIONS

Date: 08/23/2022							
Time: 1030							
Weather: Showers							
Team member(s): SM, TW, KVN, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1030	Invertebrate	No	Crayfish <i>Cambarus</i>	RBP 5-6 42.430558, -73.249828	Invertebrate	Animal	Individual
1030	Invertebrate	No	Eastern Elliptio <i>Elliptio complanata</i>	RBP 5-6 42.430558, -73.249828	Invertebrate	Animal	Multiple individuals
1030	Bird	No	Great blue heron <i>Ardea herodias</i>	RBP 5-6 42.430558, -73.249828	Bird	Animal	Individual
1030	Small mammal	No	American Beaver <i>Castor canadensis</i>	RBP 5-6 42.430558, -73.249828	Small mammal	Track	
1030	Large mammal	No	White-tailed deer <i>Odocoileus virginianus</i>	RBP 5-6 42.430558, -73.249828	Large mammal	Track	
1030	Small mammal	No	Raccoon <i>Procyon lotor</i>	RBP 5-6 42.430558, -73.249828	Small mammal	Track	

WILDLIFE FIELD OBSERVATIONS

Date: 08/23/2022							
Time: 1510							
Weather: Showers							
Team member(s): SM, TW, KVN, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1510	Amphibian	No	Pickereel Frog <i>Lithobates palustris</i>	RBP 7-9 42.429998, -73.246600	Amphibian	Animal	Individual
1510	Bird	No	Killdeer <i>Charadrius vociferus</i>	RBP 7-9 42.429998, -73.246600	Bird	Animal	Individual
1510	Invertebrate	No	Dragonfly <i>Anisoptera</i>	RBP 7-9 42.429998, -73.246600	Invertebrate	Animal	Individual
1510	Bird	No	Bluejay <i>Cyanocitta cristata</i>	RBP 7-9 42.429998, -73.246600	Bird	Animal	Individual
1510	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	RBP 7-9 42.429998, -73.246600	Bird	Animal	2 individuals
1510	Invertebrate	No	Whirligig beetles <i>Gyrinidae</i>	RBP 7-9 42.429998, -73.246600	Invertebrate	Animal	Multiple individuals

WILDLIFE FIELD OBSERVATIONS

Date: 08/23/2022							
Time: 1445							
Weather: Showers							
Team member(s): SM, TW, KVN, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1445	Invertebrate	No	Clam <i>Bivalvia</i>	RBP 10-11 42.429839, -73.241568	Invertebrate	Animal	Multiple individuals
1445	Amphibian	No	Green Frog <i>Rana clamitans</i>	RBP 10-11 42.429839, -73.241568	Amphibian	Animal	Multiple individuals
1445	Small mammal	No	Racoon <i>Procyon lotor</i>	RBP 10-11 42.429839, -73.241568	Small mammal	Scat	
1445	Fish	No	Minnow Small fish	RBP 10-11 42.429839, -73.241568	Fish	Animal	Multiple individuals
1445	Invertebrate	No	Eastern Elliptio <i>Elliptio complanata</i>	RBP 10-11 42.429839, -73.241568	Invertebrate	Animal	Multiple individuals

WILDLIFE FIELD OBSERVATIONS

Date: 08/23/2022							
Time: 1545							
Weather: Showers							
Team member(s): SM, NC, KVN, TW							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1545	Large mammal	No	White-tailed deer <i>Odocoileus virginianus</i>	RBP 12-13 42.426141, -73.238070	Large Mammal	Track	
1545	Invertebrate	No	Eastern Elliptio <i>Elliptio complanata</i>	RBP 12-13 42.426141, -73.238070	Invertebrate	Animal	Multiple individuals
1545	Small mammal	No	Raccoon <i>Procyon lotor</i>	RBP 12-13 42.426141, -73.238070	Small mammal	Track	

WILDLIFE FIELD OBSERVATIONS

Date: 08/23/2022							
Time: 1710							
Weather: Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1710	Invertebrate	No	Whirligig beetles <i>Gyrinidae</i>	RBP 14 42.25222, -73.14145	Invertebrate	Animal	Multiple individuals
1710	Bird	No	Killdeer <i>Charadrius vociferus</i>	RBP 14 42.25222, -73.14145	Bird	Animal	Individual
1710	Small mammal	No	American Beaver <i>Castor canadensis</i>	RBP 14 42.25222, -73.14145	Small mammal	Animal	Individual
1710	Large mammal	No	White-tailed deer <i>Odocoileus virginianus</i>	RBP 14 42.25222, -73.14145	Large Mammal	Tracks	
1710	Invertebrate	No	Damselfly <i>Zygoptera</i>	RBP 14 42.25222, -73.14145	Invertebrate	Animal	Individual
1710	Invertebrate	No	Dragonfly <i>Anisoptera</i>	RBP 14 42.25222, -73.14145	Invertebrate	Animal	Multiple individuals
1710	Invertebrate	No	Crayfish <i>Cambarus</i>	RBP 14 42.25222, -73.14145	Invertebrate	Animal	Individual

WILDLIFE FIELD OBSERVATIONS

Date: 08/24/22							
Time: 1050							
Weather: Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
<u>1050</u>	Invertebrate	No	Whirligig beetles <i>Gyrinidae</i>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	Invertebrate	<u>Animal</u>	<u>Multiple individuals</u>
<u>1050</u>	Invertebrate	No	Crayfish <i>Cambarus</i>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	Invertebrate	<u>Animal</u>	<u>6 individuals</u>
<u>1050</u>	<u>Amphibian</u>	No	<u>Green tree frog</u> <u><i>Hyla cinerea</i></u>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	<u>Amphibian</u>	<u>Animal</u>	<u>3 individuals</u>
<u>1050</u>	<u>Bird</u>	No	<u>Cooper's hawk</u> <u><i>Accipiter cooperii</i></u>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	<u>Bird</u>	<u>Animal</u>	<u>2 individuals</u>
<u>1050</u>	Reptile	No	Painted turtle <i>Chrysemys picta</i>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	Reptile	<u>Animal</u>	<u>2 individuals</u>
<u>1050</u>	Invertebrate	No	Eastern Elliptio <i>Elliptio complanata</i>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	Invertebrate	<u>Animal</u>	<u>Individual</u>
<u>1050</u>	<u>Bird</u>	No	<u>White-breasted</u> <u>nuthatch</u> <u><i>Sitta carolinensis</i></u>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	<u>Bird</u>	<u>Animal</u>	<u>Individual</u>
<u>1050</u>	Invertebrate	No	<u>Bumblebee</u> <u><i>Bombus</i></u>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	Invertebrate	<u>Animal</u>	<u>Multiple individuals</u>
<u>1050</u>	Invertebrate	No	<u>Honeybee</u> <u><i>Apis mellifera</i></u>	<u>RBP 15-16,</u> <u>42.25226,</u> <u>-73.14156</u>	Invertebrate	<u>Animal</u>	<u>Multiple individuals</u>

WILDLIFE FIELD OBSERVATIONS

Date: 08/24/2022							
Time: 1217							
Weather: Partly Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1217	Bird	No	American goldfinch <i>Spinus tristis</i>	RBP 17 42.416992, -73.240999	Bird	Animal	Multiple individuals
1217	Small mammal	No	American Beaver <i>Castor canadensis</i>	RBP 17 42.416992, -73.240999	Small mammal	Track	
1217	Bird	No	Canada goose <i>Branta canadensis</i>	RBP 17 42.416992, -73.240999	Bird	Scat	
1217	Bird	No	Hummingbird <i>Trochilidae</i>	RBP 17 42.416992, -73.240999	Bird	Animal	Multiple individuals

WILDLIFE FIELD OBSERVATIONS

Date: 08/24/22							
Time: 1235							
Weather: Partly Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1235	Bird	No	American goldfinch <i>Spinus tristis</i>	RBP 18 42.414557, -73.238682	Bird	Animal	Multiple individuals
1235	Invertebrate	No	Eastern Elliptio <i>Elliptio complanata</i>	RBP 18 42.414557, -73.238682	Invertebrate	Animal	Individual
1235	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	RBP 18 42.414557, -73.238682	Bird	Animal	Individual
1235	Reptile	No	Painted turtle <i>Chrysemys picta</i>	RBP 18 42.414557, -73.238682	Reptile	Animal	Multiple individuals
1235	Amphibian	No	Green Frog <i>Rana clamitans</i>	RBP 18 42.414557, -73.238682	Amphibian	Animal	Individual
1235	Bird	No	Common grackle <i>Quiscalus quiscula</i>	RBP 18 42.414557, -73.238682	Bird	Animal	Individual
1235	Bird	No	Great blue heron <i>Ardea herodias</i>	RBP 18 42.414557, -73.238682	Bird	Animal	Individual
1235	Bird	No	Canada goose <i>Branta canadensis</i>	RBP 18 42.414557, -73.238682	Bird	Animal	Individual
1235	Bird	No	Yellow warbler <i>Setophaga petechia</i>	RBP 18 42.414557, -73.238682	Bird	Animal	Individual
1235	Bird	No	Red-tailed hawk <i>Buteo jamaicensis</i>	RBP 18 42.414557, -73.238682	Bird	Animal	Multiple individuals
1235	Reptile	No	Common snapping turtle <i>Chelydra serpentina</i>	RBP 18 42.414557, -73.238682	Reptile	Animal	Individual

WILDLIFE FIELD OBSERVATIONS

Date: 08/24/2022							
Time: 1430							
Weather: Partly Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1430	Bird	No	Cedar waxwing <i>Bombycilla cedrorum</i>	RBP 19 42.415515, -73.236849	Bird	Animal	Individual
1430	Bird	No	Red bellied woodpecker <i>Melanerpes carolinus</i>	RBP 19 42.415515, -73.236849	Bird	Animal	Individual
1430	Bird	No	Sandpiper <i>Scolopacidae</i>	RBP 19 42.415515, -73.236849	Bird	Animal	Individual
1430	Invertebrate	No	Eastern Elliptio <i>Elliptio complanata</i>	RBP 19 42.415515, -73.236849	Invertebrate	Animal	Individual
1430	Reptile	No	Painted turtle <i>Chrysemys picta</i>	RBP 19 42.415515, -73.236849	Reptile	Animal	Multiple individuals
1430	Amphibian	No	Green frog <i>Lithobates clamitans</i>	RBP 19 42.415515, -73.236849	Amphibian	Animal	Individual
1430	Bird	No	Red-tailed hawk <i>Buteo jamaicensis</i>	RBP 19 42.415515, -73.236849	Bird	Animal	Individual

WILDLIFE FIELD OBSERVATIONS

Date:08/24/2022							
Time:1520							
Weather: Partly Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation ¹	Data Collected: ²	Species Observed ³	Location ⁴	Faunal Type ⁵	Observation Type ⁶	Behavior/Condition Description/Habitat Type ⁶
1520	Invertebrate	No	Crayfish <i>Cambarus</i>	RBP 20-22 42.414430, -73.234158	Invertebrate	Animal	Individual
1520	Bird	No	Great blue heron <i>Ardea herodias</i>	RBP 20-22 42.414430, -73.234158	Bird	Animal	Individual
1520	Small mammal	No	American Beaver <i>Castor canadensis</i>	RBP 20-22 42.414430, -73.234158	Small mammal	Sign	
1520	Bird	No	Mallard <i>Anas platyrhynchos</i>	RBP 20-22 42.414430, -73.234158	Bird	Animal	Individual
1520	Bird	No	American goldfinch <i>Spinus tristis</i>	RBP 20-22 42.414430, -73.234158	Bird	Animal	Multiple individuals

WILDLIFE FIELD OBSERVATIONS

Date:08/24/22							
Time:1600							
Weather: Partly Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation ¹	Data Collected: ²	Species Observed ³	Location ⁴	Faunal Type ⁵	Observation Type ⁶	Behavior/Condition Description/Habitat Type ⁶
1600	Invertebrate	No	Whirligig beetles <i>Gyrinidae</i>	RBP 23-24 42.411755, -73.233352	Invertebrate	Animal	Multiple individuals
1600	Bird	No	Great blue heron <i>Ardea herodias</i>	RBP 23-24 42.411755, -73.233352	Bird	Animal	Individual
1600	Invertebrate	No	Eastern Elliptio <i>Elliptio complanata</i>	RBP 23-24 42.411755, -73.233352	Invertebrate	Animal	Multiple individuals
1600	Fish	No	Brook trout <i>Salvelinus fontinalis</i>	RBP 23-24 42.411755, -73.233352	Fish	Animal	Individual
1600	Amphibian	No	Green frog <i>Lithobates clamitans</i>	RBP 23-24 42.411755, -73.233352	Amphibian	Animal	Multiple individuals

WILDLIFE FIELD OBSERVATIONS

Date: 08/24/2022							
Time: 1622							
Weather: Partly Cloudy							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1622	Reptile	No	Red eared slider turtle <i>Trachemys scripta elegans</i>	RBP 25-26 42.405314, -73.235891	Reptile	Animal	Individual
1622	Fish	No	Bluegill <i>Lepomis macrochirus</i>	RBP 25-26 42.405314, -73.235891	Fish	Animal	Individual
1622	Invertebrate	No	Crayfish <i>Cambarus</i>	RBP 25-26 42.405314, -73.235891	Invertebrate	Animal	Individual
1622	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	RBP 25-26 42.405314, -73.235891	Bird	Animal	Individual

WILDLIFE FIELD OBSERVATIONS

Date: 08/25/2022							
Time: 1010							
Weather: Sunny							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1010	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	RBP 27-28 42.40690, -73.23662	Bird	Animal	Individual
1010	Bird	No	Unidentified waterfowl	RBP 27-28 42.40690, -73.23662	Bird	Animal	Individual
1010	Invertebrate	No	Whirligig beetles <i>Gyrinidae</i>	RBP 27-28 42.40690, -73.23662	Invertebrate	Animal	Multiple individuals
1010	Invertebrate	No	Common water strider <i>Aquarius remigis</i>	RBP 27-28 42.40690, -73.23662	Invertebrate	Animal	Multiple individuals
1010	Bird	No	Redwing blackbird <i>Agelaius phoeniceus</i>	RBP 27-28 42.40690, -73.23662	Bird	Animal	Individual
1010	Fish	No	Minnow Small fish	RBP 27-28 42.40690, -73.23662	Fish	Animal	Multiple individuals
1010	Reptile	No	Painted turtle <i>Chrysemys picta</i>	RBP 27-28 42.40690, -73.23662	Reptile	Animal	Individual
1010	Bird	No	Great blue heron <i>Ardea herodias</i>	RBP 27-28 42.40690, -73.23662	Bird	Track	

WILDLIFE FIELD OBSERVATIONS

Date: 08/25/2022							
Time: 1115							
Weather: Sunny							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1115	Invertebrate	No	Caddisfly <i>Trichoptera</i>	RBP 29-31 42.40734, -73.23855	Invertebrate	Animal	Exoskeleton
1115	Invertebrate	No	Honeybee <i>Apis mellifera</i>	RBP 29-31 42.40734, -73.23855	Invertebrate	Animal	Multiple individuals
1115	Invertebrate	No	Dragonfly <i>Anisoptera</i>	RBP 29-31 42.40734, -73.23855	Invertebrate	Animal	Individual
1115	Invertebrate	No	Whirligig beetles <i>Gyrinidae</i>	RBP 29-31 42.40734, -73.23855	Invertebrate	Animal	Multiple individuals

WILDLIFE FIELD OBSERVATIONS

Date: 08/25/2022							
Time: 1330							
Weather: Sunny							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
Time	Observation¹	Data Collected:²	Species Observed³	Location⁴	Faunal Type⁵	Observation Type⁶	Behavior/Condition Description/Habitat Type⁶
1330	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	RBP 32 42.40581, -73.23732	Bird	Animal	Individual
1330	Invertebrate	No	Dragonfly <i>Anisoptera</i>	RBP 32 42.40581, -73.23732	Invertebrate	Animal	Multiple individuals
1330	Amphibian	No	Green tree frog <i>Hyla cinerea</i>	RBP 32 42.40581, -73.23732	Amphibian	Animal	Individual
1330	Invertebrate	No	Common water strider <i>Aquarius remigis</i>	RBP 32 42.40581, -73.23732	Invertebrate	Animal	Multiple individuals
1330	Bird	No	Gray Catbird <i>Dumetella carolinensis</i>	RBP 32 42.40581, -73.23732	Bird	Animal	Individual
1330	Small mammal	No	American Beaver <i>Castor canadensis</i>	RBP 32 42.40581, -73.23732	Small mammal	Sign	

WILDLIFE FIELD OBSERVATIONS

Date: 08/25/2022							
Time: 1341							
Weather: Sunny							
Team member(s): SM, KVN, TW, NC							
Team activity: Reach 5A BRA							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1341	Bird	No	Wood duck <i>Aix sponsa</i>	RBP 33 42.40385, -73.23812	Bird	Animal	Individual
1341	Amphibian	No	Pickereel Frog <i>Lithobates palustris</i>	RBP 33 42.40385, -73.23812	Amphibian	Animal	Individual
1341	Small mammal	No	American Beaver <i>Castor canadensis</i>	RBP 33 42.40385, -73.23812	Small mammal	Sign	
1341	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	RBP 33 42.40385, -73.23812	Bird	Animal	Individual

A-2 Benthic Macroinvertebrate Results, Field Data Sheets and Notes

Appendix A-2- Reach 5A Macroinvertebrate Sampling Full Identification List

					Station # (North to South)						
Phylum	Class	Order	Family	Final ID	1	2	3	4	5	6	TOTAL
Annelida	Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae		1					1
		Tubificida	Naididae	Aulodrilus pluriset					3		3
				Limnodrilus hoffmeisteri			2				2
				Nais bretscheri			1				1
				Tubificoid Naididae w capilliform setae				2	6		8
				Tubificoid Naididae w/out capilliform setae			1	3	20	4	28
Arthropoda	Arachnida	Trombidiformes	Hygrobatidae	Hygrobates sp.	1						1
	Insecta	Coleoptera	Elmidae	Ancyronyx variegatus				2	1	1	4
				Dubiraphia sp.				1		1	2
				Macronychus glabratus			11	16	4	2	33
				Optioservus elegans group				1			1
				Optioservus fastiditus group			1				1
				Stenelmis crenata	1			3	1		5
				Stenelmis sp.			1	2			3
			Gyrinidae	Dineutus sp.				1		0	1
			Hydrophilidae	Berosus sp.				2			2
			Psephenidae	Psephenus herricki	13		4				17
		Diptera	Ceratopogonidae	Ceratopogoninae					2	1	3
			Chironomidae	Ablabesmyia sp.		1	1	5	3	1	11
				Chironomus sp.	1	2	5	2	5		15
				Cladotanytarsus sp.				1		2	3
				Cricotopus bicinctus	1	1				3	5
				Cricotopus sp.		3	1	1		3	8
				Cricotopus/Orthocladius sp.				2			2
				Cryptochironomus sp.			1	1			2
				Dicrotendipes sp.				1	2		3
				Eukiefferiella sp.					1		1
				Kribiodorum perpulchrum				1			1
				Microtendipes pedellus group			2	1	2	1	6
				Nanocladius sp.			5	4	1	1	11
				Nilotanypus fimbriatus			1				1
				Orthocladius sp.			2				2
				Parametriocnemus sp.			1				1
				Paratendipes sp.					2		2
				Pentaneura sp.			1		1		2
				Pentaneurini						1	1
				Phaenopsectra obedians group		1		1	1		3
				Polypedilum flavum	1	3		4	4	10	22
				Polypedilum halterale group				1		2	3
				Polypedilum illinoense group		1		1	4	2	8
				Polypedilum laetum		1					1

Phylum	Class	Order	Family	Final ID	Station # (North to South)						TOTAL
					1	2	3	4	5	6	
				Polypedilum scalaenum group	1				2		3
				Potthastia gaedii group					1		1
				Procladius sp.				2	7		9
				Rheocricotopus sp.		1	10	1	4	6	22
				Rheotanytarsus exiguus group	2		6	5	10	19	42
				Rheotanytarsus sp.			1			1	2
				Saetheria tylus				1			1
				Stenochironomus sp.			1				1
				Tanypodinae			1	4			5
				Tanytarsus sp.		7	11	90	36	28	172
				Thienemanniella sp.						2	2
				Thienemannimyia group	1	2	9	33	21	21	87
				Tvetenia tshernovskii			3				3
			Empididae	Hemerodromia sp.		1	1	4	2	1	9
			Limoniidae	Antocha sp.			1				1
			Simuliidae	Simulium sp.					17	130	147
			Tipulidae	Tipula sp.			1		1		2
	Ephemeroptera	Baetidae	Baetidae			1		1	1		3
			Baetis flavistriga complex			3	8	1			12
			Baetis intercalaris	3	2	1				1	7
			Baetis sp.				1				1
			Iswaeon anoka	2	38	19	4	4	4	4	71
			Labiobaetis sp.				26		6	7	39
			Plauditus punctiventris			14			1		15
		Baetiscidae	Baetisca sp.						3	2	5
		Heptageniidae	Maccaffertium modestum	5	2	5	1				13
			Maccaffertium sp.			4	3			2	9
			Stenacron interpunctatum	2		8	3	19			32
			Stenacron sp.				1	1			2
		Isonychiidae	Isonychia sp.	2	9	3	1	4			19
		Leptophlebiidae	Leptophlebia sp.				1				1
			Leptophlebiidae				1	9	3		13
Hemiptera		Corixidae	Corixidae					4			4
Megaloptera		Sialidae	Sialis sp.						1		1
Odonata	Aeshnidae		Basiaeschna janata					1			1
			Boyeria vinosa					2			2
			Ischnura sp.					1			1
	Gomphidae		Gomphidae	2							2
			Hylogomphus sp.						1		1
			Ophiogomphus sp.		1	2					3
			Phanogomphus sp.			2					2
			Stylurus scudderi						2		2
			Stylurus spiniceps				1		1		2

Phylum	Class	Order	Family	Final ID	Station # (North to South)						TOTAL
					1	2	3	4	5	6	
		Plecoptera	Perlidae	Paragnetina media				1			1
				Perlesta sp.				1			1
		Trichoptera	Brachycentridae	Brachycentrus numerosus				9	2	3	14
			Hydropsychidae	Cheumatopsyche sp.	14	6	49	59	39	44	211
				Hydropsyche betteni	85	16	89	4	11	11	216
				Hydropsyche bronta	49	10	4		3		66
				Hydropsyche morosa	21		7				28
				Hydropsyche morosa group			2		1		3
				Hydropsyche sparna	28	1		1	5	1	36
				Hydropsychidae	1			1	1		3
			Hydroptilidae	Hydroptila sp.		3	1	2			6
				Hydroptilidae		2		2		1	5
				Leucotrichia pictipes	1						1
			Limnephilidae	Pycnopsyche sp.			1				1
			Philopotamidae	Chimarra aterrima		1					1
				Chimarra obscura	2						2
			Polycentropodidae	Polycentropodidae				2			2
				Polycentropus sensu lato complex				2			2
			Psychomyiidae	Lype diversa			2	3			5
			Thremmatidae	Neophylax sp.	1		1				2
	Malocostraca	Amphipoda	Crangonyctidae	Crangonyx sp.				1	4		5
			Hyaellidae	Hyaella sp.			1				1
		Decapoda	Cambaridae	Faxonius sp.		2	1	1	4	0	8
		Isopoda	Asellidae	Caecidotea racovitzai racovitzai				1	11		12
				Caecidotea sp.					10	1	11
Mollusca	Bivalvia	Sphaeriida	Sphaeriidae	Pisidium sp.					2		2
				Sphaeriidae					1		1
				Sphaerium sp.				1	1		2
		Unionoida	Unionidae	Elliptio complanata			1				1
	Gastropoda	Basommatophora	Lymnaeidae	Lymnaeidae			1				1
			Physidae	Physella sp.					3		3
			Planorbidae	Ferrissia sp.	2	1	4	2	2	1	12
Nematoda				Nematoda	1	2		2			5
Platyhelminthes	Trepaxonemata			Trepaxonemata				1			1
Grand Total					243	139	332	327	311	321	1673

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>Housatonic</u>		LOCATION <u>RBP 1,2</u>	
STATION # <u>1</u> RIVERMILE <u>RBP 1,2</u>		STREAM CLASS <u></u>	
LAT <u>42.43330</u> LONG <u>73.25157</u>		RIVER BASIN <u>Housatonic</u>	
STORET # <u></u>		AGENCY <u>AECOM / EPA</u>	
INVESTIGATORS <u>TW, NC</u>		LOT NUMBER <u>R5A-MI-S1 (2 Bottles)</u>	
FORM COMPLETED BY <u>TW</u>		DATE <u>08/26/22</u> TIME <u>0840</u> ☒ AM ☐ PM	REASON FOR SURVEY <u>Reach 5A BERA</u>

HABITAT TYPES	Indicate the percentage of each habitat type present ☒ Cobble <u>55</u> % ☒ Snags <u>10</u> % ☐ Vegetated Banks <u></u> % ☒ Sand <u>30</u> % ☒ Submerged Macrophytes <u>5</u> % ☐ Other (<u></u>) <u></u> %
SAMPLE COLLECTION	Gear used ☒ D-frame ☐ kick-net ☐ Other <u></u> How were the samples collected? ☒ wading ☐ from bank ☐ from boat Indicate the number of jabs/kicks taken in each habitat type. ☒ Cobble <u>10</u> ☒ Snags <u>3</u> ☐ Vegetated Banks <u></u> ☒ Sand <u>5</u> ☒ Submerged Macrophytes <u>2</u> ☐ Other (<u></u>) <u></u>
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	<u>1</u>	2	3	4	Slimes	<u>0</u>	1	2	3	4
Filamentous Algae	<u>0</u>	1	2	3	4	Macroinvertebrates	0	1	2	<u>3</u>	4
Macrophytes	0	<u>0</u>	2	3	4	Fish	0	<u>1</u>	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						No field observations were taken- pull from laboratory data											
Isopoda																	
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						

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>Housatonic</u>		LOCATION <u>RBP 10-11</u>	
STATION # <u>1</u> RIVERMILE <u>RBP 1.2</u>		STREAM CLASS <u></u>	
LAT <u>42.43033</u> LONG <u>73.24048</u>		RIVER BASIN <u>Housatonic</u>	
STORET # <u></u>		AGENCY <u>AECOM / EPA</u>	
INVESTIGATORS <u>TW, NC</u>		LOT NUMBER <u>R5A-MI-S2 (2 Bottles)</u>	
FORM COMPLETED BY <u>TW</u>		DATE <u>08/26/22</u> TIME <u>1030</u> <u>AM</u> PM	REASON FOR SURVEY <u>Reach 5A BERA</u>

HABITAT TYPES	Indicate the percentage of each habitat type present ☒ Cobble <u>5</u> % ☒ Snags <u>15</u> % ☐ Vegetated Banks <u></u> % ☒ Sand <u>80</u> % ☐ Submerged Macrophytes <u></u> % ☐ Other (<u></u>) <u></u> %
SAMPLE COLLECTION	Gear used ☒ D-frame ☐ kick-net ☐ Other <u></u> How were the samples collected? ☒ wading ☐ from bank ☐ from boat Indicate the number of jabs/kicks taken in each habitat type. ☒ Cobble <u>4</u> ☒ Snags <u>5</u> ☐ Vegetated Banks <u></u> ☒ Sand <u>15</u> ☐ Submerged Macrophytes <u></u> ☐ Other (<u></u>) <u></u>
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	①	1	2	3	4	Slimes	①	1	2	3	4
Filamentous Algae	①	1	2	3	4	Macroinvertebrates	0	①	2	3	4
Macrophytes	①	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	No field observations were taken- pull from laboratory data					
Oligochaeta																	
Isopoda																	
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						



Macro inverts

8/26

Sample 1

8:40 start DS in Station 3+00

V Branch

R Branch

0+00 Note: 4 dogs playing
@ 0937 → 0955 in the
water

1+00

2+00

3+00

Pool

NTS
N1+42.43330
73.25157~20 in the last 4
samples

Sampling pool w sand bottom w/some muck/drop

10:30 end

RSA-M1-S1 (2 bottles)

Sample 2

42.43033
73.2404842.43033
73.24048~150 samples
collected
totalMostly mixed
gravel + mud

RSA-M1-S2 (2 bottles)

Run

Sediment

Riffle

Riffle

Run

Pool

Run

Run

Run

Pool

Run

42.43001
73.24054

47+00

46+00

45+00

48+00

GE Reach 5A Macro Inverts Data
Sample 1 RSA-M1-S1 (2 sample bottles)
Starts station 3+00 DS 8:40
Samplers TW, NC

Habitat - 25% cobble, 30% sand, 0% veg banks
10% snags, 5% sub mac

Samples collected wading w DNet

Jabs: 5 in sand, 10 in cobble, 3 in snags, 2
in sub mac

Abundance: Aquatic Biota

Periphyton: 1

Fil. Algae: 0

Macrophytes: 1

Slimes: 0

Macro Inverts: 3

Fish: 1

Field Observations of macrobenthos TBD
based on lab results

GE Reach 5A Macro Inverts Data
Sample 2 RSA-M1-S2 (2 sample bottles)
Starts station 46+00 DS @ 10:30
Samplers NC, TW

Habitat - 5% cobble, 80% sand, 0% veg banks
15% snags, 0% sub mac

Jabs - 1 cobble, 15 sand, 5 snags

Samples collected wading w/ DNet

~~Macro Inverts: 1~~

Abundance: Aquatic Biota

Periphyton: 0

Fil. Algae: 0

Macrophytes: 0

Slimes: 0

Macro Inverts: 1

Fish: 1

Field Obs of Macrobenthos TBD
based on lab results

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>Housatonic</u>	LOCATION <u>RBP 14</u>
STATION # <u>78.50-2</u> RIVERMILE <u>14-16</u>	STREAM CLASS <u>Perennial</u>
LAT <u>41° 45' N</u> LONG <u>73° 45' W</u>	RIVER BASIN <u>Housatonic</u>
STORET #	AGENCY <u>ADNR / EPA</u>
INVESTIGATORS <u>K.N. Sun</u>	LOT NUMBER <u>RSA-NI-SB 2 bottles</u>
FORM COMPLETED BY <u>K.N. Sun</u>	DATE <u>8/3/22</u> TIME <u>12:25</u> AM ☒ PM ☐
REASON FOR SURVEY <u>Reassess SA Bacteria</u>	

HABITAT TYPES	Indicate the percentage of each habitat type present ☒ Cobble <u>10</u> % ☒ Snags <u>1</u> % ☒ Vegetated Banks <u>5</u> % ☒ Sand <u>45</u> % ☒ Submerged Macrophytes <u><1</u> % ☒ Other (<u>silt</u>) <u>30</u> % ☒ gravel <u>10</u> %
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 <u>2</u> ☒ Snags <u>2</u> ☒ Vegetated Banks <u>1</u> ☒ Sand <u>0</u> ☒ Submerged Macrophytes <u>0</u> ☒ Other (<u>silt</u>) <u>12</u> ☒ gravel <u>2</u>
GENERAL COMMENTS	<u>low flow conditions</u> <u>limited distinction between sand/gravel/silt</u> <u>- rain the night previous (0.5 inches)</u>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0	<u>1</u>	2	3	4	Slimes	<u>0</u>	1	2	3	4
Filamentous Algae	0	<u>1</u>	2	3	4	Macroinvertebrates	0	1	<u>2</u>	3	4
Macrophytes	0	<u>1</u>	2	3	4	Fish	0	1	<u>2</u>	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	<u>0</u>	1	2	3	4	Anisoptera	0	<u>1</u>	2	3	4	Chironomidae	<u>0</u>	1	2	3	4
Hydrozoa	<u>0</u>	1	2	3	4	Zygoptera	0	1	2	<u>3</u>	4	Ephemeroptera	0	1	<u>3</u>	<u>3</u>	4
Platyhelminthes	<u>0</u>	1	2	3	4	Hemiptera	0	1	<u>2</u>	3	4	Trichoptera	0	1	2	<u>3</u>	4
Turbellaria	<u>0</u>	1	2	3	4	Coleoptera	0	1	2	<u>3</u>	4	Other	0	1	2	3	4
Hirudinea	<u>0</u>	1	2	3	4	Lepidoptera	<u>0</u>	1	2	3	4						
Oligochaeta	<u>0</u>	<u>1</u>	2	<u>3</u>	4	Sialidae	0	1	<u>2</u>	3	4						
Isopoda	0	<u>1</u>	2	3	4	Corydalidae	0	1	<u>2</u>	3	4						
Amphipoda	0	<u>1</u>	2	3	4	Tipulidae	0	<u>1</u>	2	3	4						
Decapoda	0	<u>1</u>	2	3	4	Empididae	<u>0</u>	1	2	3	4						
Gastropoda	0	<u>1</u>	2	3	4	Simuliidae	<u>0</u>	1	2	3	4						
Bivalvia	0	<u>1</u>	2	3	4	Tabinidae	<u>0</u>	1	2	3	4						
						Culicidae	<u>0</u>	1	2	3	4						

RBP 14

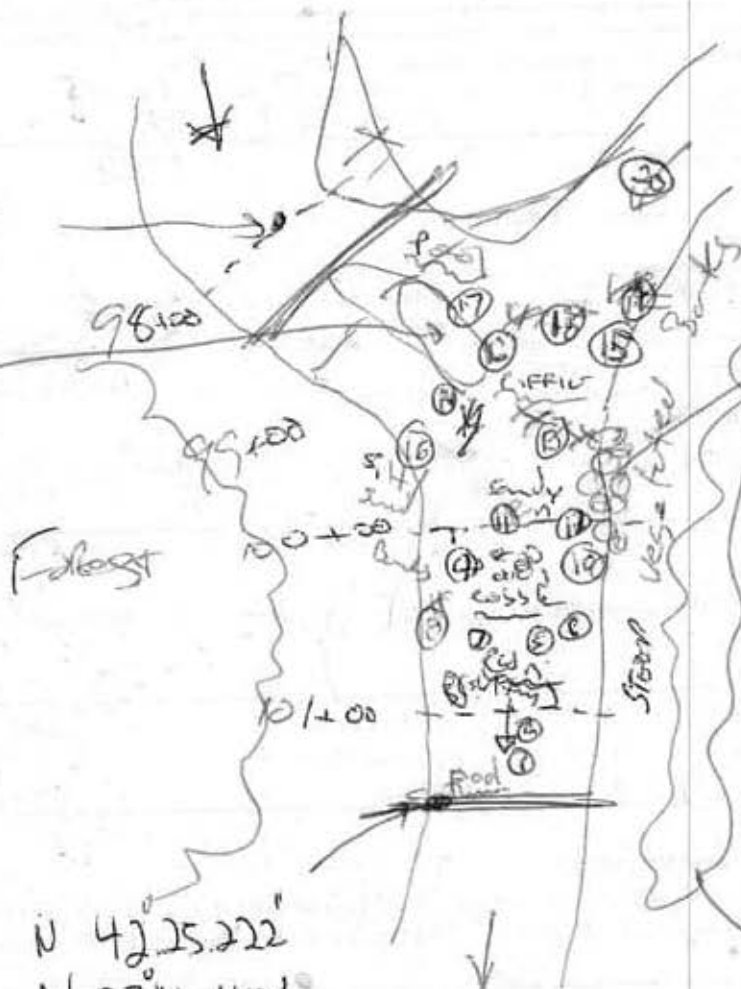
Benthic Inverte

8/31/22

N ↑
=

N 42° 25.270'
W 73° 14.171'

Sandy
island



Cobble / Boulder
Sandy island
arrows

Field

N 42° 25.222'
W 73° 14.149'

Line of
overhanging trees

= CWD

Substrate Approx.

50 Gravel
40 Sand
10 s. / t

NTS

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>Housatonic R</u>	LOCATION <u>170+50 → 173+50</u>
STATION # <u>4</u> RIVERMILE <u>21.22</u>	STREAM CLASS <u>1</u>
LAT <u>41° 00' N</u> LONG <u>73° 00' W</u>	RIVER BASIN <u>Housatonic R</u>
STORET #	AGENCY <u>Accomack EPA</u>
INVESTIGATORS <u>SM KVN</u>	LOT NUMBER <u>RSA-MI-S41B</u>
FORM COMPLETED BY <u>SM KVN</u>	DATE <u>9/1/00</u> TIME <u>11:00</u> AM PM
	REASON FOR SURVEY <u>Reach SABER</u>

HABITAT TYPES	Indicate the percentage of each habitat type present ☒ Cobble <u>0</u> % ☒ Snags <u>0</u> % ☒ Vegetated Banks <u>0</u> % ☒ Sand <u>60</u> % ☒ Gravel <u>15</u> % ☒ Submerged Macrophytes <u>2</u> % ☒ Other (<u>Silt</u>) <u>15</u> %
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 <u>2</u> ☒ Snags <u>2</u> ☐ Vegetated Banks <u>1</u> ☐ Sand <u>12</u> ☒ Gravel <u>3</u> ☒ Submerged Macrophytes <u>1</u> ☐ Other (<u>Silt</u>) <u>1</u>
GENERAL COMMENTS	<u>20.3 °C water temp</u> <u>20.3 °C water temp</u>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

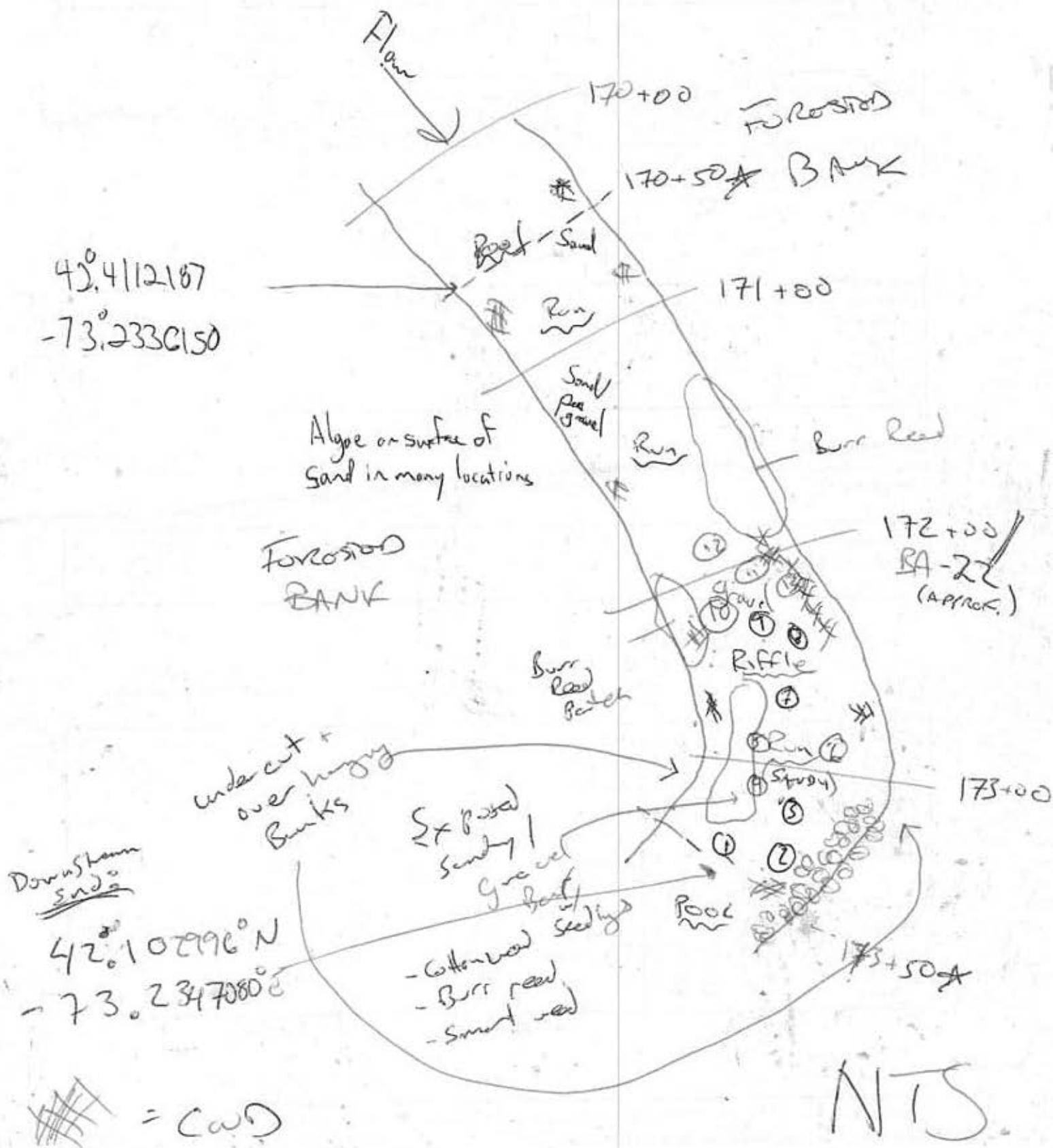
Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

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	Tabanidae	0	1	2	3	4						
						Culicidae	0	1	2	3	4						

MACROINVERT STATION # 4 + Dupl. N
RBP-21 + 22



BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME <u>Hickory Creek</u>	LOCATION <u>RSP 28</u> (Station 213+00 to 216+00)
STATION # <u>213-216</u> RIVERMILE <u>213.27</u>	STREAM CLASS
LAT <u>30° 00' N</u> LONG <u>90° 00' W</u>	RIVER BASIN <u>Houston</u>
STORET #	AGENCY <u>AECOM (EPA assigned)</u>
INVESTIGATORS <u>K.N. SMO</u>	LOT NUMBER <u>PSA-MI-S5</u>
FORM COMPLETED BY <u>K.N.</u>	DATE <u>9/1/22</u> TIME <u>1600</u> AM ☒ PM
	REASON FOR SURVEY <u>Reach 5A Beka</u>

HABITAT TYPES	Indicate the percentage of each habitat type present ☐ Cobble <u>0</u> % ☐ Snags <u>0</u> % ☐ Vegetated Banks <u>0</u> % ☐ Sand <u>75</u> % ☐ Submerged Macrophytes <u>5</u> % ☐ Other () % <u>Silty / Clayey Sand</u>
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 <u>0</u> ☐ Snags <u>2</u> ☐ Vegetated Banks <u>1</u> ☐ Sand <u>15</u> ☐ Submerged Macrophytes <u>2</u> ☐ Other () _____
GENERAL COMMENTS	<u>Run 14.5 m 1' adjacent to Butler farm</u> <u>Between 2 River Banks w/ Pools</u> <u>- very sandy substrate (silty/clayey sand) -</u> <u>Bottom rough, open water - sand bars, trough</u> <u>sporadic SAV, Rotted emergent veg patches</u>

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3 = Abundant, 4 = Dominant

Periphyton	0 1 <u>2</u> 3 4	Slimes	0 <u>2</u> 3 4
Filamentous Algae	<u>0</u> 1 2 3 4	Macroinvertebrates	0 <u>1</u> <u>2</u> 3 4
Macrophytes	0 <u>1</u> 2 3 4	Fish	0 <u>1</u> <u>2</u> 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	<u>0</u> 1 2 3 4	Anisoptera	<u>0</u> 1 2 3 4	Chironomidae	0 1 <u>2</u> 3 4
Hydrozoa	<u>0</u> 1 2 3 4	Zygoptera	<u>0</u> 1 2 3 4	Ephemeroptera	<u>0</u> 1 <u>2</u> 3 4
Platyhelminthes	<u>0</u> 1 2 3 4	Hemiptera	<u>0</u> 1 2 3 4	Trichoptera	0 <u>1</u> <u>2</u> 3 4
Turbellaria	<u>0</u> 1 2 3 4	Coleoptera	<u>0</u> 1 2 3 4	Other	<u>0</u> 1 2 3 4
Hirudinea	<u>0</u> 1 2 3 4	Lepidoptera	<u>0</u> 1 2 3 4		
Oligochaeta	0 1 <u>2</u> 3 4	Sialidae	<u>0</u> 1 2 3 4		
Isopoda	0 1 <u>2</u> 3 4	Corydalidae	<u>0</u> 1 2 3 4		
Amphipoda	0 1 <u>2</u> 3 4	Tipulidae	<u>0</u> 1 2 3 4		
Decapoda	0 <u>1</u> 2 3 4	Empididae	<u>0</u> 1 2 3 4		
Gastropoda	<u>0</u> 1 2 3 4	Simuliidae	<u>0</u> 1 2 3 4		
Bivalvia	<u>0</u> 1 2 3 4	Tabinidae	<u>0</u> 1 2 3 4		
		Culicidae	<u>0</u> 1 2 3 4		

Housatonic R
Reach SA BarA

N
↑

Sanctuary
Start coord
42. 407602°N
-73. 2372394°E



Agoutic Veg

- curly pondweed
- Valisneria
- Burr Reed
- Eurasian Milfoil

42. 4069299°N
-73. 2367056°E

= B Coord

NTS

A-3 Fisheries Photo Log

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 1	Date: 08/26/22		
Direction Photo Taken: N/A			
Description: A juvenile rock bass caught in one of three fish net locations throughout the reach.			

Photo No. 2	Date: 8/25/22	
Direction Photo Taken: South		
Description: Location of one set of fishtraps at our northernmost fish trap area, within RBP 12 looking downstream. Fish nets were secured to the pictured woody debris.		

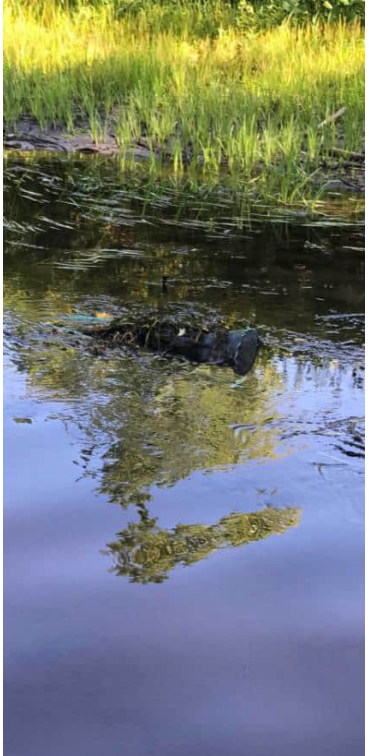
Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 3	Date: 8/25/22		
Direction Photo Taken: Northwest			
Description: Location of one set of fishtraps at our northernmost fish trap area, within RBP 12 looking upstream. Fish nets were secured to the pictured woody debris along the western bank.			

Photo No. 4	Date: 8/26/22	
Direction Photo Taken: N/A		
Description: Crayfish collected from fishnet traps at one of three sampling locations along the reach.		

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 5	Date: 8/25/22		
Direction Photo Taken: North			
Description: One of two fishtrap sets located within RBP 14 looking upstream. Fish nets were secured to the pictured boulders along the eastern bank.			

Photo No. 6	Date: 8/25/22		
Direction Photo Taken: South (Left) North (Right)			
Description: An upstream and downstream look at ne of two fishtrap sets located within RBP 14. Fish nets were secured to the pictured logs which sit in the middle of the channel.			

Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 7	Date: 8/25/22		
Direction Photo Taken: Southwest			
Description: Location of one set of fish traps at the southernmost fishtrap location located within RBP 22 looking downstream. Fish nets were secured to the hanging branches pictured over the western bank.			

Photo No. 8	Date: 8/25/22		
Direction Photo Taken: Northwest			
Description: Location of one set of fish traps at the southernmost fishtrap location within RBP 22 looking upstream. Fishnets were secured using wooden sticks as planks amongst the submerged aquatic vegetation on the eastern bank.			

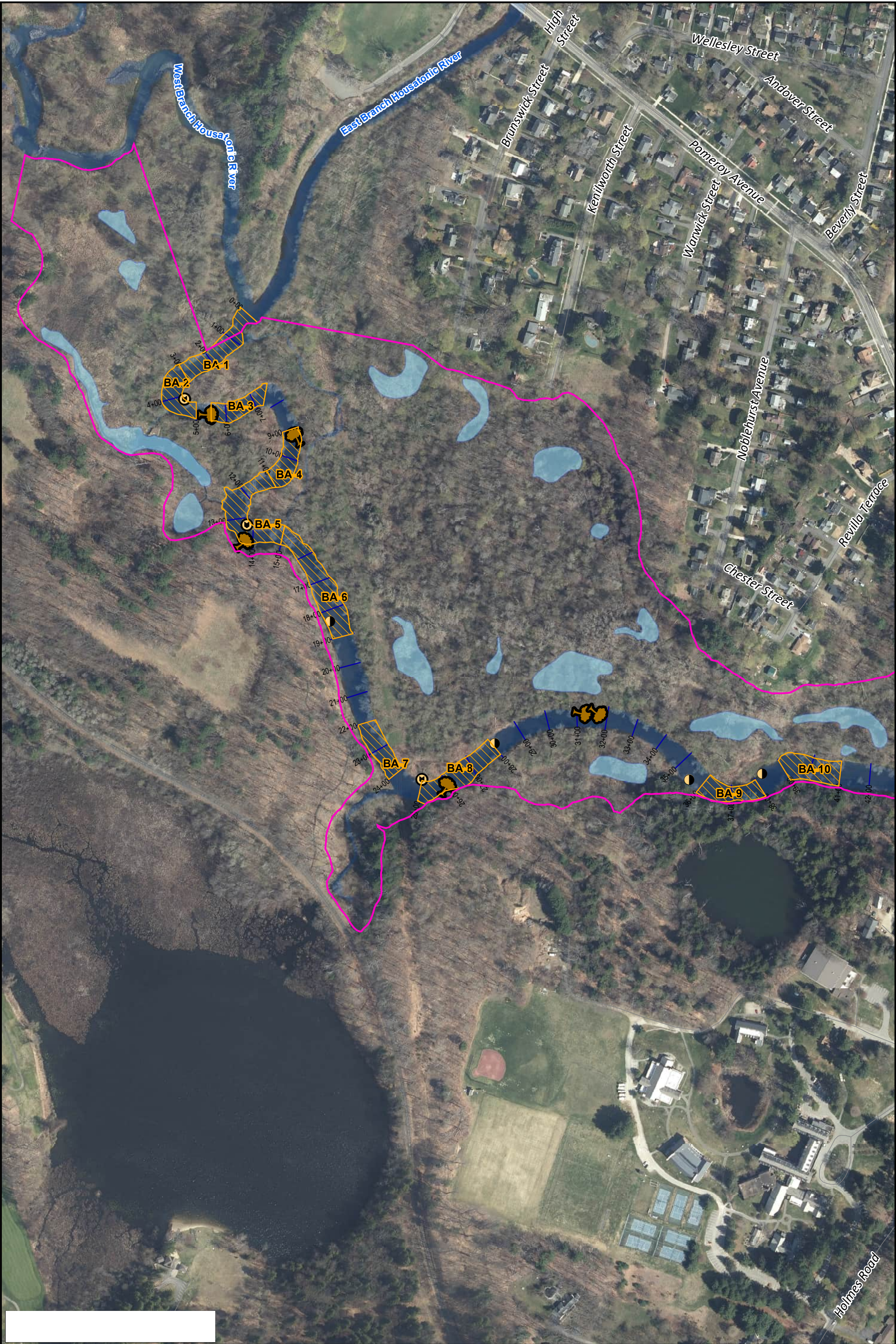
Client Name: GE		Site Location: Reach 5A Housatonic River	Project No. 60689453
Photo No. 9	Date: 8/26/22	 A close-up photograph of a small, dark-colored juvenile rock bass being measured against a ruler. The fish is positioned horizontally, and the ruler shows markings from approximately 2.5 to 5.5 inches. The fish's length is just under the 3-inch mark.	
Direction Photo Taken: N/A			
Description: A juvenile rock bass being measured after catch in one of three fish net locations throughout the reach.			

Photo No. 10	Date: 8/25/22	 A photograph showing two cylindrical fish traps set up in a river. The traps are made of dark mesh and are secured to a vertical wooden post in the water. The traps are positioned on a muddy bank, and the water is calm, reflecting the surrounding greenery.
Direction Photo Taken: N/A		
Description: Example on the bank of how fish nets are set up in water. Baiting with bread and catfood is used to lure fish through holes in the nets and the traps themselves are secured to submerged woody debris upstream.		

Appendix B

Riverbank Habitat Inventory Forms

with figures showing riverbank stations surveyed



INDEX MAP

Cover Types

- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth

Side Bar

Side Bar

Point Bar

Point Bar

Large Pile CWD, Logs / Whole Trees /

Large Pile CWD, Logs / Whole Trees /

Brush Piles / Log Jams

Brush Piles / Log Jams

Reach 5A

Riverbank Habitat Investigations

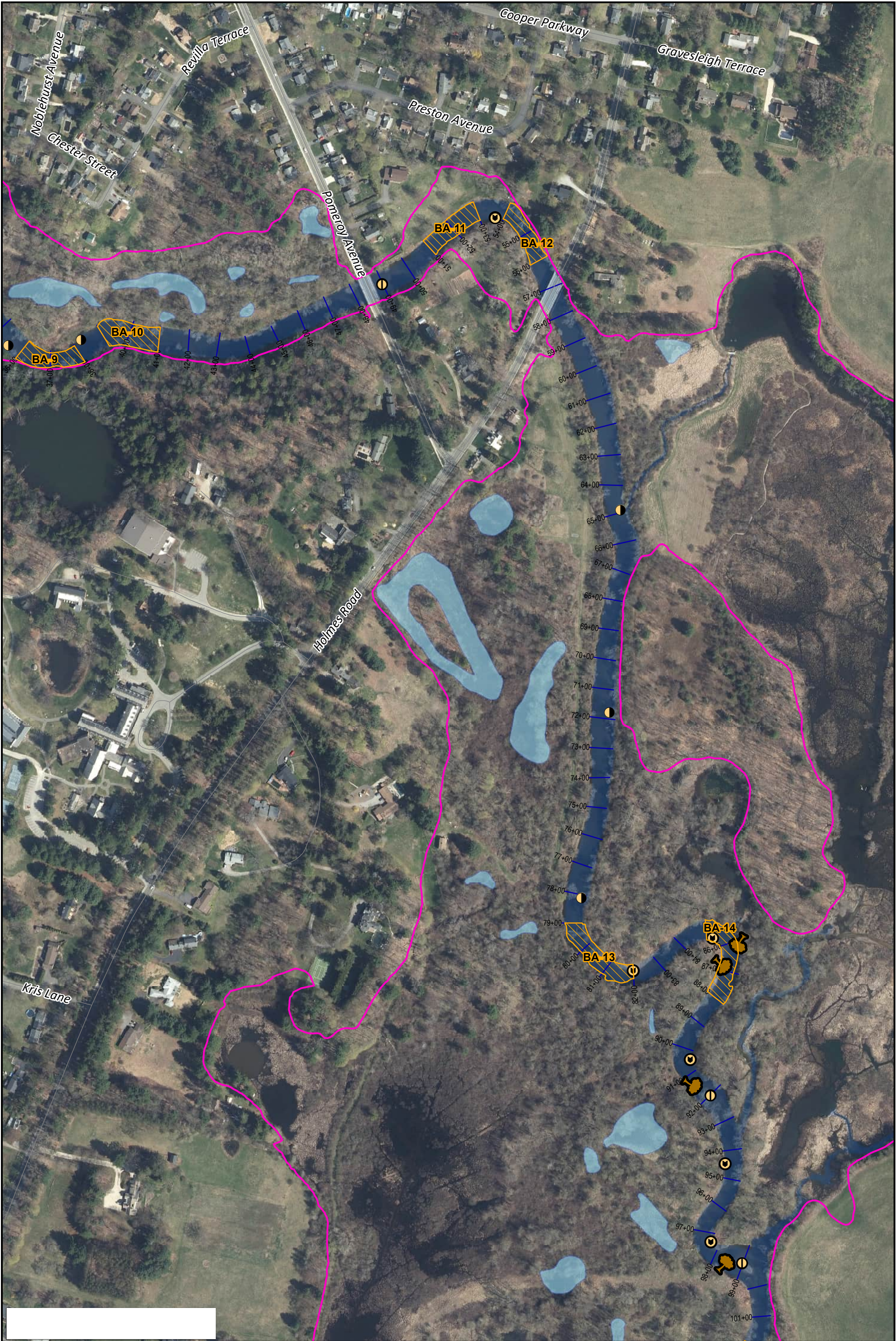
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	8/3/2023	60688342

AECOM

Figure B-1

Map Sheet 1 of 4



INDEX MAP

Cover Types

- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth

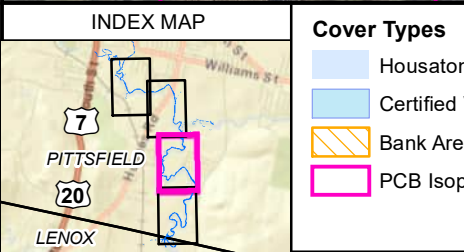
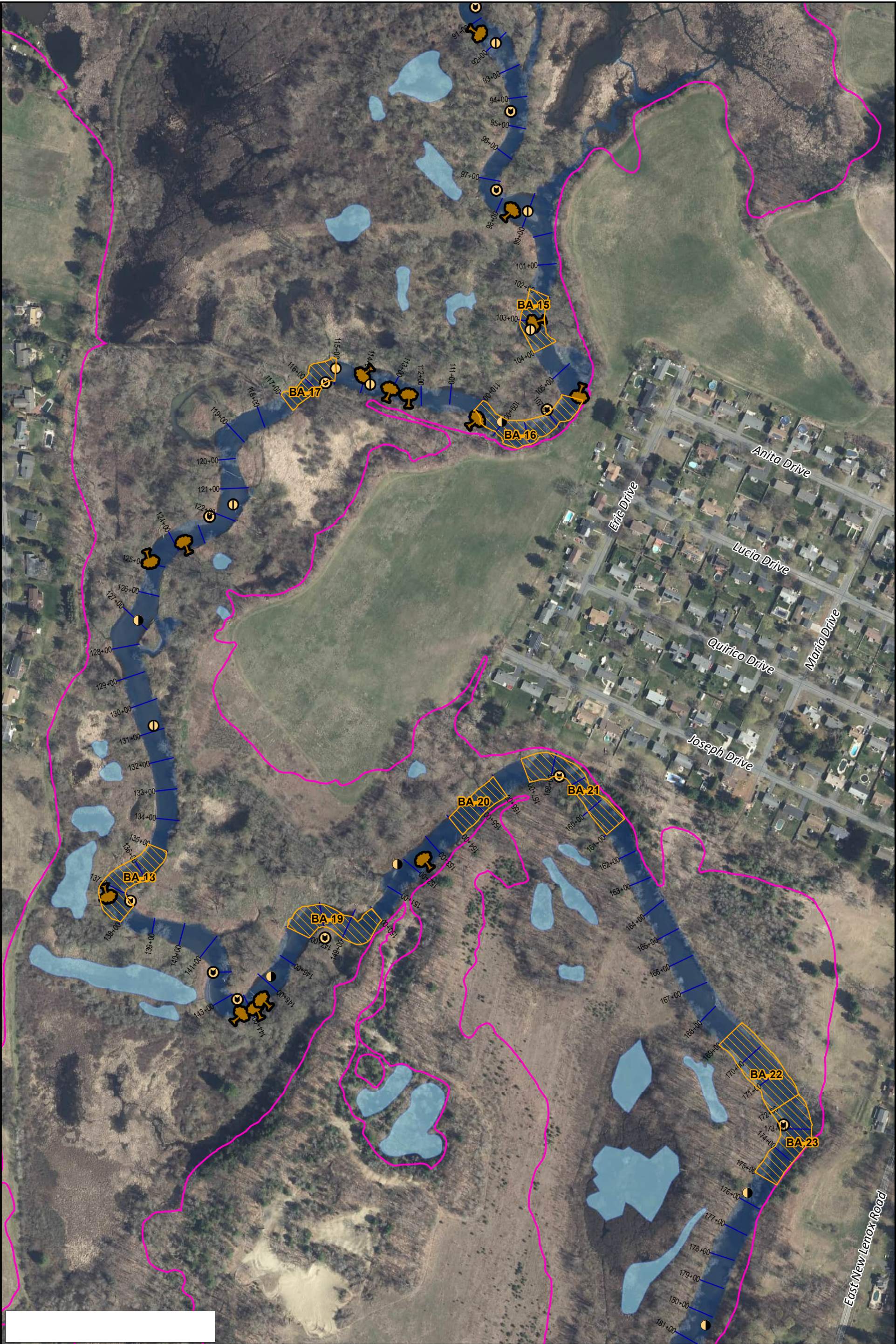
- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A
Riverbank Habitat Investigations
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	8/3/2023	60688342

AECOM

Figure B-2
Map Sheet 2 of 4



Cover Types

- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth

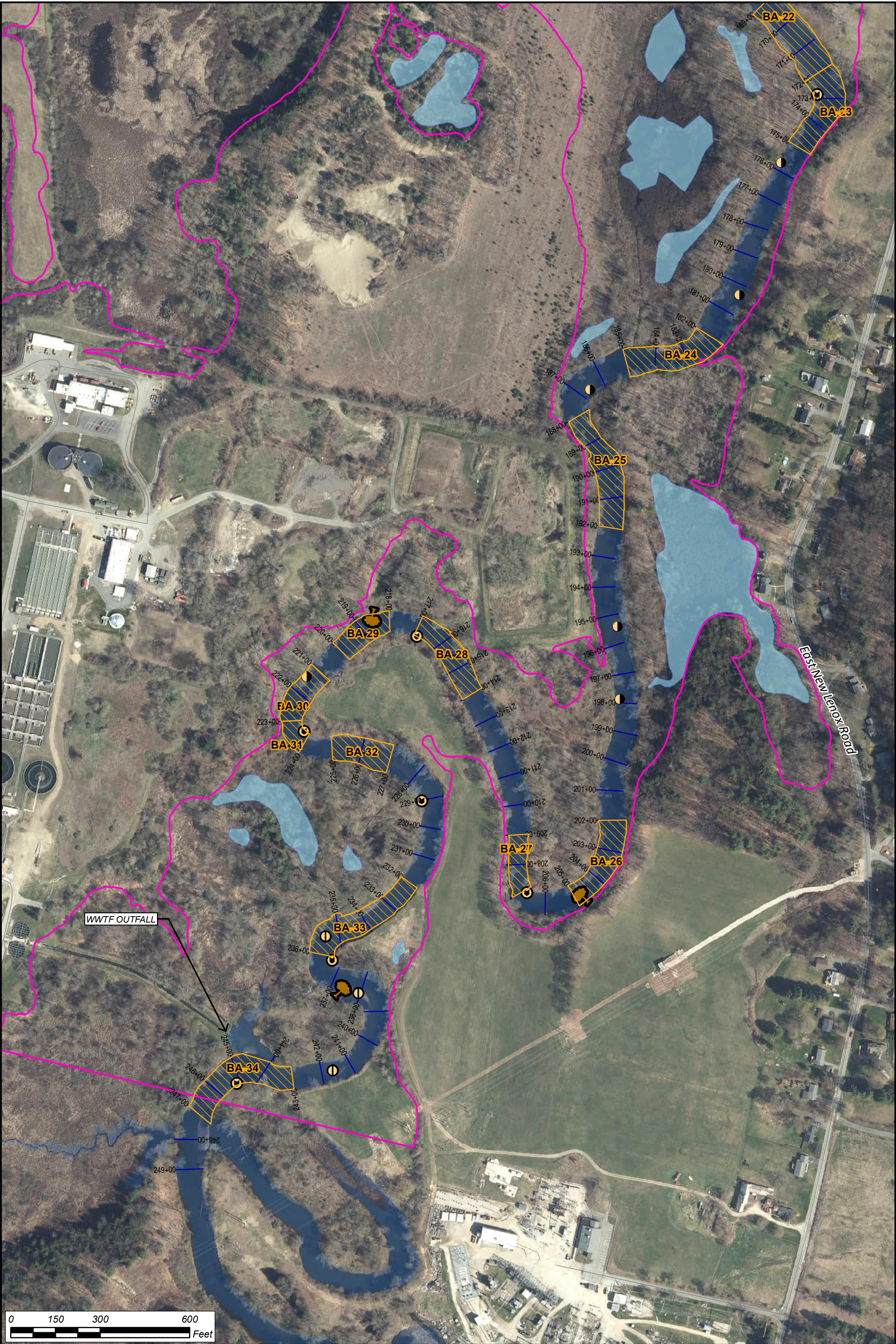
- Side Bar
- Mid-Channel Bar
- Point Bar
- Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams



Reach 5A Riverbank Habitat Investigations		
Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:3,600	8/3/2023	60688342

Figure B-3

Map Sheet 3 of 4



0 150 300 600 Feet

INDEX MAP

Cover Types

- Housatonic River
- Certified Vernal Pools
- Bank Area
- PCB Isopleth

Side Bar

Mid-Channel Bar

Point Bar

Large Pile CWD, Logs / Whole Trees / Brush Piles / Log Jams

Reach 5A

Riverbank Habitat Investigations

Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:3,600	8/3/2023	60688342

AECOM

Figure B-4

Map Sheet 4 of 4

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 1

Site Name and Evaluation Segment

Bank 1: Stations 0-3. Extends downstream of Confluence. 300-ft stretch before tight left bend.

Location/Physical Description

8/3/22

Date(s) of Site Visit(s) and Data Collection

Sunny, warm (85 degrees)

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

8/3/22

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length 300'

Width: 60'

Bank Height: 6-7'

Slope: R 30% L 90%

Sediment / Substrate composition:

% Sand: 50

% Silt 40

% Clay 0

% Gravel/cobble 10

% Boulder/Bedrock 0

% Organic matter 5

Bank stability / Observed erosional conditions:

Left bank is mostly vertical with some undercutting beneath tree root system. Roots appear to stabilize the bank.
Thalweg is along left bank. Right bank gentle and stable.

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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 6-7 ft Floodplain surface: 6-7 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: $\frac{75}{\text{Bank Vegetation}}$ $\frac{50}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{50}{\text{Trees (> 20')}} \quad \frac{40}{\text{Shrubs (< 20')}} \quad \frac{30}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{75}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover: 50 75 100
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50 60 30 0 40
Trees (> 20') Shrubs (< 20') Woody vines Mosses Herbaceous

Percent Cover of Riparian Vegetation by Strata

60% 70% 30% <5% 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
Herb	<u>Forget me not (Myosotis scorpioides)*</u>	Vine	<u>Riverbank grape (Vitis riparia)*</u>
Herb	<u>Japanese knotweed (Polygonum cuspidatum)*</u>	Tree	<u>Box elder (Acer negundo)</u>
Shrub	<u>Red osier dogwood (Cornus sericea)*</u>	Tree	<u>Silver maple (Acer saccharinum)*</u>

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):

Herb	<u>Ostrich fern (Matteuccia struthiopteris)*</u>	Vine	<u>Bittersweet (Celastrus orbiculatus)</u>
Herb	<u>Coneflower (Rudbeckia laciniata)</u>	Sapling	<u>Common buckthorn (Rhamnus cathartica)</u>
Shrub	<u>Morrow's honeysuckle (Lonicera morrowii)</u>	Tree	<u>Silver maple (Acer saccharinum)*</u>

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

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike Sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Catbird	
Cardinal	
Raccoon tracks	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Japanese knotweed (prevalent on both banks above bankfull); bittersweet common on both banks at upper levels as well as in floodplain; Morrow's honeysuckle, common buckthorn, yellow iris, forget-me-nots also present
- ☒ Evidence of other human disturbance; describe: Left bank at upstream end has apparent earth fill

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:
Coarse woody debris along left bank, Cobbles

- ☒ Other restoration opportunities:

R: Coir matting

L: Vegetated Riprap with bank spurs

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 1 Plant Species</u>	
<u>Left Bank</u>	<u>Right Bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
silver maple Acer saccharinum tree	silver maple Acer saccharinum tree
Devil's beggar-ticks Bidens frondosa herb	Devil's beggar-ticks Bidens frondosa herb
black mustard Brassica nigra herb	black mustard Brassica nigra herb
Asian bittersweet Celastrus orbiculatus vine/liana *	Asian bittersweet Celastrus orbiculatus vine/liana *
silky dogwood Cornus amomum shrub	red-osier dogwood Cornus sericea shrub
red-osier dogwood Cornus sericea shrub	hawthorn Crataegus spp. shrub/tree
Japanese knotweed Fallopia japonica herb *	Japanese knotweed Fallopia japonica herb *
jewelweed Impatiens capensis herb	green ash Fraxinus pennsylvanica tree
Morrow's honeysuckle Lonicera morrowii shrub *	American burnweed Erechtites hieraciifolius herb
common water-purslane Ludwigia palustris herb	jewelweed Impatiens capensis herb
ostrich fern Matteuccia struthiopteris herb	yellow iris Iris pseudacorus herb *
water forget-me-not Myosotis scorpioides herb *	Morrow's honeysuckle Lonicera morrowii shrub *
common buckthorn Rhamnus cathartica herb *	common water-purslane Ludwigia palustris herb
green-headed coneflower Rudbeckia laciniata herb	ostrich fern Matteuccia struthiopteris herb
stinging nettle Urtica dioica herb	Allegheny monkeyflower Mimulus ringens herb
river grape Vitis riparia vine/liana	water forget-me-not Myosotis scorpioides herb *
	sensitive fern Onoclea sensibilis herb
	water-pepper smartweed Persicaria hydropiper herb
	false water-pepper smartweed Persicaria hydropiperoides herb
	pale smartweed Persicaria lapathifolia herb
	Canada clearweed Pilea pumila herb
	common buckthorn Rhamnus cathartica herb *
	green-headed coneflower Rudbeckia laciniata herb
	curly dock Rumex crispus herb
	black willow Salix nigra tree
	American bur-reed Sparganium americanum herb
	American elm Ulmus americana tree
	stinging nettle Urtica dioica herb
	river grape Vitis riparia vine/liana

*Invasive species

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 1 Floodplain Plant Species

Japanese Knotweed	Fallopia japonica	H
false Solomon's seal	Maianthemum racemosum	H
Morrow's honeysuckle	Lonicera morrowii	S
white ash	Fraxinus americana	T
boxelder	Acer negundo	T
American linden	Tilia americana	T
river grape	Vitis riparia	V
stinging nettle	Urtica dioica	H
bishop's goutweed	Aegopodium podagraria	H
garlic-mustard	Alliaria petiolata	H
ostrich fern	Matteuccia struthiopteris	H
Asian bittersweet	Celastrus orbiculatus	V
common buckthorn	Rhamnus cathartica	S
Virginia creeper	Parthenocissus quinquefolia	V
American elm	Ulmus americana	T
sensitive fern	Onoclea sensibilis	H
moneywort	Lysimachia nummularia	H
skunk-cabbage	Symplocarpus foetidus	H
silky dogwood	Cornus amomum	S
silver maple	Acer saccharinum	T
American elm	Ulmus americana	T



Bank 1: Stations 0-3. 300-ft of straight channel below the confluence

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 1 Area. August 3, 2022.



Left bank, looking upstream at Confluence



Right bank near upstream limit



Right bank, looking downstream

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

		
Right bank in mid-portion of stretch, looking downstream		

	
Left bank, vertical face with dense shrubs and vines	Left bank near downstream end of stretch; large silver maple with undercut bank beneath
Views of left bank showing cut bank, largely vegetated	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 2

Site Name and Evaluation Segment

Bank 2: Stations 3-5. 300-500 ft downstream of Confluence along tight left bend.

Location/Physical Description

8/3/22

Date(s) of Site Visit(s) and Data Collection

Sunny, warm (85 degrees)

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

8/3/22

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 60'

Bank Height: R 8'; L 5'

Slope: R 90%; L 40%

Sediment / Substrate composition:

% Sand 50

% Silt 50

% Clay 0

% Gravel/cobble 0

% Boulder/Bedrock 0

% Organic matter 5

Bank stability / Observed erosional conditions:

Right bank is mostly vertical, with some undercutting beneath roots and significant slumping. Thalweg is along 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: Erosional channel cuts from right bank through to marsh/open water to the southwest.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 5-8 ft Floodplain surface: 6-8 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: $\frac{30}{\text{Bank Vegetation}}$ $\frac{70}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{50}{\text{Trees (> 20')}} \quad \frac{40}{\text{Shrubs (< 20')}} \quad \frac{30}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{30}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover: 75 50 90
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

30 30 25 0 75
Trees (> 20') Shrubs (< 20') Woody vines Mosses Herbaceous

Percent Cover of Riparian Vegetation by Strata

50% 70% 30% <5% 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
Herb	Stinging nettle (<i>Urtica dioica</i>)	Vine	Bittersweet (<i>Celastrus orbiculatus</i>)
Herb	Clear weed (<i>Pilea pumila</i>)	Tree	Box elder (<i>Acer negundo</i>)
Shrub	Red osier dogwood (<i>Cornus sericea</i>)	Tree	Silver maple (<i>Acer saccharinum</i>)

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):

Herb	Ostrich fern (<i>Matteuccia struthiopteris</i>)*	Vine	Bittersweet (<i>Celastrus orbiculatus</i>)
Herb	Coneflower (<i>Rudbeckia laciniata</i>)	Sapling	Common buckthorn (<i>Rhamnus cathartica</i>)
Shrub	Morrow's honeysuckle (<i>Lonicera morrowii</i>)	Tree	Box elder (<i>Acer negundo</i>)

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

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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, Brook Snaketail, Matted Spike Sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Catbird	
Great blue heron	
Raccoon tracks	
Spotted sandpiper	
Song sparrow	
Green frog	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Dragonflies	

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:
bittersweet common on both banks at upper levels as well as in floodplain; Morrow's honeysuckle, common buckthorn, Japanese knotweed, 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:
Coarse woody debris along both banks.

- ☒ Other restoration opportunities:

R: Vegetated riprap; Log or rock vanes

L: Coir matting

Invasive species control

Revegetation

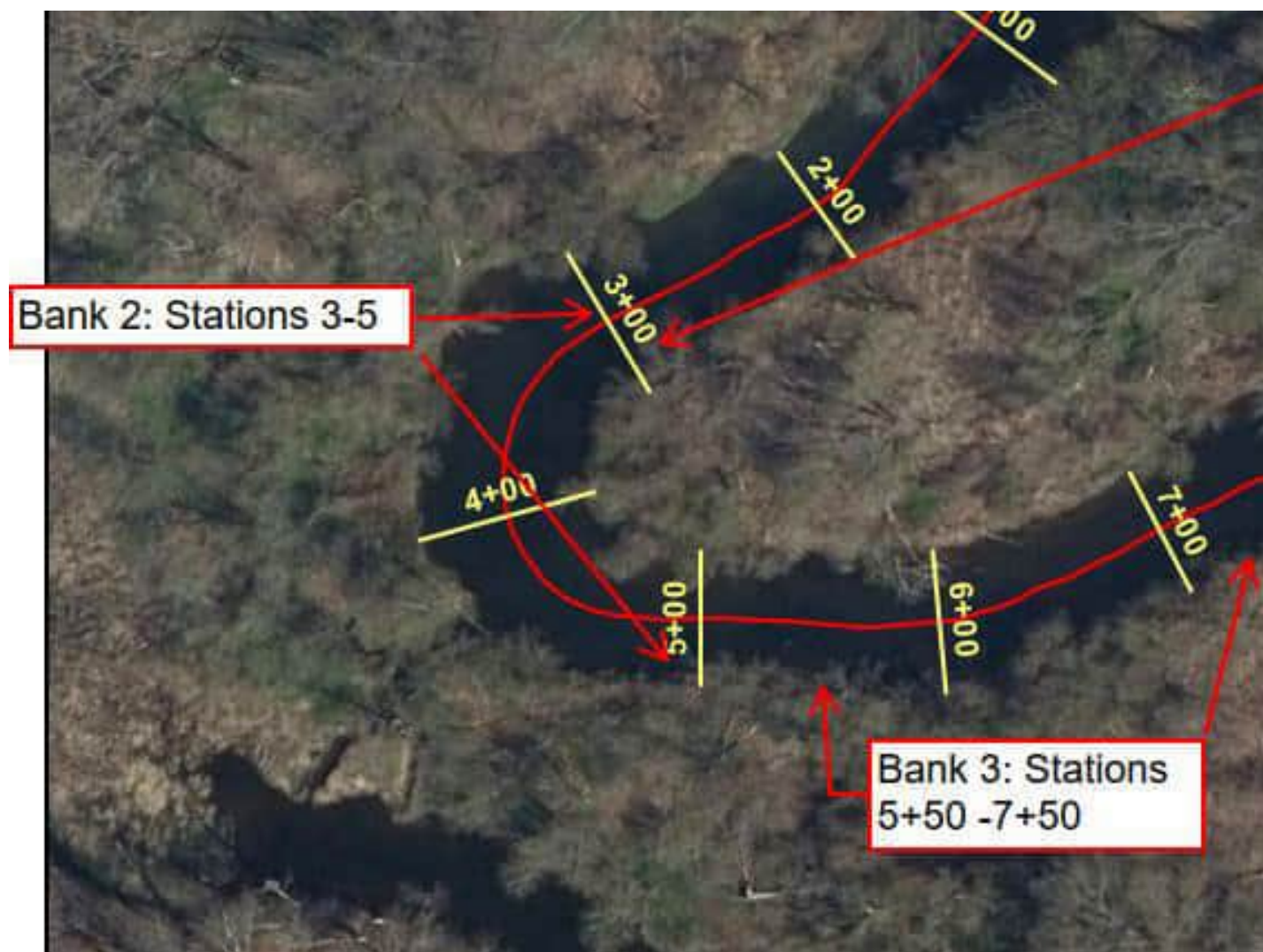
**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 2 Plant Species</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
silver maple Acer saccharinum tree	silver maple Acer saccharinum tree
Asian bittersweet Celastrus orbiculatus vine/liana *	Asian bittersweet Celastrus orbiculatus vine/liana *
red-osier dogwood Cornus sericea shrub	silky dogwood Cornus amomum shrub
Japanese knotweed Fallopia japonica herb *	red-osier dogwood Cornus sericea shrub
green ash Fraxinus pennsylvanica tree	Japanese knotweed Fallopia japonica herb *
common water-purslane Ludwigia palustris herb	green ash Fraxinus pennsylvanica tree
water forget-me-not Myosotis scorpioides herb *	Morrow's honeysuckle Lonicera morrowii shrub *
pale smartweed Persicaria lapathifolia herb	ostrich fern Matteuccia struthiopteris herb
common buckthorn Rhamnus cathartica herb *	common buckthorn Rhamnus cathartica herb *
stinging nettle Urtica dioica herb	stinging nettle Urtica dioica herb

*Invasive species

Bank 2 Floodplain Plant Species

stinging nettle	<i>Urtica dioica</i>	H
bishop's goutweed	<i>Aegopodium podagraria</i>	H
garlic-mustard	<i>Alliaria petiolata</i>	H
ostrich fern	<i>Matteuccia struthiopteris</i>	H
Asian bittersweet	<i>Celastrus orbiculatus</i>	V
Morrow's honeysuckle	<i>Lonicera morrowii</i>	S
common buckthorn	<i>Rhamnus cathartica</i>	S
boxelder	<i>Acer negundo</i>	S/T
Virginia creeper	<i>Parthenocissus quinquefolia</i>	V
American elm	<i>Ulmus americana</i>	T



Bank 2: Stations 3-5. 200 ft of sharp left bend. Vertical cut bank on outer bend. Gentle bank on inside with point bar development.

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 2 Area, August 3, 2023



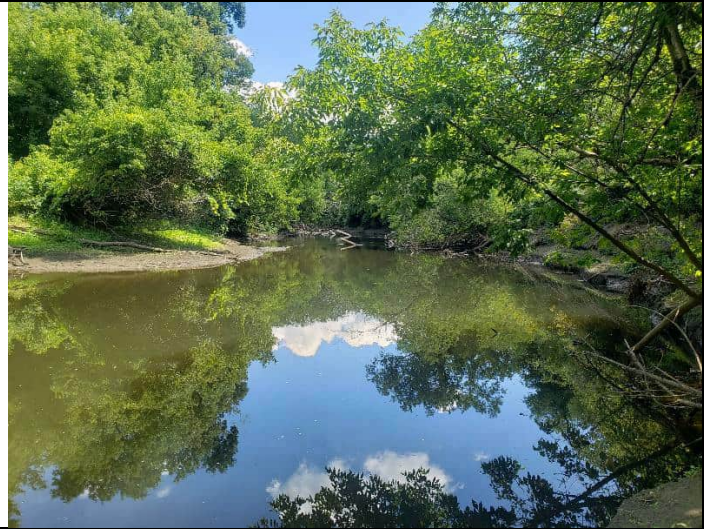
Right bank, looking downstream from Station 3



Right bank in mid-portion of bend; channel to marsh to right



Left bank, looking from right bank



Left and Right banks, looking downstream



Channel from right bank to the southwest connecting to marsh/pond (5A-VP1)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 3

Site Name and Evaluation Segment

Bank 3: Stations 5+50 to 7+50; 550-ft downstream of Confluence; 200-ft long straight stretch between tight bends

Location/Physical Description

8/3/22

Date(s) of Site Visit(s) and Data Collection

Sunny, warm (85 degrees)

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

8/3/22

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 60'

Bank Height: R 8' L 5'

Slope: R 90% L 40%

Sediment / Substrate composition:

% Sand 50

% Silt 50

% Clay 0

% Gravel/cobble 0

% Boulder/Bedrock

% Organic matter 5

Bank stability / Observed erosional conditions:

Right bank is mostly vertical, with some undercutting beneath roots and some slumping; moderate – high BEHI.
Thalweg along right bank. Left bank gentle and stable.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 5-8 ft Floodplain surface: 6-8 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: good bankfull bench on left bank

D. Inventory (Plant Community)

Right Bank

Total % Cover: $\frac{50}{\text{Bank Vegetation}}$ $\frac{80}{\text{Overhanging Vegetation}}$ $\frac{90}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{60}{\text{Trees (> 20')}} \quad \frac{40}{\text{Shrubs (< 20')}} \quad \frac{30}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{25}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover: 75 20 100
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

25 50 25 0 75
Trees (> 20') Shrubs (< 20') Woody vines Mosses Herbaceous

Percent Cover of Riparian Vegetation by Strata

50 70 30 <5 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
Herb	<u>Japanese knotweed (Polygonum cuspidat)</u>	Vine	<u>Bittersweet (Celastrus orbiculatus)</u>
Herb	<u>Clear weed (Pilea pumila)</u>	Tree	<u>Box elder (Acer negundo)</u>
Shrub	<u>Red osier dogwood (Cornus sericea)</u>	Tree	<u>American elm (Ulmus americana)</u>

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):

Herb	<u>Ostrich fern (Matteuccia struthiopteris)*</u>	Vine	<u>Bittersweet (Celastrus orbiculatus)</u>
Herb	<u>Japanese knotweed (Polygonum cuspidatum)</u>	Sapling	<u>Common buckthorn (Rhamnus cathartica)</u>
Shrub	<u>Morrow's honeysuckle (Lonicera morrowil)</u>	Tree	<u>Box elder (Acer negundo)</u>

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

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Green frog	
Raccoon tracks	
Spotted sandpiper	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:

Japanese knotweed prevalent at top of left bank and some on right bank; bittersweet common on both banks at upper levels as well as in floodplain; Morrow's honeysuckle, common buckthorn

☐ 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:
Coarse woody debris; large trees; root wads

☒ Other restoration opportunities:

R: Compartmentalized fill

L: Grade bank/Coir matting

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 3 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
Asian bittersweet Celastrus orbiculatus vine/liana *	Asian bittersweet Celastrus orbiculatus vine/liana *
red-osier dogwood Cornus sericea shrub	red-osier dogwood Cornus sericea shrub
Japanese knotweed Fallopia japonica herb *	Japanese knotweed Fallopia japonica herb *
	American elm Ulmus americana tree

*Invasive species

Bank 3 Floodplain Plant Species

Japanese knotweed	<i>Fallopia japonica</i>	H
false Solomon's seal	<i>Maianthemum racemosum</i>	H
Morrow's honeysuckle	<i>Lonicera morrowii</i>	S
white ash	<i>Fraxinus americana</i>	T
boxelder	<i>Acer negundo</i>	T
American linden	<i>Tilia americana</i>	T
river grape	<i>Vitis riparia</i>	V



Bank 3 Stations 5.5 - 7.5. 550-ft downstream of Confluence. 200-ft long straight stretch between tight bends

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 3 Area, August 3, 2023



Left bank



Right bank (to left), left bank to right, looking upstream



Right bank, looking upstream

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 4

Site Name and Evaluation Segment

Bank 4: Stations 9-11. 900-ft downstream of Confluence. After sharp right bend and covering 200 ft of slight right curve in river.

Location/Physical Description

8/3/22

Date(s) of Site Visit(s) and Data Collection

Sunny, warm (85 degrees)

Weather Conditions During Site Visit

AECOM

8/3/22

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 60'

Bank Height: R 7' L 8'

Slope: R 60% L 40%

Sediment / Substrate composition:

% Sand 40

% Silt 30

% Clay 0

% Gravel/cobble: 30

% Boulder/Bedrock 0

% Organic matter <5

Bank stability / Observed erosional conditions:

Left bank high BEHI and NBS. Side channel comes into contact with left bank near station 10+00 and has eroded into the left bank (see last photo attached). Right bank stable.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 7-8 ft Floodplain surface: 7-8 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: $\frac{60}{\text{Bank Vegetation}}$ $\frac{70}{\text{Overhanging Vegetation}}$ $\frac{90}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{50}{\text{Trees (> 20')}}$	$\frac{40}{\text{Shrubs (< 20')}}$	$\frac{50}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{50}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover: 60 70 90
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50 40 60 0 50
Trees (> 20') Shrubs (< 20') Woody vines Mosses Herbaceous

Percent Cover of Riparian Vegetation by Strata

70 70 30 <5 55
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
Herb	<u>Pale Smartweed (Persicaria lapathifolia)</u>	Vine	<u>Bittersweet (Celastrus orbiculatus)</u>
Herb	<u>Japanese knotweed (Polygonum cusp.)</u>	Tree	<u>Box elder (Acer negundo)</u>
Vine	<u>Riverbank grape (Vitis riparia)</u>	Tree	<u>Silver maple (Acer saccharinum)</u>

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):

Herb	<u>Ostrich fern (Matteuccia struthiopteris)*</u>	Vine	<u>Bittersweet (Celastrus orbiculatus)</u>
Herb	<u>Stinging nettle (Urtica dioica)</u>	Sapling	<u>Common buckthorn (Rhamnus cathartica)</u>
Shrub	<u>Morrow's honeysuckle (Lonicera morrowil)</u>	Tree	<u>Box elder (Acer negundo)</u>

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

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

VII. Habitat Degradation (identify specific location on bank segment if applicable)

- ☐ Evidence of significant levels of dumping
- ☒ Evidence of significant erosion or sedimentation problems: side channel eroding into left bank
- ☒ Occurrence of invasive plants:
Bittersweet, Japanese knotweed
-
- ☐ Evidence of other human disturbance; describe: _____
-

VIII. Restoration Opportunities

☒ Presence of potential restoration resources:
Coarse woody debris along both banks; good cobble and gravel material for stream and bank restoration/habitat enhancement

☒ Other restoration opportunities:

R: Reshape point bar

L: Log or rock vanes

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 4 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
silver maple Acer saccharinum tree	silver maple Acer saccharinum tree
Asian bittersweet Celastrus orbiculatus vine/liana *	Asian bittersweet Celastrus orbiculatus vine/liana *
Japanese knotweed Fallopia japonica herb *	Japanese knotweed Fallopia japonica herb *
common water-purslane Ludwigia palustris herb	Morrow's honeysuckle Lonicera morrowii shrub *
pale smartweed Persicaria lapathifolia herb	pale smartweed Persicaria lapathifolia herb
river grape Vitis riparia vine/liana	river grape Vitis riparia vine/liana

*Invasive species

Bank 4 Floodplain Plant Species

Japanese knotweed	<i>Fallopia japonica</i>	H
false Solomon's seal	<i>Maianthemum racemosum</i>	H
Morrow's honeysuckle	<i>Lonicera morrowii</i>	S
white ash	<i>Fraxinus americana</i>	T
boxelder	<i>Acer negundo</i>	T
American elm	<i>Tilia americana</i>	T
river grape	<i>Vitis riparia</i>	V
bishop's goutweed	<i>Aegopodium podagraria</i>	H
common buckthorn	<i>Rhamnus cathartica</i>	S
privet	<i>Ligustrum vulgare</i>	S
silver maple	<i>Acer saccharinum</i>	T

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Bank 4 Stations 9-11. 900-ft downstream of Confluence. After sharp right bend and covering 200 ft of slight right curve in river.

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 4 Area. August 3, 2022



Left bank with cobble substrate



Left bank (above and below photos), cobble section with dense grape vines above



Left bank (left) to right bank (right)



General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Right bank views, looking downstream



Right bank, Japanese knotweed



Photo in floodplain along left bank near Station 10+00, where side channel that comes from left bank near the Confluence has eroded into the left river bank (main flow channel of side channel stays left and continues to Station 15+00).

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Housatonic ROR R5A Bank 5

Site Name and Evaluation Segment

Bank 5: Stations 11-14. 1100-ft downstream of Confluence. 300-ft stretch from Stations 11-14 along left bend

Location/Physical Description

8/3/22

Date(s) of Site Visit(s) and Data Collection

Sunny, warm (85 degrees)

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

8/3/22

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 60'

Bank Height: L 8' R 5'

Slope: L 90% R 40%

Sediment / Substrate composition:

% Sand 50

% Silt 50

% Clay 0

% Gravel/cobble 0

% Boulder/Bedrock 0

% Organic matter 5

Bank stability / Observed erosional conditions:

Downstream end of right bank is near vertical sandy bank up high, but lower parts are more stable. Thalweg is along right bank around bend. Left bank gentle and stable, with point bar development. High BEHI and NBS along right 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: Erosional channel cuts from right bank through to marsh/open water to the northwest.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

C. Hydrology

Stream gradient: ☐ Low Gradient ☒ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity

- ☒ High-flow channels present in adjacent floodplain (left) ☒ 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: 5-8 ft Floodplain surface: 6-8 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:

<u>80</u> Bank Vegetation	<u>50</u> Overhanging Vegetation	<u>100</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>60</u> Trees (> 20')	<u>40</u> Shrubs (< 20')	<u>30</u> Woody vines	<u>0</u> Mosses	<u>75</u> Herbaceous
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover: 90 75 100
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

60 50 50 0 50
Trees (> 20') Shrubs (< 20') Woody vines Mosses Herbaceous

Percent Cover of Riparian Vegetation by Strata

40 70 30 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
Herb	Japanese knotweed (<i>P. cuspidatum</i>)	Vine	Bittersweet (<i>Celastrus scandens</i>)
Herb	Cocklebur (<i>Xanthium orientale</i>)	Tree	Box elder (<i>Acer negundo</i>)
Shrub	Red osier dogwood (<i>Cornus sericea</i>)	Tree	Silver maple (<i>Acer saccharinum</i>)

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):

Herb	Ostrich fern (<i>Matteuccia struthiopteris</i>)*	Vine	Bittersweet (<i>Celastrus scandens</i>)
Herb	Coneflower (<i>Rudbeckia laciniata</i>)	Sapling	Common buckthorn (<i>Rhamnus cathartica</i>)
Shrub	Morrow's honeysuckle (<i>Lonicera morrowii</i>)	Tree	Box elder (<i>Acer negundo</i>)

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.

Notes: Right bank and adjacent vegetation varies as it runs along marsh and then steep upland forest at bend. Multistem silver maple at Station 11+80 crosses from left bank to right bank and is significant habitat feature

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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): 3'x2' cavern in right bank near Station 13+00

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, Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Belted kingfisher	
Deer tracks	
Raccoon tracks	
Spotted sandpiper	
Song sparrow	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Green frog	
Wood pewee	

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:
Japanese knotweed, Morrow's honeysuckle, bishop's goutweed
-

- ☐ 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:
Coarse woody debris along both banks, including root wads
-

- ☒ Other restoration opportunities:

R: Compartmentalized Fill; Vegetated riprap; Log or rock vanes; Root wads

L: Compartmentalized Fill; Reshape point bar

Invasive species control

Revegetation

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

<u>Bank 5 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
silver maple Acer saccharinum tree	silver maple Acer saccharinum tree
bishop's goutweed Aegopodium podagraria herb *	Devil's beggar-ticks Bidens frondosa herb
red-osier dogwood Cornus sericea shrub	red-osier dogwood Cornus sericea shrub
Japanese knotweed Fallopia japonica herb *	Japanese knotweed Fallopia japonica herb *
green ash Fraxinus pennsylvanica tree	common water-purslane Ludwigia palustris herb
Morrow's honeysuckle Lonicera morrowii shrub *	ostrich fern Matteuccia struthiopteris herb
common water-purslane Ludwigia palustris herb	pale smartweed Persicaria lapathifolia herb
common buckthorn Rhamnus cathartica herb *	blue vervain Verbena hastata herb
	rough cocklebur Xanthium strumarium herb

*Invasive species

Bank 5 Floodplain Plant Species

bishop's goutweed	Aegopodium podagraria	H
common buckthorn	Rhamnus cathartica	S
privet	Ligustrum vulgare	S
silver maple	Acer saccharinum	T
boxelder	Acer negundo	T



Bank 5: Stations 11-14. 1100-ft downstream of Confluence. 300-ft stretch from Stations 11-14 along sharp left bend

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 5 Area. August 3, 2022.



Left bank (left) to right bank (right), looking from right bank.
Large silver maple overhanging from left bank to right.
Station 11+80



Left bank, multi-stem silver maple rooted on left bank



Left bank



Left bank



Right bank, looking upstream where marsh and 5A-VP1
discharges to river at Station 12+50

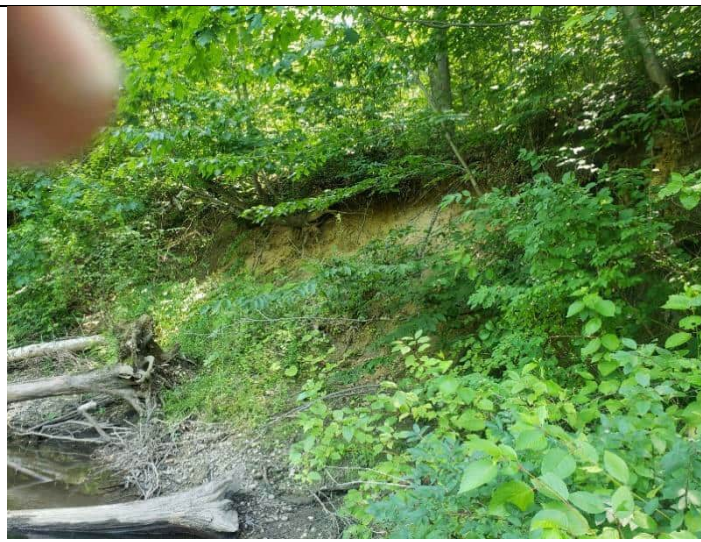


Right bank along outer sharp bend at Station 13+00

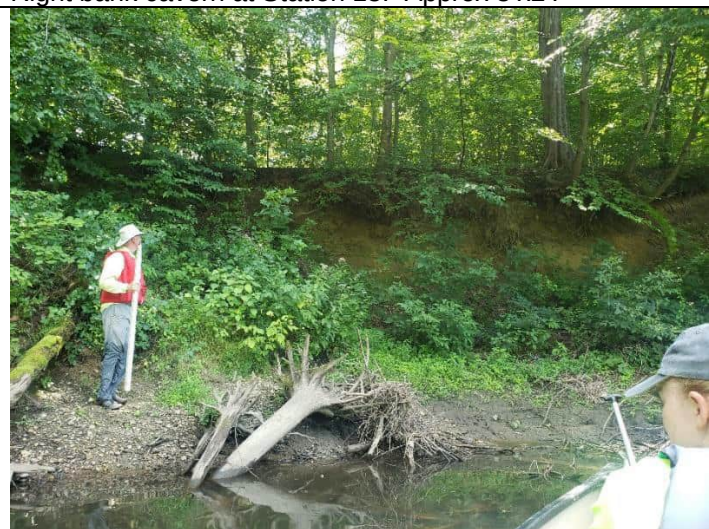
General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



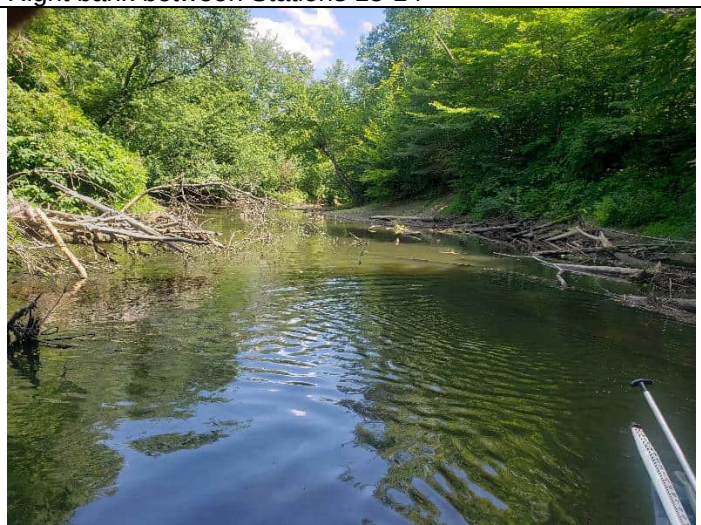
Right bank cavern at Station 13. Approx 3'x2'.



Right bank between Stations 13-14



Right bank at Station 14



Looking downstream below Station 14

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 6

Site Name and Evaluation Segment

Bank 6: Stations 15-19. 1500-ft downstream of Confluence. 400-ft stretch below multiple meanders and inflow from side channel.

Location/Physical Description

8/3/22

Date(s) of Site Visit(s) and Data Collection

Sunny, warm (85 degrees)

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

8/3/22

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 400'

Width: 60-70'

Bank Height: R 4' L 6'

Slope: L 90-120% R 30%

Sediment / Substrate composition:

% Sand 40

% Silt 50

% Clay 0

% Gravel/cobble 10

% Boulder/Bedrock 0

% Organic matter

Bank stability / Observed erosional conditions:

Left bank is mostly vertical, with some undercutting beneath roots and some slumping. Thalweg is along left bank. BEHI and NBS are mostly low – moderate. Right bank gentle and stable, with mid-channel bar at 18+50.

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: Steep upland hillside borders right bank. TFF along left bank.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

C. Hydrology

Stream gradient: ☐ Low Gradient ☒ Mid-Gradient ☐ High-Gradient

Degree of overbank flooding potential / floodplain connectivity: Low hydrologic connectivity here

- ☒ High-flow channels present in adjacent floodplain ☒ Topographic breaks present in the riverbank (right)
- ☐ 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: 5-6 ft

Floodplain surface: 6-8 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: $\frac{75}{\text{Bank Vegetation}}$ $\frac{75}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{50}{\text{Trees (> 20')}}$	$\frac{25}{\text{Shrubs (< 20')}}$	$\frac{25}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{75}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover: 60 60 90
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

75 75 50 0 25
Trees (> 20') Shrubs (< 20') Woody vines Mosses Herbaceous

Percent Cover of Riparian Vegetation by Strata

70 70 30 <5 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
Herb	<u>Water-pepper (Persicaria hydropiper)</u>	Vine	<u>Riverbank grape (Vitis riparia)</u>
Herb	<u>Forget-me-not (Myosotis scorpioides)</u>	Tree	<u>Box elder (Acer negundo)</u>
Shrub	<u>Morrow's honeysuckle (Lonicera morrowii)</u>	Tree	<u>Silver maple (Acer saccharinum)</u>

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):

Herb	<u>Ostrich fern (Matteuccia struthiopteris)*</u>	Vine	<u>Bittersweet (Celastrus scandens)</u>
Herb	<u>Coneflower (Rudbeckia laciniata)</u>	Sapling	<u>Common buckthorn (Rhamnus cathartica)</u>
Shrub	<u>Morrow's honeysuckle (Lonicera morrowii)</u>	Tree	<u>Box elder (Acer negundo)</u>

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

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Great blue heron	
Deer tracks	
Raccoon tracks	
Spotted sandpiper	
Mussels (Elliptio or Eastern Lampmussel)	
Green frog	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Dragonflies	

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:
Bittersweet common on both banks at upper levels as well as in floodplain; Morrow's honeysuckle, common buckthorn, Japanese knotweed, bishop's goutweed, forget-me-knots
-
- ☐ 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:
Coarse woody debris along both banks, large trees, cobbles
-

- ☒ Other restoration opportunities:

R: Coir matting;

L: Grade bank/Coir matting; Bank spurs; Compartmentalized fill

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 6 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
bishop's goutweed <i>Aegopodium podagraria</i> herb *	boxelder <i>Acer negundo</i> tree
Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *	Devil's beggar-ticks <i>Bidens frondosa</i> herb
Japanese knotweed <i>Fallopia japonica</i> herb *	northern catalpa <i>Catalpa speciosa</i> tree
Morrow's honeysuckle <i>Lonicera morrowii</i> shrub *	Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *
ostrich fern <i>Matteuccia struthiopteris</i> herb	red-osier dogwood <i>Cornus sericea</i> shrub
common buckthorn <i>Rhamnus cathartica</i> herb *	Japanese knotweed <i>Fallopia japonica</i> herb *
American elm <i>Ulmus americana</i> tree	Canada wood nettle <i>Laportea canadensis</i> herb
river grape <i>Vitis riparia</i> vine/liana	rice cut-grass <i>Leersia oryzoides</i> herb
	ostrich fern <i>Matteuccia struthiopteris</i> herb
	water forget-me-not <i>Myosotis scorpioides</i> herb *
	sensitive fern <i>Onoclea sensibilis</i> herb
	water-pepper smartweed <i>Persicaria hydropiper</i> herb
	pale smartweed <i>Persicaria lapathifolia</i> herb
	northern red oak <i>Quercus rubra</i> tree
	green-headed coneflower <i>Rudbeckia laciniata</i> herb
	blue vervain <i>Verbena hastata</i> herb
	river grape <i>Vitis riparia</i> vine/liana
	rough cocklebur <i>Xanthium strumarium</i> herb

*Invasive species

Bank 6 Floodplain Plant Species

bishop's goutweed	<i>Aegopodium podagraria</i>	H
common buckthorn	<i>Rhamnus cathartica</i>	S
privet	<i>Ligustrum vulgare</i>	S
silver maple	<i>Acer saccharinum</i>	T
boxelder	<i>Acer negundo</i>	T
ostrich fern	<i>Matteuccia struthiopteris</i>	H
Morrow's honeysuckle	<i>Lonicera morrowii</i>	S
Eastern cottonwood	<i>Populus deltoides</i>	T
American elm	<i>Ulmus americana</i>	T
dame's-rocket	<i>Hesperis matronalis</i>	H
green-headed coneflower	<i>Rudbeckia laciniata</i>	H
enchanter's-nightshade	<i>Circaea canadensis</i>	H
jumpseed	<i>Persicaria virginiana</i>	H
Virginia creeper	<i>Parthenocissus quinquefolia</i>	V
virgin's-bower	<i>Clematis virginiana</i>	V



Bank 6 area: Station 15-19. 400' along Right bend at inflow from overflow channel on left bank followed by straight run.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 6 Area. August 4, 2022.



Left bank (left) to right bank (right), looking downstream toward Bank 6 area



Left bank, looking at location where overflow channel discharges into river at Station 15+00



Looking downstream through Bank 6 at mid-bar



Left bank



Left bank: undercut tree root system



Right bank at Station 17+00; red oaks

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 7

Site Name and Evaluation Segment

Bank 7: Stations 22-24; 2200 feet below Confluence; 200-ft straight run before sharp left bend just above Morewood Lake tributary confluence.

Location/Physical Description

8/4/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 70'

Bank Height: R 4-5' L 6'

Slope: R 50% L 90-100%

Sediment / Substrate composition:

% Sand 40

% Silt 40

% Clay

% Gravel/cobble 20

% Boulder/Bedrock

% Organic matter <5

Bank stability / Observed erosional conditions:

Some cut bank and undercutting on left bank, but mostly stable (low - moderate BEHI and NBS). Right bank has high BEHI but low NBS. Thalweg changes from left to right side.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 4-6 ft Floodplain surface: 4-6 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: $\frac{80}{\text{Bank Vegetation}}$ $\frac{40}{\text{Overhanging Vegetation}}$ $\frac{90}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{60}{\text{Trees (> 20')}}$	$\frac{50}{\text{Shrubs (< 20')}}$	$\frac{30}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{75}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	<u>70</u> Bank Vegetation	<u>60</u> Overhanging Vegetation	<u>90</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>75</u> Trees (> 20')	<u>50</u> Shrubs (< 20')	<u>25</u> Woody vines	<u>0</u> Mosses	<u>25</u> Herbaceous
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Percent Cover of Riparian Vegetation by Strata

<u>70</u> Trees (> 20')	<u>70</u> Shrubs (< 20')	<u>25</u> Woody vines	<u>0</u> Mosses	<u>75</u> Herbaceous
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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: See attached tables for plant species lists.

Notes: Steep upland wooded slope above right bank.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Green frogs	
Raccoon tracks	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Japanese knotweed, bittersweet, common buckthorn, forget-me-not

- ☒ Evidence of other human disturbance; describe: Power line right-of-way crosses between Stations 23 - 24.

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:
Coarse woody debris, Large trees, Cobbles

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting; Compartmentalized fill; Bank spurs

L: Grade bank/Coir matting; Compartmentalized fill; Reshape point bar

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 7 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	yellow birch Betula alleghaniensis tree
rice cut-grass Leersia oryzoides herb	river birch Betula nigra tree
ostrich fern Matteuccia struthiopteris herb	Devil's beggar-ticks Bidens frondosa herb
sensitive fern Onoclea sensibilis herb	Asian bittersweet Celastrus orbiculatus vine/liana *
cinnamon fern Osmunda cinnamomea herb	spotted Joe-Pye weed Eupatorium maculatum herb
common buckthorn Rhamnus cathartica herb *	Japanese knotweed Fallopia japonica herb *
poison-ivy Toxicodendron radicans liana/vine	ostrich fern Matteuccia struthiopteris herb
stinging nettle Urtica dioica herb	water forget-me-not Myosotis scorpioides herb *
river grape Vitis riparia vine/liana	sensitive fern Onoclea sensibilis herb
	cinnamon fern Osmunda cinnamomea herb
	Virgini-creeper Parthenocissus quinquefolia vine/liana
	false water-pepper smartweed Persicaria hydropiperoides herb
	black oak Quercus velutina tree
	eastern hemlock Tsuga canadensis tree
	American elm Ulmus americana tree

*Invasive species

Bank 7 Floodplain Plant Species

ostrich fern	Matteuccia struthioptera	H
Virginia creeper	Parthenocissus quinquefolia	V
spotted Joe-Pye weed	Eupatorium maculatum	H
bishop's goutweed	Aegopodium podagraria	H
Jerusalem artichoke	Helianthus tuberosus	H
Canada goldenrod	Solidago canadensis	H
Morrow's honeysuckle	Lonicera morrowii	S
silver maple	Acer saccharinum	T
American linden	Tilia americana	T
virgin's bower	Clematis virginiana	H
common buckthorn	Rhamnus cathartica	S
boxelder	Acer negundo	S
cinnamon fern	Osmunda cinnamomea	H
jumpseed	Persicaria virginiana	H
Asian bittersweet	Celastrus orbiculatus	V



Bank 7: Stations 22-24. 200-ft Straight run before left bend

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 7 area. August 4, 2022.



Left bank



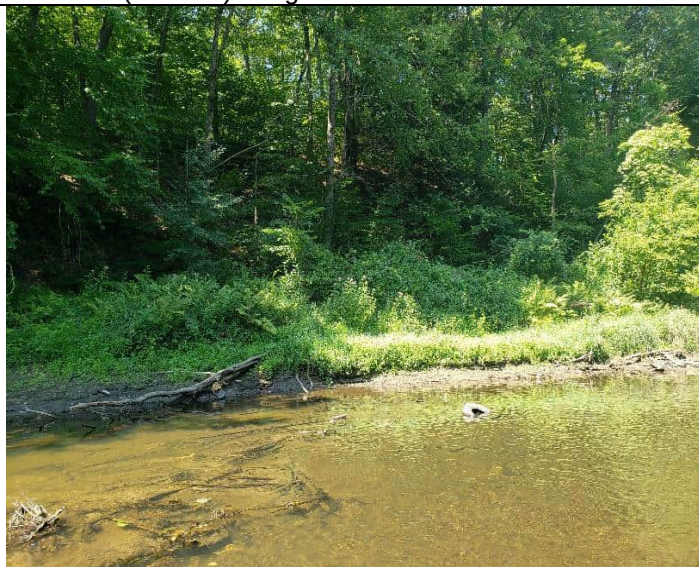
Left bank



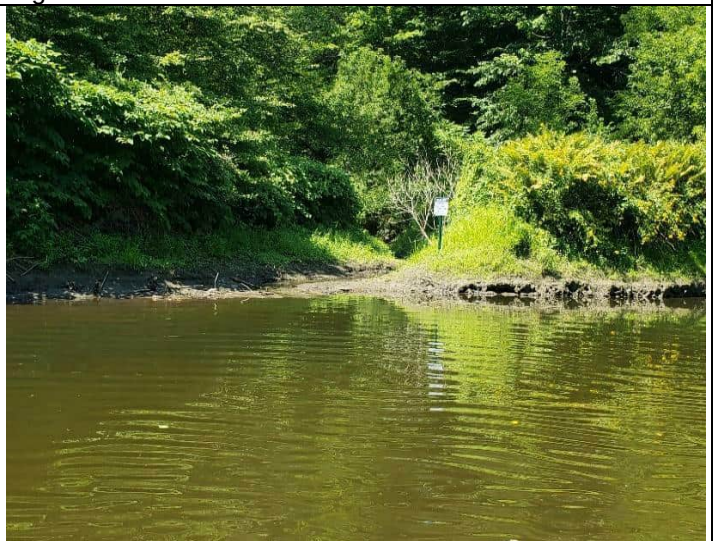
Left bank (left side) to right bank.



Right bank



Right bank



Right bank at Station 24+20; inlet from Morewood Lake

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 8

Site Name and Evaluation Segment

Bank 8: Stations 25-28: 300-ft stretch at left bend below Morewood Lake tributary into straight run

Location/Physical Description

8/4/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 70'

Bank Height: R 6' L 4-5'

Slope: R 90% L 50%

Sediment / Substrate composition:

% Sand 30

% Silt 50

% Clay 0

% Gravel/cobble 20

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Right bank starts as steep eroding/slumping bank with sandy eroding embankment above floodplain (moderate – high BEHI and NBS). Left bank is stable with silty point bar (moderate BEHI and NBS). Thalweg moves to right side of river 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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 4-6ft Floodplain surface: 4-6ft

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:

<u>60</u> Bank Vegetation	<u>50</u> Overhanging Vegetation	<u>100</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>40</u> Trees (> 20')	<u>60</u> Shrubs (< 20')	<u>20</u> Woody vines	<u>0</u> Mosses	<u>20</u> Herbaceous
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	75 Bank Vegetation	50 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50 Trees (> 20')	30 Shrubs (< 20')	20 Woody vines	0 Mosses	50 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

75 Trees (> 20')	75 Shrubs (< 20')	30 Woody vines	0 Mosses	60 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Green heron	
Spotted sandpiper	
Mallards	
Catbird	
Cardinal	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Tennessee warbler	
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:
Bittersweet, Japanese knotweed, Morrow's honeysuckle

☐ 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:
Coarse woody debris, large trees, cobbles

- ☒ Other restoration opportunities:

R: Vegetated riprap; Log or rock vanes; Grade bank/Coir matting

L: Reshape point bar

Invasive species control

Revegetation

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

<u>Bank 8 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	Asian bittersweet Celastrus orbiculatus vine/liana *
Japanese knotweed Fallopia japonica herb *	hawthorn Crataegus spp. shrub/tree
rice cut-grass Leersia oryzoides herb	Morrow's honeysuckle Lonicera morrowii shrub *
water-pepper smartweed Persicaria hydropiper herb	
rough cocklebur Xanthium strumarium herb	

*Invasive species

Bank 8 Floodplain Plant Species

European privet	Ligustrum vulgare	S
river grape	Vitis riparia	V
moneywort	Lysimachia nummularia	H
silky dogwood	Cornus amomum	S
black ash	Fraxinus nigra	T
white ash	Fraxinus americana	T
virgin's-bower	Clematis virginiana	H
multiflora rose	Rosa multiflora	S
goldenrod sp.	Solidago sp.	H
white avens	Geum canadensis	H
red raspberry	Rubus idaeus	S
jewelweed	Impatiens capensis	H
Boxelder	Acer negundo	T
Green ash	Fraxinus pennsylvanica	T
Boxelder	Acer negundo	S
Sensitive fern	Onoclea sensibilis	H
Burnweed	Erechtites hieraciifolius	H
Cinnamon fern	Osmunda cinnamomea	H



Bank 8: Stations 25-28. 300-ft stretch at left bend below Morewood Lake tributary into straight run.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 8 Area. August 4, 2022



Right bank just below Morewood tributary



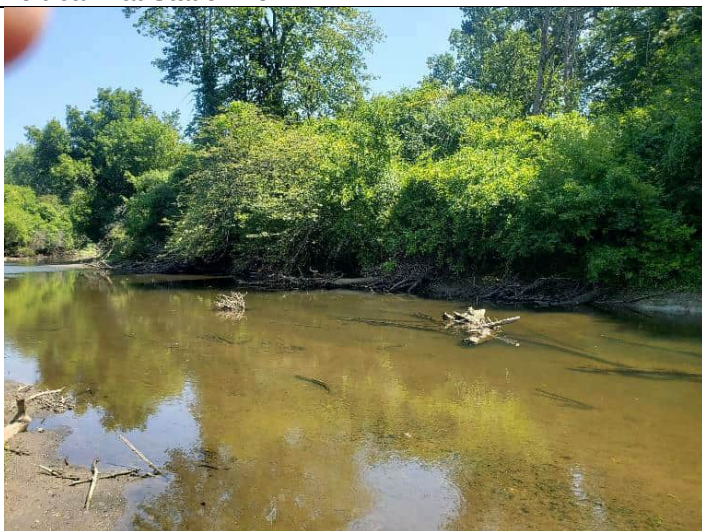
Right bank at Station 26



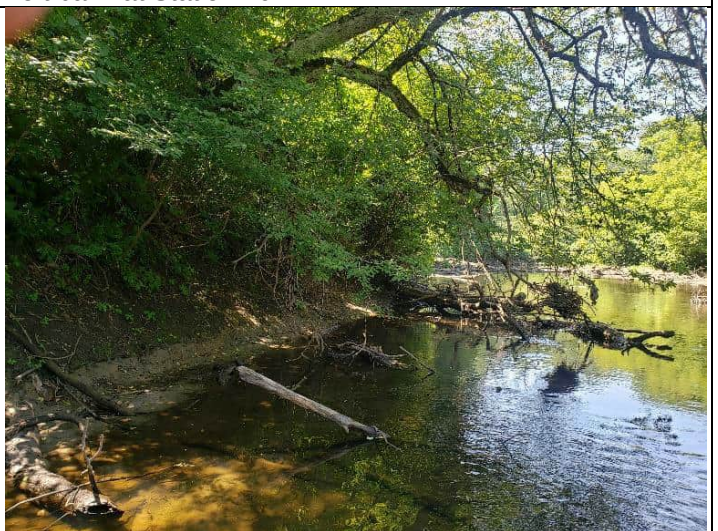
Left bank at Station 25



Left bank at Station 26



Right bank from left bank



Right bank

Right bank at Station 26 in 2009



**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 9

Site Name and Evaluation Segment

Bank 9: Stations 36-38. 200-ft stretch along a moderate left bend from Station 36-38.

Location/Physical Description

8/4/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 70'

Bank Height: R 6' L 5'

Slope: R 90% L 25%

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay 0

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable. Large hemlock and oak have fallen across the right bank into river. Thalweg along right 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: Steep upland forested hillside along right bank.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 5-6ft Floodplain surface: 5-6ft

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: $\frac{80}{\text{Bank Vegetation}}$ $\frac{60}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{40}{\text{Trees (> 20')}}$	$\frac{40}{\text{Shrubs (< 20')}}$	$\frac{10}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{70}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	<u>80</u> Bank Vegetation	<u>30</u> Overhanging Vegetation	<u>90</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>20</u> Trees (> 20')	<u>50</u> Shrubs (< 20')	<u>30</u> Woody vines	<u>0</u> Mosses	<u>70</u> Herbaceous
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Percent Cover of Riparian Vegetation by Strata

<u>75</u> Trees (> 20')	<u>60</u> Shrubs (< 20')	<u>25</u> Woody vines	<u><5</u> Mosses	<u>75</u> Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Raccoon tracks	
Catbird	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, Japanese knotweed, bishop's goutweed, 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:
Coarse woody debris, root wads, large trees, cobbles

- ☒ Other restoration opportunities:

R: Root wads; Log or rock vanes; Vegetated riprap

L: Reshape point bar

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 9 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
nodding beggar-ticks <i>Bidens cernua</i> herb	sugar maple <i>Acer saccharum</i> tree
Devil's beggar-ticks <i>Bidens frondosa</i> herb	bishop's goutweed <i>Aegopodium podagraria</i> herb *
black mustard <i>Brassica nigra</i> herb	yellow birch <i>Betula alleghaniensis</i> tree
tussock sedge <i>Carex stricta</i> herb	nodding beggar-ticks <i>Bidens cernua</i> herb
spotted Joe-Pye weed <i>Eupatorium maculatum</i> herb	Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *
Japanese knotweed <i>Fallopia japonica</i> herb *	red-osier dogwood <i>Cornus sericea</i> shrub
jewelweed <i>Impatiens capensis</i> herb	rice cut-grass <i>Leersia oryzoides</i> herb
purple loosestrife <i>Lythrum salicaria</i> herb *	ostrich fern <i>Matteuccia struthiopteris</i> herb
pale smartweed <i>Persicaria lapathifolia</i> herb	Virgini-creeper <i>Parthenocissus quinquefolia</i> vine/liana
green-headed coneflower <i>Rudbeckia laciniata</i> herb	pale smartweed <i>Persicaria lapathifolia</i> herb
dark-green bulrush <i>Scirpus atrovirens</i> herb	northern red oak <i>Quercus rubra</i> tree
stinging nettle <i>Urtica dioica</i> herb	eastern hemlock <i>Tsuga canadensis</i> tree
blue vervain <i>Verbena hastata</i> herb	American elm <i>Ulmus americana</i> tree
rough cocklebur <i>Xanthium strumarium</i> herb	

*Invasive species

Bank 9 Floodplain Plant Species

Eastern hemlock	<i>Tsuga canadensis</i>	T
silver maple	<i>Acer saccharinum</i>	T
boxelder	<i>Acer negundo</i>	S
Japanese knotweed	<i>Fallopia japonica</i>	H



Bank 9: Stations 36-38. 200-ft stretch along a moderate left bend from Station 36-38

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 9 Area. August 4, 2022.



Right bank (right) to left bank looking downstream from Station 35



Right bank at Station 37



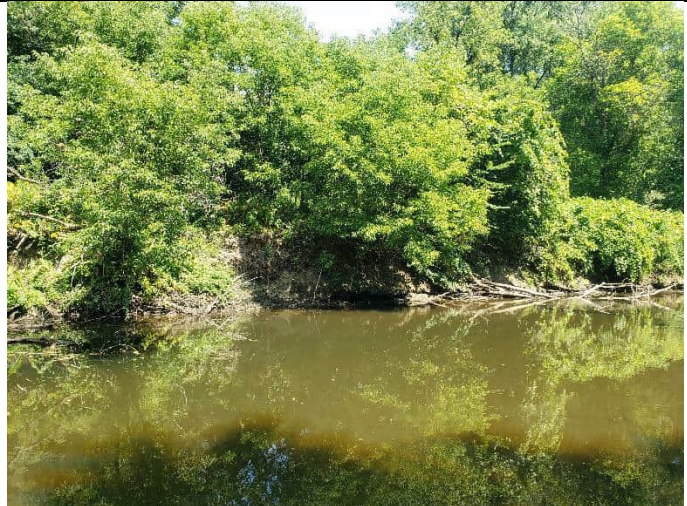
Left bank (left) to right bank at Station 36 +50



Right bank at Station 37+80; downed hemlock and oak



Left bank at Station 38; downed hemlock from right bank is on the right.



Left bank above Station 36

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 10

Site Name and Evaluation Segment

Bank 10: Stations 39-41. 200-ft stretch along a moderate right bend from Station 39-41

Location/Physical Description

8/4/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 80'

Bank Height: R 6' L 3-4'

Slope: R 80% L 50%

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay 0

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable, no major erosional issues. Thalweg along the right 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: Right bank bordered by steep upland forest.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 4-6 ft Floodplain surface: 4-6 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: $\frac{90}{\text{Bank Vegetation}}$ $\frac{80}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{70}{\text{Trees (> 20')}}$	$\frac{75}{\text{Shrubs (< 20')}}$	$\frac{30}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{50}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	70 Bank Vegetation	10 Overhanging Vegetation	90 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

10 Trees (> 20')	50 Shrubs (< 20')	25 Woody vines	0 Mosses	80 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

65 Trees (> 20')	70 Shrubs (< 20')	30 Woody vines	0 Mosses	70 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Japanese knotweed, bittersweet, 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:
Coarse woody debris, large trees, cobbles

- ☒ Other restoration opportunities:

R: Vegetated riprap

L: Grade bank/Coir matting

Invasive species control

Revegetation

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Bank 10 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
rice cut-grass <i>Leersia oryzoides</i> herb	Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *
common water-purslane <i>Ludwigia palustris</i> herb	Japanese knotweed <i>Fallopia japonica</i> herb *
purple loosestrife <i>Lythrum salicaria</i> herb *	ostrich fern <i>Matteuccia struthiopteris</i> herb
Allegheny monkeyflower <i>Mimulus ringens</i> herb	Virgini-creeper <i>Parthenocissus quinquefolia</i> vine/liana
pale smartweed <i>Persicaria lapathifolia</i> herb	American linden <i>Tilia americana</i> tree
blue vervain <i>Verbena hastata</i> herb	

*Invasive species

Bank 10 Flooplain Plant Species

Canada wood nettle	<i>Laportea canadensis</i>	H
ostrich fern	<i>Matteuccia struthiopteris</i>	H
green-headed coneflower	<i>Rudbeckia laciniata</i>	H
stinging nettle	<i>Urtica dioica</i>	H
boxelder	<i>Acer negundo</i>	S
boxelder	<i>Acer negundo</i>	T



Bank 10: 200-ft stretch along a moderate right bend from Station 39-41.

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 10. August 4, 2022



Left bank around Station 39

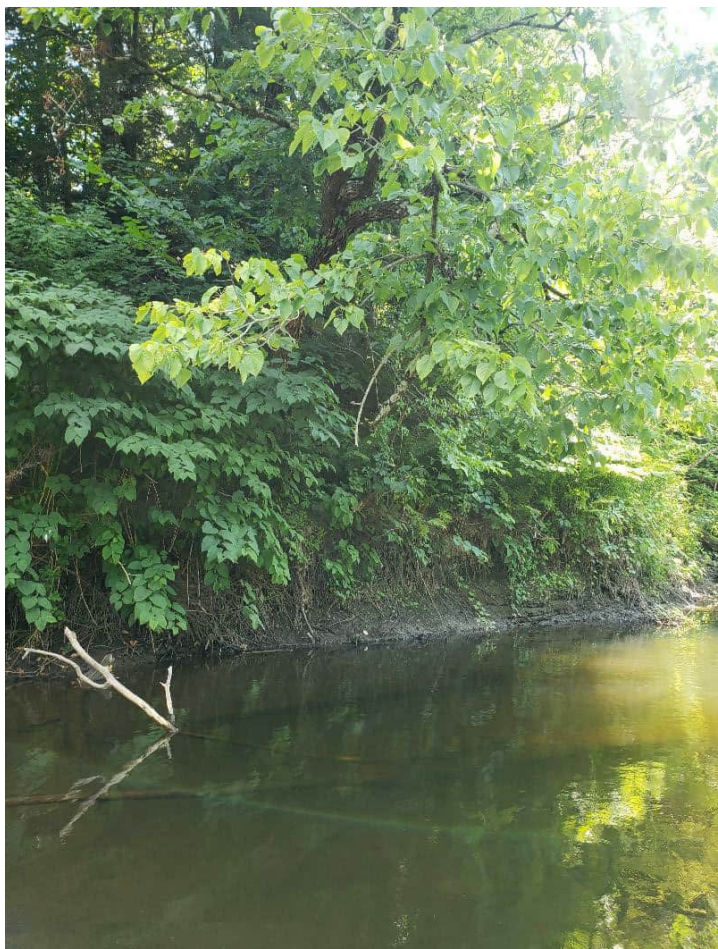


Left bank looking upstream from Station 39

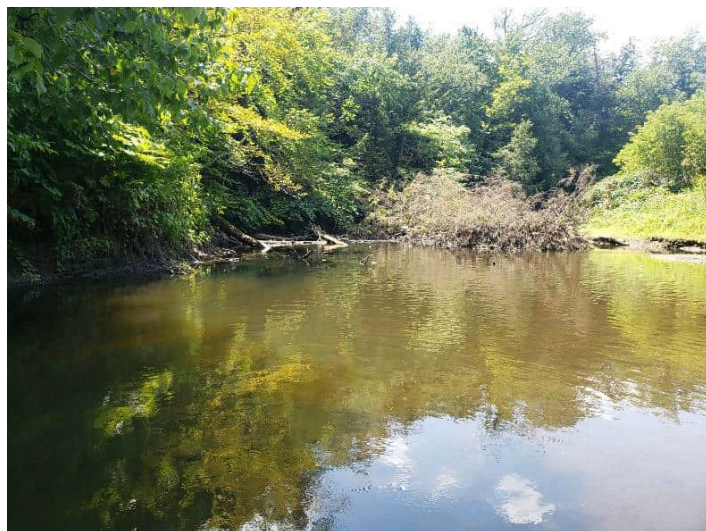


Right bank at Station 39

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Right bank at Station 39+50; overhanging Linden



Looking upstream from Station 39

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 11

Site Name and Evaluation Segment

Bank 11: Stations 51-53. 200-ft stretch along a straight run from Station 51-53

Location/Physical Description

8/4/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 80'

Bank Height: R 8' L 6'

Slope: R 80% L 60%

Sediment / Substrate composition:

% Sand 40

% Silt 40

% Clay 0

% Gravel/cobble 20

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Some undercutting on Right bank. Left bank is stable. Thalweg moves from right to left side.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 6-8 ft Floodplain surface: 6-8 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:

<u>75</u> Bank Vegetation	<u>60</u> Overhanging Vegetation	<u>70</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>60</u> Trees (> 20')	<u>50</u> Shrubs (< 20')	<u>20</u> Woody vines	<u>0</u> Mosses	<u>25</u> Herbaceous
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	80 Bank Vegetation	60 Overhanging Vegetation	80 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

20 Trees (> 20')	60 Shrubs (< 20')	25 Woody vines	0 Mosses	75 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

10 Trees (> 20')	20 Shrubs (< 20')	10 Woody vines	0 Mosses	80 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, common buckthorn, Morrow's honeysuckle, hedge bindweed
- ☒ Evidence of other human disturbance; describe: Active mowed lawns along river

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:
Coarse woody debris, large trees, cobbles

- ☒ Other restoration opportunities:

R: Compartmentalized fill

L: Grade bank/Coir matting; Log or rock vanes

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 11 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
red maple <i>Acer rubrum</i> tree	ironwood <i>Carpinus caroliniana</i> tree
common ragweed <i>Ambrosia artemisiifolia</i> herb	Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *
swamp milkweed <i>Asclepias incarnata</i> herb	hedge bindweed <i>Convolvulus sepium</i> vine *
Devil's beggar-ticks <i>Bidens frondosa</i> herb	American witch hazel <i>Hamamelis virginiana</i> shrub
red-osier dogwood <i>Cornus sericea</i> shrub	Morrow's honeysuckle <i>Lonicera morrowii</i> shrub *
spotted Joe-Pye weed <i>Eupatorium maculatum</i> herb	common buckthorn <i>Rhamnus cathartica</i> herb *
lance-leaved tiger-lily <i>Lilium lancifolium</i> herb	poison-ivy <i>Toxicodendron radicans</i> liana/vine
Allegheny monkeyflower <i>Mimulus ringens</i> herb	
pale smartweed <i>Persicaria lapathifolia</i> herb	
green-headed coneflower <i>Rudbeckia laciniata</i> herb	
American bur-reed <i>Sparganium americanum</i> herb	
river grape <i>Vitis riparia</i> vine/liana	

*Invasive species

Bank 11 Floodplain Plant Species

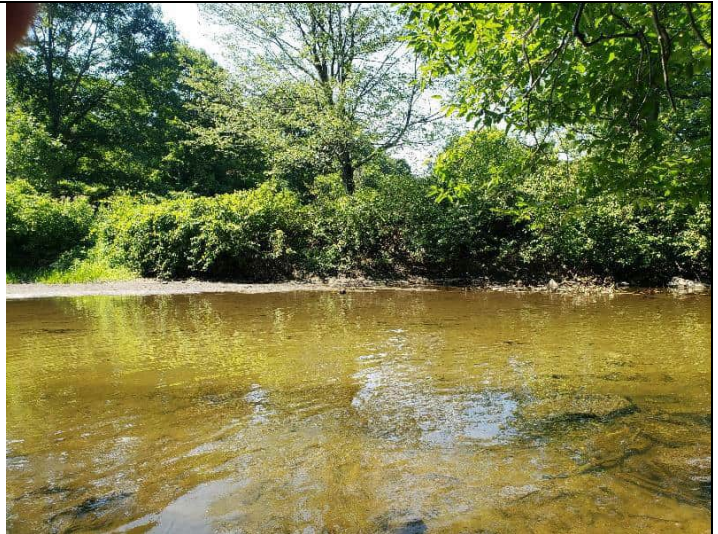
ostrich fern	<i>Matteuccia struthiopteris</i>	H
bishop's goutweed	<i>Aegopodium podagraria</i>	H
boxelder maple	<i>Acer negundo</i>	T/S
weeping willow	<i>Salix babylonica</i>	T
Asian bittersweet	<i>Celastrus orbiculatus</i>	V
river grape	<i>Vitis riparia</i>	V



Bank 11: Stations 51-53. 200-ft stretch along a straight run from Station 51-53

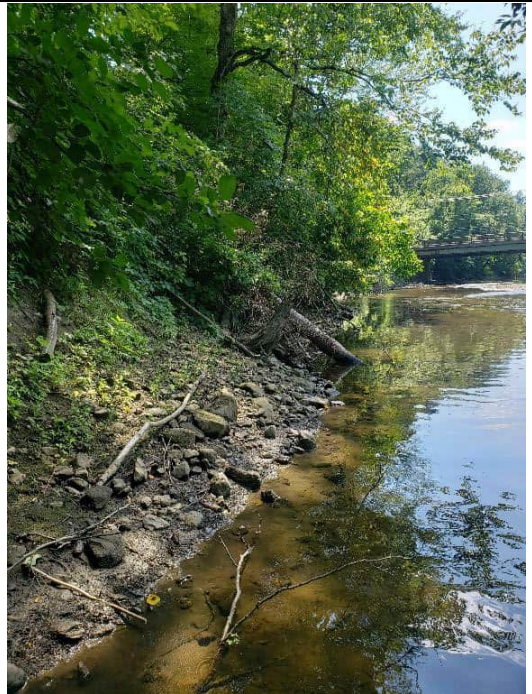
**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 11 Area. August 4, 2022



Left bank at Station 51

Left bank near Station 53



Views of right bank between Stations 51 and 53 (above left and right, and below left)



**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 12

Site Name and Evaluation Segment

Bank 12: Stations 54-56. 200-ft stretch along a sharp right bend from Station 54-56

Location/Physical Description

8/4/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 60'

Bank Height: R 6' L 8'

Slope: R 30% L 80-90%

Sediment / Substrate composition:

% Sand 30

% Silt 30

% Clay 0

% Gravel/cobble 20

% Boulder/Bedrock 20

% Organic matter

Bank stability / Observed erosional conditions:

Left bank has riprap from bridge protection work. Left bank has high NBS. Both banks stable. Right bank has point bar around the bend.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 6-8 ft Floodplain surface: 6-8 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: $\frac{80}{\text{Bank Vegetation}}$ $\frac{50}{\text{Overhanging Vegetation}}$ $\frac{80}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{30}{\text{Trees (> 20')}}$	$\frac{60}{\text{Shrubs (< 20')}}$	$\frac{30}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{70}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	80 Bank Vegetation	60 Overhanging Vegetation	70 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

70 Trees (> 20')	80 Shrubs (< 20')	30 Woody vines	0 Mosses	30 Herbaceous
---------------------	----------------------	-------------------	-------------	------------------

Percent Cover of Riparian Vegetation by Strata

60 Trees (> 20')	60 Shrubs (< 20')	20 Woody vines	0 Mosses	70 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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Spotted sandpiper	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Japanese knotweed, Morrow's honeysuckle

☐ 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:
Coarse woody debris, large trees, cobbles, boulders

☒ Other restoration opportunities:

R: Reshape point bar; Grade bank/Coir matting

L: Vegetated riprap; Log or rock vanes

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 12 Plant Species List</u>	
<u>Lef bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	silver maple Acer saccharinum tree
Devil's beggar-ticks Bidens frondosa herb	nodding beggar-ticks Bidens cernua herb
Morrow's honeysuckle Lonicera morrowii shrub *	Japanese knotweed Fallopia japonica herb *
eastern cottonwood Populus deltoides tree	rice cut-grass Leersia oryzoides herb
	pale smartweed Persicaria lapathifolia herb
	Canada clearweed Pilea pumila herb

*Invasive species

Bank 12 Floodplain Plant Species

ostrich fern	Matteuccia struthiopteris	H
bishop's goutweed	Aegopodium podagraria	H
boxelder	Acer negundo	T/S
weeping willow	Salix babylonica	T
Asian bittersweet	Celastrus orbiculatus	V
river grape	Vitis riparia	V



Bank 12: Stations 54-56. 200-ft stretch along a straight run from Station 54-56

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 12 Area. August 4, 2022



Right bank from Station 55 looking downstream



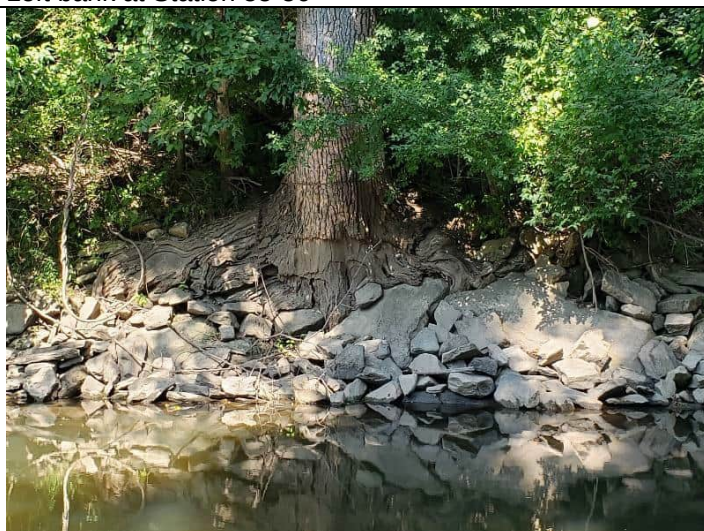
Right bank at Station 54



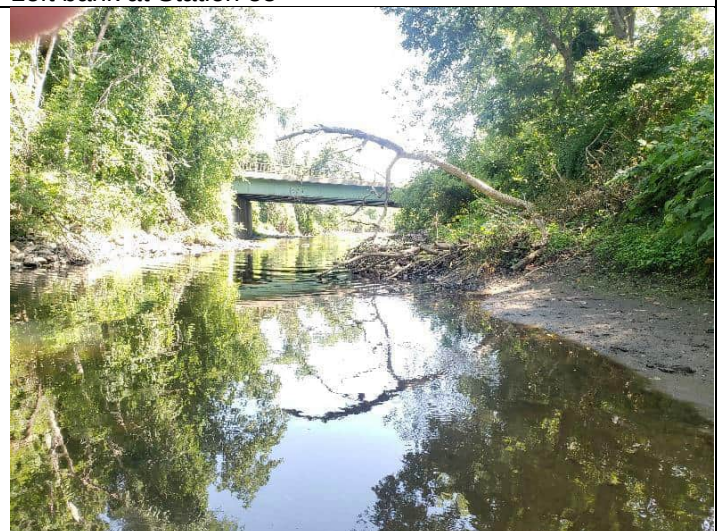
Left bank at Station 55-56



Left bank at Station 55



Left bank at Station 54+50



Right bank (right) to left bank from Station 54

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 13

Site Name and Evaluation Segment

Bank 13: Stations 78-81. 300-ft stretch along a mild left bend from Station 78-81.

Location/Physical Description

9/15/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 60'

Bank Height R: 7' L: 5'

Slope: R 90% L 30%

Sediment / Substrate composition:

% Sand 40

% Silt 50

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable. Right bank largely vertical with undercuts. High – very high NBS on right bank. Thalweg along right side.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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' Top of bank slope: 5-7' Floodplain surface: 5-7'

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: $\frac{30}{\text{Bank Vegetation}}$ $\frac{100}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{50}{\text{Trees (> 20')}} \quad \frac{70}{\text{Shrubs (< 20')}} \quad \frac{75}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{10}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	90 Bank Vegetation	80 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50 Trees (> 20')	50 Shrubs (< 20')	30 Woody vines	0 Mosses	90 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

75 Trees (> 20')	80 Shrubs (< 20')	30 Woody vines	5 Mosses	75 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Brook Snaketail, Matted Spike-sedge, Mustard White, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Deer	
Green heron	
Kingfisher	
Painted turtle	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, common buckthorn, Morrow's honeysuckle, Japanese knotweed, purple loosestrife, yellow iris, 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:
Coarse woody debris, large trees, cobble

- ☒ Other restoration opportunities:

R: Vegetated riprap; Log or rock vanes

L: Reshape point bar

Invasive species control

Revegetation

Bank 13 Plant Species List

<u>Left</u>	<u>Right</u>
boxelder Acer negundo tree	silver maple Acer saccharinum tree
silver maple Acer saccharinum tree	sugar maple Acer saccharum tree
nodding beggar-ticks Bidens cernua herb	Asian bittersweet Celastrus orbiculatus vine/liana *
awl-fruited sedge Carex stipata herb	black walnut Juglans nigra tree
Asian bittersweet Celastrus orbiculatus vine/liana *	Morrow's honeysuckle Lonicera morrowii shrub *
wild cucumber Echinocystis lobata vine	American elm Ulmus americana tree
spike rush Eleocharis sp herb	river grape Vitis riparia vine/liana
spotted Joe-Pye weed Eupatorium maculatum herb	
Japanese knotweed Fallopia japonica herb *	
American manna grass Glyceria grandis herb	
yellow iris Iris pseudacorus herb *	
common water-purslane Ludwigia palustris herb	
purple loosestrife Lythrum salicaria herb *	
ostrich fern Matteuccia struthiopteris herb	
Allegheny monkeyflower Mimulus ringens herb	
water forget-me-not Myosotis scorpioides herb *	
lady's-thumb smartweed Persicaria maculosa herb	
jumpseed Persicaria virginiana herb	
Canada clearweed Pilea pumila herb	
pickerelweed Pontederia cordata herb	
common buckthorn Rhamnus cathartica herb *	
lance-leaved American aster Symphyotrichum lanceolatum herb	
small white aster Symphyotrichum racemosum herb	
marsh fern Thelypteris palustris herb	
blue vervain Verbena hastata herb	
*Invasive species	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 13 Floodplain Plant Species

black cherry	<i>Prunus serotina</i>	T
boxelder	<i>Acer negundo</i>	T
common buckthorn	<i>Rhamnus cathartica</i>	S
Morrow's honeysuckle	<i>Lonicera morrowii</i>	S
Japanese barberry	<i>Berberis thunbergii</i>	S
American bittersweet	<i>Celastrus orbiculatus</i>	V
river grape	<i>Vitis riparia</i>	V
moneywort	<i>Lysimachia nummularia</i>	H
Canada wood nettle	<i>Laportea canadensis</i>	H

(B-60)



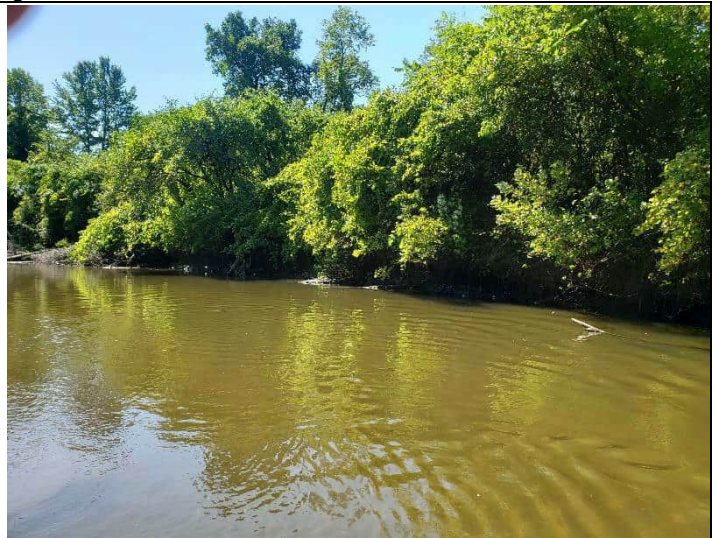
Bank 13: 300-ft stretch along a mild left bend from Station 78-81

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

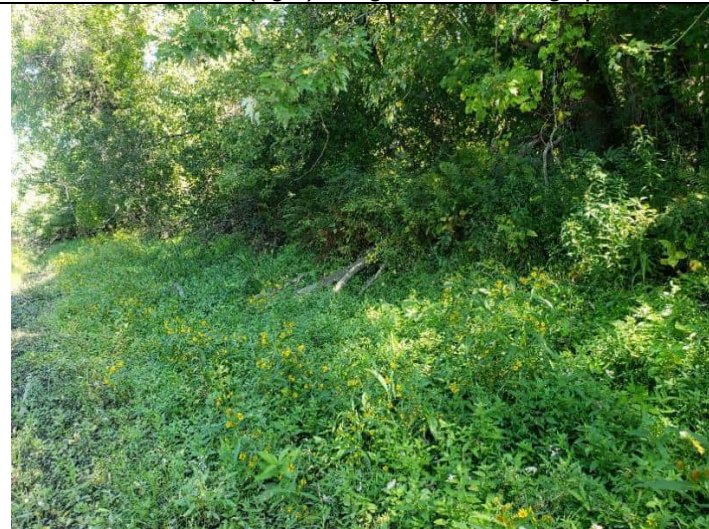
Photos of Bank 13 on September 15, 2022: 300-ft stretch along a mild left bend from Station 78-81



Station 78 left bank (right) to right bank looking upstream



Station 78 right bank



Station 79 left bank



Station 79 right bank



Station 80 left bank



Station 80 right bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Station 81 left bank



Station 81 right bank

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 14

Site Name and Evaluation Segment

Bank 14: Stations 85-88. 300-ft stretch along a sharp right bend from Station 85-88.

Location/Physical Description

9/15/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 80'

Bank Height: R: 6' L 7'

Slope: R 60% L 90%

Sediment / Substrate composition:

% Sand 40

% Silt 40

% Clay 0

% Gravel/cobble 20

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Channel from backwater cuts through left bank at Station 86. Left bank is shear cut bank. Right bank is stable with point bar development.

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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 5-7 ft Floodplain surface: 5-7 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: $\frac{100}{\text{Bank Vegetation}}$ $\frac{80}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{10}{\text{Trees (> 20')}} \quad \frac{10}{\text{Shrubs (< 20')}} \quad \frac{10}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{90}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	<u>70</u> Bank Vegetation	<u>100</u> Overhanging Vegetation	<u>100</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>20</u> Trees (> 20')	<u>80</u> Shrubs (< 20')	<u>60</u> Woody vines	<u>0</u> Mosses	<u>50</u> Herbaceous
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Percent Cover of Riparian Vegetation by Strata

<u>75</u> Trees (> 20')	<u>85</u> Shrubs (< 20')	<u>35</u> Woody vines	<u>0</u> Mosses	<u>70</u> Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Bristly Buttercup, Brook Snaketail, Matted Spike-sedge, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Mallards	
Deer	
Catbird	
Painted turtle	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, common buckthorn, Morrow's honeysuckle, Japanese knotweed, purple loosestrife, bishop's
goutweed
- ☐ 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:
Coarse woody debris, large trees, cobble

- ☒ Other restoration opportunities:

R: Reshape point bar

L: Log or rock vanes; Root wads; Vegetated riprap

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 14 Plant Species List</u>	
<u>Left</u>	<u>Right</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
silver maple Acer saccharinum tree	nodding beggar-ticks Bidens cernua herb
bishop's goutweed Aegopodium podagraria herb *	water hemlock Cicutula bulbifera herb
nodding beggar-ticks Bidens cernua herb	wild cucumber Echinocystis lobata vine
purple-stemmed beggar-ticks Bidens connata herb	Japanese knotweed Fallopia japonica herb *
Asian bittersweet Celastrus orbiculatus vine/liana *	pale smartweed Persicaria lapathifolia herb
hawthorn Crataegus spp. shrub/tree	jumpseed Persicaria virginiana herb
Morrow's honeysuckle Lonicera morrowii shrub *	blue vervain Verbena hastata herb
purple loosestrife Lythrum salicaria herb *	
Allegheny monkeyflower Mimulus ringens herb	
Canada clearweed Pilea pumila herb	
common buckthorn Rhamnus cathartica herb *	
American speedwell Veronica americana herb	
*Invasive species	

Bank 14 Floodplain Plant Species

silver maple	Acer saccharinum	T
boxelder	Acer negundo	T
boxelder	Acer negundo	S
silky dogwood	Cornus amomum	S
Canada wood nettle	Laportea canadensis	H
ostrich fern	Matteuccia struthiopteris	H
bishop's goutweed	Aegopodium podagraria	H

(B-60)



Bank 14: Stations 85-88. 300-ft stretch along a sharp right bend from Station 85-88

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 14 Area. September 15, 2022.



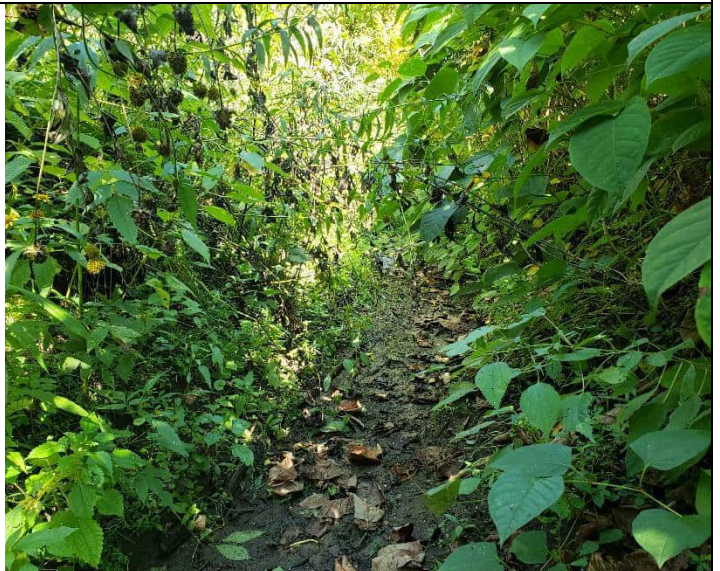
Station 85-86 right bank, looking upstream



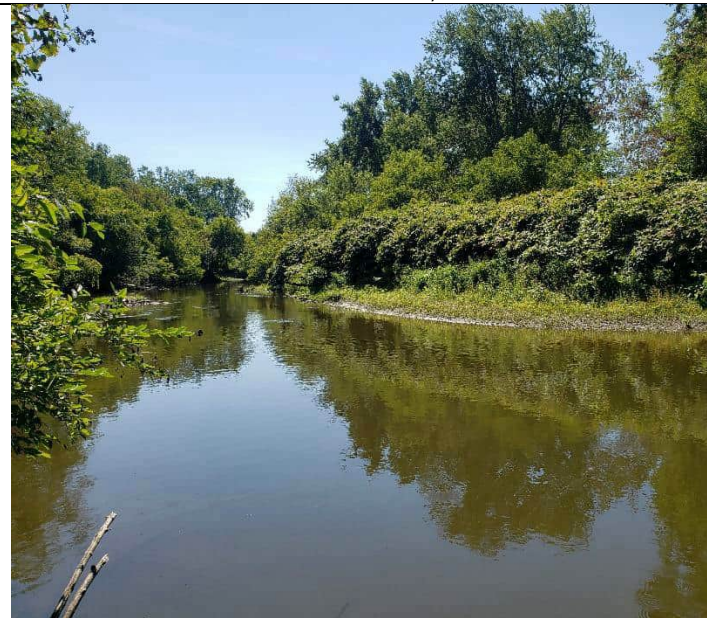
Station 86 left bank



Outlet from backwater at Station 86, left bank



Swale from backwater to left bank at Station 86

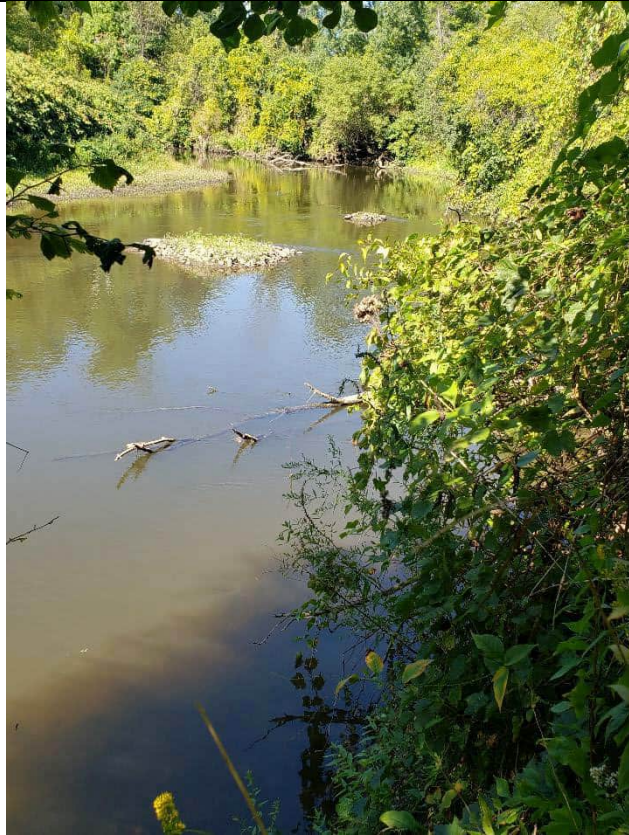


Station 87-88, right bank



Station 88 left bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Station from left bank (right side) over to right bank



From Station 88 left bank looking upstream

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 15

Site Name and Evaluation Segment

Bank 15: Stations 102-104. 200-ft stretch with bend to right, then left, with mid-channel bar

Location/Physical Description

8/30/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 70'

Bank Height: R 5' L 6'

Slope: R 30%, 90% L 90-120%

Sediment / Substrate composition:

% Sand 40

% Silt 50

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Very variable conditions. Upper right bank very gentle and stable. Lower right cut steep but stable. Left bank steep with undercuts and heavy root cover. Mid-channel bar diverts flow to both 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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 5-6 ft Floodplain surface: 5-6 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 75 100
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50 10 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:	<u>80</u> Bank Vegetation	<u>70</u> Overhanging Vegetation	<u>100</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>80</u> Trees (> 20')	<u>60</u> Shrubs (< 20')	<u>50</u> Woody vines	<u>0</u> Mosses	<u>40</u> Herbaceous
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Percent Cover of Riparian Vegetation by Strata

<u>80</u> Trees (> 20')	<u>80</u> Shrubs (< 20')	<u>30</u> Woody vines	<u>0</u> Mosses	<u>60</u> 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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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, raccoon):

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Bristly Buttercup, Brook Snaketail, Matted Spike-sedge, Mustard White, Ostrich Fern Borer Moth, Riffle Snaketail, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations	
Green heron	
Black-capped chickadee	
Wood pewee	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Common buckthorn, bittersweet, Japanese knotweed, 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:
Coarse woody debris, large trees, root wads, cobble

- ☒ Other restoration opportunities:

R: Compartmentalized fill; Grade bank/Coir matting

L: Grade bank/Coir matting

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 15 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
silver maple Acer saccharinum tree	boxelder Acer negundo tree
nodding beggar-ticks Bidens cernua herb	silver maple Acer saccharinum tree
Asian bittersweet Celastrus orbiculatus vine/liana *	nodding beggar-ticks Bidens cernua herb
silky dogwood Cornus amomum shrub	Japanese knotweed Fallopia japonica herb *
red-osier dogwood Cornus sericea shrub	common water-purslane Ludwigia palustris herb
spotted Joe-Pye weed Eupatorium maculatum herb	water forget-me-not Myosotis scorpioides herb *
jewelweed Impatiens capensis herb	pale smartweed Persicaria lapathifolia herb
ostrich fern Matteuccia struthiopteris herb	blue vervain Verbena hastata herb
common buckthorn Rhamnus cathartica herb *	
American elm Ulmus americana tree	

*Invasive species

Bank 15 Floodplain Plant Species

silver maple	Acer saccharinum	T
common buckthorn	Rhamnus cathartica	S
Japanese knotweed	Fallopia japonica	H
ostrich fern	Matteuccia struthiopteris	H
stinging nettle	Urtica dioica	H
bishop's goutweed	Aegopodium podagraria	H



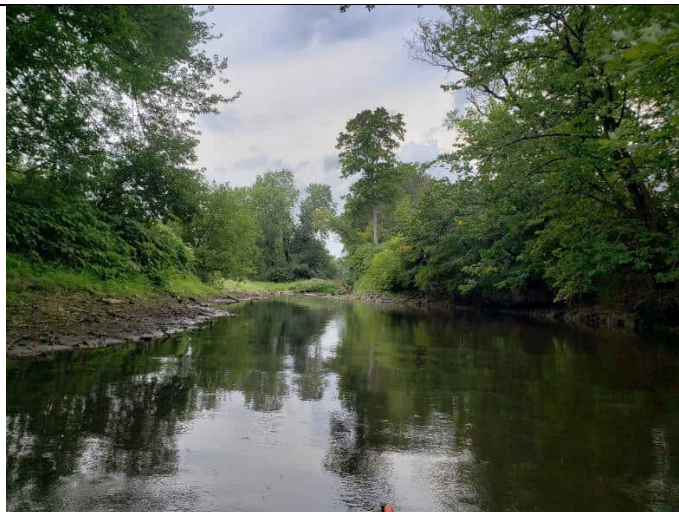
Bank 15: Stations 102-104. 200-ft bend to right and then left with large mid-channel bar at Station 103.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 15 Area, August 30, 2022



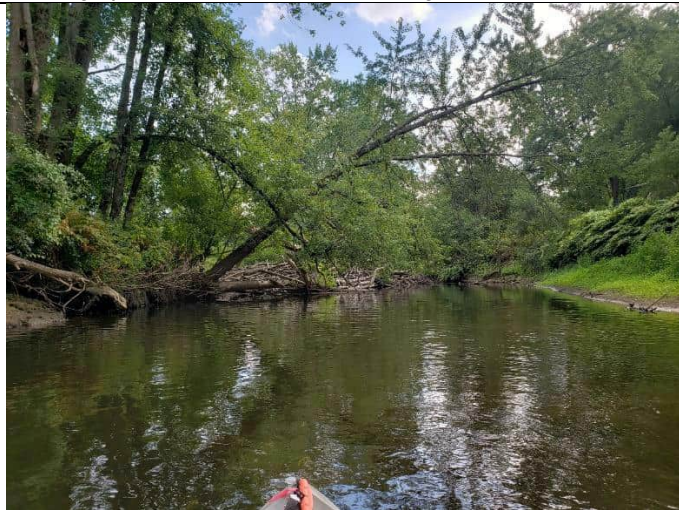
Right bank at Station 102



Looking upstream from Station 102. Right bank is on left side.



Right bank looking downstream toward Station 103



Looking downstream at left bank (left) to right bank (right) toward Station 103

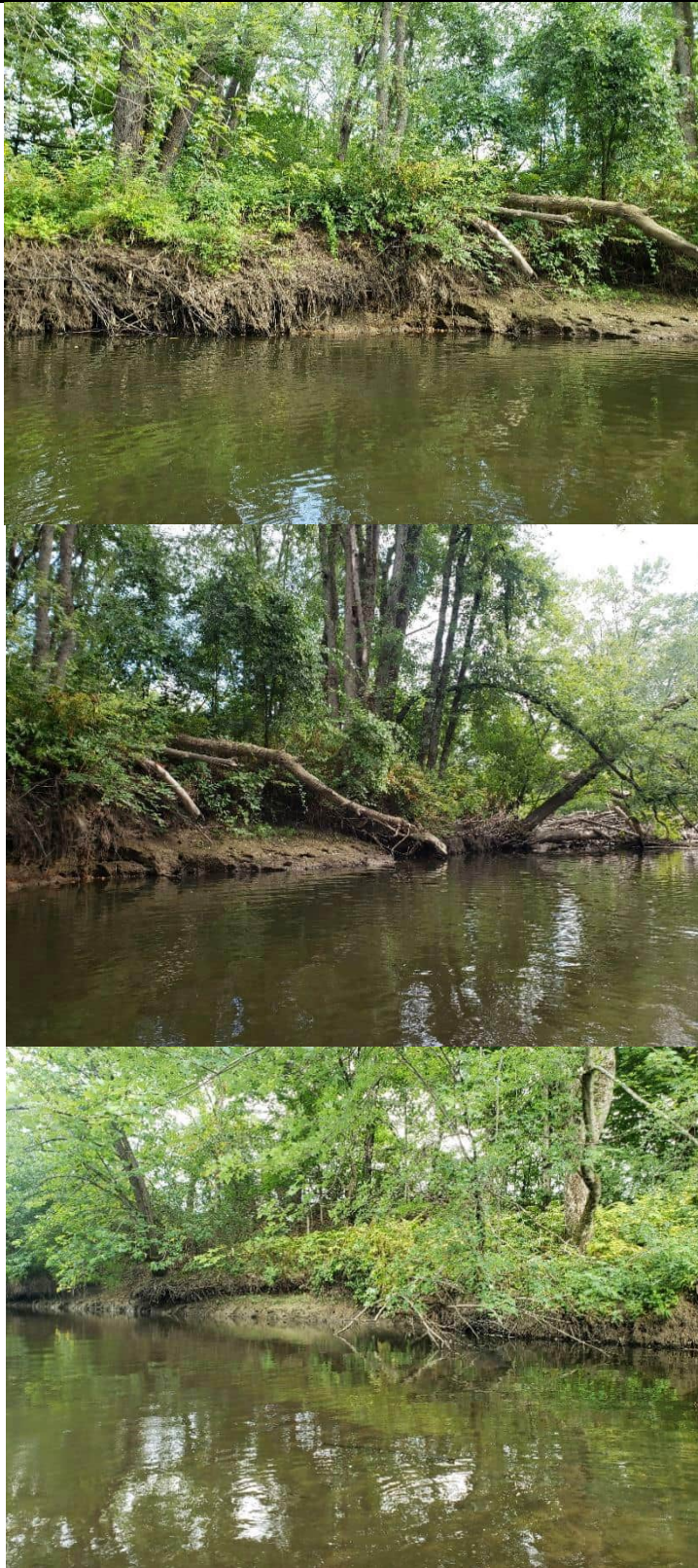


Right bank at Station 104



Right bank at Station 104

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Views of left bank between Stations 102-103

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank at upstream side of Station 103



Left bank (right side) at downstream side of Station 103. Mid-channel bar is to the left. Looking upstream.



Looking upstream at downstream end of mid-channel bar.
From Station 103+50



Looking upstream from Station 105. Mid-channel bar in view
at Station 103.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 16

Site Name and Evaluation Segment

Bank 16: Stations 106-110. 400-ft sharp left and right bend, then back to left

Location/Physical Description

8/30/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 400'

Width: 70'

Bank Height: R 4-5'

L 10'

Slope: R 45% L 90%

Sediment / Substrate composition:

% Sand 40

% Silt 30

% Clay

% Gravel/cobble 20

% Boulder/Bedrock 10

% Organic matter

Bank stability / Observed erosional conditions:

Left bank is cut and erodible. High BEHI and extreme NBS on left bank. Right bank is relatively stable. Thalweg is slightly left of 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 _____

Notes:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 2-4 ft Top of bank slope: 4-10 ft Floodplain surface: 4-10 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: $\frac{90}{\text{Bank Vegetation}}$ $\frac{80}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{60}{\text{Trees (> 20')}} \quad \frac{30}{\text{Shrubs (< 20')}} \quad \frac{10}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{80}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	60 Bank Vegetation	90 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

80 Trees (> 20')	40 Shrubs (< 20')	20 Woody vines	0 Mosses	70 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

50 Trees (> 20')	60 Shrubs (< 20')	20 Woody vines	0 Mosses	90 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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, Bristly Buttercup, Brook Snaketail, Matted Spike-sedge, Mustard White, Ostrich Fern Borer Moth, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Kingfisher	
Red-bellied woodpecker	
Crow	
Raccoon tracks	
Deer tracks	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Common buckthorn, Japanese knotweed, bittersweet, Morrow's honeysuckle, yellow iris, bishop's goutweed, 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:
Coarse woody debris, large trees, root wads, cobbles, boulders

- ☒ Other restoration opportunities:

R: Reshape point bar; Vegetated riprap

L: Vegetated riprap; Grade bank/Coir matting

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 16 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
silver maple <i>Acer saccharinum</i> tree	boxelder <i>Acer negundo</i> tree
bishop's goutweed <i>Aegopodium podagraria</i> herb *	silver maple <i>Acer saccharinum</i> tree
Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *	nodding beggar-ticks <i>Bidens cernua</i> herb
white turtlehead <i>Chelone glabra</i> herb	small-spiked false-nettle <i>Boehmeria cylindrica</i> herb
Japanese knotweed <i>Fallopia japonica</i> herb *	wild cucumber <i>Echinocystis lobata</i> vine
green ash <i>Fraxinus pennsylvanica</i> tree	Japanese knotweed <i>Fallopia japonica</i> herb *
yellow iris <i>Iris pseudacorus</i> herb *	common water-purslane <i>Ludwigia palustris</i> herb
Morrow's honeysuckle <i>Lonicera morrowii</i> shrub *	water forget-me-not <i>Myosotis scorpioides</i> herb *
ostrich fern <i>Matteuccia struthiopteris</i> herb	common buckthorn <i>Rhamnus cathartica</i> herb *
sensitive fern <i>Onoclea sensibilis</i> herb	blue vervain <i>Verbena hastata</i> herb
eastern cottonwood <i>Populus deltoides</i> tree	
common buckthorn <i>Rhamnus cathartica</i> herb *	
American elm <i>Ulmus americana</i> tree	
river grape <i>Vitis riparia</i> vine/liana	

*Invasive species

Bank 16 Floodplain Plant Species

silver maple	<i>Acer saccharinum</i>	T
hawthorn	<i>Crataegus</i> spp.	T
ostrich fern	<i>Matteuccia struthiopteris</i>	H
stinging nettle	<i>Urtica dioica</i>	H



Bank 16: Stations 106-110. 400-ft along tight right bend along sandy cut outer bank.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

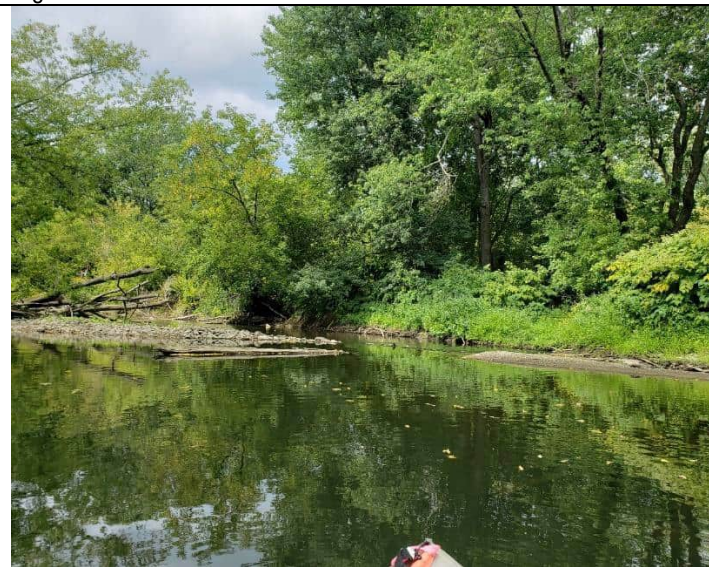
Photos of Bank 16 Area. August 30, 2022.



Right bank Stations 106-108



Right bank around Station 109



Right bank at Station 109. Rock bar in center is on left side



Looking upstream. Right bank is on left. LWD extends out from left bank just below mid-channel rock bar



Station 106 left bank



Station 107 left bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



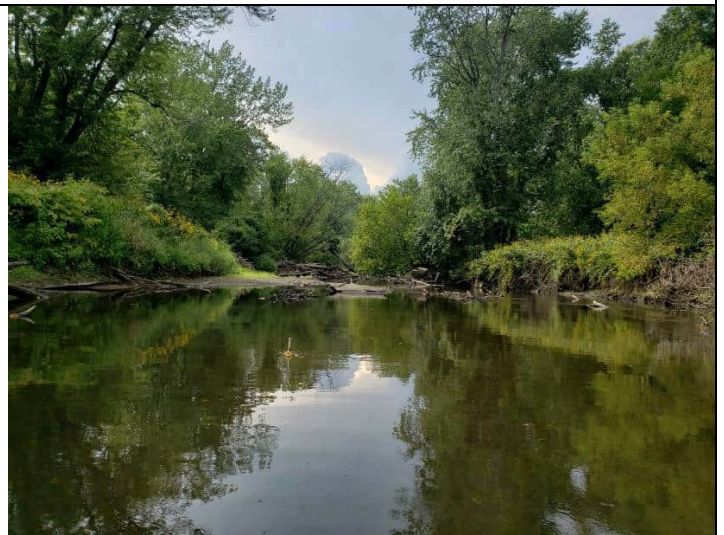
Left bank around Station 108



Left bank around Station 109



Looking at left bank from right bank just below Station 109



Looking downstream from Station 110

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 17

Site Name and Evaluation Segment

Bank 17: Stations 115-117. 200-ft along left bend at sewer line crossing

Location/Physical Description

8/30/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 70'

Bank Height: R 5-6' L 5-6'

Slope: R 90% L 70%

Sediment / Substrate composition:

% Sand 30

% Silt 30

% Clay

% Gravel/cobble 20

% Boulder/Bedrock 20

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable; bar development on right bank; large down trees at upper end divert lower flows to left bank. Thalweg towards 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 sewer line crossing

Notes:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 2.5 ft Top of bank slope: 5-6 ft Floodplain surface: 5-6 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: $\frac{90}{\text{Bank Vegetation}}$ $\frac{75}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{30}{\text{Trees (> 20')}}$	$\frac{0}{\text{Shrubs (< 20')}}$	$\frac{0}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{90}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	80 Bank Vegetation	80 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

70 Trees (> 20')	70 Shrubs (< 20')	50 Woody vines	0 Mosses	20 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

80 Trees (> 20')	70 Shrubs (< 20')	30 Woody vines	0 Mosses	60 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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, Bristly Buttercup, Brook Snaketail, Matted Spike-sedge, Mustard White, Ostrich Fern Borer Moth, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Kingfisher	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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, reed canary grass
- ☒ Evidence of other human disturbance; describe: Sewer line crossing

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:
Coarse woody debris, root wads, boulders, cobbles

- ☒ Other restoration opportunities:

R: Root wads; Log or rock vanes

L: Reshape point bar

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 17 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	silver maple Acer saccharinum tree
silver maple Acer saccharinum tree	nodding beggar-ticks Bidens cernua herb
nodding beggar-ticks Bidens cernua herb	spotted Joe-Pye weed Eupatorium maculatum herb
Asian bittersweet Celastrus orbiculatus vine/liana *	green ash Fraxinus pennsylvanica tree
red-osier dogwood Cornus sericea shrub	common soft rush Juncus effusus herb
jewelweed Impatiens capensis herb	Allegheny monkeyflower Mimulus ringens herb
pale smartweed Persicaria lapathifolia herb	sensitive fern Onoclea sensibilis herb
Canada clearweed Pilea pumila herb	ditch-stonecrop Penthorum sedoides herb
river grape Vitis riparia vine/liana	pale smartweed Persicaria lapathifolia herb
	reed canary grass Phalaris arundinacea herb *
	Canada clearweed Pilea pumila herb
	green-headed coneflower Rudbeckia laciniata herb

*Invasive species

Bank 17 Floodplain Plant Species

Eastern cottonwood	Populus deltoides	T
silver maple	Acer saccharinum	T
green ash	Fraxinus pennsylvanica	T
common buckthorn	Rhamnus cathartica	S
American elm	Ulmus americana	S
Asian bittersweet	Celastrus orbiculatus	V
stinging nettle	Urtica dioica	H
Pennsylvania smartweed	Persicaria pensylvanica	H
black mustard	Brassica nigra	H
water forget-me-not	Myosotis scorpioides	H
reed canary grass	Phalaris arundinacea	H



**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 17 Area, August 30, 2022



Looking downstream at left bank (left) over to right bank from Station 114 down to Station 116



Looking upstream from Station 116 at right bank (on left) over to left bank (on right)



Looking upstream from Station 116 at right bank



Looking downstream around Station 117 at right bank



Looking downstream around Station 117. Right bank to right over to left bank (left)



Looking upstream at left bank from Station 116. Bar off the right bank is visible on left side

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Looking at left bank from right bank at Station 116

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 18

Site Name and Evaluation Segment

Bank 18: Stations 135-138. 300-ft stretch of sharp bends

Location/Physical Description

8/25/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 70'

Bank Height: R 6-7' L 7-8'

Slope: R 60% L 90-100%

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Left bank is steep and cut in upper part, followed by bar development around the bend. Right bank is gentle with bar development in upper part, followed by steep cut with mature tree rooting in lower part around the bend. Right bank NBS is extreme at Stations 137-138. Thalweg runs left to 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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 6-8 ft Floodplain surface: 6-8 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: $\frac{100}{\text{Bank Vegetation}}$ $\frac{25}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{20}{\text{Trees (> 20')}} \quad \frac{20}{\text{Shrubs (< 20')}} \quad \frac{20}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{90}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	70 Bank Vegetation	80 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

30 Trees (> 20')	50 Shrubs (< 20')	30 Woody vines	0 Mosses	70 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

60 Trees (> 20')	80 Shrubs (< 20')	20 Woody vines	0 Mosses	75 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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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, Brook Snaketail, Matted Spike-sedge, Mustard White, Ostrich Fern Borer Moth, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Canada geese	
Great blue heron	
Painted turtle	
Titmouse	
Goldfinch	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, Japanese knotweed, common buckthorn, dame's-rocket, 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:
Coarse woody debris, large trees, root wads, cobbles

- ☒ Other restoration opportunities:

R: Log or rock vanes; Vegetated riprap; Root wads

L: Reshape point bar

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 18 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
silver maple Acer saccharinum tree	silver maple Acer saccharinum tree
nodding beggar-ticks Bidens cernua herb	nodding beggar-ticks Bidens cernua herb
Asian bittersweet Celastrus orbiculatus vine/liana *	Asian bittersweet Celastrus orbiculatus vine/liana *
white turtlehead Chelone glabra herb	crested wood fern Dryopteris cristata herb
virgin's-bower Clematis virginiana vine	Japanese knotweed Fallopia japonica herb *
Japanese knotweed Fallopia japonica herb *	purple loosestrife Lythrum salicaria herb *
dame's-rocket Hesperis matronalis herb *	pale smartweed Persicaria lapathifolia herb
common water-purslane Ludwigia palustris herb	Atlantic ninebark Physocarpus opulifolius shrub
ostrich fern Matteuccia struthiopteris herb	American sycamore Platanus occidentalis tree
giant chickweed Myosoton aquaticum herb	blue vervain Verbena hastata herb
pale smartweed Persicaria lapathifolia herb	
common buckthorn Rhamnus cathartica herb *	
eastern black currant Ribes americanum shrub	
green-headed coneflower Rudbeckia laciniata herb	
river grape Vitis riparia vine/liana	

*Invasive species

Bank 18 Floodplain Plant Species

boxelder	Acer negundo	T
boxelder	Acer negundo	S
American sycamore	Platanus occidentalis	T
dotted smartweed	Persicaria punctata	H
black mustard	Brassica nigra	H
common cocklebur	Xanthium strumarium	H



**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 18 Area. August 25, 2022



Right bank (right) to left bank (left) looking upstream. Overhanging silver maple off right bank is to the right. Large sycamore just above left bank is in the rear left.



Right bank looking downstream from Station 136

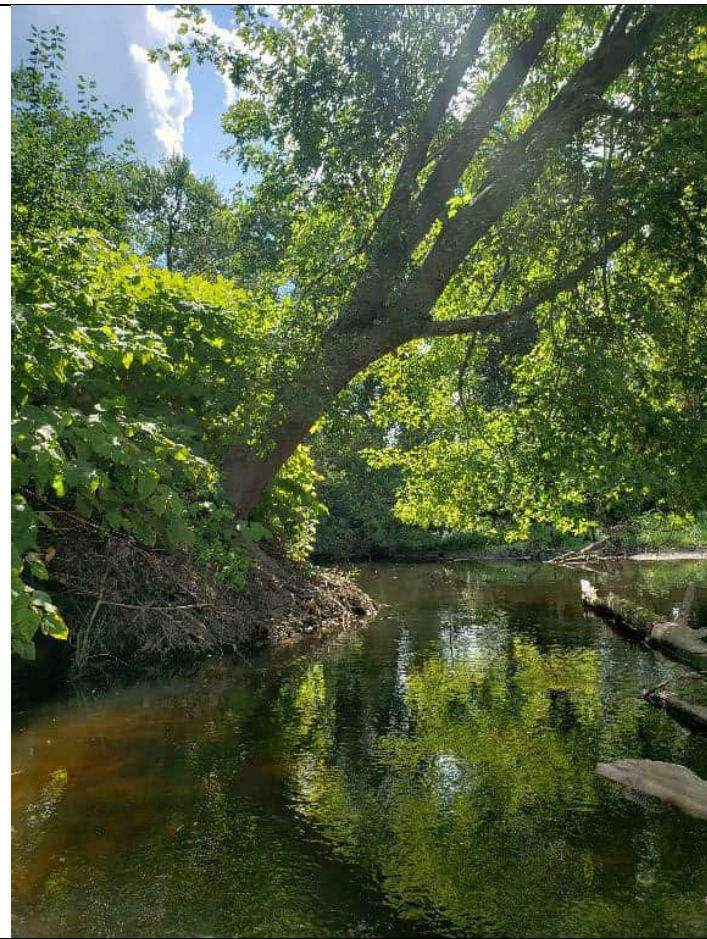


Left bank looking downstream from Station 135 +50



Left bank looking upstream from Station 136

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank looking downstream from Station 136+50.
Overhanging silver maple.



Right bank (right) to left bank (left) looking downstream
from Station 137

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 19

Site Name and Evaluation Segment

Bank 19: Stations 147-150. 300-ft along sharp right bend

Location/Physical Description

8/25/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 80'

Bank Height: R 7' L 5-7'

Slope: R 40% L 30% upstream,
90% downstream

Sediment / Substrate composition:

% Sand 40

% Silt 50

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions: Very variable on both banks.

Left bank around bend is slumping (Extreme BEHI and moderate NBS). Right bank also with some slumping but mostly moderate BEHI and low NBS. Thalweg moves right to 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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 3-4' ft Top of bank slope: 5-7 ft Floodplain surface: 5-7 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: $\frac{100}{\text{Bank Vegetation}}$ $\frac{10}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{10}{\text{Trees (> 20')}} \quad \frac{10}{\text{Shrubs (< 20')}} \quad \frac{10}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{90}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	60 Bank Vegetation	10 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

10 Trees (> 20')	10 Shrubs (< 20')	10 Woody vines	0 Mosses	60 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

40 Trees (> 20')	70 Shrubs (< 20')	25 Woody vines	0 Mosses	80 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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, Hairy Wild Rye, Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

VII. Habitat Degradation (identify specific location on bank segment if applicable)

- ☐ Evidence of significant levels of dumping
- ☒ Evidence of significant erosion or sedimentation problems: Slumping along left bank
- ☒ Occurrence of invasive plants:
Japanese knotweed
- ☐ 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:
Coarse woody debris, large trees, cobbles

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting; Reshape point bar

L: Log or rock vanes; Vegetated riprap; Root wads

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 19 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
nodding beggar-ticks <i>Bidens cernua</i> herb	boxelder <i>Acer negundo</i> tree
Japanese knotweed <i>Fallopia japonica</i> herb *	silver maple <i>Acer saccharinum</i> tree
pale smartweed <i>Persicaria lapathifolia</i> herb	nodding beggar-ticks <i>Bidens cernua</i> herb
green-headed coneflower <i>Rudbeckia laciniata</i> herb	Japanese knotweed <i>Fallopia japonica</i> herb *
American bur-reed <i>Sparganium americanum</i> herb	yellow-seeded false pimpernel <i>Lindernia dubia</i> herb
blue vervain <i>Verbena hastata</i> herb	pale smartweed <i>Persicaria lapathifolia</i> herb
	green-headed coneflower <i>Rudbeckia laciniata</i> herb
	blue vervain <i>Verbena hastata</i> herb

*Invasive species

Bank 19 Floodplain Plant Species

silver maple	<i>Acer saccharinum</i>	T
Canadian nettle	<i>Laportea canadensis</i>	H
garlic-mustard	<i>Alliaria petiolata</i>	H
ostrich fern	<i>Matteuccia struthiopteris</i>	H
white avens	<i>Geum canadense</i>	H



Bank 19: Station 147-150. 300-ft tight bend to right

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 19 Area. August 25, 2022



Right bank (right) to left bank (left) looking downstream from Station 146 +50



Right bank at Station 147.



Right bank below Station 147 looking downstream. Bar formation with sandy material in higher elevations with siltier material lower down.



Right bank at Station 148 looking downstream, bar transitions to bankfull marsh in right cove. Trees to rear are near Station 150 as river bends left

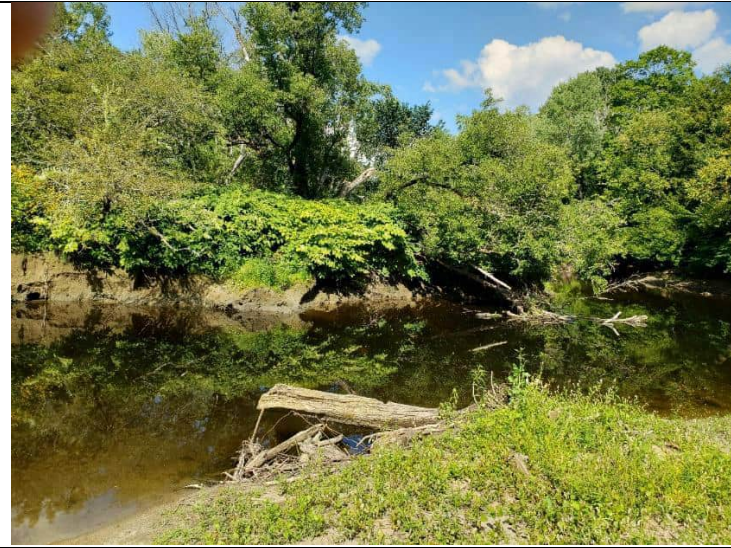


Left bank looking downstream from Station 147



Left bank from right bank at Station 148

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank from right bank at Station 149



Left bank from right bank looking upstream from Station 149



Bankfull marsh between Stations 149-150

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 20

Site Name and Evaluation Segment

Bank 20: Stations 154-156. 200-ft stretch along straight run

Location/Physical Description

8/16/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 80'

Bank Height: R 5' L 4'

Slope: R 50% L 30%

Sediment / Substrate composition:

% Sand 50%

% Silt 35%

% Clay

% Gravel/cobble 15%

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable. Both banks have low NBS and moderate BEHI. Thalweg runs along 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 _____

Notes:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 2.5-3 ft Top of bank slope: 4 ft L 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: $\frac{80}{\text{Bank Vegetation}}$ $\frac{60}{\text{Overhanging Vegetation}}$ $\frac{80}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{60}{\text{Trees (> 20')}}$	$\frac{20}{\text{Shrubs (< 20')}}$	$\frac{20}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{60}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	90 Bank Vegetation	80 Overhanging Vegetation	90 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0 Trees (> 20')	75 Shrubs (< 20')	40 Woody vines	0 Mosses	20 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

50 Trees (> 20')	75 Shrubs (< 20')	20 Woody vines	0 Mosses	90 Herbaceous
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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: See attached tables for plant lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Hairy Wild Rye, Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Kingfisher	
Wood pewee	
Phoebe	
Painted turtle	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, 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:
Medium woody debris/Coarse woody debris, cobbles

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting; Reshape point bar; Bank spurs

L: Grade bank/Coir matting; Bank spurs

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 20 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
nodding beggar-ticks <i>Bidens cernua</i> herb	sugar maple <i>Acer saccharum</i> tree
red-osier dogwood <i>Cornus sericea</i> shrub	Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *
wild cucumber <i>Echinocystis lobata</i> vine	red-osier dogwood <i>Cornus sericea</i> shrub
black walnut <i>Juglans nigra</i> tree	wild cucumber <i>Echinocystis lobata</i> vine
common water-purslane <i>Ludwigia palustris</i> herb	European spindle-tree <i>Euonymus europaeus</i> shrub/tree
water forget-me-not <i>Myosotis scorpioides</i> herb *	American beech <i>Fagus grandifolia</i> tree
water-pepper smartweed <i>Persicaria hydropiper</i> herb	American witch hazel <i>Hamamelis virginiana</i> shrub
pale smartweed <i>Persicaria lapathifolia</i> herb	border privet <i>Ligustrum obtusifolium</i> shrub
American bur-reed <i>Sparganium americanum</i> herb	ostrich fern <i>Matteuccia struthiopteris</i> herb
blue vervain <i>Verbena hastata</i> herb	Allegheny monkeyflower <i>Mimulus ringens</i> herb
	pale smartweed <i>Persicaria lapathifolia</i> herb
	American bur-reed <i>Sparganium americanum</i> herb
	eastern hemlock <i>Tsuga canadensis</i> tree

*Invasive species

Bank 20 Floodplain Plant Species

silky dogwood	<i>Cornus amomum</i>	S
Joe-Pye weed	<i>Eutrochium maculatum</i>	H
moneywort	<i>Lysimachia nummularia</i>	H
sensitive fern	<i>Onoclea sensibilis</i>	H
jewelweed	<i>Impatiens capensis</i>	H
tearthumb	<i>Persicaria sagittata</i>	H
Japanese knotweed	<i>Fallopia japonica</i>	H
Asian bittersweet	<i>Celastrus orbiculatus</i>	V
river grape	<i>Vitis riparia</i>	V
red maple	<i>Acer rubrum</i>	T
American linden	<i>Tilia americana</i>	T
sugar maple	<i>Acer saccharum</i>	T
black cherry	<i>Prunus serotina</i>	T
hickory	<i>Carya sp.</i>	T
American witch hazel	<i>Hamamelis virginiana</i>	H
poison ivy	<i>Toxicodendron radicans</i>	H
Pennsylvania sedge	<i>Carex pensylvanica</i>	H
jumpseed	<i>Persicaria virginiana</i>	H
burning bush	<i>Euonymus alatus</i>	S



Bank 20 Stations 154-1156; straight channel before right bend below Joseph Road residential area

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 20 Area, August 16, 2022



downstream left bank (left side) to right bank from Station 155



right bank at Station 155+50



Left bank at Station 156



Right bank at Station 156

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 21

Site Name and Evaluation Segment

Bank 21: Stations 157-161. 400-ft stretch around sharp right bend to run

Location/Physical Description

8/16/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 400'

Width: 80'

Bank Height: R 6-7' L 4'

Slope: R 90% L 30%

Sediment / Substrate composition:

% Sand 30

% Silt 30

% Clay

% Gravel/cobble 20

% Boulder/Bedrock 20

% Organic matter

Bank stability / Observed erosional conditions:

Left bank has high NBS, but is stable with rock. Right bank has undercuts but is well vegetated.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 2.5-3 ft Top of bank slope: 4-7' ft Floodplain surface: 4-7'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: $\frac{70}{\text{Bank Vegetation}}$ $\frac{50}{\text{Overhanging Vegetation}}$ $\frac{90}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{80}{\text{Trees (> 20')}}$	$\frac{50}{\text{Shrubs (< 20')}}$	$\frac{50}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{10}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	60 Bank Vegetation	50 Overhanging Vegetation	80 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50 Trees (> 20')	30 Shrubs (< 20')	20 Woody vines	0 Mosses	80 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

70 Trees (> 20')	60 Shrubs (< 20')	20 Woody vines	0 Mosses	40 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Hairy Wild Rye, Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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

: Common buckthorn, bittersweet, forget-me-not

- ☒ Evidence of other human disturbance; describe: outlet culvert

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:
Coarse woody debris, large trees, root wads, cobbles, boulders

- ☒ Other restoration opportunities:

R: Reshape point bar

L: Coir matting; Vegetated rip rap

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 21 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
silver maple <i>Acer saccharinum</i> tree	sugar maple <i>Acer saccharum</i> tree
nodding beggar-ticks <i>Bidens cernua</i> herb	yellow birch <i>Betula alleghaniensis</i> tree
ironwood <i>Carpinus caroliniana</i> tree	Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *
Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *	red-osier dogwood <i>Cornus sericea</i> shrub
red-osier dogwood <i>Cornus sericea</i> shrub	red-root flatsedge <i>Cyperus erythrorhizos</i> herb
water forget-me-not <i>Myosotis scorpioides</i> herb *	common buckthorn <i>Rhamnus cathartica</i> herb *
water-pepper smartweed <i>Persicaria hydropiper</i> herb	eastern hemlock <i>Tsuga canadensis</i> tree
American sycamore <i>Platanus occidentalis</i> tree	
eastern hemlock <i>Tsuga canadensis</i> tree	
river grape <i>Vitis riparia</i> vine/liana	

*Invasive species

Bank 21 Floodplain Plant Species

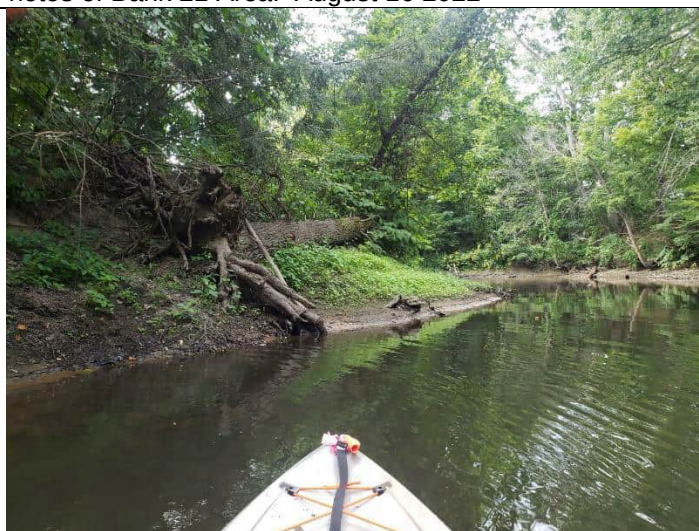
red maple	<i>Acer rubrum</i>	T
American linden	<i>Tilia americana</i>	T
sugar maple	<i>Acer saccharum</i>	T
black cherry	<i>Prunus serotina</i>	T
hickory	<i>Carya</i> sp.	T
American witch hazel	<i>Hamamelis virginiana</i>	H
poison ivy	<i>Toxicodendron radicans</i>	H
sensitive fern	<i>Onoclea sensibilis</i>	H
Pennsylvania sedge	<i>Carex pensylvanica</i>	H
jumpseed	<i>Persicaria virginiana</i>	H
burning bush	<i>Euonymus alatus</i>	S



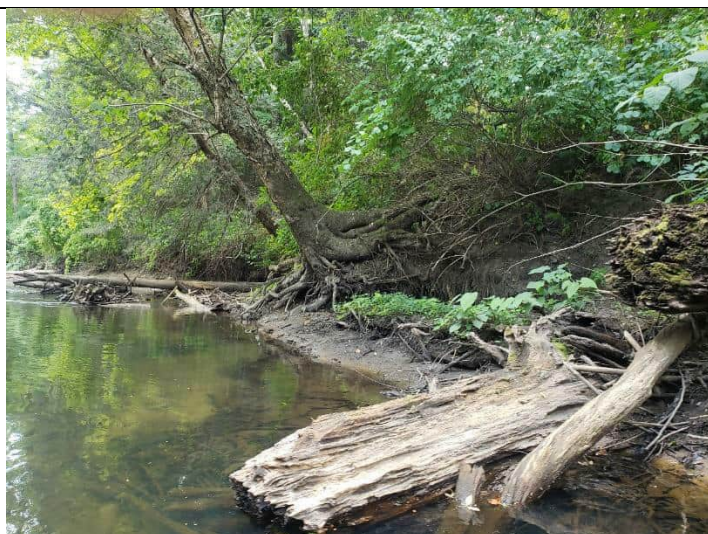
Bank 21: Stations 157-161. 400-ft stretch along sharp right bend to run from Station 157-161

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 21 Area. August 16 2022



Right bank (left side) to left bank at bend, looking upstream



Right bank near Station 158



Left bank near Station 159



Right bank near Station 159

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Right bank near Stations 159-160



Right bank near Station 160



Right bank (on left) to left bank near Station 160



Left bank near Station 160

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank at right bend, Stations 158-159

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 22

Site Name and Evaluation Segment

Bank 22: Stations 169-172. 300-ft run.

Location/Physical Description

8/16/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 80'

Bank Height: R 4' L 4'

Slope: R 40% L 40%

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable; no erosion, undercutting or cut banks. Both banks moderate BEHI and low NBS.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 2-3 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: $\frac{80}{\text{Bank Vegetation}}$ $\frac{30}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{10}{\text{Trees (> 20')}}$	$\frac{10}{\text{Shrubs (< 20')}}$	$\frac{10}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{80}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	80 Bank Vegetation	10 Overhanging Vegetation	70 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

0 Trees (> 20')	80 Shrubs (< 20')	10 Woody vines	0 Mosses	80 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

10 Trees (> 20')	80 Shrubs (< 20')	10 Woody vines	0 Mosses	80 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Hairy Wild Rye, Matted Spike Sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Spotted sandpiper	
Red-tailed hawk	
Green frog	
Raccoon tracks	
Deer	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Reed canary grass, Eurasian water-milfoil, forget-me-not
- ☒ Evidence of other human disturbance; describe: Disturbed by foot traffic for canoe launching

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:
Coarse woody debris

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting

L: Grade bank/Coir matting; Log or rock vanes

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 22 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
nodding beggar-ticks <i>Bidens cernua</i> herb	nodding beggar-ticks <i>Bidens cernua</i> herb
red-osier dogwood <i>Cornus sericea</i> shrub	umbrella sedge <i>Cyperus strigosus</i> herb
spotted Joe-Pye weed <i>Eupatorium maculatum</i> herb	eastern willow-herb <i>Epilobium coloratum</i> herb
sensitive fern <i>Onoclea sensibilis</i> herb	jewelweed <i>Impatiens capensis</i> herb
pale smartweed <i>Persicaria lapathifolia</i> herb	common water-purslane <i>Ludwigia palustris</i> herb
American bur-reed <i>Sparganium americanum</i> herb	Eurasian water-milfoil <i>Myriophyllum spicatum</i> herb *
river grape <i>Vitis riparia</i> vine/liana	water forget-me-not <i>Myosotis scorpioides</i> herb *
rough cocklebur <i>Xanthium strumarium</i> herb	water-pepper smartweed <i>Persicaria hydropiper</i> herb
	pale smartweed <i>Persicaria lapathifolia</i> herb
	arrow-leaved tearthumb <i>Persicaria sagittata</i> herb
	reed canary grass <i>Phalaris arundinacea</i> herb *
	American bur-reed <i>Sparganium americanum</i> herb
	blue vervain <i>Verbena hastata</i> herb
	American speedwell <i>Veronica americana</i> herb

*Invasive species

Bank 22 Floodplain Plant Species

red maple	<i>Acer rubrum</i>	T
silky dogwood	<i>Cornus amomum</i>	S
pussy willow	<i>Salix discolor</i>	S
white meadowsweet	<i>Spiraea alba</i>	S
currant	<i>Ribes</i> sp.	S
sensitive fern	<i>Onoclea sensibilis</i>	H
moneywort	<i>Lysimachia nummularia</i>	H
river grape	<i>Vitis riparia</i>	V



Bank 22: Stations 169-172. 300-ft straight stretch from Station 169-172

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 22 Area. August 16, 2022



Left bank (right side) to right bank from Station 172 looking upstream



Left bank



Right bank

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Housatonic ROR R5A Bank 23

Site Name and Evaluation Segment

Bank 23: Stations 172-175. 300-ft stretch around sharp right bend.

Location/Physical Description

8/16/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 80'

Bank Height: R 6-7' L 5'

Slope: R 80% L 90%

Sediment / Substrate composition:

% Sand 40

% Silt 40

% Clay

% Gravel/cobble 20

% Boulder Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Right bank is cut but stable. Left bank is steep with some undercutting, but rocky. Left bank has extreme NBS.
Thalweg runs along the 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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 5-7 ft Floodplain surface: 5-7 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 9 | ☒ Lower limits in perennial vegetation |
| ☒ Break in slope of banks (floodplain break) | |
| ☐ Other _____ | |

D. Inventory (Plant Community)

Right Bank

Total % Cover: $\frac{80}{\text{Bank Vegetation}}$ $\frac{60}{\text{Overhanging Vegetation}}$ $\frac{90}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{70}{\text{Trees (> 20')}}$	$\frac{70}{\text{Shrubs (< 20')}}$	$\frac{30}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{50}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	60 Bank Vegetation	70 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

70 Trees (> 20')	20 Shrubs (< 20')	0 Woody vines	0 Mosses	10 Herbaceous
---------------------	----------------------	------------------	-------------	------------------

Percent Cover of Riparian Vegetation by Strata

80 Trees (> 20')	60 Shrubs (< 20')	20 Woody vines	0 Mosses	60 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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Hairy Wild Rye, Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Kingfisher	
Veery	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, common buckthorn
- ☐ 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:
Coarse woody debris, large trees, root wads, cobble

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting

L: Log or rock vanes; Root wads; Vegetated riprap

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 23 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
sugar maple <i>Acer saccharum</i> tree	silver maple <i>Acer saccharinum</i> tree
Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *	Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *
eastern hemlock <i>Tsuga canadensis</i> tree	white ash <i>Fraxinus americana</i> tree
American elm <i>Ulmus americana</i> tree	ostrich fern <i>Matteuccia struthiopteris</i> herb
	common buckthorn <i>Rhamnus cathartica</i> herb *
	green-headed coneflower <i>Rudbeckia laciniata</i> herb
	American linden <i>Tilia americana</i> tree

*Invasive species

Bank 23 Floodplain Plant Species

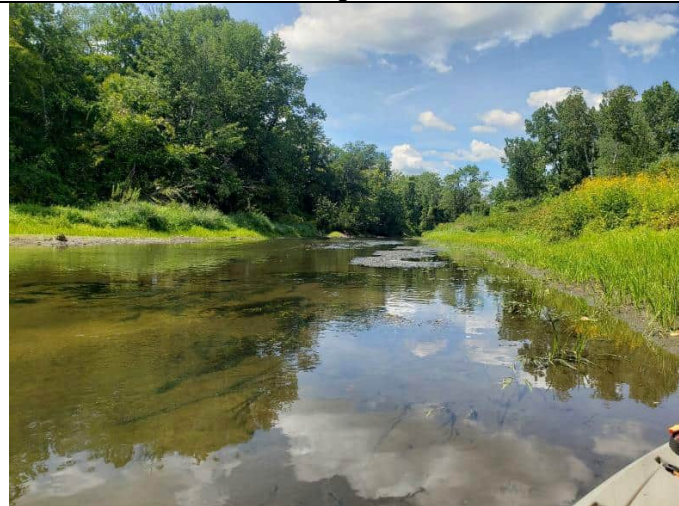
Solomon's seal	<i>Polygonatum</i> sp.	H
Japanese barberry	<i>Berberis thunbergii</i>	S
greater bladder sedge	<i>Carex intumescens</i>	H
ostrich fern	<i>Matteuccia struthiopteris</i>	H
meadow horsetail	<i>Equisetum pratense</i>	H
white ash	<i>Fraxinus americana</i>	T
American linden	<i>Tilia americana</i>	T
silver maple	<i>Acer saccharinum</i>	T
American hornbeam	<i>Carpinus caroliniana</i>	T
American hornbeam	<i>Carpinus caroliniana</i>	S
poison-ivy	<i>Toxicodendron radicans</i>	V
Virginia creeper	<i>Parthenocissus quinquefolia</i>	V



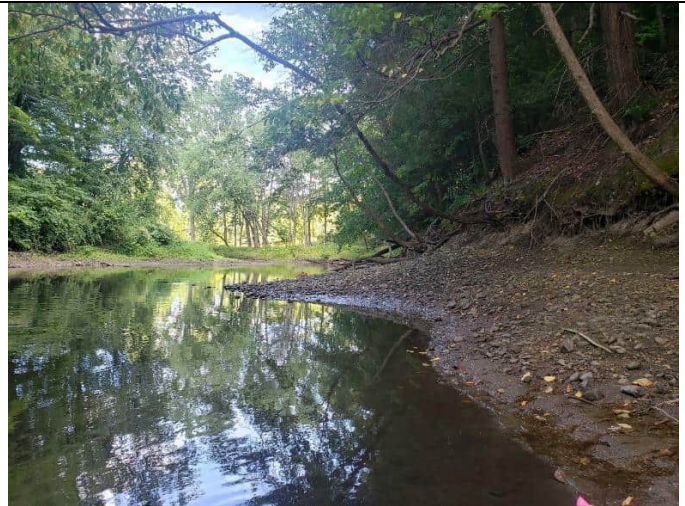
Bank 23: Stations 172-175. Right bend from Station 172 to 175.
Left bank at bend in river

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 23 Area. August 23, 2022



Looking upstream from Station 172 toward Bank 22. Left bank is to the right.



Left bank at bend in river 173-174



Right bank around Station 174



Right bank around Station 174



Right bank downstream of Station 174



Right bank around Station 174-175

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 24

Site Name and Evaluation Segment

Bank 24: Stations 182-185. 300-ft stretch around sharp right bend

Location/Physical Description

8/16/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 80'

Bank Height: R: 6' L: 6'

Slope: R 60% L 90%

Sediment / Substrate composition:

% Sand 30

% Silt 30

% Clay

% Gravel/cobble 30

% Boulder/Bedrock 10

% Organic matter

Bank stability / Observed erosional conditions:

Left bank is erosional cut bank. Left bank BEHI is high, and NBS is very high from Stations 182-183. Right bank is stable. Thalweg runs from left side to 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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 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: 70 60 100
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

40 50 30 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:	70 Bank Vegetation	80 Overhanging Vegetation	90 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

80 Trees (> 20')	40 Shrubs (< 20')	50 Woody vines	0 Mosses	10 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

70 Trees (> 20')	60 Shrubs (< 20')	30 Woody vines	0 Mosses	60 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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Hairy Wild Rye, Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, bishop's goutweed
- ☐ 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:
Coarse woody debris, large trees, root wads, cobbles and boulders

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting

L: Vegetated riprap; Log or rock vanes; Grade bank/Coir matting

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 24 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
bishop's goutweed <i>Aegopodium podagraria</i> herb *	boxelder <i>Acer negundo</i> tree
ironwood <i>Carpinus caroliniana</i> tree	silver maple <i>Acer saccharinum</i> tree
Asian bittersweet <i>Celastrus orbiculatus</i> vine/liana *	nodding beggar-ticks <i>Bidens cernua</i> herb
American linden <i>Tilia americana</i> tree	black walnut <i>Juglans nigra</i> tree
eastern hemlock <i>Tsuga canadensis</i> tree	lady's-thumb smartweed <i>Persicaria maculosa</i> herb
river grape <i>Vitis riparia</i> vine/liana	American sycamore <i>Platanus occidentalis</i> tree
	American elm <i>Ulmus americana</i> tree
	blue vervain <i>Verbena hastata</i> herb
	river grape <i>Vitis riparia</i> vine/liana
	rough cocklebur <i>Xanthium strumarium</i> herb

*Invasive species

Bank 24 Floodplain Plant Species

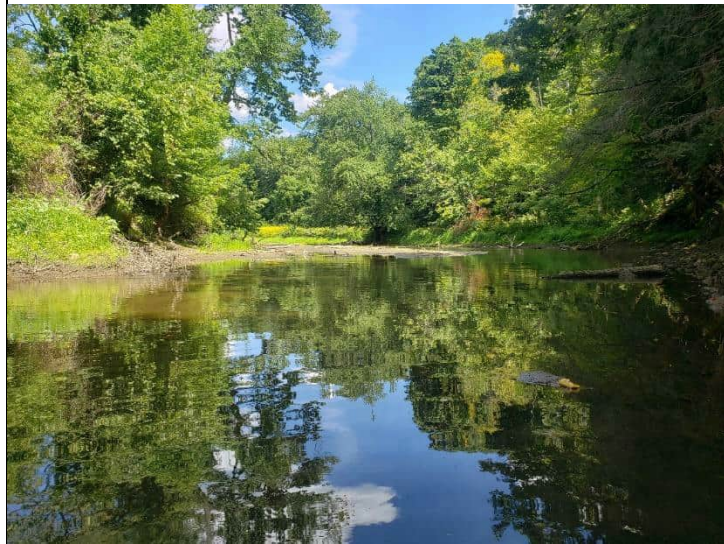
wrinkled-leaved goldenrod	<i>Solidago rugosa</i>	H
ostrich fern	<i>Matteuccia struthiopteris</i>	H
blue cohosh	<i>Caulophyllum thalictroides</i>	H
Morrow's honeysuckle	<i>Lonicera morrowii</i>	S
common buckthorn	<i>Rhamnus cathartica</i>	S
sugar maple	<i>Acer saccharum</i>	T
white ash	<i>Fraxinus americana</i>	T
black cherry	<i>Prunus serotina</i>	T
American linden	<i>Tilia americana</i>	T
Asian bittersweet	<i>Celastrus orbiculatus</i>	V
Japanese barberry	<i>Berberis thunbergii</i>	V



Bank 24: Stations 182-185. 300-ft along Right bend.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 24. August 16, 2022

			
Looking upstream at point/mid-channel bar around Station 176-177. Right bank is left.			
			
Looking upstream toward point/mid-channel bar at left bend in river at Station 177	Right bank near Station 182		

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank near Station 184, looking downstream



Left bank near Station 183, looking upstream



Looking downstream at left bank point bar at Stations 186-187

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 25

Site Name and Evaluation Segment

Bank 25: Stations 188-192. 400-ft stretch around moderate right bend

Location/Physical Description

8/16/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 400'

Width: 80'

Bank Height: R 8' L 7'

Slope: R 90% L 60%

Sediment / Substrate composition:

% Sand 40

% Silt 40

% Clay

% Gravel/cobble

% Boulder Bedrock 10

% Organic matter ~5

Bank stability / Observed erosional conditions:

Stable on both sides. BEHI ranges from moderate – high on both sides. Right bank NBS is extreme from Stations 188-189 and remainder is low - moderate on both banks. Thalweg runs from right to left side.

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: Right bank borders Pittsfield POTW

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 7-8 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: $\frac{80}{\text{Bank Vegetation}}$ $\frac{60}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{50}{\text{Trees (> 20')}}$	$\frac{60}{\text{Shrubs (< 20')}}$	$\frac{40}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{60}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	<u>75</u> Bank Vegetation	<u>50</u> Overhanging Vegetation	<u>90</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>50</u> Trees (> 20')	<u>70</u> Shrubs (< 20')	<u>40</u> Woody vines	<u>0</u> Mosses	<u>70</u> Herbaceous
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Percent Cover of Riparian Vegetation by Strata

<u>80</u> Trees (> 20')	<u>60</u> Shrubs (< 20')	<u>30</u> Woody vines	<u>0</u> Mosses	<u>50</u> Herbaceous
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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
H	Persicaria	S	Cornus sericea
H	Sparganium	T	Boxelder
V/L	River grape	T	Linden

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

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Hairy Wild Rye, Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Dragonflies	
Phoebe	
Great crested flycatcher	
Titmouse	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Minor amounts of purple loosestrife and Japanese knotweed; Asian bittersweet prevalent throughout (>25%),
reed canary grass, yellow iris
-
- ☒ Evidence of other human disturbance; describe: POTW abutment and related material
-

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:
Coarse woody debris, large trees, root wads, boulders

- ☒ Other restoration opportunities:

Remove POTW structures

R: Log or rock vanes; Grade bank/Coir matting; Vegetated riprap

L: Reshape point bar; Grade bank/Coir matting; Vegetated riprap

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 25 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
sugar maple Acer saccharum tree	nodding beggar-ticks Bidens cernua herb
Asian bittersweet Celastrus orbiculatus vine/liana *	black mustard Brassica nigra herb
red-osier dogwood Cornus sericea shrub	ironwood Carpinus caroliniana tree
yellow iris Iris pseudacorus herb *	Asian bittersweet Celastrus orbiculatus vine/liana *
purple loosestrife Lythrum salicaria herb *	wild cucumber Echinocystis lobata vine
ostrich fern Matteuccia struthiopteris herb	pale smartweed Persicaria lapathifolia herb
sensitive fern Onoclea sensibilis herb	reed canary grass Phalaris arundinacea herb *
pale smartweed Persicaria lapathifolia herb	Canada clearweed Pilea pumila herb
green-headed coneflower Rudbeckia laciniata herb	green-headed coneflower Rudbeckia laciniata herb
American bur-reed Sparganium americanum herb	American linden Tilia americana tree
blue vervain Verbena hastata herb	river grape Vitis riparia vine/liana
river grape Vitis riparia vine/liana	

*Invasive species

Bank 26 Floodplain Plant Species

Morrow's honeysuckle	Lonicera morrowii	S
common buckthorn	Rhamnus cathartica	S
wrinkled-leaved goldenrod	Solidago rugosa	H
ostrich fern	Matteuccia struthiopteris	H
dame's-rocket	Hesperis matronalis	H
Asian bittersweet	Celastrus orbiculatus	V
Virginia creeper	Parthenocissus quinquefolia	V
river grape	Vitis riparia	V



Bank 25: Stations 188-192. 400-ft stretch around moderate right bend

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 25 Area. August 16, 2022



Right bank at upper limit of Bank 25, by
WWTP fence near Station 189



Right bank, looking downstream. WWTP foundation near Station 189



Right bank near Station 190



Looking downstream through Bank 25 area below Station
190.

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



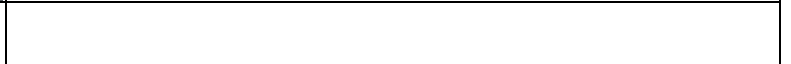
Right bank near Station 191.



Right bank near south limits of Bank 25 near Station 192.



Right bank near south limits of Bank 25 area near Station 192



General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



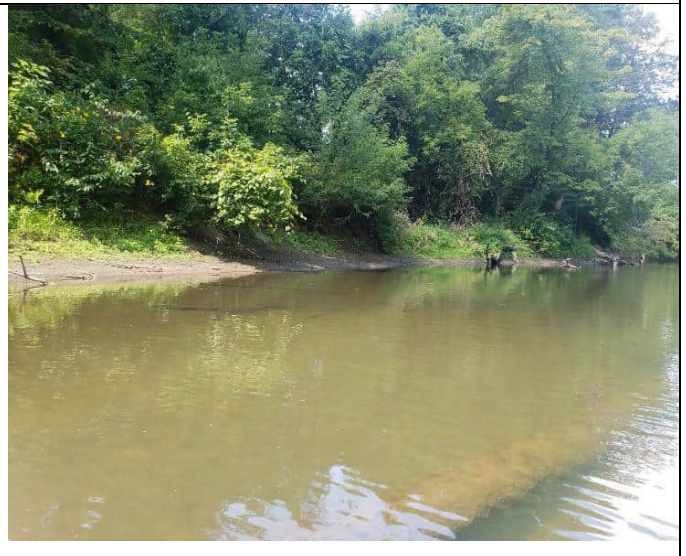
Left bank looking upstream. Overhanging Linden tree near Station 190



Left bank, looking downstream near Station 190



Left bank from right bank near Station 191



Left bank from right bank near Station 191



Left bank, looking downstream near Station 191.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 26

Site Name and Evaluation Segment

Bank 26: Stations 202-205. 300-ft stretch entering halfway around sharp right bend

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 80'

Bank Height: R 8' L 6'

Slope: R 90% L 90%

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks are steep but stable. Left bank borders steep upland hillside. BEHI mostly moderate on both sides. NBS is low on both sides. Thalweg moves from right to 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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 6-8 ft Floodplain surface: 6-8 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 50 90
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

50 40 0 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:	50 Bank Vegetation	80 Overhanging Vegetation	100 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

80 Trees (> 20')	10 Shrubs (< 20')	10 Woody vines	0 Mosses	10 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

70 Trees (> 20')	40 Shrubs (< 20')	10 Woody vines	0 Mosses	50 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Hairy Wild Rye, Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Great blue heron	
Red tail hawk	
Redstart	
Phoebe	
Painted turtle	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Japanese knotweed, bittersweet, common buckthorn, privet
- ☒ Evidence of other human disturbance; describe: Bricks and metal debris near toe of left bank

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:
Coarse woody debris, large trees, root wads, cobbles

- ☒ Other restoration opportunities:

R: Reshape point bar

L: Log and rock vanes

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 26 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
striped maple Acer pensylvanicum tree	silver maple Acer saccharinum tree
paper birch Betula papyrifera tree	nodding beggar-ticks Bidens cernua herb
ironwood Carpinus caroliniana tree	Japanese knotweed Fallopia japonica herb *
Asian bittersweet Celastrus orbiculatus vine/liana *	border privet Ligustrum obtusifolium shrub *
wood-reed grass Cinna arundinacea herb	pale smartweed Persicaria lapathifolia herb
burning bush Euonymus alatus shrub	common buckthorn Rhamnus cathartica herb *
ostrich fern Matteuccia struthiopteris herb	
Canada clearweed Pilea pumila herb	
eastern hemlock Tsuga canadensis tree	
American elm Ulmus americana tree	

*Invasive species

(A-82) Bank 26 Floodplain Plant Species

American beech	Fraxinus grandifolia	T
Basswood	Tilia cordata	T
Silver maple	Acer saccharinum	T
Boxelder maple	Acer negundo	S
American elm	Ulmus americana	S
Sensitive fern	Onoclea sensibilis	H
American aster	Symphyotrichum lateriflorum	H
Horsetail	Equisetum hyemale	H
Moneywort	Lysimachia nummularia	H
Sweet wood-reed	Cinna arundinacea	H
Lady fern	Athyrium angustum	H

(B-78)



Bank 26: Stations 202-205. 300-ft stretch entering halfway around sharp right bend.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

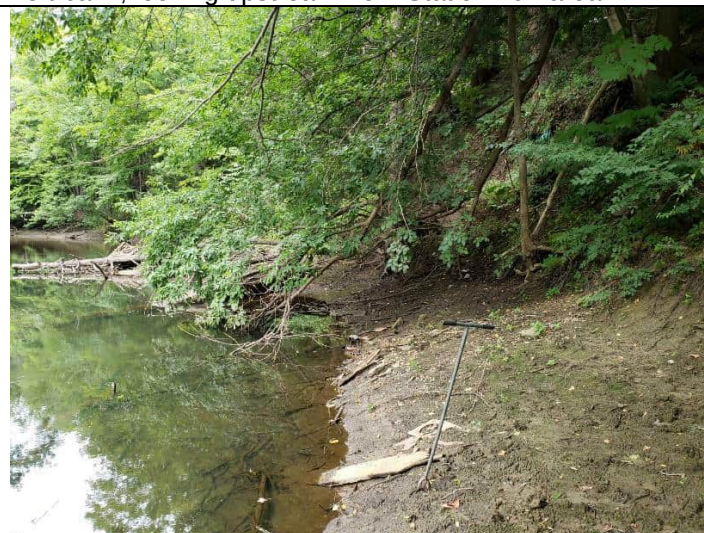
Photos of Bank 26 Area. August 10, 2022



Left bank, looking upstream from Station 204 area



Left bank (right side) to right bank (left side) Station 203



Left bank Station 203 area



Left bank (left) to right bank (right) looking downstream



Left bank hemlock roots near Station 204



Right bank view from left bank; Station 204 area

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 27

Site Name and Evaluation Segment

Bank 27: Stations 207-209. 200-ft stretch coming out of sharp right bend.

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 70'

Bank Height: R 6' L 7'

Slope%: R 60% L 100%

Sediment / Substrate composition:

% Sand 45

% Silt 50

% Clay

% Gravel/cobble 5

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Left bank undercut, eroding and slumping; Right bank stable. Extreme NBS on left bank at Stations 207-208.
Thalweg along left side.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: R 6 L 7 ft Floodplain surface: 6-7 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:

<u>75</u> Bank Vegetation	<u>60</u> Overhanging Vegetation	<u>90</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>10</u> Trees (> 20')	<u>20</u> Shrubs (< 20')	<u>10</u> Woody vines	<u>0</u> Mosses	<u>90</u> Herbaceous
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	90 Bank Vegetation	75 Overhanging Vegetation	80 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

90 Trees (> 20')	50 Shrubs (< 20')	70 Woody vines	0 Mosses	0 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

70 Trees (> 20')	60 Shrubs (< 20')	20 Woody vines	0 Mosses	60 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Creek chub	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet
- ☐ 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:
Coarse woody debris, large trees, root wads, cobbles

- ☒ Other restoration opportunities:

R: Reshape point bar

L: Log or rock vanes; Root wads; Vegetated riprap

Invasive species control

Revegetation

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Bank 27 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
ironwood Carpinus caroliniana tree	nodding beggar-ticks Bidens cernua herb
Asian bittersweet Celastrus orbiculatus vine/liana *	Asian bittersweet Celastrus orbiculatus vine/liana *
red-osier dogwood Cornus sericea shrub	common water-purslane Ludwigia palustris herb
Virgini-creeper Parthenocissus quinquefolia vine/liana	pale smartweed Persicaria lapathifolia herb
American elm Ulmus americana tree	eastern cottonwood Populus deltoides tree
river grape Vitis riparia vine/liana	American bur-reed Sparganium americanum herb
	American elm Ulmus americana tree
	blue vervain Verbena hastata herb
	river grape Vitis riparia vine/liana

*Invasive species

(A-66) Bank 27 Floodplain Plant Species

boxelder maple	Acer negundo	T
devil's beggar-tick	Bidens frondosa	H
clearweed	Pilea pumila	H
moneywort	Lysimachia nummularia	H
burr-cucumber	Sicyos sp.	H
marsh bedstraw	Galium palustre	H
smartweed	Persicaria hydropiper	H
jewelweed	Impatiens capensis	H

(B-78)



Bank 27: Stations 207-209. 200-ft stretch coming out of sharp right bend.

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

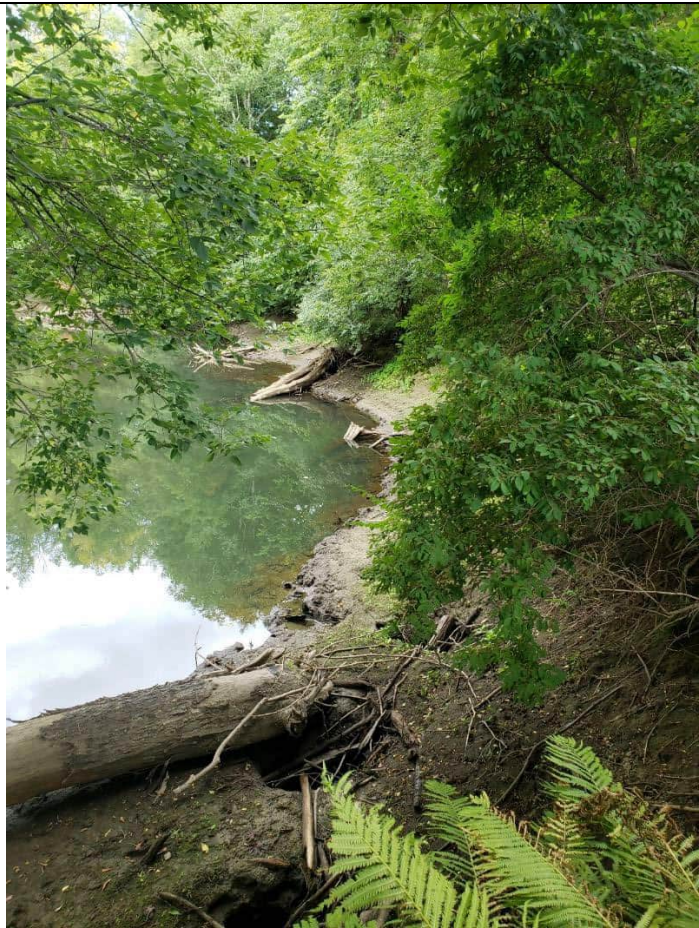
Photos of Bank 27 Area. August 10, 2022.



Left bank in bend at Station 207



Left bank at bend in river, showing slumping silty bank toe



Left bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank just below bend looking downstream



Left bank



Left bank looking downstream; dense dogwood with slumps at toe



Left bank undercutting



Left bank at Station 208



Left bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



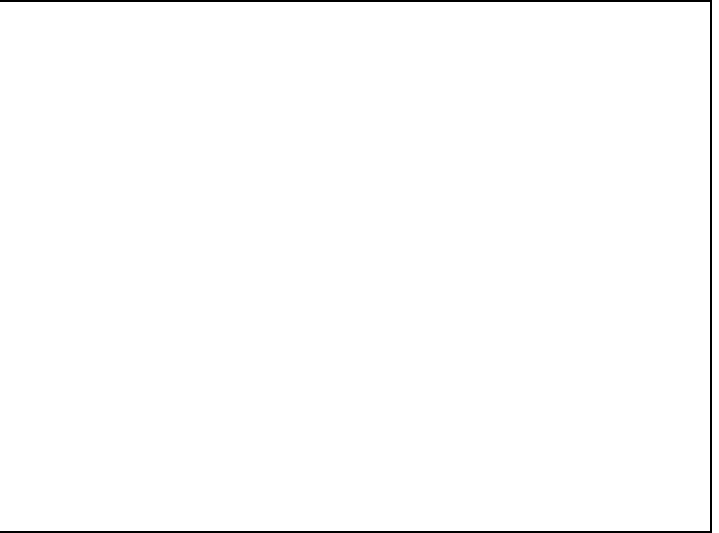
Right bank near 209



Right bank near 209



Right bank near 209



**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 28

Site Name and Evaluation Segment

Bank 28: Stations 214-217. 300-ft run entering left bend

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 300'

Width: 70'

Bank Height: R 7' L 6'

Slope%: R 90% L 40%

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Right bank is steep with some slumping. Left bank is gentle and stable. Thalweg runs along right side.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: 6-7ft Floodplain surface: 6-7 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: $\frac{80}{\text{Bank Vegetation}}$ $\frac{60}{\text{Overhanging Vegetation}}$ $\frac{100}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{60}{\text{Trees (> 20')}} \quad \frac{40}{\text{Shrubs (< 20')}} \quad \frac{20}{\text{Woody vines}} \quad \frac{0}{\text{Mosses}} \quad \frac{30}{\text{Herbaceous}}$

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	90 Bank Vegetation	70 Overhanging Vegetation	75 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

20 Trees (> 20')	60 Shrubs (< 20')	30 Woody vines	0 Mosses	70 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

50 Trees (> 20')	50 Shrubs (< 20')	25 Woody vines	0 Mosses	60 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet
- ☐ 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:
Coarse woody debris, large trees, root wads, cobbles

- ☒ Other restoration opportunities:

R: Bank spurs; Log or rock vanes; Grade bank/Coir matting

L: Grade bank/Coir matting; Reshape point bar; Bank spurs

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Bank 28 Plant Species List

<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
nodding beggar-ticks Bidens cernua herb	Asian bittersweet Celastrus orbiculatus vine/liana *
ironwood Carpinus caroliniana tree	common water-purslane Ludwigia palustris herb
Asian bittersweet Celastrus orbiculatus vine/liana *	pale smartweed Persicaria lapathifolia herb
red-osier dogwood Cornus sericea shrub	eastern cottonwood Populus deltoides tree
Virginia-creeper Parthenocissus quinquefolia vine/liana	American bur-reed Sparganium americanum herb
pale smartweed Persicaria lapathifolia herb	blue vervain Verbena hastata herb
common arrowhead Sagittaria latifolia herb	river grape Vitis riparia vine/liana
American elm Ulmus americana tree	
river grape Vitis riparia vine/liana	

*Invasive species

Bank 28 Floodplain Plant Species

boxelder	Acer negundo	T
devil's beggar-tick	Bidens frondosa	H
Canada clearweed	Pilea pumila	H
moneywort	Lysimachia nummularia	H
burr-cucumber	Sicyos sp.	H
marsh bedstraw	Galium palustre	H
water pepper smartweed	Persicaria hydropiper	H
jewelweed	Impatiens capensis	H

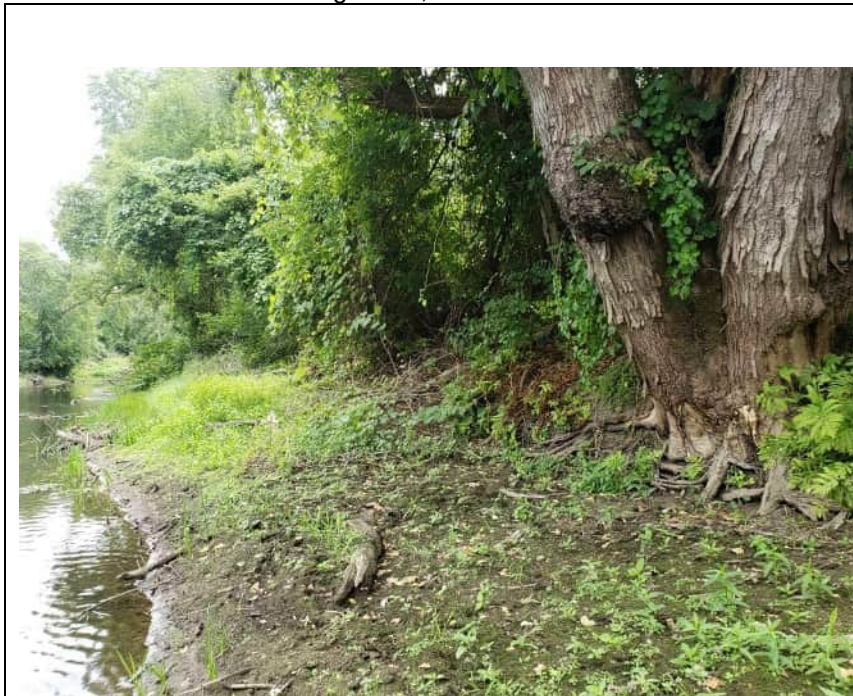
(B-79)



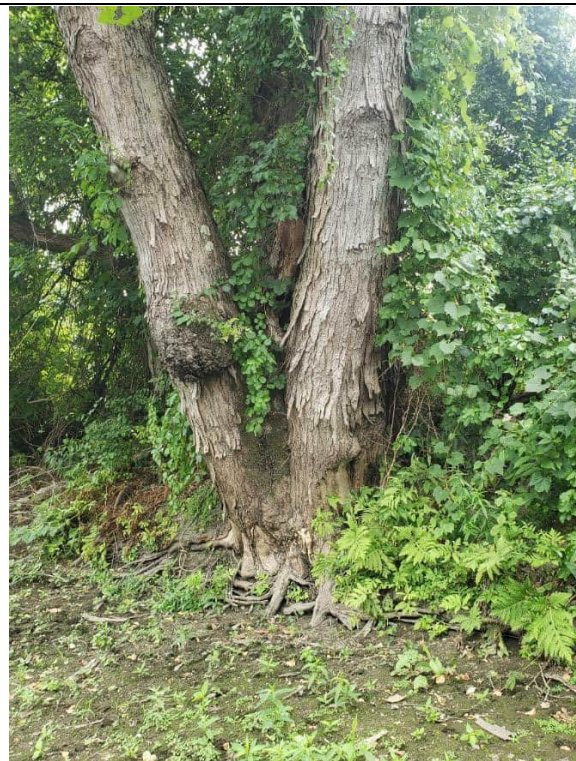
Bank 28: Stations 214-217. 300-ft run entering left bend.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

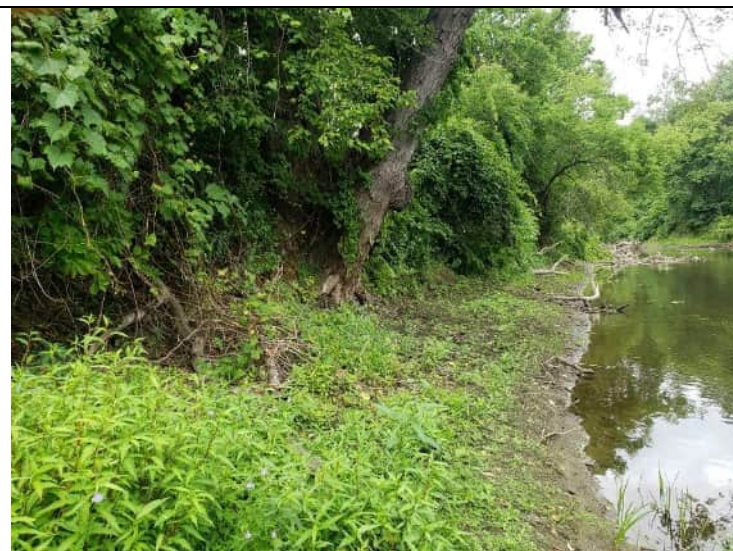
Photos of Bank 28 Area. August 10, 2022.



Left bank. Multi-stem silver maple at station 214



Left bank. Multi-stem silver maple at station 214



Left bank near Station 215 looking downstream

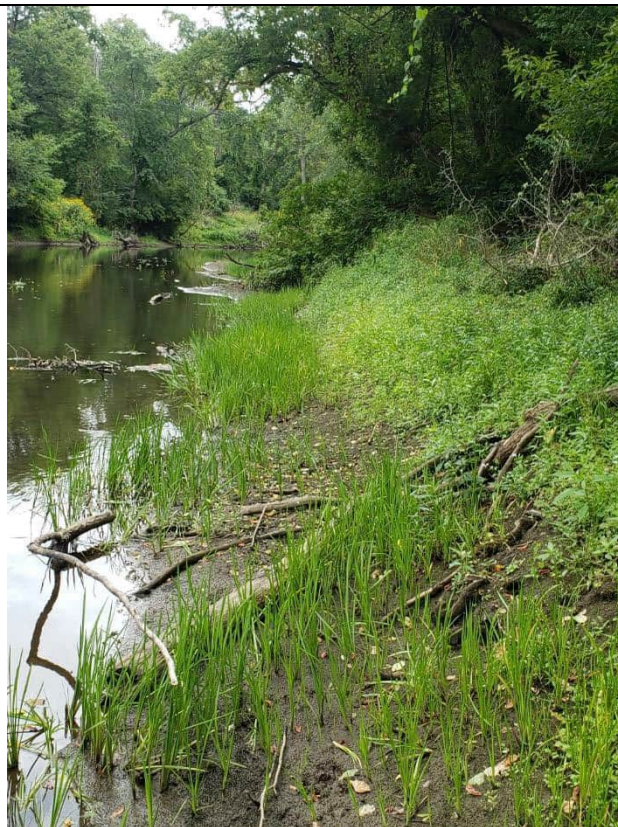


Left bank near Station 215 looking upstream

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank, looking upstream near Station214



Left bank, looking upstream. Sparganium at low water, bank full to right



Left bank



Sagittaria latifolia...Left bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank



Left bank



Creek chub nest, left bank



Left bank

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Right bank



Right bank



Right bank



Right bank

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 29

Site Name and Evaluation Segment

Bank 29: Stations 218-220. 200-ft stretch from halfway around left bend

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 70'

Bank Height: R 6'-7' L5'

Slope: R 70%

L 40%

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Right bank is stable but steep, high BEHI at 218-219 and moderate NBS at 218-219. Left bank is stable with point bar development. Thalweg along right side

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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: R 3ft L 2ft Top of bank slope: 5-7ft Floodplain surface: 5-7ft

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 60 100
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

30 70 20 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:	75 Bank Vegetation	50 Overhanging Vegetation	80 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

10 Trees (> 20')	0 Shrubs (< 20')	0 Woody vines	0 Mosses	90 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

70 Trees (> 20')	75 Shrubs (< 20')	25 Woody vines	0 Mosses	70 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
: Bittersweet, Japanese knotweed, purple loosestrife, common buckthorn
- ☐ 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:
Coarse woody debris, large trees, cobbles

- ☒ Other restoration opportunities:

R: Log or rock vanes; Root wads; Vegetated riprap

L: Reshape point bar

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 29 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
nodding beggar-ticks Bidens cernua herb	silver maple Acer saccharinum tree
black mustard Brassica nigra herb	nodding beggar-ticks Bidens cernua herb
wild cucumber Echinocystis lobata vine	Asian bittersweet Celastrus orbiculatus vine/liana *
Japanese knotweed Fallopia japonica herb *	pale smartweed Persicaria lapathifolia herb
purple loosestrife Lythrum salicaria herb *	common buckthorn Rhamnus cathartica herb *
pale smartweed Persicaria lapathifolia herb	river grape Vitis riparia vine/liana
jumpseed Persicaria virginiana herb	
American speedwell Veronica americana herb	
river grape Vitis riparia vine/liana	
rough cocklebur Xanthium strumarium herb	

*Invasive species

Bank 29 Floodplain Plant Species

Boxelder	Acer negundo	T
devil's beggar-tick	Bidens frondosa	H
Canada clearweed	Pilea pumila	H
moneywort	Lysimachia nummularia	H
burr-cucumber	Sicyos sp.	H
marsh bedstraw	Galium palustre	H
water-pepper smartweed	Persicaria hydropiper	H
jewelweed	Impatiens capensis	H



Bank 29: Stations 218-220. 200-ft stretch from halfway around left bend.

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form

Photos of Bank 29 Area. August 10, 2022.

		
Right bank		
		
Right bank		
		
Right bank		

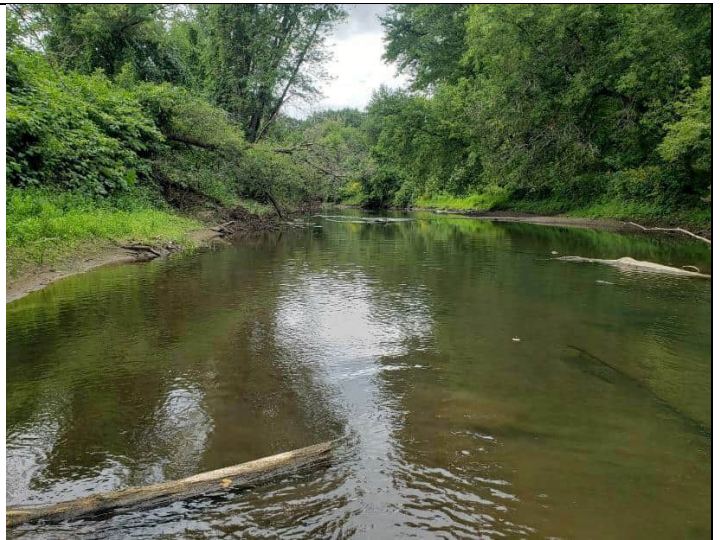
General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank, looking upstream



Left bank, looking downstream



Left bank, looking downstream



Left bank

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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Housatonic ROR R5A Bank 30

Site Name and Evaluation Segment

Bank 30: Stations 221-223. 200-ft stretch that enters left bend

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 80'

Bank Height: R 4'-6' L 6'

Slope%: R 40 L 70

Sediment / Substrate composition:

% Sand 40

% Silt 40

% Clay

% Gravel/cobble 20

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable. Low - moderate BEHI and low NBS on both banks. Thalweg towards right side.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: R 3 ft L 3 ft Top of bank slope: 4-6 ft Floodplain surface: 4-6 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:

<u>80</u> Bank Vegetation	<u>60</u> Overhanging Vegetation	<u>90</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>80</u> Trees (> 20')	<u>10</u> Shrubs (< 20')	<u>10</u> Woody vines	<u>0</u> Mosses	<u>80</u> Herbaceous
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	80 Bank Vegetation	60 Overhanging Vegetation	80 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

30 Trees (> 20')	30 Shrubs (< 20')	10 Woody vines	0 Mosses	60 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

40 Trees (> 20')	70 Shrubs (< 20')	30 Woody vines	0 Mosses	60 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Spotted sandpiper	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Bittersweet, yellow iris, Japanese knotweed
- ☐ 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:
Coarse woody debris, large trees, root wads, cobbles

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting; Log or rock vanes

L: Grade bank/Coir matting

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 30 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
silver maple Acer saccharinum tree	silver maple Acer saccharinum tree
nodding beggar-ticks Bidens cernua herb	nodding beggar-ticks Bidens cernua herb
Japanese knotweed Fallopia japonica herb *	Asian bittersweet Celastrus orbiculatus vine/liana *
common water-purslane Ludwigia palustris herb	umbrella sedge Cyperus strigosus herb
pale smartweed Persicaria lapathifolia herb	eastern willow-herb Epilobium coloratum herb
Canada clearweed Pilea pumila herb	yellow iris Iris pseudacorus herb *
	Virginia water-horehound Lycopus virginicus herb
	ostrich fern Matteuccia struthiopteris herb
	American wild mint Mentha canadensis herb
	Allegheny monkeyflower Mimulus ringens herb
	water-pepper smartweed Persicaria hydropiper herb
	pale smartweed Persicaria lapathifolia herb
	jumpseed Persicaria virginiana herb
	creeping yellow-cress Rorippa sylvestris herb
	American speedwell Veronica americana herb

*Invasive species

Bank 30 Floodplain Plant Species

boxelder	Acer negundo	T
devil's beggar-tick	Bidens frondosa	H
Canada clearweed	Pilea pumila	H
moneywort	Lysimachia nummularia	H
burr-cucumber	Sicyos sp.	H
marsh bedstraw	Galium palustre	H
water-pepper smartweed	Persicaria hydropiper	H
jewelweed	Impatiens capensis	H



Bank 30: Stations 221-223. 200-ft stretch that enters left bend.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 30 Area. August 10, 2022



Upstream end of reach. CWD in stream creating riffle.
Right bank in background. Station 221



Right bank just below Station 221.



Right bank, looking upstream near Station 221



Right bank, looking upstream from Station 222



Right bank, downstream end of reach. Station 223.

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Multi-stem silver maple on left bank at station 221



Left bank looking downstream from Station 221



Left bank near Station 222



Left bank near Station 222



Left bank, just above the bend (Station 223) looking upstream



Left bank (left) to right bank, looking downstream

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 31

Site Name and Evaluation Segment

Bank 31: Stations 223-224. 100' sharp bend to left.

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 100'

Width: 70'

Bank Height: R 8' L 5'

Slope%: R 100 L 50

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Right bank is steep but stable. Right bank BEHI is high and NBS is extreme. Left bank more gentle and stable. Left bank BEHI and NBS are low – moderate.

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 _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: R 3 ft L 3 ft Top of bank slope: 5-8 ft Floodplain surface: 5-8 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 80 90
Bank Vegetation Overhanging Vegetation Riparian Vegetation

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

20 70 20 0 40
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:	<u>80</u> Bank Vegetation	<u>30</u> Overhanging Vegetation	<u>80</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>20</u> Trees (> 20')	<u>40</u> Shrubs (< 20')	<u>20</u> Woody vines	<u>0</u> Mosses	<u>70</u> Herbaceous
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Percent Cover of Riparian Vegetation by Strata

<u>40</u> Trees (> 20')	<u>60</u> Shrubs (< 20')	<u>30</u> Woody vines	<u>0</u> Mosses	<u>70</u> 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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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, raccoon):

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Spotted sandpiper	
Canada geese	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Morrow's honeysuckle, Japanese knotweed, common buckthorn
- ☐ 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:
Coarse woody debris, large trees, cobbles

- ☒ Other restoration opportunities:

R: Log or rock vanes; Root wads; Vegetated riprap

L: Reshape point bar

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 31 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
northern water-plantain <i>Alisma triviale</i> herb	boxelder <i>Acer negundo</i> tree
nodding beggar-ticks <i>Bidens cernua</i> herb	Morrow's honeysuckle <i>Lonicera morrowii</i> shrub *
black mustard <i>Brassica nigra</i> herb	common buckthorn <i>Rhamnus cathartica</i> herb *
wild cucumber <i>Echinocystis lobata</i> vine	American elm <i>Ulmus americana</i> tree
Japanese knotweed <i>Fallopia japonica</i> herb *	
yellow-seeded false pimpernel <i>Lindernia dubia</i> herb	
common water-purslane <i>Ludwigia palustris</i> herb	
water-pepper smartweed <i>Persicaria hydropiper</i> herb	
Pale smartweed <i>Persicaria lapathifolia</i> herb	
eastern cottonwood <i>Populus deltoides</i> tree	
blue vervain <i>Verbena hastata</i> herb	

*Invasive species

Bank 31 Floodplain Plant Species

red maple	<i>Acer rubrum</i>	T
silver maple	<i>Acer saccharinum</i>	T
American linden	<i>Tilia americana</i>	T
boxelder	<i>Acer negundo</i>	T
devil's beggar-tick	<i>Bidens frondosa</i>	H
Pennsylvania smartweed	<i>Persicaria pensylvanica</i>	H
moneywort	<i>Lysimachia nummularia</i>	H
Canada clearweed	<i>Pilea pumila</i>	H
water-starwort	<i>Callitriche palustris</i>	H



Bank 31: Stations 223-224. 100-ft sharp bend to left.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 31 Area. August 10, 2022



Left bank (left) to right bank (right) Station 223



Right bank from Station 223



Right bank below Station 223



Left bank at left bend below Station 223



Left bank near Station 224

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 32

Site Name and Evaluation Segment

Bank 32: Stations 225-227. 200-ft mild right bend

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 200'

Width: 90'

Bank Height: R 6'-7' L 4'

Slope%: R 30 L 90

Sediment / Substrate composition:

% Sand 45

% Silt 45

% Clay

% Gravel/cobble 10

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Right bank is steep but only minor erosion. Right bank NBS drops from extreme - low. Left bank more gradual and stable with low – moderate NBS and BEHI. Thalweg moves from right side to 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 _____

Notes:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: R 3 ft L 2 ft Top of bank slope: R 6-7ft L 4ft Floodplain surface: 4-7ft

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:

<u>50</u> Bank Vegetation	<u>30</u> Overhanging Vegetation	<u>80</u> Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>30</u> Trees (> 20')	<u>70</u> Shrubs (< 20')	<u>70</u> Woody vines	<u>0</u> Mosses	<u>10</u> Herbaceous
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	60 Bank Vegetation	80 Overhanging Vegetation	60 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

40 Trees (> 20')	60 Shrubs (< 20')	30 Woody vines	0 Mosses	60 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

40 Trees (> 20')	60 Shrubs (< 20')	20 Woody vines	0 Mosses	60 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Deer tracks	
Raccoon tracks	
Goldfinch	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Common buckthorn, Morrow's honeysuckle, bittersweet, Japanese knotweed, 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:
Coarse woody debris, large trees, root wads, cobbles

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting

L: Grade bank/Coir matting

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 32 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
boxelder Acer negundo tree	boxelder Acer negundo tree
black mustard Brassica nigra herb	nodding beggar-ticks Bidens cernua herb
wild cucumber Echinocystis lobata vine	Asian bittersweet Celastrus orbiculatus vine/liana *
Japanese knotweed Fallopia japonica herb *	Morrow's honeysuckle Lonicera morrowii shrub *
common water-purslane Ludwigia palustris herb	pale smartweed Persicaria lapathifolia herb
purple loosestrife Lythrum salicaria herb *	common buckthorn Rhamnus cathartica herb *
Allegheny monkeyflower Mimulus ringens herb	river grape Vitis riparia vine/liana
pale smartweed Persicaria lapathifolia herb	
eastern cottonwood Populus deltoides tree	
blue vervain Verbena hastata herb	

*Invasive species

Bank 32 Floodplain Plant Species

red maple	Acer rubrum	T
silver maple	Acer saccharinum	T
American linden	Tilia americana	T
boxelder	Acer negundo	T
devil's beggar-tick	Bidens frondosa	H
Pennsylvania smartweed	Persicaria pensylvanica	H
moneywort	Lysimachia nummularia	H
Canada clearweed	Pilea pumila	H
water-starwort	Callitriche palustris	H



Bank 32 Stations 225-227. 200-ft mild right bend.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 32 Area. August 10, 2022



Right bank near Station 226



Right bank above Station 226



Right bank (left) to left bank (right) looking upstream



Left bank from Station 225 area



Left bank from Station 225 area

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Housatonic ROR R5A Bank 33

Site Name and Evaluation Segment

Bank 33: Stations 232-236. 400-ft stretch with last 200' entering and following halfway around sharp left bend.

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length: 400'

Width: 80'

Bank Height: R:6 ft L:7 ft

Slope: R 30% L 90%

Sediment / Substrate composition:

% Sand 40

% Silt 40

% Clay

% Gravel/cobble 20

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Right bank is stable, with low BEHI except high between 235-236. Right bank NBS is low except extreme between 235-236. Left bank is an eroding sandy bank with slumping silt at base. Left bank BEHI is very high and NBS is low.

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:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: R 4 ft L 3 ft Top of bank slope: 6-7 ft Floodplain surface: 6-7 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: $\frac{90}{\text{Bank Vegetation}}$ $\frac{25}{\text{Overhanging Vegetation}}$ $\frac{90}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{20}{\text{Trees (> 20')}}$	$\frac{50}{\text{Shrubs (< 20')}}$	$\frac{30}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{70}{\text{Herbaceous}}$
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**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	60 Bank Vegetation	20 Overhanging Vegetation	90 Riparian Vegetation
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Percent Cover of Bank and Overhanging Stream Vegetation by Strata

10 Trees (> 20')	30 Shrubs (< 20')	20 Woody vines	0 Mosses	60 Herbaceous
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Percent Cover of Riparian Vegetation by Strata

50 Trees (> 20')	50 Shrubs (< 20')	30 Woody vines	0 Mosses	80 Herbaceous
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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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

Matted Spike-sedge, Mustard White, Spine-crowned Clubtail, Wapato, Wood Turtle

Rare species direct observations during current field surveys:

VI. Incidental Direct Wildlife Observations

Painted turtle	
Bull frog	
Green frog	
Song sparrow	
Robin	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Catbird	
Veery	
Bank swallow nesting cavities	

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:
Bittersweet, Morrow's honeysuckle, yellow iris, garlic mustard, Japanese knotweed, 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:
Coarse woody debris, large trees, root wads, cobbles

- ☒ Other restoration opportunities:

R: Log or rock vanes; Grade bank/Coir matting

L: Log or rock vanes; Compartmentalized fill

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 33 Plant Species List</u>	
<u>Left</u>	<u>Right</u>
garlic-mustard Alliaria petiolata herb *	silver maple Acer saccharinum tree
swamp milkweed Asclepias incarnata herb	nodding beggar-ticks Bidens cernua herb
nodding beggar-ticks Bidens cernua herb	lurid sedge Carex lurida herb
black mustard Brassica nigra herb	Asian bittersweet Celastrus orbiculatus vine/liana *
wild cucumber Echinocystis lobata vine	Japanese knotweed Fallopia japonica herb *
eastern willow-herb Epilobium coloratum herb	yellow iris Iris pseudacorus herb *
field horsetail Equisetum arvense herb	Morrow's honeysuckle Lonicera morrowii shrub *
climbing bindweed Fallopia scandens vine	ostrich fern Matteuccia struthiopteris herb
yellow-seeded false pimpernel Lindernia dubia herb	pale smartweed Persicaria lapathifolia herb
ostrich fern Matteuccia struthiopteris herb	green-headed coneflower Rudbeckia laciniata herb
water forget-me-not Myosotis scorpioides herb *	blue vervain Verbena hastata herb
common evening primrose Oenothera biennis herb	Boxelder Acer negundo tree
ditch-stonecrop Penthorum sedoides herb	
red raspberry Rubus idaeus shrub	
common soapwort Saponaria officinalis herb	
common mullein Verbascum thapsus herb	
blue vervain Verbena hastata herb	
rough cocklebur Xanthium strumarium herb	

*Invasive species

Bank 33 Floodplain Plant Species

reed canary grass	Phalaris arundinacea	H
green-headed coneflower	Rudbeckia laciniata	H
stinging nettle	Urtica dioica	H
hemp dogbane (Indina hemp)	Apocynum cannabinum	H
bedstraw	Galium aparine	H
purple-stemmed aster	Symphyotrichum puniceum	H
common dandelion	Taraxacum officinale	H
boxelder	Acer negundo	T
silky dogwood	Cornus amomum	S
Canada goldenrod	Solidago canadensis	H
river grape	Vitis riparia	V



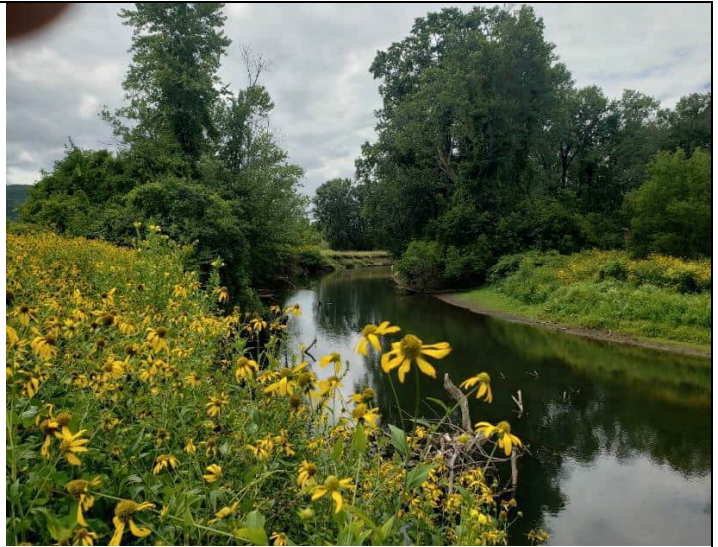
Bank 33 Stations 232-236. 400-ft stretch with last 200' entering and following halfway around sharp left bend.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Photos of Bank 33 Area. August 10, 2022



Left bank (right side) to right bank (left side) looking upstream from Station 232



Left bank to right bank looking downstream from Station 232



Right bank---Knotweed upstream of Station 232



Right bank (left) to left bank (right). Looking upstream from Station 233



Left bank (left) to right bank looking downstream from Station 233



Left bank (left) to right bank looking downstream from Station 233

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank near Station 233; bank swallow cavities



Left bank near Station 233; bank swallow cavities



Left bank near Station 233; bank swallow cavities

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Left bank looking upstream around Station 234



Left bank looking upstream from Station 234



Left bank near Station 234

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



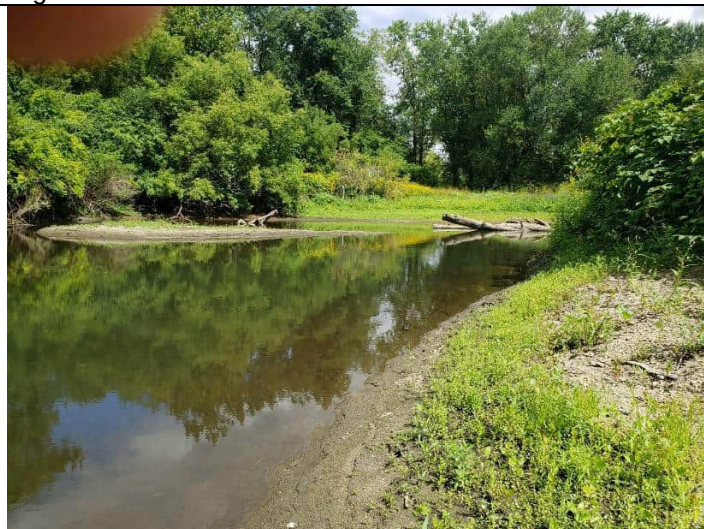
Right bank between Station 235 (left side) to Station 234



Right bank near Station 235



Right bank near Station 236



Right bank (left) to Left bank (right) Station 235 from Station 236



Left bank to right bank. Looking downstream from Station 236

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Housatonic ROR R5A Bank 34

Site Name and Evaluation Segment

Bank 34: Stations 243-247. 400-ft stretch around right to left bend. POTW discharge along right bank.

Location/Physical Description

8/10/22

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

AECOM

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Bank Characterization

Physical Dimensions (ft):

Length 400'

Width 80'

Bank Height R 6-7' L 7-8'

Slope: R 60% L 90-100%

Sediment / Substrate composition:

% Sand 50

% Silt 50

% Clay

% Gravel/cobble

% Boulder/Bedrock

% Organic matter

Bank stability / Observed erosional conditions:

Both banks relatively stable. High BEHI and low NBS on both banks. Thalweg in 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 _____

Notes:

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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: R 3ft L ft Top of bank slope: 4ft Floodplain surface: 4ft

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: $\frac{70}{\text{Bank Vegetation}}$ $\frac{60}{\text{Overhanging Vegetation}}$ $\frac{90}{\text{Riparian Vegetation}}$

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

$\frac{40}{\text{Trees (> 20')}}$	$\frac{70}{\text{Shrubs (< 20')}}$	$\frac{30}{\text{Woody vines}}$	$\frac{0}{\text{Mosses}}$	$\frac{70}{\text{Herbaceous}}$
-----------------------------------	------------------------------------	---------------------------------	---------------------------	--------------------------------

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Left Bank

Total % Cover:	<u>80</u> Bank Vegetation	<u>30</u> Overhanging Vegetation	<u>90</u> Riparian Vegetation
----------------	------------------------------	-------------------------------------	----------------------------------

Percent Cover of Bank and Overhanging Stream Vegetation by Strata

<u>20</u> Trees (> 20')	<u>50</u> Shrubs (< 20')	<u>30</u> Woody vines	<u>0</u> Mosses	<u>70</u> Herbaceous
----------------------------	-----------------------------	--------------------------	--------------------	-------------------------

Percent Cover of Riparian Vegetation by Strata

<u>30</u> Trees (> 20')	<u>50</u> Shrubs (< 20')	<u>30</u> Woody vines	<u>0</u> Mosses	<u>60</u> 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: See attached tables for plant species lists.

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants

☐ 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)

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

☐ 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

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

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

Spotted sandpiper	

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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:
Japanese knotweed, bishop's goutweed
- ☒ Evidence of other human disturbance; describe: Discharge from POTW

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:
Coarse woody debris, large trees, root wads

- ☒ Other restoration opportunities:

R: Grade bank/Coir matting; Log or rock vanes; Vegetated riprap

L: Grade bank/Coir matting; Root wads

Invasive species control

Revegetation

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

<u>Bank 34 Plant Species List</u>	
<u>Left bank</u>	<u>Right bank</u>
silver maple Acer saccharinum tree	American linden Tilia americana tree
bishop's goutweed Aegopodium podagraria herb *	American elm Ulmus americana tree
Japanese knotweed Fallopia japonica herb *	Japanese knotweed Fallopia japonica herb *
nodding beggar-ticks Bidens cernua herb	Boxelder Acer negundo tree
pale smartweed Persicaria lapathifolia herb	
blue vervain Verbena hastata herb	

*Invasive species

Bank 34 Floodplain Plant Species

boxelder	Acer negundo	T
silky dogwood	Cornus amomum	S
Canada goldenrod	Solidago canadensis	H
bedstraw	Galium aparine	H
river grape	Vitis riparia	V

(B-76)



Bank 34: Station 243-247. 400-ft stretch around right to left bend. POTW discharge along right bank.

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

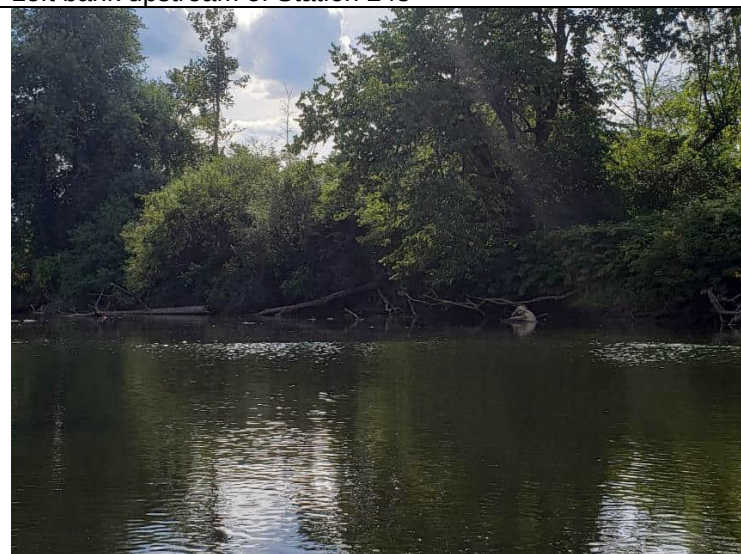
Photos of Bank 34 Area. August 16, 2022.



Left bank upstream of Station 243



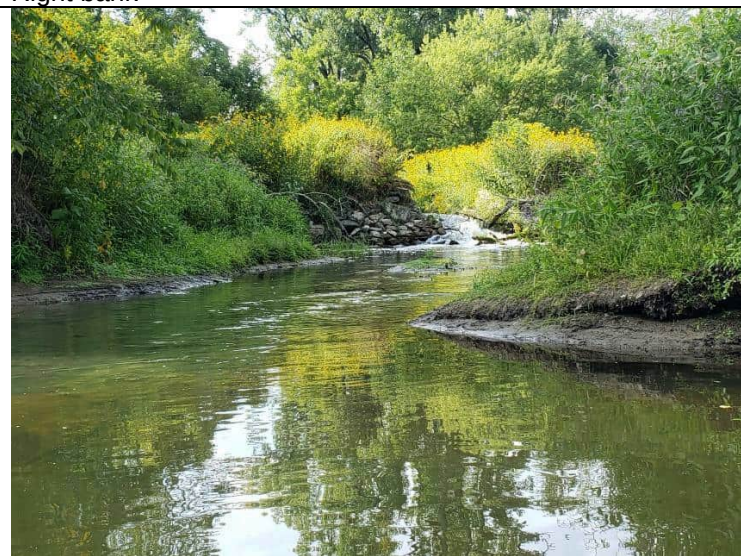
Right bank just above Station 245



Right bank



Right bank near Station 245



Right bank near Station 244; POTW discharge to rear

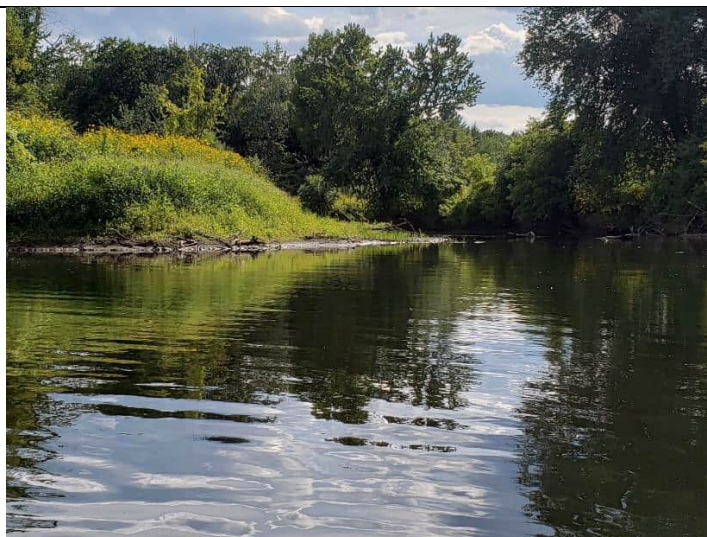


Right bank near Station 244

General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form



Right bank near Station 245



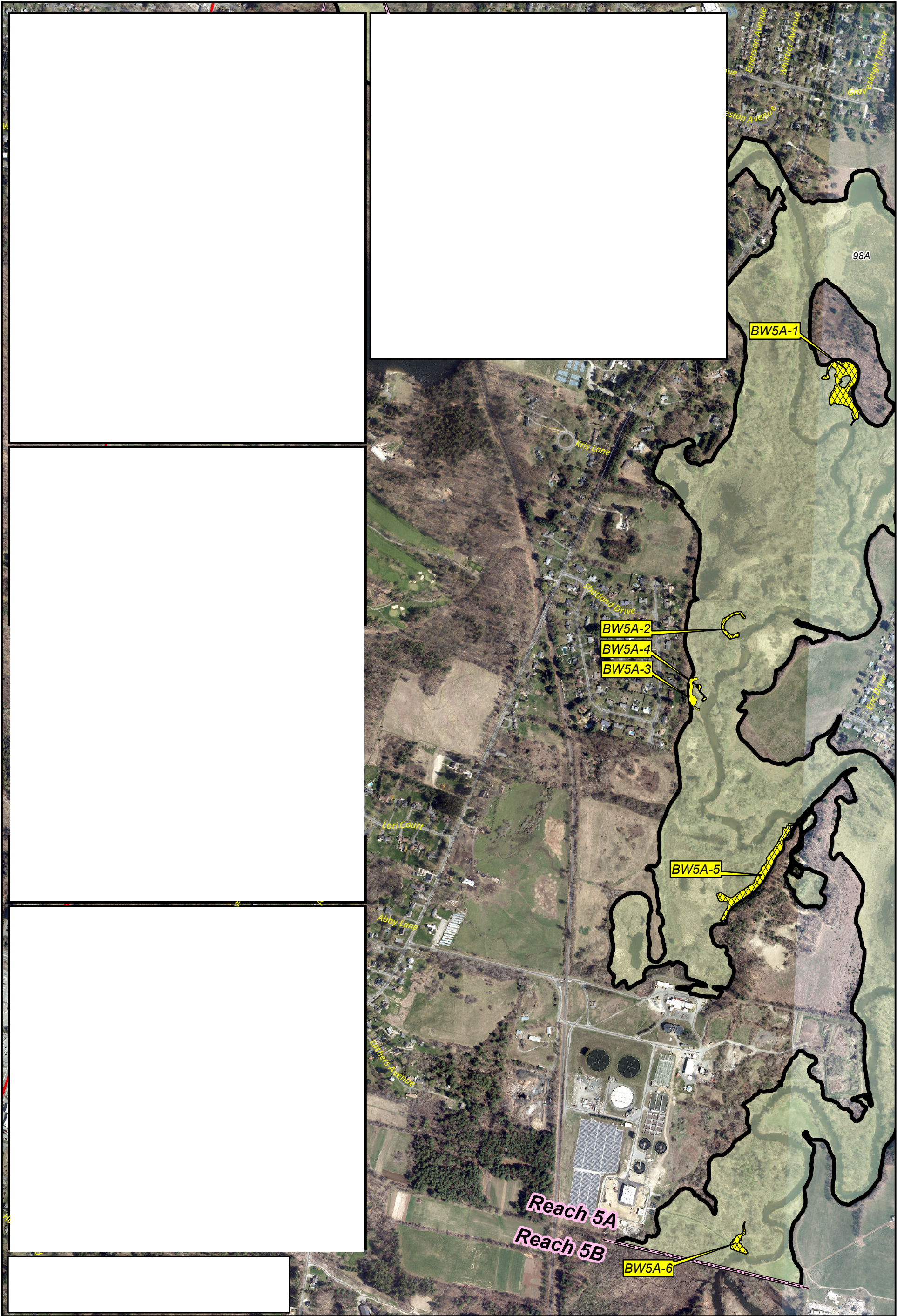
Left bank looking downstream from Station 243



Looking upstream from Station 245; left bank is to the right

Appendix C

Backwater Habitat Inventory Forms



Natural Communities (2023)		
Open Water	Wet meadow	Cultural grasslands
Stream	Shrub swamp	Agricultural Field
Deep emergent marsh	Red maple swamp	Successional Northern Hardwoods
Shallow emergent marsh	Transitional floodplain forest	Northern hardwoods-hemlock-white pine forest
	High-terrace floodplain forest	Red oak-sugar maple transition forest
		Backwaters



Reach 5A Backwaters and Natural Communities Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:9,600	7/31/2023	60670015

Figure C-1

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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: At the time of the initial survey the majority of area with no surface water. Northern end has standing water. Connected to river by a swale that extends northeast off the main channel of the river. This swale is 3' wide at the bottom elevation. Secondary outlet to Sackett Brook to the southeast.

Water level fluctuation: _____

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) | ☒ Changes 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 _____ | |

D. Inventory of Aquatic Plant Community

% Cover:	0	1-5	51-75	26-50
	Overall Aquatic Vegetation	Floating -Leaved Cover	Emergent Cover	Trees

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
RV	Yellow pond-lily (<i>Nuphar variegata</i>)	S	Silky dogwood (<i>Cornus amomum</i>)
RV	Pickrelweed (<i>Pontederia cordata</i>)	H	Sensitive fern (<i>Onoclea sensibilis</i>)
RV	Water-chestnut (<i>Trapa natans</i>)	T	Silver maple (<i>Acer saccharinum</i>)
H	Rice cut grass (<i>Leersia oryzoides</i>)	H	American bur-reed (<i>Sparganium americana</i>)
H	Nodding bur marigold (<i>Bidens cernua</i>)	H	Arrowhead tearthumb (<i>Persicaria sagittata</i>)
H	Woolgrass (<i>Scirpus cyperinus</i>)	H	Water horehound (<i>Lycopus uniflorus</i>)

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

H	Canadian wood nettle (<i>Laportea canadensis</i>)	H	False nettle (<i>Boehmeria cylindrica</i>)
H	Dotted smartweed (<i>Persicaria punctata</i>)	H	Moneywort (<i>Lysimachia nummularia</i>)
H	Marsh bedstraw (<i>Galium palustre</i>)		

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)

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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): Muskrat

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)

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

- ☐ 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

Blue jay	
Yellow warbler	
American goldfinch	
Pickerel frog	
Green frog	

VII. Habitat Degradation (identify specific location within backwater if applicable)

- ☐ Evidence of significant levels of dumping
- ☐ Evidence of significant erosion or sedimentation problems

General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory

☒ 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: Water chestnut patch 30'x30'

☐ 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: eradicate water chestnut

☐ Other restoration opportunities: _____

Notes:

IX. General Water Chemistry

Date: 5/9/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.236427 42.425612 WGS84, northeast portion

pH 7.63
Temperature 20.7°C
SpC Conductivity 458.3
Dissolved Oxygen 105%, 9.44 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 3 mg/L

Location 2 (describe): -73.236846 42.425428 WGS84, northwest portion

pH 7.5
Temperature 20.3°C
SpC Conductivity 477.0
Dissolved Oxygen 89.4%, 7.93 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Location 3 (describe): -73.236332 42.424562 WGS84, southern portion

pH 7.51
Temperature 19.1°C
Sp Conductivity 487.8

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

Dissolved Oxygen 87.0%, 7.88 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Date: 6/6/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.236427 42.425612 WGS84, northeast portion

pH 7.53
Temperature 17.9°C
Sp Conductivity 514
Dissolved Oxygen 129.7%, 12.27 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Location 2 (describe): -73.236846 42.425428 WGS84, northwest portion

pH 7.71
Temperature 18.0°C
Sp Conductivity 504
Dissolved Oxygen 137%, 12.94 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 0.7 mg/L

Location 3 (describe): -73.236332 42.424562 WGS84, southern portion

pH 7.81
Temperature 18.8°C
Sp Conductivity 513
Dissolved Oxygen 145.9%, 13.55 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Date: 6/14/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.236427 42.425612 WGS84, northeast portion

pH 7.64
Temperature 15.4°C
Sp Conductivity 618
Dissolved Oxygen 99.4%, 9.85 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 0.6 mg/L

Location 2 (describe): -73.236846 42.425428 WGS84, northwest portion

pH 7.72
Temperature 15.7°C
Sp Conductivity 518
Dissolved Oxygen 106.4%, 10.55 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1.2 mg/L

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

Location 3 (describe): -73.236332 42.424562 WGS84, southern portion

pH 7.91

Temperature 15.5°C

Sp Conductivity 522

Dissolved Oxygen 120.6%, 11.98 mg/L

Chlorophyll-a (or other measure of photosynthetic organisms) 2.0 mg/L

5A BW-1 Representative Photographs

Flooded conditions with aquatic floating leaved plants

Northern end (left) and southern end (right) of BW-1 during period of low water in 2022



Central portion of BW-1 during period of low water dominated by reed-canary grass in 2022



Southern end of BW-1 flooded in 2023



General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory

I. General Information

5A-BW-2

Site Name and Backwater Number

620 linear feet east Shetland Dr. and Palomino Dr. intersection (-73.2404 42.4192 WGS84)

Location/Physical Description

8/18/2022

Date(s) of Site Visit(s) and Data Collection

Sunny, 70°F

Weather Conditions During Site Visit

O'Sullivan/Stearns

Field Staff Performing Evaluation

7/18/2023

Date this form was completed

II. Site Description

A. Backwater Characterization

Physical Dimensions (ft): Length 460' Width 26-44' Depth _____ Area 0.38 acres

Sediment / Substrate composition: % Sand _____ % Silt 10 %Organic 90 Other _____

Bank stability / Observed erosional conditions: Bank appeared stable, large areas are colonized by

Japanese knotweed (*Fallopia japonica*)

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:

Only one small area of shallow surface water was present (approx. 60' x 20'), depth to 6" observed during the 8/18/2022 survey.

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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: One outlet to river with small channel
In middle approx. 1' wide with variable bank height up to 12-14".

Water level fluctuation: _____

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) | ☒ Changes 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 _____ | |

D. Inventory of Aquatic Plant Community

% Cover:	0-5	0	51-75	0
	Overall Aquatic Vegetation	Floating -Leaved Cover	Emergent Cover	Trees

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
H	<u><i>Onoclea sensibilis</i></u>	H	<u><i>Bidens cernua</i></u>
H	<u><i>Lysimachia nummularia</i></u>	H	<u><i>Ludwiga palustris</i></u>
H	<u><i>Galium palustre</i></u>	H	<u><i>Iris pseudacorus</i></u>
H	<u><i>Boehmeria cylindrica</i></u>	H	<u><i>Rudbeckia laciniata</i></u>
H	<u><i>Asclepias incarnata</i></u>	H	<u><i>Bidens frondosa</i></u>
H	<u><i>Persicaria sagittata</i></u>	H	<u><i>Veronica catenata</i></u>
H	<u><i>Sagittaria latifolia</i></u>	H	<u><i>Leersia oryzoides</i></u>

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

H	<u>Penthorum sedoides</u>	H	<u>Myosotis scorpioides</u>
H	<u>Persicaria sp.</u>	H	<u>Cuscuta gronovii</u>
H	<u>Physostegia virginiana</u>	H	<u>Eleocharis sp.</u>
H	<u>Verbena hastata</u>	H	<u>Eutrochium maculatum</u>
H	<u>Carex lupulina</u>	H	<u>Mimulus ringens</u>
H	<u>Lythrum salicaria</u>	SA	<u>Myriophyllum spicatum</u>
SA	<u>Hydrilla sp.</u>		

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)

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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): Muskrat

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.)

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

Gray catbird	
Snapping turtle	
American crow	
Raccoon	
Cedar waxwing	
Great blue heron	

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: Japanese knotweed present

☐ 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

Date: 5/9/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.240243 42.419407 WGS84, northern portion

pH 7.72

Temperature 11.6°C

Sp Conductivity 432.8

Dissolved Oxygen 134%, 14.62 mg/L

Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Location 2 (describe): -73.240455 42.419242 WGS84, middle (western) portion

pH 7.3

Temperature 11.1°C

Sp Conductivity 404.0

Dissolved Oxygen 74.3%, 8.15 mg/L

Chlorophyll-a (or other measure of photosynthetic organisms) 1.8 mg/L

Location 3 (describe): -73.240421 42.419043 WGS84, southern portion

pH 8.28
 Temperature 16.0°C
 Sp Conductivity 413.3
 Dissolved Oxygen 158.6%, 15.46 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Date: 6/6/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.240243 42.419407 WGS84, northern portion

pH 7.32
 Temperature 14.8°C
 Sp Conductivity 561
 Dissolved Oxygen 67.2%, 6.78 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 1.6 mg/L

Location 2 (describe): -73.240455 42.419242 WGS84, middle (western) portion

pH 7.40
 Temperature 12.1°C
 Sp Conductivity 476.5
 Dissolved Oxygen 96.9%, 10.40 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 4.7 mg/L

Location 3 (describe): -73.240421 42.419043 WGS84, southern portion

pH 7.55
 Temperature 16.8°C
 Sp Conductivity 431.3
 Dissolved Oxygen 71.8%, 6.95 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 2.5 mg/L

Date: 6/14/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.240243 42.419407 WGS84, northern portion

pH 7.47
 Temperature 14.8°C
 Sp Conductivity 499
 Dissolved Oxygen 81.2%, 8.25 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 1.5 mg/L

Location 2 (describe): -73.240455 42.419242 WGS84, middle (western) portion

pH 7.24

Temperature 12.8°C
Sp Conductivity 509
Dissolved Oxygen 79.4%, 8.32 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1.9 mg/L

Location 3 (describe): -73.240421 42.419043 WGS84, southern portion

pH 7.50
Temperature 19.0°C
Sp Conductivity 449
Dissolved Oxygen 60.0%, 5.53 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 2.0 mg/L

5A BW-2 Representative Photographs

Shallowly flooded central portions of BW-2 with aquatic submergent plants still visible in 2022



Dry northern portion of BW-2 with aquatic emergent vegetation still visible in 2022



Dry south-central portion of BW-2 with aquatic emergent, submergent and floating-leaved aquatic still visible in 2022 vegetation



Flooded central portions of BW-2 in 2023



**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

I. General Information

5A-BW-3

Site Name and Backwater Number

320 feet southeast of Pinto Dr. and Palomino Dr. intersection (-73.2415 42.4175 WGS84)

Location/Physical Description

8/18/2022

Date(s) of Site Visit(s) and Data Collection

Sunny, breezy, 73°F

Weather Conditions During Site Visit

O'Sullivan/Stearns

Field Staff Performing Evaluation

7/18/2023

Date this form was completed

II. Site Description

A. Backwater Characterization

Physical Dimensions (ft): Length 235' Width 24-38' Depth _____ Area 0.16 acres

Sediment / Substrate composition: % Sand _____ % Silt 10 %Organic 90 Other _____

Bank stability / Observed erosional conditions: Banks appear stable

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:

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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: One outlet to the river.

Measurements at contour 954 outlet channel is 65' long x 2' wide at low flow, 3-4' wide at contour 954

Water level fluctuation: _____

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) | ☒ Changes 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 _____ | |

D. Inventory of Aquatic Plant Community

% Cover:	1-5	0	96-100	6-15
	Overall Aquatic Vegetation	Floating -Leaved Cover	Emergent Cover	Trees

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
SA	<u>Callitriche palustris</u>	H	<u>Mentha canadensis</u>
H	<u>Persicaria hydropiperoides</u>	H	<u>Sium suave</u>
H	<u>Phalaris arundinacea</u>	H	<u>Leersia oryzoides</u>
	<u>Cornus amomum</u>	H	<u>Myosotis scorpioides</u>
H	<u>Penthorum sedoides</u>	H	<u>Laportea canadensis</u>
H	<u>Boehmeria cylindrica</u>	H	<u>Lythrum salicaria</u>
H	<u>Cuscuta gronovii</u>	H	<u>Galium palustre</u>

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

H	<u>Iris pseudacorus</u>	V	<u>Vitis riparia</u>
H	<u>Impatiens capensis</u>	H	<u>Persicaria punctata</u>
H	<u>Epilobium coloratum</u>	H	<u>Bidens cernua</u>
H	<u>Persicaria sp.</u>	H	<u>Rudbeckia laciniata</u>
T	<u>Platanus occidentalis</u>	T	<u>Acer saccharinum</u>
		T	<u>Acer negundo</u>

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

Green frog	
King Fisher	

VII. Habitat Degradation (identify specific location within backwater if applicable)

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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: Japanese knotweed present at approx. 10%

☐ 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

Date: 5/9/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.241516 42.417558 WGS84

pH 7.23

Temperature 22.4°C

Sp Conductivity 393.5

Dissolved Oxygen 74.5%, 6.47 mg/L

Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Location 2 (describe): -73.241519 42.417449 WGS84

pH 7.32

Temperature 19.6°C

Sp Conductivity 381.2

Dissolved Oxygen 77.6%, 7.04 mg/L

Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Location 3 (describe): -73.241485 42.417326 WGS84

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

pH 7.38
Temperature 17.5°C
Sp Conductivity 412.9
Dissolved Oxygen 86.9%, 8.13 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Date: 6/6/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.241516 42.417558 WGS84

pH 7.19
Temperature 22.0°C
Sp Conductivity 439.1
Dissolved Oxygen 80.1%, 6.99 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1.9 mg/L

Location 2 (describe): -73.241519 42.417449 WGS84

pH 7.47
Temperature 19.9°C
Sp Conductivity 469.2
Dissolved Oxygen 112.1%, 10.2 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1.5 mg/L

Location 3 (describe): -73.241485 42.417326 WGS84

pH 7.34
Temperature 19.4°C
Sp Conductivity 456.6
Dissolved Oxygen 95.2%, 8.75 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Date: 6/14/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.241516 42.417558 WGS84

pH 7.21
Temperature 21.9°C
Sp Conductivity 524
Dissolved Oxygen 51.0%, 4.45 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1.6 mg/L

Location 2 (describe): -73.241519 42.417449 WGS84

pH 7.6
Temperature 19.5°C
Sp Conductivity 482.7
Dissolved Oxygen 101.8%, 9.30 mg/L

Form BW-1: Backwater Habitat Inventory

Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Location 3 (describe): -73.241485 42.417326 WGS84

pH 7.81

Temperature 19.6°C

Sp Conductivity 465

Dissolved Oxygen 116.6%, 10.6mg/L

Chlorophyll-a (or other measure of photosynthetic organisms) 1.1 mg/L

5A BW-3 Representative Photographs

Shallowly flooded central portions of BW-3 with aquatic submergent plants still visible in 2022



Flooded outlet channel during high water 2023



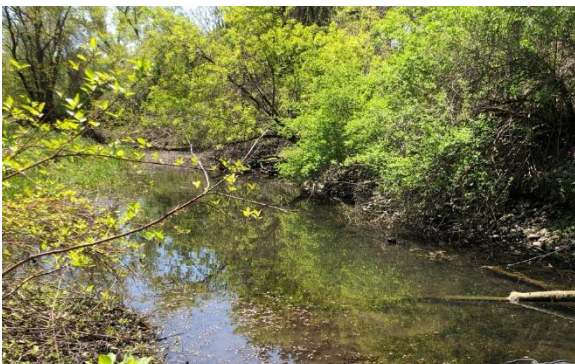
Dry outlet channel during low water in 2022



Central portion of BW-3 during low water in 2022



Central portion of BW-3 flooded in 2023



**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

I. General Information

5A-BW-4
Site Name and Backwater Number
380 feet southeast of Pinto Dr. and Palomino Dr. intersection (-73.2412 42.4176 WGS84)
Location/Physical Description
8/18/2022
Date(s) of Site Visit(s) and Data Collection
Sunny, breezy, 72°F
Weather Conditions During Site Visit
O'Sullivan/Stearns
Field Staff Performing Evaluation
8/18/2022
Date this form was completed

II. Site Description

A. Backwater Characterization

Physical Dimensions (ft): Length 60' Width 30' Depth _____ Area 0.04 acres

Sediment / Substrate composition: % Sand _____ % Silt 10 %Organic 90 Other _____

Bank stability / Observed erosional conditions: Banks well vegetated and appear stable

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:

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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: One outlet to river

Outlet is approx. 100' long and 1-2' wide at low flow, 6' wide at contour 954

Water level fluctuation: _____

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) | ☐ Changes 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 _____ | |

D. Inventory of Aquatic Plant Community

% Cover:	<u>1-5</u>	<u>0</u>	<u>96-100</u>	<u>26-50</u>
	Overall Aquatic Vegetation	Floating -Leaved Cover	Emergent Cover	Trees

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
SA	<u>Callitriche palustris</u>	H	<u>Cuscuta gronovii</u>
H	<u>Verbena hastata</u>	H	<u>Rudbeckia laciniata</u>
H	<u>Persicaria hydropiperoides</u>	H	<u>Iris pseudacorus</u>
H	<u>Myosotis scorpioides</u>	H	<u>Epilobium sp.</u>
H	<u>Bidens frondosa</u>	H	<u>Leersia oryzoides</u>
H	<u>Impatiens capensis</u>	H	<u>Cicuta maculata</u>
H	<u>Alisma triviale</u>	H	<u>Persicaria sagittata</u>

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

H	<u>Bidens cernua</u>	H	<u>Lycopus uniflorus</u>
H	<u>Mentha canadensis</u>	H	<u>Mimulus ringens</u>
H	<u>Veronica catenata</u>	T	<u>Acer saccharinum</u>
T	<u>Acer negundo</u>	T	

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

- ☐ 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

Green frog	
King Fisher	
Gray catbird	
Blue jay	

VII. Habitat Degradation (identify specific location within backwater if applicable)

- ☐ Evidence of significant levels of dumping
- ☐ Evidence of significant erosion or sedimentation problems

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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

Date: 5/9/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.24116 42.41762 WGS84

pH 7.48
Temperature 17.4°C
Sp Conductivity 470.7
Dissolved Oxygen 73.3%, 6.84 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 0.5 mg/L

Location 2 (describe): -73.24114 42.41765 WGS84

pH 7.38
Temperature 18°C
Sp Conductivity 482.4
Dissolved Oxygen 58.6%, 5.48 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 0.5 mg/L

Location 3 (describe): -73.24117 42.41769 WGS84

pH 7.48
Temperature 17°C
Sp Conductivity 492.4

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

Dissolved Oxygen 73.6%, 7.04 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 0.5 mg/L

Date: 6/6/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.24116 42.41762 WGS84

pH 7.85
Temperature 17.9°C
Sp Conductivity 444.1
Dissolved Oxygen 139.3%, 13.37 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 0.7 mg/L

Location 2 (describe): -73.24114 42.41765 WGS84

pH 7.76
Temperature 17.3°C
Sp Conductivity 449.4
Dissolved Oxygen 119.8%, 11.50 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Location 3 (describe): -73.24117 42.41769 WGS84

pH 7.53
Temperature 17.8°C
Sp Conductivity 471.7
Dissolved Oxygen 97.3%, 9.24 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1 mg/L

Date: 6/14/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.24116 42.41762 WGS84

pH 7.72
Temperature 18.3°C
Sp Conductivity 457
Dissolved Oxygen 83.2%, 7.80 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1.3 mg/L

Location 2 (describe): -73.24114 42.41765 WGS84

pH 8.29
Temperature 17.5°C
Sp Conductivity 423.7
Dissolved Oxygen 148.7%, 14.17 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 2.2 mg/L

Location 3 (describe): -73.24117 42.41769 WGS84

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

pH 7.80
Temperature 17.4°C
Sp Conductivity 462.0
Dissolved Oxygen 88.0%, 8.41 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 1.7 mg/L

5A BW-4 Representative Photographs

Shallowly flooded central portions of BW-4 with aquatic submergent plants still visible in 2022



Dry outlet channel during low water in 2022



Flooded central portion of BW-4 in 2023



Flooded outlet channel during high water in 2023



**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

I. General Information

5A-BW-5

Site Name and Backwater Number

3300 feet northeast of Utility Dr. and Holms Road intersection (-73.2388 42.4132 WGS84)

Location/Physical Description

8/10/2022

Date(s) of Site Visit(s) and Data Collection

Cloudy

Weather Conditions During Site Visit

O'Sullivan/Stearns

7/18/2023

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Backwater Characterization

Physical Dimensions (ft): Length 1,020' Width 25-70' Depth _____ Area 1.6 acres

Sediment / Substrate composition: % Sand _____ % Silt 15 %Organic 85 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:

Wet meadow observed during 8/10/2022 survey though the area floods to more of shallow marsh

Conditions at high water.

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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: _____

Connects at river during high water approx. 100' wide, but during lower flow periods only two narrow channels through Wet meadow/SEM habitats are connected. Channels are about 40' long by 3' wide, and 85' long by 6-9' wide at 953el

Water level fluctuation: No surface water during the 8/10/2022 survey

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) | ☒ Changes 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 _____ | |

D. Inventory of Aquatic Plant Community

% Cover:	0	0	76-95	10.5
	Overall Aquatic Vegetation	Floating -Leaved Cover	Emergent Cover	Trees

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
NE	<u>Leersia oryzoides</u>	NE	<u>Onoclea sensibilis</u>
NE	<u>Bidens frondosa</u>	RV	<u>Sagittaria latifolia</u>
PE	<u>Acorus calamus</u>	NE	<u>Phalaris arundinacea</u>
NE	<u>Impatiens capensis</u>	NE	<u>Sium suave</u>
NE	<u>Impatiens pallida</u>	NE	<u>Persicaria punctata</u>
NE	<u>Bidens cernua</u>	T	<u>Acer rubrum</u>
T	<u>Acer saccharinum</u>	NE	

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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

Garter snake	Deer tracks
Blue jay	Black bear – sow with cubs - tracks
Tufted titmouse	
American gold finch	
Coyote tracks	
Green frog	
American toad	

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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

Date: 5/9/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.238468 42.413907 WGS84

pH 7.61
Temperature 17.8°C
Sp Conductivity 585
Dissolved Oxygen 98.4%, 9.24 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 4 mg/L

Location 2 (describe): -73.239080 42.413035 WGS84

pH 7.47
Temperature 17.0°C
Sp Conductivity 572
Dissolved Oxygen 84.8%, 8.09 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 2 mg/L

Location 3 (describe): -73.239820 42.412451 WGS84

pH 7.36
Temperature 19.1°C
Conductivity 603
Dissolved Oxygen 79.7%, 7.34 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 2 mg/L

Date: 6/6/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.238468 42.413907 WGS84

pH 7.74

Temperature 20.5°C
 Sp Conductivity 676
 Dissolved Oxygen 107.5%, 9.66 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 2.5 mg/L

Location 2 (describe): -73.239080 42.413035 WGS84

pH 7.45
 Temperature 17.6°C
 Sp Conductivity 694
 Dissolved Oxygen 75.9%, 7.23 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 6 mg/L

Location 3 (describe): -73.239820 42.412451 WGS84

pH 7.49
 Temperature 18.7°C
 Conductivity 709
 Dissolved Oxygen 100.5%, 9.36 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 2.2 mg/L

Date: 6/14/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.238468 42.413907 WGS84

pH 7.88
 Temperature 19.3°C
 Sp Conductivity 672
 Dissolved Oxygen 94.6%, 8.60 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 3.6 mg/L

Location 2 (describe): -73.239080 42.413035 WGS84

pH 7.66
 Temperature 18.3°C
 Sp Conductivity 686
 Dissolved Oxygen 71.8%, 6.70 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 2.3 mg/L

Location 3 (describe): -73.239820 42.412451 WGS84

pH 7.48
 Temperature 18.5°C
 Sp Conductivity 694
 Dissolved Oxygen 60.9%, 5.67 mg/L
 Chlorophyll-a (or other measure of photosynthetic organisms) 1.2 mg/L

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

5A BW-5 Representative Photographs

Dry central portions of BW-5 with aquatic emergent and submergent plants still present in 2022



Dry outlet channel during low water, some aquatic emergent vegetation visible with other wetland sedges and forbs in 2022



Flooded outlet channel of BW-5 in 2023



Shallowly flooded southern portion of BW-5
With aquatic emergent vegetation



Flooded southern portion of BW-5 in 2023



**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

I. General Information

5A-BW-6

Site Name and Backwater Number

1200 feet northwest of EPRI Facility (-73.2396 42.404 WGS84)

Location/Physical Description

8/24/2022

Date(s) of Site Visit(s) and Data Collection

Sunny 75°F

Weather Conditions During Site Visit

O'Sullivan/Stearns

7/18/2023

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Backwater Characterization

Physical Dimensions (ft): Length 115' Width 140' Depth Area 0.36 acres

Sediment / Substrate composition: % Sand 5 % Silt 15 %Organic 80 Other

Bank stability / Observed erosional conditions: Banks appear well vegetated

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:

Floodway channel feeds BW-5A-6 at high water

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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: _____

Surface water connection along river is about 130' at elevation 953, floodway channel (B-73) feeds BW, area also fed by intermittent stream.

Water level fluctuation: _____

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) | ☒ Changes 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 _____ | |

D. Inventory of Aquatic Plant Community

% Cover:	0	0	96-100	6-15
	Overall Aquatic Vegetation	Floating -Leaved Cover	Emergent Cover	Trees

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
H	<u><i>Bidens cernua</i></u>	H	<u><i>Lythrum salicaria</i></u>
H	<u><i>Leersia oryzoides</i></u>	H	<u><i>Lindernia dubia</i></u>
H	<u><i>Veronica catenata</i></u>	H	<u><i>Sagittaria latifolia</i></u>
H	<u><i>Persicaria lapathifolia</i></u>	H	<u><i>Calla palustris</i></u>
H	<u><i>Persicaria punctata</i></u>	H	<u><i>Eleocharis sp.</i></u>
H	<u><i>Urtica dioica</i></u>	T	<u><i>Acer saccharinum</i></u>

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

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

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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

Ruby-throated hummingbird	
American gold finch	
Osprey	

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: _Sewage treatment plant outfall is immediately adjacent to this area.

VIII. Restoration Opportunities

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

☐ 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

Date: 5/9/2023

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): -73.239622 42.404170 WGS84 This location receives back flow from
sewage treatment plant outfall

pH 8.01
Temperature 18.4°C
Sp Conductivity 478.2
Dissolved Oxygen 193.4%, 15.07 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 40 mg/L

Location 2 (describe): -73.239462 42.404128 WGS84

pH 7.53
Temperature 25.1°C
Sp Conductivity 477.8
Dissolved Oxygen 94.6%, 7.56 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 4 mg/L

Location 3 (describe): -73.239387 42.404235 WGS84

pH 7.46
Temperature 25.1°C
Sp Conductivity 472.7
Dissolved Oxygen 83.2%, 6.86 mg/L
Chlorophyll-a (or other measure of photosynthetic organisms) 3 mg/L

Date: 6/6/2023 – no surface water present in BW-6

Record data at multiple locations at least three times during the growing season.

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

5A BW-6 Representative Photographs

Dry central portions of BW-6 in 2022



Looking west across the outlet to the river 2022



Flooded conditions in BW-6 during 2023 inspections

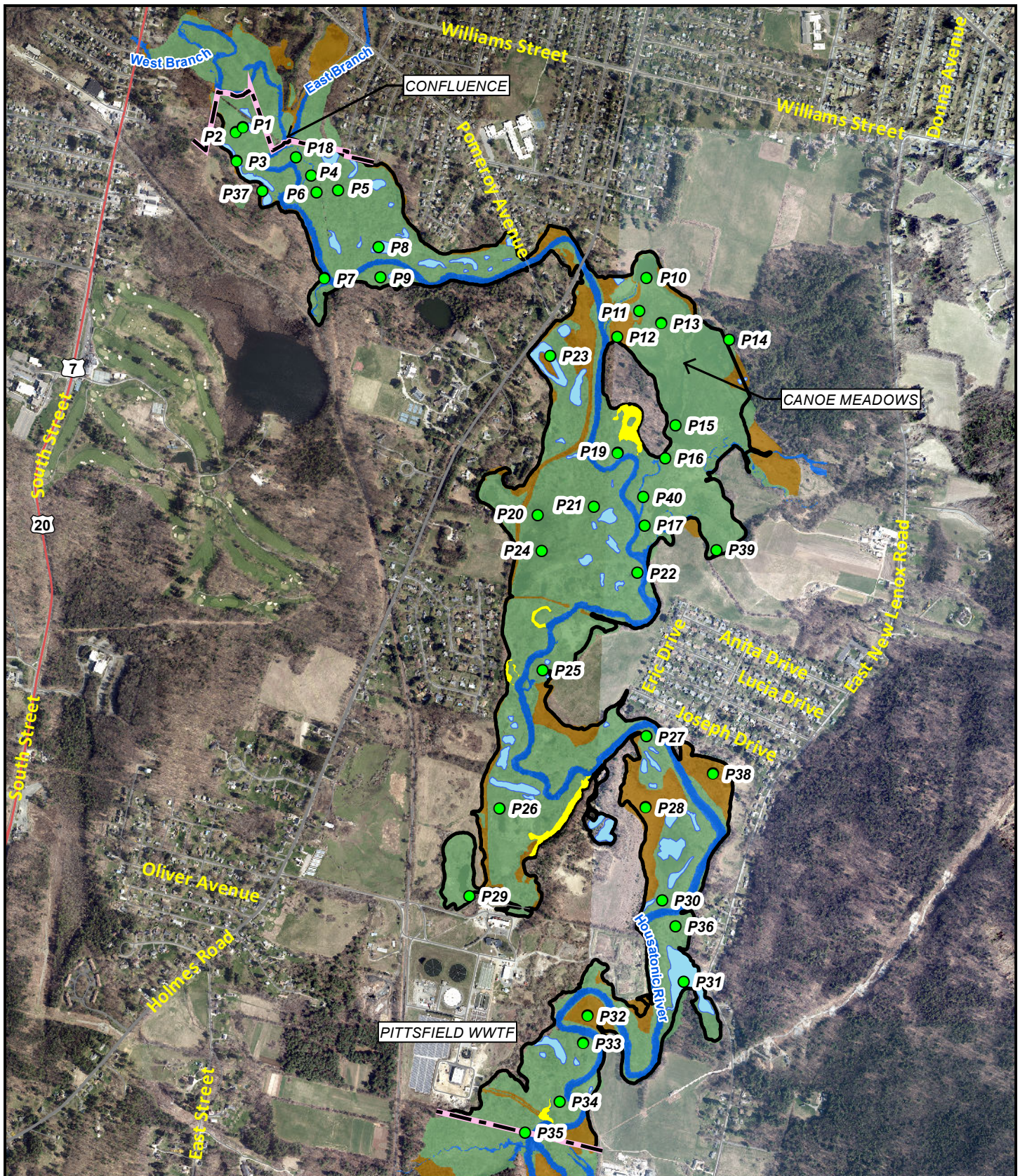


Appendix D

Floodplain Habitat Inventory

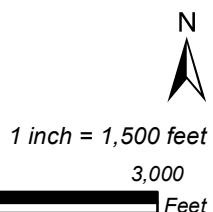
1. Representative photographs of floodplain habitats
2. Form FP-1 (Blank)
3. Incidental Wildlife Observations During Floodplain Surveys

D-1 Representative Photographs of Floodplain Habitats



Legend

- | | |
|--|--|
| <ul style="list-style-type: none"> Reach Boundaries Reach 5A Isopleth Backwater Areas Certified Vernal Pools | <p>Cover Types</p> <ul style="list-style-type: none"> Stream Upland Wetland |
|--|--|



**Reach 5A Representative Photo
Locations of Floodplain Habitats**
Housatonic River - Pittsfield, MA

SCALE	DATE	PROJECT NO.
1:8,400	8/19/2023	60670015

AECOM

Figure D-1

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 1		Date: 08/02/22		Photo No. 2	
Description: View NW, wet meadow / shallow emergent marsh habitats.		Description: View W, shallow emergent marsh and shrub swamp habitats			
					

Photo No. 3		Date: 08/02/22		Photo No. 4	
Description: View S, wet meadow dominated by reed canary grass		Description: View N, high-flow channel through transitional floodplain forest			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 5		Date: 08/03/22		Photo No. 6	
Description: View N, large standing snag with tree cavities		Description: View N, powerline easement across floodplain with developing common reed stand			
					

Photo No. 7		Date: 08/05/22		Photo No. 8	
Description: View NE, Japanese knotweed stand growing along bank and floodplain under powerline easement		Description: View N, shrub swamp habitats dominated by box elder and silky dogwood (5A-VP-9)			
					

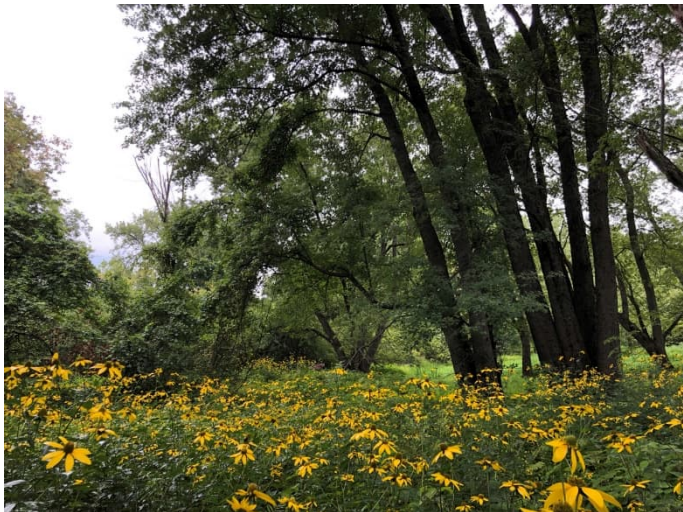
Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 9		Date: 08/05/22		Photo No. 10	
Description: View E, transitional floodplain forest with dense cover of ostrich fern		Description: View N, Canoe Meadows, West Pond open water and emergent marsh habitats			
					

Photo No. 11		Date: 08/16/22		Photo No. 12	
Description: View N, wet meadow and shallow emergent marsh habitats in Canoe Meadows		Description: View N, cultural grasslands / former agricultural areas in Canoe Meadows			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 13		Date: 08/16/22		Photo No. 14	
Description: View NW, shallow emergent marsh and shrub swamp habitats in Canoe Meadows with common reed stand in background		Description: View WSW, Canoe Meadows, deep and shallow emergent marsh habitats, beaver lodge and common reed stand on opposite shoreline		Date: 08/17/22	
					

Photo No. 15		Date: 08/17/22		Photo No. 16	
Description: View W, Canoe Meadows open water and shallow emergent marsh habitats with former concrete constructed dam/wier		Description: View NE, Canoe Meadows approximately 5-foot tall beaver dam in Sackett Brook		Date: 08/16/22	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 17		Date: 08/16/22		Photo No. 18	
Description: View NE, Canoe Meadows shallow emergent and deep emergent marsh habitats		Description: View NW, large woody debris on the ground with cavity habitat			
					

Photo No. 19		Date: 08/17/22		Photo No. 20	
Description: View NNE, transitional floodplain forest		Description: View S, shallow emergent marsh dominated by smartweed. Deep mucky/organic soils			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA	Project No. 60670015
Photo No. 21	Date: 08/16/22	Photo No. 22	Date: 08/08/22
Description: View NW, shallow emergent marsh and shrub swamp habitats in Canoe Meadows with common reed stand in background		Description: View N, transitional floodplain forest, 42" dbh silver maple with knotweed stand adjacent to river	
			

Photo No. 23	Date: 08/04/22	Photo No. 24	Date: 08/18/22
Description: View S, buttonbush shrub swamp and shallow emergent marsh habitats in 5A-VP-21		Description: View S, shallow emergent marsh and shrub swamp dominated by bur-reed, smartweed, silky dogwood and buttonbush	
			

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 25		Date: 08/30/22		Photo No. 26	
Description: View NW, transitional floodplain forest dominated by silver maple, boxelder and goldenrods		Description: View S, shallow and deep emergent marshes with bur-reed, smartweed, soft-stemmed bulrush, rice cut-grass, common arrowhead		Date: 08/18/22	
					

Photo No. 27		Date: 08/11/22		Photo No. 28	
Description: View ESE, high terrace floodplain forest dominated by sugar maple, ash, American linden, witch-hazel and sensitive fern		Description: View SW, former agricultural fields / cultural grasslands		Date: 08/10/22	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 29		Date: 08/24/22		Photo No. 30	
Description: View NNW, cattail marsh / deep emergent marsh habitats		Description: View S, high-flow channel through transitional floodplain forest. Drains 5A-VP-71, 72 & 73 into the Housatonic River		Date: 04/30/19	
					

Photo No. 31		Date: 09/15/22		Photo No. 32	
Description: View N, shrub swamp in 5A-VP-77. Dominated by buttonbush, black willow, winterberry, smartweeds, royal fern.		Description: View SE, agricultural fields		Date: 08/31/22	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 33		Date: 08/25/22		Photo No. 34	
Description: View S, 7.8-foot dbh (24.4-foot cir) eastern cottonwood		Description: View E, transitional floodplain forest with silver maple, boxelder and American sycamore tree canopy			
					

Photo No. 35		Date: 08/25/22		Photo No. 36	
Description: View N, 6.7-foot dbh silver maple		Description: View W, former gravel pit, developing transitional floodplain forest with eastern cottonwood, American sycamore, American elm, Morrow's honeysuckle and moneywort			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 37		Date: 08/2/22		Photo No. 38	
Description: View SW, northern hardwoods-hemlock-white pine forest with sugar maple, black birch, white pine, American hazelnut and woodfern		Description: View S, successional northern hardwoods with white pine, eastern cottonwood, red maple, Morrow's honeysuckle, European buckthorn, Asian bittersweet			
					

Photo No. 39		Date: 08/17/22		Photo No. 40	
Description: View N, red maple swamp with silky dogwood, arrowwood, sensitive fern and skunk cabbage		Description: View S, stream habitats (Sackett Brook)			
					

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

☐ Saturated

☐ Intermittently exposed

☐ Temporarily flooded

☐ Semi-permanently flooded

☐ Intermittently flooded

☐ Seasonally flooded

☐ Artificially flooded

☐ Upland

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 _____

**General Electric Housatonic Rest of River
Form FP-1: Floodplain Habitat Inventory Form**

Notes:

Bordering Riverine/Aquatic Habitat

- ☐ High-gradient stream ☐ Low-gradient stream
- ☐ Medium-gradient stream ☐ Moderately alkaline lake/pond
- ☐ Backwater ☐

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

**General Electric Housatonic Rest of River
Form FP-1: Floodplain Habitat Inventory Form**

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, logs, hollow logs, tree roots or hummocks (for multiple wildlife habitat purposes)

☐ Abundant ☐ Present ☐ Absent ☐ Not Applicable

**General Electric Housatonic Rest of River
Form FP-1: Floodplain Habitat Inventory Form**

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)

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 (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-leaved 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)

**General Electric Housatonic Rest of River
Form FP-1: Floodplain Habitat Inventory Form**

- ☐ 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: _____

D-3 Incidental Wildlife Observations During Floodplain Surveys

WILDLIFE FIELD OBSERVATIONS

Date: 08/02/2022							
Time: Various							
Weather: Sunny, Scattered Showers							
Team member(s): SE, AH							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1323	Bird	No	American crow <i>Corvus brachyrhynchos</i>	42.432166, -73.250955	Bird	Animal	Adult
1323	Amphibian	No	Green frog <i>Lithobates clamitans</i>	42.432536, -73.250398	Amphibian	Call	
1421	Reptile	No	Unidentified turtle	42.431955 -73.251274	Reptile	Tracks	Potentially snapping turtle (<i>Chelydra serpentina</i>) or wood turtle (<i>Glyptemys insculpta</i>)
15:55	Small mammal	No	Raccoon <i>Procyon lotor</i>	42.432323, -73.252041	Small mammal	Tracks	
0922	Amphibian	No	Green frog <i>Lithobates clamitans</i>	42.432536, -73.250398	Animal	Invertebrate	Multiple individuals calling from edge of vernal pool
1100	Bird	No	Hummingbird <i>Trochilidae</i>	42.432536, -73.250398	Animal	Bird	One individual flying
1427	Invertebrate	No	Monarch butterfly <i>Danaus plexippus</i>	42.432536, -73.250398	Animal	Bird	Feeding in joe pyweed (<i>Eutrochium purpureum</i>) flowers
1505	Invertebrate	No	Tiger swallowtail butterfly <i>Papilio glaucus</i>	42.432536, -73.250398	Animal	Invertebrate	
1520	Amphibian	No	Green frog <i>Lithobates clamitans</i>	42.432536 -73.250398	Animal	Amphibian	Multiple individuals

WILDLIFE FIELD OBSERVATIONS

Date:08/03/2022							
Time: Various							
Weather: Sunny							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
Time	Observation ¹	Data Collected: ²	Species Observed ³	Location ⁴	Faunal Type ⁵	Observation Type ⁶	Behavior/Condition Description/Habitat Type ⁶
1652	Bird	No	Hairy woodpecker <i>Leuconotopicus villosus</i>	42.432119, -73.248168	Bird	Animal	Individual
1711	Amphibian	No	Gray tree frog <i>Hyla versicolor</i>	42.432141, -73.249529	Amphibian	Animal	Individual
1252	Amphibian	No	Wood frog <i>Lithobates sylvaticus</i>	42.432367, -73.247571	Amphibian	Animal	Individual metamorph

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/04/23							
Time: Various							
Weather: Sunny							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1358	Bird	No	Baltimore Oriole <i>Icterus galbula</i>	42.427609, -73.238515	Bird	Animal	Individual
1358	Invertebrate	No	Monarch Butterfly <i>Danaus plexippus</i>	42.427609, -73.238515	Invertebrate	Animal	Individual
1649	Invertebrate	No	Darner dragonfly <i>Odonata: Aeshnidae</i>	42.426833, -73.239684	Invertebrate	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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/05/23							
Time: Various							
Weather: Partly Cloudy							
Team member(s):							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1500	Bird	No	American crow <i>Corvus brachyrhynchos</i>	42.425869, -73.239612	Bird	Animal	Individual
1550	Bird	No	Red eyed vireo <i>Vireo olivaceus</i>	42.425110, -73.239445	Bird	Animal	Individual
1904	Amphibian	No	Leopard frog <i>Lithobates pipiens</i>	42.430467, -73.237122	Amphibian	Animal	Individual
1936	Reptile	Photo	Painted turtle <i>Chrysemys picta</i>	42.429496, -73.236451	Reptile	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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish

6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other

7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/08/2022							
Time: Various							
Weather: Partly Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1321	Bird	No	Woodcock <i>Scolopax minor</i>	42.422814, -73.238697	Bird	Animal	Individual
1327	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	42.422588, -73.238195	Bird	Animal	Individual
1332	Amphibian	No	Leopard frog <i>Lithobates pipiens</i>	42.422305, -73.237634	Amphibian	Animal	Individual
1949	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	42.420429, -73.236149	Bird	Animal	2 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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/10/22							
Time: Various							
Weather: Partly Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1443	Bird	No	Mourning dove <i>Zenaida macroura</i>	42.412632, -73.237827	Bird	Animal	Individual
1745	Bird	No	Cedar waxwing <i>Bombycilla cedrorum</i>	42.412505, -73.235579	Bird	Animal	5 individuals
1237	Reptile	No	Snapping turtle <i>Chelydra serpentina</i>	42.4117291, -73.239105	Reptile	Nest	Over 6 predated snapping turtle nests
1519	Reptile	No	Painted turtle <i>Chrysemys picta</i>	42.412921, -73.237214	Reptile	Animal	Deceased individual
1536	Reptile	No	Painted turtle <i>Chrysemys picta</i>	42.412999, -73.237259	Reptile	Animal	Individual female
1554	Large mammal	Photo	Coyote <i>Canis latrans</i>	42.413224, -73.238760	Large mammal	Track	
1637	Large mammal	Photo	Black Bear <i>Ursus americanus</i>	42.413977, -73.238308	Large mammal	Track	
1945	Bird	No	Woodcock <i>Scolopax minor</i>	42.414099, -73.235574	Bird	Animal	3 + individuals, likely family group
2018	Reptile	No	Garter snake <i>Thamnophis sirtalis</i>	42.412720, -73.236392	Reptile	Animal	individual

Appendix A-1 (continued). Incidental Direct Wildlife Observations during floodplain habitat surveys.

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/11/2022							
Time: Various							
Weather: Sunny							
Team member(s):							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1710	Bird	No	Robin <i>Turdus migratorius</i>	42.412554, -73.233110	Bird	Animal	Individual. Nest also observed w/ juveniles.
1710	Bird	No	Red-tailed hawk <i>Buteo jamaicensis</i>	42.412554, -73.233110	Bird	Animal	Individual
1710	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	42.412554, -73.233110	Bird	Animal	Individual
1710	Bird	No	Hairy woodpecker <i>Leuconotopicus villosus</i>	42.412554, -73.233110	Bird	Animal	Individual
1710	Amphibian	No	Wood frog <i>Lithobates sylvaticus</i>	42.412554, -73.233110	Amphibian	Animal	Multiple Individuals
1925	Bird	No	Cedar waxwing <i>Bombycilla cedrorum</i>	42.410992, -73.235404	Bird	Animal	Individual
1925	Invertebrate	No	Moths <i>Lepidoptera</i>	42.410992, -73.235404	Invertebrate	Animal	Individual
1925	Invertebrate	No	Bees <i>Anthophila</i>	42.410992, -73.235404	Invertebrate	Animal	Individual
1608	Small mammal	No	Chipmunk <i>Tamias striatus</i>	42.413327, -73.233884	Small mammal	Animal	Multiple individuals
1715	Small mammal	No	Beaver <i>Castor canadensis</i>	42.412243, -73.234577	Small mammal	Lodge	Individual

Appendix A-1 (continued). Incidental Direct Wildlife Observations during floodplain habitat surveys.

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/16/2022							
Time: Various							
Weather: Sunny							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0800	Bird	No	Mallard <i>Anas platyrhynchos</i>	Canoe meadows	Bird	Animal	Multiple individuals feeding/swimming in pond
0800	Reptile	No	Painted turtle <i>Chrysemys picta</i>	Canoe meadows	Reptile	Animal	Multiple individuals feeding/swimming in pond
0820	Large mammal	No	White-tailed deer <i>Odocoileus virginianus</i>	A-38	Large mammal	Animal	Walking & feeding in marsh
0840	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	Sackett Brook	Bird	Animal	Calling whilst flying/hunting near beaver dam
1245	Invertebrate	No	Swallowtail butterfly <i>Papilionidae</i>	42.424115, -73.234982	Invertebrate	Animal	Individual
1245	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	42.424115, -73.234982	Bird	Animal	Individual
1245	Fish	No	Unidentified fish	42.424115, -73.234982	Fish	Animal	Swimming individual
1520	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	42.427818, -73.235989	Bird	Call	
1452	Bird	No	Mallard <i>Anas platyrhynchos</i>	42.427842, -73.234817	Bird	Animal	Multiple individuals flying overhead
2027	Small mammal	No	Beaver <i>Castor canadensis</i>	42.422430, -73.235849	Small mammal	Lodge	
1840	Amphibian	Photo	Spring peeper <i>Pseudacris crucifer</i>	42.422430, -73.235849	Amphibian	Animal	Individual
1834	Small mammal	Photo	Beaver <i>Castor canadensis</i>	42.423556, -73.235493	Small mammal	Dam	
1806	Bird	Photo	Canada goose <i>Branta canadensis</i>	42.424872, -73.235217	Bird	Animal	Multiple individuals
18:23	Amphibian	Photo	Green frog	42.424013, -73.235389	Amphibian	Animal	Individual

Appendix A-1 (continued). Incidental Direct Wildlife Observations during floodplain habitat surveys.

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/17/2022							
Time: Various							
Weather: Partly Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0835	Fish	No	Bass <i>Micropterus</i>	Sackett Brook	Fish	Animal	Individual breaking surface of water feeding in deep portion along cut bank
0838	Bird	No	Hummingbird <i>Trochilidae</i>	Sackett Brook	Bird	Animal	Individual female feeding on jewelweed (<i>Impatiens capensis</i>) flowers
0856	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	A-44 42.422505, -73.232411	Bird	Call	Individual in shrub thicket
0856	Bird	No	Belted kingfisher <i>Megaceryle alcyon</i>	A-44 42.422505, -73.232411	Bird	Animal	Individual flying by
1100	Small mammal	Photo	Beaver <i>Castor canadensis</i>	Sykes Brook	Small mammal	Den/Lodge	
1120	Reptile	Photo	Snapping turtle <i>Chelydra serpentina</i>	Sykes Brook	Reptile	Track	In mud of dried channel next to sykes brook
1300	Large mammal	Photo	Black bear <i>Ursus americanus</i>	Sykes Brook	Large mammal	Track	In mud along edge of the channel below small beaver dam
1343	Amphibian	Photo	Pickerel frog	42.425183, -73.236783	Amphibian	Animal	Individual
1615	Mammal	Photo	Black bear <i>Ursus americanus</i>	VP-24 42.426537, -73.232023	Large mammal	Scat	In trail near VP-24

WILDLIFE FIELD OBSERVATIONS

Date: 08/18/22							
Time: Various							
Weather: Partly Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1317	Bird	No	American crow <i>Corvus brachyrhynchos</i>	42.422379, -73.240718	Bird	Animal	Individual
1317	Bird	No	Cedar waxwing <i>Bombycilla cedrorum</i>	42.422379, -73.240718	Bird	Animal	Individual
1342	Bird	No	Cardinal <i>Cardinalis cardinalis</i>	42.422351, -73.239535	Bird	Animal	Individual
1342	Bird	No	Green heron <i>Butorides virescens</i>	42.422351, -73.239535	Bird	Animal	Individual
1342	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	42.422351, -73.239535	Bird	Animal	Individual
1430	Small mammal	Photo	Beaver <i>Castor canadensis</i>	42.421437, -73.240720	Small mammal	Lodge	
1430	Bird	No	Downy woodpecker <i>Picoides pubescens</i>	42.421437, -73.240720	Bird	Animal	Individual
1700	Invertebrate	No	Ruby Meadowhawk <i>Sympetrum rubicundulum</i>	42.410649, -73.240432	Invertebrate	Animal	Individual
1508	Reptile	Photo	Snapping turtle <i>Chelydra serpentina</i>	42.421269, -73.239880	Reptile	Sign	Shells

Appendix A-1 (continued). Incidental Direct Wildlife Observations during floodplain habitat surveys.

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/24/22							
Time: Various							
Weather: Partly Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1248	Bird	No	Mallard <i>Anas platyrhynchos</i>	42.410574, -73.243776	Bird	Animal	Multiple individuals
1248	Bird	No	Hummingbird <i>Trochilidae</i>	42.410574, -73.243776	Bird	Animal	Multiple individuals
1314	Bird	No	Goldfinch <i>Spinus tristis</i>	42.412019, -73.243813	Bird	Animal	Individual
1536	Large mammel	No	Black Bear <i>Ursus americanus</i>	42.403923, -73.241235	Large mammel	Sign	

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish

6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other

7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 08/25/22							
Time: Various							
Weather: Sunny							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1227	Amphibian	Photo	Wood frog <i>Lithobates sylvaticus</i>	42.405286, -73.239049	Amphibian	Animal	Individual
1315	Bird	No	Mallard <i>Anas platyrhynchos</i>	42.405232, -73.238013	Bird	Animal	5 individuals flying
1520	Amphibian	No	Gray tree frog <i>Dryophytes versicolor</i>	42.408008, -73.237887	Amphibian	Animal	Individual
1228	Amphibian	Photo	Wood frog <i>Lithobates sylvaticus</i>	42.405422, -73.238892	Amphibian	Animal	Multiple morphs hopping through moneywort
1448	Amphibian	Photo	Wood frog <i>Lithobates sylvaticus</i>	42.406229, -73.235447	Amphibian	Animal	Individual adult

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date:08/30/22							
Time: Various							
Weather: Partly Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
Time	Observation ¹	Data Collected: ²	Species Observed ³	Location ⁴	Faunal Type ⁵	Observation Type ⁶	Behavior/Condition Description/Habitat Type ⁶
1254	Bird	No	Woodcock <i>Scolopax minor</i>	42.418757, -73.239414	Bird	Animal	Individual
1349	Bird	No	American crow <i>Corvus brachyrhynchos</i>	42.416951, -73.240569	Bird	Animal	Individual
1349	Reptile	Photo	Unidentified turtle	42.416951, -73.240569	Reptile	Tracks	
1505	Bird	No	Blue jay <i>Cyanocitta cristata</i>	42.416103, -73.240340	Bird	Animal	Individual
1505	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	42.416103, -73.240340	Bird	Animal	Individual
1753	Bird	No	Canada goose <i>Branta canadensis</i>	42.414250, -73.239303	Bird	Animal	Multiple individuals flying
1753	Bird	No	Hairy woodpecker <i>Leuconotopicus villosus</i>	42.414250, -73.239303	Bird	Call	
1504	Small mammal	No	Beaver <i>Castor canadensis</i>	42.415949, -73.240299	Small mammal	Sign	Bank slide

Appendix A-1 (continued). Incidental Direct Wildlife Observations during floodplain habitat surveys.

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date:08/31/22							
Time: Various							
Weather: Partly Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
Time	Observation ¹	Data Collected: ²	Species Observed ³	Location ⁴	Faunal Type ⁵	Observation Type ⁶	Behavior/Condition Description/Habitat Type ⁶
1354	Bird	No	American crow <i>Corvus brachyrhynchos</i>	42.416081, -73.236924	Bird	Animal	Individual
1516	Bird	No	Field Sparrow <i>Spizella pusilla</i>	42.415675, -73.238590	Bird	Animal	Individual
1712	Bird	No	Bald eagle <i>Haliaeetus leucocephalus</i>	42.407028, -73.237864	Bird	Animal	Individual flying above

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 09/15/22							
Time: Various							
Weather: Sunny							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1134	Reptile	Photo	Garter snake <i>Thamnophis sirtalis</i>	42.407295, -73.233019	Reptile	Animal	2 individuals
1134	Bird	No	Tufted titmouse <i>Baeolophus bicolor</i>	42.407295, -73.233019	Bird	Animal	Individual
1401	Bird	No	Mourning dove <i>Zenaida macroura</i>	42.408070, -73.234361	Bird	Animal	Multiple individuals
1417	Bird	No	Gray catbird <i>Dumetella carolinensis</i>	42.408936, -73.234437	Bird	Animal	Individual feeding

- Observation:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
- Data Collected:**
 - Photos/video: Yes (number)/No
 - Sketch: Yes (attach)/No
- Species:** Common name/Family/Genus/Species; Certain/Uncertain/Unknown - Basis for determination
- Location:** Station #/GPS coords/Description
- Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
- Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
- If animal then record:**
 - Behavior** Rest or Roost/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
 - Other** Diseased/Injured/Dead – Describe
 - Number observed** Individual/Pair/Family/Multiple (# or range)

WILDLIFE FIELD OBSERVATIONS

Date:09/28/22							
Time: Various							
Weather: Cloudy							
Team member(s): SE, AH							
Team activity: Floodplain/ Vernal Pool Surveys							
Details of Observations:							
Time	Observation ¹	Data Collected: ²	Species Observed ³	Location ⁴	Faunal Type ⁵	Observation Type ⁶	Behavior/Condition Description/Habitat Type ⁶
1148	Bird	No	Wild turkey <i>Meleagris gallopavo</i>	42.413540, -73.232722	Bird	Animal	Individual
1148	Bird	No	Mallard <i>Anas platyrhynchos</i>	42.413540, -73.232722	Bird	Animal	Multiple individuals
1148	Bird	No	American crow <i>Corvus brachyrhynchos</i>	42.413540, -73.232722	Bird	Animal	Individual
1148	Bird	No	Tufted titmouse <i>Baeolophus bicolor</i>	42.413540, -73.232722	Bird	Animal	Individual
1148	Bird	No	Cardinal <i>Cardinalis cardinalis</i>	42.413540, -73.232722	Bird	Animal	Individual
1220	Bird	No	Pileated woodpecker <i>Dryocopus pileatus</i>	42.414290, -73.233513	Bird	Animal	Individual
1347	Large mammal	No	Black Bear <i>Ursus americanus</i>	42.426258, -73.230961	Large mammal	Scat	
1602	Small mammal	No	Beaver <i>Castor canadensis</i>	42.427407, -73.233030	Small mammal	Lodge	
1627	Invertebrate	No	Northern Harrier <i>Circus hudsonius</i>	42.426873, -73.234469	Invertebrate	Animal	Individual
1635	Bird	No	Wood duck <i>Aix sponsa</i>	42.425410, -73.234369	Bird	Animal	Multiple individuals
	Bird	No	Great blue heron <i>Ardea herodias</i>		Bird	Animal	Individual

Appendix A-1 (continued). Incidental Direct Wildlife Observations during floodplain habitat surveys.

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-2-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 70°F							
Team member(s): TO, JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0900	Bird		King fisher, Black-capped chickadee, Song sparrow, Northern cardinal, Tufted titmouse	Housatonic River	Bird	Call, animal	Flying, adult
0940	Bird		American robin, Song sparrow, Yellow warbler	Housatonic River	Bird	Call, animal	Flying, adult
1030	Bird		Yellow shafted flicker, American robin, Cardinal	Housatonic River	Bird	Call, animal	Flying, adult
1200	Bird		Gray catbird, American crow, Great blue heron, Cedar waxwing,	Housatonic River	Bird	Call, animal	Flying, adult
1300	Bird		American robin, Black-capped chickadee, Cat bird, Pee wee	Housatonic River	Reptile	Call, animal	Flying, adult
1200	Small mammal		Raccoon	Housatonic River	Small mammal	track	

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-3-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 82°F							
Team member(s): TO, JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0930	Bird		American robin, Black-capped chickadee, Gray catbird, Pee wee	Housatonic River	Bird	Call, animal	Flying, feeding, adults
1200	Bird		American robin, Yellow warbler	Housatonic River	Bird	Call, animal	Flying, adults
1300	Bird		Hairy woodpecker, American robin	Housatonic River	Bird	Call, animal	Flying, feeding, adults
1400	Bird		Cray catbird, American robin, Northern cardinal	Housatonic River	Bird	Call, animal	Flying, resting, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-4-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 70°F							
Team member(s): TO, JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0930	Bird		Gold finch	Housatonic River	Bird	Animal	Flying, adult
1100	Bird		American robin, Great-crested flycatcher	Housatonic River	Bird	Animal	Flying, adult
1200	Bird		Great-crested flycatcher	Housatonic River	Bird	Animal	Feeding, adult
1300	Bird		Great-crested flycatcher, American robin	Housatonic River	Bird	Animal	Feeding, adult

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-5-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 80°F							
Team member(s): JS,CM,DH							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0830	Amphibian		Wood frog	Housatonic River	Amphibian	Animal	Resting, subadult
0930	Bird		American crow, Fish crow, Belted kingfisher	Housatonic River	Bird	Animal, call	Flying, resting, adults
1200	Bird		Blue jay, Red-tail hawk	Housatonic River	Bird	Animal	Resting, adults
1400	Bird		4 Mallards	Housatonic River	Bird	Animal	Swimming, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-8-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 85°F							
Team member(s): JS,AM							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1000	Bird		American crow, Pee wee	Housatonic River	Bird	Animal, call	Resting/roosting, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-9-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 70°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0900	Bird		American crow	Housatonic River	Bird	Animal, call	Resting/roosting, adult
0945	Bird		American crow, Gray catbird, Pee wee, Downy woodpecker, Blue jay	Housatonic River	Bird	Animal, call	Resting/roosting, flying, adults
1030	Bird		American crow, Goldfinch	Housatonic River	Bird	Animal, call	Flying, adults
1200	Bird		American crow, Pee wee, Goldfinch	Housatonic River	Bird	Animal, call	Resting/roosting, flying, adults
1330	Bird		American crow, House wren	Housatonic River	Bird	Animal, call	Flying, adults
1400	Bird		Cedar waxwing, song sparrow, Goldfinch, Canada goose, Hummingbird	Housatonic River	Bird	Animal, call	Resting/roosting, flying, adults
1445	Bird		Downy woodpecker, Tufted titmouse, American robin, Black-capped chickadee	Housatonic River	Bird	Animal, call	Resting/roosting, flying, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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

WILDLIFE FIELD OBSERVATIONS

Date: 8-10-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 70°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0900	Bird		American crow, Cedar waxwing, American robin, Gray catbird, Tufted titmouse, Black-capped chickadee	Housatonic River	Bird	Animal, call	Resting/roosting, flying, feeding, adults
0945	Bird		Ruby-throated hummingbird, American crow, Gray catbird, Tufted titmouse, Common yellowthroat	Housatonic River	Bird	Animal, call	Resting/roosting, flying, feeding, adults
1030	Bird		Ruby-throated hummingbird, American crow, Gray catbird, Canada goose.	Housatonic River	Bird	Animal, call	Feeding, flying, adults
1230	Insect		Monarch butterfly	Housatonic River	Insect	Animal	Feeding, adult
1330	Bird		Mourning dove, Goldfinch	Housatonic River	Bird	Animal, call	Roosting, flying, adults
1430	Bird		Ruby-throated hummingbird, Goldfinch	Housatonic River	Bird	Animal, call	Feeding, flying, adults
1500	Bird		Goldfinch, Canada goose, Song sparrow, Tufted titmouse	Housatonic River	Bird	Animal, call	Flying, adults
1530	Bird		Ruby-throated hummingbird, American robin	Housatonic River	Bird	Animal, call	Feeding, resting, adults
1400	Reptile		Garter snake	BW-5	Reptile	Animal	Resting, subadult
1415	Large mammal		Coyote	BW-5	Large mammal	Tracks	a.

Appendix A-1 (continued). Incidental Direct Wildlife Observations during floodplain habitat surveys.

1420	Large mammal		Black bear	BW-5	Large mammal	Tracks	Sow with cubs
1420	Large mammal		Deer	BW-5	Large mammal	Tracks	Adult
1430	Amphibian		Green frog	BW-5	Amphibian	Animal	Resting, subadult
1430	Amphibian		American toad	BW-5	Amphibian	Animal	Resting, subadult
1430	Bird		Blue jay, Tufted titmouse, Goldfinch				Flying, resting, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-11-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 80°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0900	Bird		American crow	Housatonic River	Bird	Animal, call	Resting, adult
1000	Amphibian		Wood frog	Housatonic River	Amphibian	Animal, call	Resting, subadult
1030	Bird		Red-tailed hawk, Goldfinch, American woodcock	Housatonic River	Bird	Animal, call	Flying, resting, adults
1100	Reptile		Garter snake	Housatonic River	Reptile	Animal	Resting, subadult
1145	Bird		Cedar waxwing	Housatonic River	Bird	Animal, call	Flying, adult
1230	Bird		Gray catbird, Goldfinch, A. robin, Common grackle, Red-tail hawk	Housatonic River	Bird	Animal, call	Foraging, flying, adults
1330	Bird		Blue jay, Red-tail hawk, A. robin, Goldfinch	Housatonic River	Bird	Animal, call	Foraging, Flying, adults
1500	Reptile		Painted turtle shell	Housatonic River	Reptile	Animal	
1530	Small mammal		Muskrat	Housatonic River	Small mammal	Scat	Muskrat in lodge

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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

WILDLIFE FIELD OBSERVATIONS

Date: 8-16-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 80°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0900	Bird		American crow, King fisher, Great blue heron	Housatonic River	Bird	Animal, call	Flying, adults
0930	Amphibian		Green frog	Housatonic River	Amphibian	Animal	Resting, adult
1030	Bird		American crow, Yellow warbler, King fisher	Housatonic River	Bird	Animal, call	Flying, adults
1100	Bird		Mourning dove, Goldfinch, Great blue heron, Marsh wren	Housatonic River	Bird	Animal	Resting, flying, adults
1115	Amphibian		Green frog	Housatonic River	Amphibian	Animal	Resting, adult
1200	Bird		Gray catbird, Goldfinch	Housatonic River	Bird	Animal, call	Foraging, flying, adults
1230	Bird		Gray catbird, Goldfinch, American crow	Housatonic River	Bird	Animal, call	Foraging, flying, adults
1300	Bird		Mallard	Housatonic River	Bird	Animal, call	Swimming, adult
1315	Reptile		Painted turtle	Housatonic River	Reptile	Animal	Swimming, subadult
1330	Amphibian		Green frog	Housatonic River	Amphibian	Animal	Resting, subadult
1400	Bird		Gray catbird	Housatonic River	Bird	Animal, call	Resting, adult
1500	Bird		Red-bellied woodpecker	Housatonic River	Bird	Animal, call	Feeding, adult
1545	Bird		Gray catbird, Goldfinch	Housatonic River	Bird	Animal, call	Flying, adults

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 floodplain habitat surveys.*

5. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-17-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Cloudy 80°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0900	Bird		American robin, Blue jay, Pee wee	Housatonic River	Bird	Animal, call	Flying, resting, adults
0915	Amphibian		Spring peeper	Housatonic River	Amphibian	Animal	Resting, adult
1000	Small mammal		Chipmunk	Housatonic River	Small mammal	Animal	Running, adult
1100	Bird		Ruby-throated hummingbird, A. crow, Gray catbird, Great blue heron	Housatonic River	Bird	Animal	Feeding, flying, adults
1200	Bird		Gray catbird, A. crow, Ruby-throated hummingbird	Housatonic River	Bird	Animal	Feeding, flying, adults
1230	Bird		American crow, Goldfinch	Housatonic River	Bird	Animal, call	Resting, adults
1330	Bird		Ruby-throated hummingbird, A. crow	Housatonic River	Bird	Animal, call	Feeding, flying adults
1400	Amphibian		Green frog	Housatonic River/BW-1	Amphibian	Animal	Swimming, adult
1415	Amphibian		Pickerel frog	BW-1	Amphibian	Animal	Swimming, subadult
1430	Bird		Blue jay, Yellow warbler, Goldfinch	BW-1	Bird	Animal, call	Flying, resting, adults
1500	Bird		Black-capped chickadee, A. crow	Housatonic River	Bird	Animal, call	Flying, resting, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **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 floodplain habitat surveys.

7. 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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-18-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Cloudy 80°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1030	Bird		Green heron, Great blue heron, A. crow, Goldfinch, Catbird	Housatonic River	Bird	Animal, call	Flying, feeding, adults
1200	Bird		Red-tail hawk	Housatonic River	Bird	Animal, call	Flying, adult
1500	Bird		Canada goose, Red-tail hawk	Housatonic River	Bird	Animal, call	Flying, walking, adults
1530	Bird		Gray catbird, Great blue heron, A. crow, Cedar waxwing	Housatonic River/BW-2	Bird	Animal, call	Flying, resting, adults
1544	Reptile		Snapping turtle	Housatonic River/BW-2	Reptile	Animal	Swimming, adult
1550	Small mammal		Racoon	Housatonic River/BW-2	Small mammal	Tracks	Adult
1600	Bird		King fisher	Housatonic River/BW-3	Bird	Animal	Flying/feeding, adult
1615	Amphibian		Green frog	Housatonic River/BW-3	Amphibian	Animal	Resting, subadult
1630	Bird		King fisher, Catbird, Blue jay	Housatonic River/BW-4	Bird	Animal	Flying/feeding, adults
1630	Amphibian		Green frog	Housatonic River/BW-4	Amphibian	Animal	Resting, adult

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 floodplain habitat surveys.*

5. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-24-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Partly sunny 80°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
0900	Bird		Catbird, Mallard, Common grackle	Housatonic River	Bird	Animal, call	Swimming, resting, adults
1000	Bird		Mallard, King fisher, Gray catbird, Goldfinch	Housatonic River	Bird	Animal	Swimming, flying/feeding, adults
1100	Bird		Ruby-throated hummingbird, Gray catbird, Goldfinch, Downy woodpecker	Housatonic River	Bird	Animal	Feeding, adults
1200	Bird		Goldfinch	Housatonic River	Bird	Animal	Flying, adult
1230	Bird		Gray catbird	Housatonic River	Bird	Animal	Foraging, adult
1400	Bird		Black-capped chickadee	Housatonic River	Bird	Animal, call	Resting, adult
1430	Bird		Ruby-throated hummingbird, Osprey, Goldfinch,	BW-6	Bird	Animal, call	Feeding, flying, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish

6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other

7. **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)

WILDLIFE FIELD OBSERVATIONS

Date: 8-25-2022							
Time:							
Weather: Sunny/Partly Cloudy/Cloudy/Mist/Showers/Rain/Snow: Sunny 80°F							
Team member(s): TO,JS							
Team activity: Floodplain Surveys							
Details of Observations:							
<u>Time</u>	<u>Observation¹</u>	<u>Data Collected:²</u>	<u>Species Observed³</u>	<u>Location⁴</u>	<u>Faunal Type⁵</u>	<u>Observation Type⁶</u>	<u>Behavior/Condition Description/Habitat Type⁶</u>
1000	Bird		Goldfinch, Great blue heron	Housatonic River	Bird	Animal, call	Flying, adults
1130	Bird		Northern cardinal, Gray catbird, A. crow	Housatonic River	Bird	Animal	Flying, resting, adults
1330	Bird		Gray catbird	Housatonic River	Bird	Animal	Foraging, adult
1330	Amphibian		Wood frog	Housatonic River	Amphibian	Animal	Resting, subadult
1500	Bird		American robin, Goldfinch	Housatonic River	Bird	Animal	Flying, adults

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. **Faunal Type:** Bird/Large mammal/Small mammal/Reptile/Amphibian/Fish
6. **Observation Type:** Animal/Scat/Track/Rub/Call or other sound/Eggs/Nest, den, or bed/Molt/Other
7. **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 Function and Value Assessment

As discussed in Section 6.3.4 of the main Baseline Restoration Assessment (BRA) Report for Reach 5A, a floodplain wetland functional assessment was conducted of three wetland functional units in the floodplain of Reach 5A of the Housatonic Rest of River (depicted on Figure 6-4). Those units are:

- Wetlands in Reach 5A from the Confluence to Holmes Road;
- Wetlands of Canoe Meadows (including the association with Sackett Brook/Sykes Brook and other surface waters); and
- Wetlands in the remainder of Reach 5A.

For each of these functional units, the functional assessment process was documented on a Wetland Function Form (Form FP-2). As discussed in Section 6.3.4 of the main BRA Report, 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 functions evaluated are 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. It 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.

The results of this wetlands functional assessment are provided in the completed Wetland Function Forms FP-2 for the three wetland functional units. These results are summarized in tabular form in the following Table E-1:

Table E-1: 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
5A-1	X	X	X	X	X	X	X	X	X	X	X	X	X
5A-2	X	X	X	X	X	X	X	X	X	X	X	X	X
5A-3	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.

The completed Forms FP-2 are provided below. The results are discussed, by function, in Section 6.3.4 of the main BRA Report. Overall, they show that all three of the floodplain wetland units provide a full range of functions and values.

Form FP-2: Wetland Function-Value Evaluation Form

Project Name: GE/Housatonic River

Total area of Evaluation Unit: ~160 acres
Is area part of a wildlife corridor? Yes
Adjacent land use: Residential
Distance to nearest roadway or development: 100 feet
Dominant wetland/aquatic systems present: Transitional Floodplain Forest, Shallow Emergent Marsh, Shrub Swamp.
Contiguous undeveloped buffer zone present? Yes, located west of Medium-gradient stream.
Upland communities present: Northern Hardwoods-Hemlock-White Pine Forest, Red Oak-Sugar Maple Transitional Forests.
Rare species habitat? Yes, NHESP Estimated Habitats and Priority Habitats of Rare species
Other unique or notable ecological conditions:

Site I.D.: Area 5A-1
Latitude: 42.431652 **Longitude:** -73.249945
Prepared by: Julia Stearns **Date:** 6/21/2023
Wetland Impact
Type: Floodplain Forest, Shallow Emergent Marsh, Shrub Swamp.
Area: 160 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	Associated wetlands meet some of the qualifiers though water quality may not be considered high.
	Floodflow Alteration	X		1, 2, 3, 6, 7, 8, 10, 13, 14, 15, 18	F	Wetlands relatively flat, receives and detains excessive flood water from adjacent river.
	Fish and Shellfish Habitat	X		1, 2, 4, 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.
	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.
	Nutrient Removal	X		4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14.	F	Sources of excess nutrients present in watershed.
	Production Export	X		1, 2, 4, 7, 8, 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, 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 and diversity of plant community structure, wildlife food sources.
	Recreation	X		1, 2, 4, 5, 8, 9, 10, 12	V	Wetlands and river are adjacent to and part of Fred Garner River Park with public parking and canoe access.
	Educational/Scientific Value	X		1, 5, 7, 8, 9, 10, 11	V	Potential for educational value though minimal easy access available at Fred Garner River Park.
	Uniqueness/Heritage	X		3, 4, 5, 6, 7, 8, 9, 11, 12, 22, 24,	V	Value is high for wildlife though no opportunity for visual observations available, parking is available at Fred Garner River Park.
	Visual Quality/Aesthetics		X	8	V	Area contains threatened/endangered species and contains critical habitat for state listed species though no opportunity for viewing.
	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: ~140 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, Low-gradient Stream, Moderately Alkaline Lakes/Ponds.

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 5A-2

Latitude: 42.426964 Longitude: -73.234915

Prepared by: Julia Stearns Date: 6/21/2023

Wetland Impact

Type: Shrub Swamp, Wet Meadow, Deep Emergent Marsh, Floodplain Forest

Area: 140 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, 6, 7, 8, 10, 13, 14, 15, 18	F	Wetlands relatively flat, receive and detain excessive flood water from adjacent river.
	Fish and Shellfish Habitat	X		1, 2, 4, 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.
	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.
	Nutrient Removal	X		4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14.	F	Sources of excess nutrients present in watershed
	Production Export	X		1, 2, 4, 7, 8, 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, 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 and diversity of plant community structure, wildlife food sources.
	Recreation	X		1, 4, 5, 7, 8, 9, 10, 11, 12	V	Wetlands are a part of Canoe Meadow Wildlife Sanctuary.
	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.
	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: ~330 acres
Is area part of a wildlife corridor? Yes
Adjacent land use: Residential, Agricultural, Utilities
Distance to nearest roadway or development: Within approx.. 0.25 miles
Dominant wetland/aquatic systems present: Transitional Floodplain Forest, Red Maple Swamp, Wet Meadow, Deep Emergent Marsh, Low-gradient stream.
Contiguous undeveloped buffer zone present? Yes
Upland communities present: Agricultural Fields, Successional Northern Hardwoods, Northern Hardwoods-Hemlock-White Pine Forest.
Rare species habitat? Yes, NHESP Estimated Habitats and Priority Habitats of Rare species

Site I.D.: Area 5A-3
Latitude: 42.416193 **Longitude:** -73.239080
Prepared by: Julia Stearns **Date:** 6/21/2023
Wetland Impact
Type: Transitional Floodplain Forest, Red Maple Swamp, Shrub Swamp, Wet Meadow, Deep Emergent Marsh.
Area: 330 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	Associated wetlands meet some of the qualifiers though water quality may not be considered high.
	Floodflow Alteration	X		2, 3, 6,7,8,9,10,11, 13, 14, 18	F	Wetlands relatively flat, receives and detains excessive flood water from adjacent river.
	Fish and Shellfish Habitat	X		1, 2, 4, 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.
	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
	Nutrient Removal	X		4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14.	F	Sources of excess nutrients present in watershed
	Production Export	X		1, 2, 4, 7, 8, 10, 12	F	Wildlife food sources, high degree of plant community structure, flowering plants used by nectar-gathering insects
	Sediment/Shoreline Stabilization	X		1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 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 and diversity of plant community structure, wildlife food sources.
	Recreation	X		4, 5, 7, 9	V	Walking path present, public use present.
	Educational/Scientific Value		X	1, 3, 5	V	No potential education sites available though walking path is present.
	Uniqueness/Heritage	X		1, 4, 5, 6, 7, 11, 12, 22, 24,	V	Value is high for wildlife though no opportunity for visual observations available.
	Visual Quality/Aesthetics		X	4, 6, 8	V	No public parking available and no real viewing locations available.
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

1. Vernal Pool Photo Log (2018-2019)
2. Form VP-1 Vernal Pool Characterization Form (Blank)

F-1 Vernal Pool Photo Log (2018-2019)

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 1		Date:		Photo No. 2	
Description: View of Vernal Pool 5A-VP-1 looking West				Date: 4/26/19	
		Description: View of Vernal Pool 5A-VP-1A looking North			
					

Photo No. 3		Date: 4/23/19		Photo No. 4	
Description: View of Vernal Pool 5A-VP-1B looking North				Date: 4/17/18	
		Description: View of Vernal Pool 5A-VP-2 looking North			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 5		Date: 5/23/18		Photo No. 6	
Description: View of Vernal Pool 5A-VP-3 looking North		Description: View of Vernal Pool 5A-VP-4 looking West			
					

Photo No. 7		Date: 4/26/18		Photo No. 8	
Description: View of Vernal Pool 5A-VP-5 looking East		Description: View of Vernal Pool 5A-VP-6 looking West			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 9		Date: 5/23/18		Photo No. 10	
Description: View of Vernal Pool 5A-VP-7 looking West		Description: View of Vernal Pool 5A-VP-8 looking West		Date: 4/13/19	
					

Photo No. 11		Date: 4/10/19		Photo No. 12	
Description: View of Vernal Pool 5A-VP-9 looking West		Description: View of Vernal Pool 5A-VP-10 looking North		Date: 4/26/18	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 13		Date: 6/9/09		Photo No. 14	
Description: View of Vernal Pool 5A-VP-12 looking West		Description: View of Vernal Pool 5A-VP-13 looking West			
					

Photo No. 15		Date: 5/2/19		Photo No. 16	
Description: View of Vernal Pool 5A-VP-14 looking North		Description: View of Vernal Pool 5A-VP-15 looking Northwest			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 17		Date: 4/13/19		Photo No. 18	
Description: View of Vernal Pool 5A-VP-15A looking West				Description: View of Vernal Pool 5A-VP-16 looking North	
					

Photo No. 19		Date: 4/26/18		Photo No. 20	
Description: View of Vernal Pool 5A-VP-18 looking West				Description: View of Vernal Pool 5A-VP-18A looking East	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 21		Date: 4/25/19		Photo No. 22	
Description: View of Vernal Pool 5A-VP-19 looking North				Description: View of Vernal Pool 5A-VP-20 looking North	
					

Photo No. 23		Date: 4/23/19		Photo No. 24	
Description: View of Vernal Pool 5A-VP-21 looking South				Description: View of Vernal Pool 5A-VP-22 looking North	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 25		Date: 5/14/18		Photo No. 26	
Description: View of Vernal Pool 5A-VP-24 looking West				Description: View of Vernal Pool 5A-VP-26 looking West	
					

Photo No. 27		Date: 5/1/18		Photo No. 28	
Description: View of Vernal Pool 5A-VP-27 looking West				Description: View of Vernal Pool 5A-VP-28A looking North	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 29		Date: 5/14/18		Photo No. 30	
Description: View of Vernal Pool 5A-VP-32 looking Northwest		Description: View of Vernal Pool 5A-VP-33 looking Northeast			
					

Photo No. 31		Date: 4/23/19		Photo No. 32	
Description: View of Vernal Pool 5A-VP-35 looking East		Description: View of Vernal Pool 5A-VP-36 looking West			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 33		Date: 5/1/18		Photo No. 34	
Description: View of Vernal Pool 5A-VP-40 looking West		Description: View of Vernal Pool 5A-VP-42 looking East			
					

Photo No. 35		Date: 4/25/19		Photo No. 36	
Description: View of Vernal Pool 5A-VP-49A looking East		Description: View of Vernal Pool 5A-VP-50 looking West			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 37		Date: 5/14/18		Photo No. 38	
Description: View of Vernal Pool 5A-VP-52 looking North		Description: View of Vernal Pool 5A-VP-54 looking West			
					

Photo No. 39		Date: 9/17/18		Photo No. 40	
Description: View of Vernal Pool 5A-VP-55 looking West		Description: View of Vernal Pool 5A-VP-57 looking Southwest			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 41		Date: 7/10/19		Photo No. 42	
Description: View of Vernal Pool 5A-VP-59A looking North		Description: View of Vernal Pool 5A-VP-60 looking Southeast		Date: 4/27/18	
					

Photo No. 43		Date: 4/27/18		Photo No. 44	
Description: View of Vernal Pool 5A-VP-61 looking Southeast		Description: View of Vernal Pool 5A-VP-62 looking North		Date: 4/27/18	
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 45		Date: 5/14/18		Photo No. 46	
Description: View of Vernal Pool 5A-VP-63 looking West		Description: View of Vernal Pool 5A-VP-64 looking West			
					

Photo No. 47		Date: 5/1/18		Photo No. 48	
Description: View of Vernal Pool 5A-VP-65 looking North		Description: View of Vernal Pool 5A-VP-69 looking Southwest			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 49		Date: 4/27/18		Photo No. 50	
Description: View of Vernal Pool 5A-VP-70 looking East		Description: View of Vernal Pool 5A-VP-71 looking Northwest			
					

Photo No. 51		Date: 5/14/18		Photo No. 52	
Description: View of Vernal Pool 5A-VP-72 looking West		Description: View of Vernal Pool 5A-VP-73 looking West			
					

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 53		Date: 5/14/18		Photo No. 54	
Description: View of Vernal Pool 5A-VP-73A looking North		Description: View of Vernal Pool 5A-VP-74 looking Southeast			
					

Photo No. 55		Date: 5/3/18		Photo No. 56	
Description: View of Vernal Pool 5A-VP-77 looking North		Description: View of Vernal Pool 5A-VP-79 looking Southeast			
					



PHOTOGRAPHIC LOG

Client Name: General Electric Company, Pittsfield, MA		Site Location: Housatonic River Reach 5A BRA		Project No. 60670015	
Photo No. 57		Date: 5/2/18		Photo No. 58	
Description: View of Vernal Pool 5A-VP-80 looking Northwest		Description: View of Vernal Pool 5A-VP-81 looking South			
					

Photo No. 59		Date: 5/2/18		Photo No.	
Description: View of Vernal Pool 5A-VP-83 looking Southwest		Description:		Date:	
					

F-2. Form VP-1 Vernal Pool Characterization Form (Blank)

Form VP-1: Vernal Pool Characterization Form¹

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).

Appendix G

Rare Species Information

Appendix G: Rare Species Information

To identify federally listed threatened or endangered species in Reach 5A, the U.S. Fish and Wildlife Service (USFWS) on-line Information, Planning, and Consultation System (IpaC) was consulted in August 2023. That review identified only one federally listed rare species as potentially occurring within the limits of Reach 5A – the northern long-eared bat (*Myotis septentrionalis*). It also identified one candidate species (under consideration for federal listing) – the monarch butterfly (*Danaus plexippus*) – as potentially occurring within the Reach 5A area.

State-listed species and their habitats in Reach 5A were determined based upon information provided by MNHESP. In October 2022 MNHESP provided GE with digital information presenting its delineation of state-listed species habitats in Reaches 5 through 8 of the ROR. These individual species maps are referred to as Species Habitat Maps. They are prepared by MNHESP using the “best scientific evidence available,” examining individual occurrence records in the context of species listing status and applying certain criteria, as described in Section 8.1.2 of the main Baseline Restoration Assessment Report for Reach 5A.

Table G-1 presents a summary of the state-listed species information generated from the digital data provided by MNHESP. In addition to the Species Habitat mapping provided by MNHESP for 20 state-listed species in Reach 5A, one additional state-listed species (the northern long-eared bat) is also included in the table that was not included in the MNHESP data. MNHESP has advised GE that it will not allow presentation of the Species Habitat Maps by individual species, although GE may report the overall area (i.e., acreage) in Reach 5A mapped for each state-listed species and present a general description of that area. Therefore, Table G-1 also provides the acreage of the Species Habitat map for each of the 20 species for which digital map information was provided. For the northern long-eared bat, the full area of the Reach 5A limits was included in the acreage tabulation based upon the mapping of this species from the USFWS IPaC consultation.

Following Table G-1, a summary is provided for each of the federally or state-listed species, describing the life-cycle and general habitat requirements of each species, along with a discussion of the extent (i.e., acreage) of the mapped Species Habitat for each state-listed species in Reach 5A and a general description of that area and of the observed suitability of Reach 5A to meet the species’ habitat requirements based upon the field surveys conducted to date. Most of the life-cycle and habitat information for each state-listed species has been generated from the species fact sheets provided by MNHESP as available on its website. These fact sheets are referenced in the species summaries and also included in the references listed after those summaries along with some additional references for certain species as appropriate. The extent of mapped Species Habitat for each species is taken from the Species Habitat maps provided by MNHESP.

Table G-1: State-Listed Species with Species Habitat Mapping Overlapping Reach 5A as shown on MNHESP Data Provided in October 2022

Scientific Name	Common Name	State Status	Area in 5A (Acres)	Taxonomic Group
<i>Botaurus lentiginosus</i>	American Bittern	E	164.0	Bird
<i>Ranunculus pensylvanicus</i>	Bristly Buttercup	SC	29.4	Plant
<i>Ophiogomphus aspersus</i>	Brook Snaketail	SC	240.6	Invertebrate
<i>Gallinula galeata</i>	Common Gallinule	SC	16.2	Bird
<i>Veronicastrum virginicum</i>	Culver's-Root	T	0.1	Plant
<i>Eragrostis frankii</i>	Frank's Lovegrass	SC	25.9	Plant
<i>Carex grayi</i>	Gray's Sedge	T	27.5	Plant
<i>Rhododendron maximum</i>	Great Laurel	T	1.7	Plant
<i>Elymus villosus</i>	Hairy Wild Rye	E	18.9	Plant
<i>Eleocharis intermedia</i>	Matted Spike-Sedge	T	116.8	Plant
<i>Pieris oleracea</i>	Mustard White	T	327.4	Invertebrate
<i>Myotis septentrionalis</i>	Northern Long-Eared Bat	E	409.8*	Mammal
<i>Boyeria grafiana</i>	Ocellated Darner	SC	276.8	Invertebrate
<i>Papaipema sp. 2 near pterisi</i>	Ostrich Fern Borer	SC	171.3	Invertebrate
<i>Phanogomphus quadricolor</i>	Rapids Clubtail	E	55.0	Invertebrate
<i>Ophiogomphus carolus</i>	Riffle Snaketail	T	191.7	Invertebrate
<i>Hylogomphus abbreviatus</i>	Spine-Crowned Clubtail	S	256.2	Invertebrate
<i>Carex tuckermanii</i>	Tuckerman's Sedge	E	0.9	Plant
<i>Sagittaria cuneata</i>	Wapato	T	171.2	Plant
<i>Malaxis monophyllos ssp. brachypoda</i>	White Adder's-Mouth	E	1.6	Plant
<i>Glyptemys insculpta</i>	Wood Turtle	SC	396.3	Reptile

*The acreage of the Northern Long-Eared Bat is derived from the IPaC data, since no Species Habitat map for this species was provided by MNHESP.

GENERAL INFORMATION ON LISTED RARE SPECIES

American Bittern (*Botaurus lentiginosus*)

Summary of Species Life Cycle and Habitat Requirements

The American Bittern (*Botaurus lentiginosus*) is a wading bird that inhabits freshwater wetlands, spending most of its time secretly dwelling in marshland emergent vegetation. The American Bittern is an Endangered Species under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). It is a brown, streaked, medium sized (23-34 inches long) heron that hides among emergent vegetation including sedges, rushes, and grasses. It has pale yellow or yellowish-green bill, legs, and feet, and a buff-colored stripe over its yellow eyes. Its wingspan is 32 to 50 inches with black wingtips easily identified in flight. 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. Its slow and stealthy walk and characteristic motionless stance with bill pointed upwards when startled, enhance its resemblance to marsh vegetation or debris, a camouflage which the American Bittern relies on to escape notice by predators, or with slowly aimed bill, strike and seize unsuspecting prey. Preferred foods include frogs, small snakes and eels, salamanders, crayfish, fish, and occasionally mice and grasshoppers caught on visits to wet meadows and grasslands.

The American Bittern migrates from its winter habitat in the southern United States and arrives in Massachusetts marshes in April. Courtship behavior includes aerial and ground chases with males stalking females, displaying their white plumes and calling in loud, guttural “pumps.” Courtship calls stop by the end of May, and the female builds a nest of dead reeds, cattails, grasses and sedges about 1 foot in (30 cm) in diameter on the ground in dense vegetation. American Bitterns prefer marshes for nesting sites and are known to also construct nesting platforms of vegetation a foot above water. They will occasionally nest in uplands adjacent to wetlands. American Bitterns have shown relatively high site fidelity (Azure 1998). Males appear territorial during the breeding season and stay close to the nest site. They may be polygamous. Females care for the young. A clutch will typically have 4 to 5 eggs that will hatch within 24 to 29 days. The chicks become fledglings after 14 days and by the end of the summer, juvenile American Bitterns begin to wander away from the nest. There is only one clutch per year with the female continuing to tend to her young for an undetermined length of time after they leave the nest. American Bitterns may winter as far north as the east coast of Massachusetts. Migration to habitats in the southern U.S. occurs during October and November, and by December, most American Bitterns have left Massachusetts. The American Bittern has been reported from many towns of Berkshire County, including Pittsfield and Lenox, as well as across Massachusetts (MNHESP 2015).

American Bittern Habitat in Reach 5A

According to 2022 MNHESP database information, Species Habitat for the American Bittern occurs in Reach 5A totaling 164 acres in three general areas. One area is located downstream of the Confluence on the west side of the River. A larger habitat area is located to the east of the River associated with the marshes of Canoe Meadows and south to Sykes Brook. The largest of the three

habitat areas within Reach 5A is located to the west of the River, extending from across Sackett Brook along the river corridor to the south to marshes on the north side of the Pittsfield WWTP. The collective assemblage of the habitat types included in the mapped Species Habitat areas for the American Bittern provides conditions suitable for various life-cycle functions of this species, including courtship, nesting, resting, cover, and foraging. The diversity and complex juxtaposition of the varied habitats in Reach 5A are expected to promote a broad distribution of the American Bittern throughout the mapped Species Habitat for these various functions; there are no specific habitat cover types in these mapped areas that would be incompatible with the needs of and use by this species.

Bristly Buttercup (*Ranunculus pensylvanicus*)

Summary of Species Life Cycle and Habitat Requirements

Bristly Buttercup (*Ranunculus pensylvanicus*) is an annual or short-lived perennial member of the Buttercup family (*Ranunculus*). Bristly Buttercup is a Species of Special Concern under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). Bristly Buttercup is differentiated from other buttercups by its leaves, hairy (pubescent) stem, flowers and fruits. Leaves are alternate, toothed, and trifoliate with three deeply cut lobes. Stiff, bristly, spreading hairs cover the tall branched or unbranched stems (1 to 2.25 ft), creating a distinctive pubescence. The small, pale yellow flowers (0.6 to 0.8 cm wide) form on short stalks and are composed of 5 egg-shaped petals which turn whitish over time. The achenes (small dry fruits) have short, stout, but not hooked, appendages projecting from their tips that form a short cylindrical cluster (0.8 cm to 1.3 cm long). In Massachusetts, Bristly Buttercup flowers from the beginning of July through September. Bristly Buttercup is not typically capable of spreading vegetatively, although is able to colonize a variety of habitats through seed dispersal by water and wildlife. The successful germination of its seeds and seedling establishment are critical to its persistence. 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 Buttercup 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. Bristly Buttercup populations are currently known to occur in Berkshire County in the towns of Pittsfield, Lenox, Sheffield, and New Marlborough; and 14 towns from Hampden and Worcester Counties (MNHESP 2015).

Bristly Buttercup Habitat in Reach 5A

According to 2022 MNHESP database information, the Species Habitat of the Bristly Buttercup occurs in one area of Reach 5A, approximately 29.36 acres in size in the central portion of Reach 5A to the west of the Housatonic River. This area contains riverbank and a diversity of floodplain habitats conducive to the growth of the Bristly Buttercup, including floodplain forests, wet meadows, shallow emergent marshes, and shrub swamps. Due to the ability of Bristly Buttercup to grow successfully in many different wetland and floodplain habitats, it could potentially be found within any of the habitat types which have been mapped by MNHESP (other than any strictly aquatic habitat in Reach

5A), and most of the mapped Species Habitat appears suitable for this species. In addition, due to the annual nature of this species, plants may not always occur in the same areas from year to year.

Brook Snaketail (*Ophiogomphus aspersus*)

Summary of Species Life Cycle and Habitat Requirements

The Brook Snaketail (*Ophiogomphus aspersus*) is a dragonfly member of the Gomphidae family known as the clubtails. It is a Species of Special Concern under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020). Clubtails have small, widely separated compound eyes that distinguish it from most other dragonflies. The name clubtail derives from the lateral swelling near the end of the abdomen that appears “club-like”. The extent of the swelling or club varies greatly depending on the species. Males generally have a larger club than females. Although unknown, the club may have use in courtship displays or enhance the aerodynamics of flight. The Brook Snaketail belongs to the genus *Ophiogomphus* which are snaketails that characteristically exhibit a brilliant green thorax, eyes, and face. The club of the Brook Snaketail is over half the width of its thorax. Pale green to yellow markings that run down the sides of the black to dark brown abdomen are largest at the club, while wide, yellow, dagger shaped markings run down the center of the top of the abdomen. The clear wings display a dense network of veins and are held horizontally in the characteristic horizontal perching stance of the Brook Snaketail on rocks, logs, vegetation, and the ground. Adult Brook Snaketails are 1.7-1.8 inches in length. The female is larger and has a smaller club near the tip of the abdomen than the male.

Two distinct stages complete the life cycle of the dragonfly after hatching from an egg including an aquatic larval or nymph stage and a flying adult stage. The nymphs of the Brook Snaketail prefer sandy substrates in clear running water, and have a relatively high oxygen requirement among this family (Hart and Fuller 1974, Merritt and Cummins 1978, NHESP 2008). A near-neutral to slightly basic pH is preferred. Nymphs are found near the surface of the sediment (within the upper inch), where they develop over at least a year-long period, possibly two to three years. Brook Snaketail nymphs spend most of their time burrowing in the sand which protects them from predators. It also camouflages them as they are ambush predators, attacking a variety of aquatic life from passing insects to small fish and tadpoles. When ready to emerge as adults, typically in the last half of May, nymphs climb onto open sandy to gravelly banks and rocks or woody debris, the exoskeleton splits, and adults emerge. The newly emerged adult, or teneral dragonfly, is very soft and vulnerable, and can be damaged by rain showers, falling debris, or predators. As soon as the wings are dry and strong enough, the adult Brook Snaketail flies into adjacent woodland or shrubland that surround the breeding habitat to find safe shelter among the leaves and branches of trees where it can continue to develop. The maturation process of the new adult dragonflies occurs during the following week as they wander from woodland to forest clearings and fields, feeding on small aerial insects such as flies and mosquitos. With completion of the maturation process, the adults return to the stream to breed. The male Brook Snaketail patrols the water and stream banks to search for potential mates and to drive out competing males. This family is typically a “short flight” species requiring substantial perching places as they move along the stream, usually woody debris, live woody plants, and rocks. Females return to the stream only briefly when they are ready to mate and

release eggs singly or in small clusters through ovipositors by repeatedly touching their abdomens to the water surface in riffle zones while flying back and forth.

In Massachusetts, the Brook Snaketail is thought to breed from early June through late August. The eggs incubate over one to two weeks and hatch into larvae which re-initiate the life cycle. Adults may live out the rest of the summer far from the stream, often in dense woodland or shrubland. In Massachusetts, the flight period of the adult is mid-May through August. The Brook Snaketail has not been found in large numbers in Massachusetts (MNHESP 2015). Despite the current Brook Snaketail Species Habitat mapping from MNHESP extending throughout Reach 5A of the ROR, the MNHESP (2015) Brook Snaketail fact sheet shows this species to be distributed only in central Massachusetts west to the Connecticut River valley, with no towns in Berkshire County indicated in the MNHESP distribution map of this species.

Mapped Species Habitat in Reach 5A

According to 2022 MNHESP database information, mapped Species Habitat of the Brook Snaketail occurs in 240.65 acres within Reach 5A, extending from the confluence of the East and West Branches downstream for approximately two miles. The areal extent of the nymph habitat includes the main stem of the river plus the banks for eclosion (emergence as adults). The areal extent of adult habitat is broader and includes the main stem of the river, backwaters, floodplain, and some adjacent upland forests or scrubland. The MNHESP Species Habitat extends into these habitats.

Common Gallinule (*Gallinula galeata*)

Summary of Species Life Cycle and Habitat Requirements

The Common Gallinule (*Gallinula galeata*), formerly known as the Common Moorhen, is a duck-like swimming bird that inhabits large freshwater or brackish marshes and water bodies with cattails and other emergent vegetation. The Common Gallinule is a Species of Special Concern under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). It is described as having a length of 13 inches with a wingspan of 21 inches, large yellow unwebbed feet, a black head and neck, and a yellow-tipped red bill that runs up its forehead to form a red shield. Its back is brown, underside is slate-grey, and its short, upturned tail has white outer and black inner undertail feathers. Preferred habitat is 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 water bodies that are at least one foot deep with dense cattail beds, and occasionally shrub marsh adjacent to open water with aquatic bed vegetation. Though Common Gallinules prefer emergent wetlands as foraging, breeding, nesting, and protective cover habitat, they also utilize margins of lakes, ponds, and slow-flowing rivers and streams as feeding areas. Using the cover of the dense vegetation at the edges of open water, the wading or dabbling Common Gallinule feeds on grass, sedge seeds, berries, foliage, underwater plants, and duckweed, along with insects, snails, worms, and other invertebrates.

The Common Gallinule migrates from wintering ranges in the southern U.S. to Massachusetts in late April or May. Nesting begins in May to early June. The nest is well-made of dead cattails, rushes, and stems of other aquatic plants. It is built in supportive dense vegetation typically less than 1 foot over water but up to 2 feet where it is well hidden within the surrounding plants, often with a ramp leading from the water. Unfinished nest-like platforms may be found in the vicinity of the nest for

roosting and brooding, and may be used by the young that have left the original nest to spend the night as they wander the marsh. Incubation of the 6-17 eggs (typically 10-12) beginning in late May involves both parents for 3 weeks. As the chicks hatch, they are cared for by the male while the female incubates the remaining eggs, completing hatching by mid-July. The young are precocial and ready to leave the nest within a day of hatching, feed independently after 3 weeks, and fly in 6-7 weeks, however, they remain with their parents for some time thereafter. The Common Gallinule may have one or two broods per year. Although a rare breeder in Massachusetts, this species has been found breeding across the state. There have been twenty-three verified sites in Massachusetts over the past 25 years with most supporting only single breeding pairs. MNHESP's field surveys find the presence of invasive plants, particularly Phragmites, to be the largest limiting factor to current Common Gallinule occupied sites. The flight pattern of the Common Gallinule tends to consist of short, local flights, except during migration when they are found to exhibit a strong site fidelity, returning to familiar grounds (Bannor and Kiviat 2002). Home range sizes for this species are relatively small averaging approximately 3 acres (range of 0.5-8 acres) for nesting adults, and home ranges of 15 acres for non-nesting adults (Bannor and Kiviat 2002). Migration to their wintering range occurs in October. Reported occurrences of the Common Gallinule in Berkshire County are from the towns of Pittsfield, Lenox, Lee, Richmond, Washington, Stockbridge, Egremont, and Sheffield; other reports are from eastern Massachusetts (MNHESP 2019).

Common Gallinule Habitat in Reach 5A

According to 2022 MNHESP database information, the Species Habitat of the Common Gallinule occurs in two small areas in Reach 5A, both in marshes north of the Pittsfield WWTP on the west side of the Housatonic River. The mapped Species Habitat for this species in Reach 5A comprises 16.23 acres. The areal extent of habitat includes the backwater deep marshland off the main stem of the river, and nearby shallow marshes.

Culver's-root (*Veronicastrum virginicum*)

Summary of Species Life Cycle and Habitat Requirements

Culver's-root (*Veronicastrum virginicum*) is an herbaceous perennial wildflower of tall stature (2.6-6.5 ft) with showy arrays of dense pink or white flowers on several candelabra-like terminal spikes. Culver's-root is a Threatened Species under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). It has several erect unbranched stems with whorls of three to six finely serrate, narrow leaves to tapering terminal spikes (5-15 cm or 2-6 in long) that are densely covered with tubular flowers. In Massachusetts, Culver's-root flowers from the beginning of July through August. In Massachusetts, Culver's-root is found in open habitats created by periodic disturbances such as flooding, mowing, or grazing. Typically, it inhabits moist, open meadows with alkaline soils that often have been previously cultivated. Reported populations have also occurred along a roadside and in a moist utility right-of-way. Sites in which the plant may have been introduced are not regulated. Culver's-root is found in Berkshire County in the towns of Pittsfield, Lenox, Great Barrington, Alford, Egremont, and Sheffield; and one town each in Hampden, Hampshire and Worcester Counties (MNHESP 2015).

Culver's-Root Habitat in Reach 5A

According to 2022 MNHESP database information, Species Habitat of the Culver's-root occurs within one small (0.12 acres) of Reach 5A. The habitat is a tiny area located near the Confluence of Reach 5A to the east of the Housatonic River. Culver's-root could potentially be found within the/any of the habitat types which have been mapped by MNHESP (other than any strictly aquatic habitat in Reach 5A), and most of the mapped Species Habitat is suitable for this species.

Frank's Lovegrass (*Eragrostis frankii*)

Summary of Species Life Cycle and Habitat Requirements

Frank's lovegrass (*Eragrostis frankii*), also known as sandbar lovegrass, is an annual grass species identified by its repeatedly branching clusters on straight stems from about 4 inches up to a foot high. Frank's lovegrass is listed as a Species of Special Concern under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). It has narrow blades measuring 5-13 cm long and 1-3mm wide, and tiny ovate spikelets with typically 3-5 flowers that flower from August- September. In Massachusetts, Frank's lovegrass occurs on sandbars and sandy riverbanks found only along the Housatonic and Connecticut Rivers. Despite the current Frank's Lovegrass Species Habitat mapping from MNHESP extending throughout the southern portion of Reach 5A, the MNHESP (2015) Frank's Lovegrass fact sheet does not show this species occurring in Pittsfield on the MNHESP distribution map, however does show it occurring in Berkshire County in the towns of Lee, Cheshire, Windsor, Richmond, Great Barrington, Alford, Sheffield, and New Marlborough; as well as in eight towns throughout Franklin, Hampshire, and Hampden Counties. Eighteen current occurrences have been verified (MNHESP 2015).

Mapped Species Habitat in Reach 5A

According to the 2010 NHESP database information, the Species Habitat mapping for Frank's Lovegrass did not occur in Reach 5A. According to the 2022 MNHESP database information, the Species Habitat mapping for Frank's Lovegrass now covers the lower half of Reach 5A, as well as further downstream as in 2010. The mapped Species Habitat for Frank's lovegrass is composed of river channel, including sandbars within the river, riverbank, and some floodplain habitat, and totals approximately 25.90 acres in size along a roughly 2.5-mile stretch of the River in the downstream end of Reach 5A. This species prefers sandy substrate within or at edges of the river channel. Based upon the recent surveys of habitat conditions along the Housatonic River in Reach 5A, suitable conditions to support the growth of Frank's Lovegrass appear to occur throughout this portion of Reach 5A.

Gray's Sedge (*Carex grayi*)

Summary of Species Life Cycle and Habitat Requirements

Gray's Sedge (*Carex grayi*) is a perennial member of the sedge family (Cyperaceae) that is a clump forming plant with an identifying striking 'spiked-ball looking' flower created by a spherical flowering spike comprised of inflated perigynia radiating outward in all directions. Gray's sedge is a Threatened Species under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). Gray's Sedge grows as clusters of solitary or multiple stems with short rhizomes up to about 3.6 feet high.

The culms (reproductive stems) are triangular and each has a staminate spike above one or two pistillate spikes. Achenes (dry, indehiscent, one-seeded fruit) develop within the perigynia following flowering. Mature perigynia are present throughout most of the summer, from mid-June through September. It has broad (4 to 11 mm wide), pale green to gray-green leaves with loose, persistent purplish-red sheaths at the base.

Gray's Sedge is found in rich, mesic soils of forests, calcareous seepage swamps, marshes, banks, 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. More specifically, many current populations of Gray's Sedge in the state are found along oxbows within floodplain forests or in low depression or swales where they prefer lower slopes and bottoms. Despite the current Gray's Sedge Species Habitat mapping from MNHESP shown in the southern portion of Reach 5A of the ROR, the MNHESP (2015) Gray's Sedge fact sheet does not show this species occurring in Pittsfield on the MNHESP distribution map, however does show it occurring in Berkshire County in the towns of Lenox and Sheffield; and in six towns throughout Franklin, Hampshire and Hampden Counties (MNHESP 2015).

Gray's Sedge Habitat Reach 5A

According to 2022 MNHESP database information, the Species Habitat for Gray's Sedge within Reach 5A occurs in 27.5 acres of floodplain wetland along a roughly one-mile section of the River north of the Pittsfield WWTP. The mapped Species Habitat in Reach 5A consists primarily of shrub swamp and floodplain forest communities, but also includes some portions of the river channel, riverbanks, and backwaters. As described above, the Gray's Sedge is able to grow successfully in many different wetland and floodplain habitats, therefore most of the mapped Species Habitat, with the exception of the permanently inundated riverine and backwater habitat, appears suitable for this species.

Great Laurel (*Rhododendron maximum*)

Summary of Species Life Cycle and Habitat Requirements

Great Laurel (*Rhododendron maximum*) is an evergreen shrub or small tree that grows up to 33 ft high belonging to the Ericaceae or Heath family. Great Laurel is a Threatened Species under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). Its leathery evergreen leaves are 3-8 inches long, smooth-margined, alternate, wider above the middle, and vary in color with dark green on top and paler green underneath. The underside of the leaves and young branchlets are pubescent. The flower of Great Laurel is a pink to white, five-lobed calyx having yellow or orange spots on its inner surface. It measures about 1.5 inches long and is clustered on sticky pedicels of terminal inflorescences forming a dome shape. In Massachusetts, Great Laurel flowers from late June to mid-July.

Great Laurel grows best in filtered light in moist woods, swamps, and pond edges. In Massachusetts, its habitats have been observed to include a boggy swamp edge, an Atlantic White Cedar swamp near an open pond, a forested seepage fen where peat is forming and very cold, nutrient-poor water seeps to the surface, and the edge of a red maple swamp. Despite the current Great Laurel Species Habitat mapping from MNHESP shown in the central portion of Reach 5A of the ROR, the MNHESP

(2015) Great Laurel fact sheet does not show this species occurring in Pittsfield on the MNHESP distribution map, however does show it occurring in Berkshire County in the towns of Savoy, Peru, Richmond, Egremont, and Otis; and in 8 towns throughout Hampshire, Franklin, Worcester, Norfolk, Counties (MNHESP 2015).

Great Laurel Habitat in Reach 5A

According to 2022 MNHESP database information, the Species Habitat for Great Laurel occurs within a single small (1.72 acres) area of Canoe Meadows east of the River in Reach 5A. The mapped Species Habitat in Reach 5A consists primarily of shrub swamp and floodplain forest communities, but also includes some portions of the river channel, riverbanks, and backwaters.

Hairy Wild Rye (*Elymus villosus*)

Summary of Species Life Cycle and Habitat Requirements

Hairy Wild Rye (*Elymus villosus*) is a native perennial, tufted grass in the family Poaceae distinguished by its bristly, white pubescent “bottle-brush” inflorescence. Hairy wild rye is an Endangered Species under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020). It grows to just over a meter high with stems topped by an elongate, often arching terminal spike (inflorescence) which is densely covered with whitish villous pubescence, creating the very bristly appearance distinctive of Hairy Wild Rye. Spikelets form tightly within the typically arching spike. Each spikelet has 1 or 2 florets containing a mature single seeded fruit or grain for much of the summer (mid-June through September). Its dark green, evenly distributed leaf blades are 4-12 millimeters wide with a dense villous upper surface.

Hairy Wild Rye is found in floodplain forests, rich moist thickets, and rocky woodlands. In Massachusetts, Hairy Wild Rye inhabits high terrace floodplain forests with moist alluvial soils, and moist to dry, rich, rocky open woods and thickets. Hairy Wild Rye is currently known from Berkshire County in the towns of Pittsfield, Great Barrington, and Sheffield, and Worcester County (MNHESP 2015).

Hairy Wild Rye Habitat in Reach 5A

According to 2022 MNHESP database information, Species Habitat of hairy wild rye occurs in the central portion of Reach 5A northeast of the City of Pittsfield Wastewater Treatment Facility on the west side of the Housatonic River. Hairy Wild Rye Species Habitat comprises approximately 18.90 acres. The areal extent of the mapped Species Habitat includes the riverbanks as well as forested, shrub swamp, and emergent marsh areas in the floodplain. The Species Habitat contains high quality habitat suitable for Hairy Wild Rye. Specific occurrences of Hairy Wild Rye have been reported within the forested floodplain habitat in Reach 5A (Woodlot 2002).

Matted Spike-sedge (*Eleocharis intermedia*)

Summary of Species Life Cycle and Habitat Requirements

The Matted Spike-sedge (*Eleocharis intermedia*), formerly known as the Intermediate Spike-sedge, is an annual herb belonging to the Sedge Family. The Matted Spike-sedge is a Threatened Species under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020). The Matted Spike-sedge

is a small, tufted plant, about 2-10 inches tall with thin, wiry, leafless-looking stems of different lengths that typically clump together to form the appearance of a mat as shorter stems stand erect and taller stems bend and lay horizontally. The very slender, round stem has a single vertical groove up it and only leaf sheaths surround it, no leaf blades, which gives its leafless appearance. The apex of each stem has a tight cluster of inconspicuous flowers forming the spike appearance of the spike-sedge. A hard, nut-like, tiny achene ((dry, one-seeded fruit about 1 mm wide) or fruit of the Matted Spike-sedge protects its single seed, and the characteristic narrow, small dunce cap appearance of the achene's tubercle (protuberance) distinguishes it from other spike-sedges. As an annual plant, the occurrence and distribution of the Matted Spike-sedge may vary from year to year depending on the presence of suitable habitat and seed production. The achenes of these species are distributed by moving water, and germinate when conditions are suitable at their dispersed location. The light brown to pale olive or yellow achene matures in mid to late summer, and flowers from August-October.

The Matted Spike-sedge is typically found in marshes, freshwater mudflats, or in other wet areas with muddy substrates. Based on the occurrence of Matted Spike-sedge in freshwater marsh mudflats or muddy soils, observations of populations in Massachusetts established that habitat of Matted Spike-sedge involves an essential proximity to a freshwater source, particularly with beneficial fluctuating water levels that create exposed mud conditions during low-water years, such as rivers, ponds, and streams. Regular flooding and/or gentle wave action create the low-level disturbance needed to maintain the more open, muddy habitat conditions where Matted Spike-sedge thrive. In Massachusetts, the Matted Spike-sedge is found on muddy, alkaline riverbanks and pond shores, usually during periods of low water when mud is exposed. It is reported only in the western part of the state from twelve towns of Berkshire County including Pittsfield, Lenox and Lee; and four towns from Franklin and Hampshire counties (MNHESP 2019).

Matted Spike Sedge Habitat in Reach 5A

According to 2022 MNHESP database information, the Species Habitat of the Matted Spike-sedge extends from the Confluence south through all of Reach 5A. Occurrences of the Matted Spike-sedge have historically been reported along the Housatonic River within Reach 5A west of the Joseph Road area (Woodlot 2002). This species prefers muddy shoreline habitat, and such habitat is broadly distributed along the river margins and shallow backwaters throughout the mapped Species Habitat. The total Species Habitat of the Matted Spike-sedge in Reach 5A covers 116.79 acres. The areal extent of the mapped Species Habitat in Reach 5A is primarily confined to the main channel of the Housatonic River, its riverbanks, and the contiguous backwater areas; however, mapped Species Habitat also includes areas of forested floodplain, shrub swamp, and emergent marsh along the margins of the river. It is assumed that plants or achenes are also broadly distributed throughout the river and backwater areas, as well as emergent marsh habitats, within the mapped Species Habitat; however, as this species is an annual plant, the locations of growing plants within the Species Habitat from year to year are likely to vary.

Monarch Butterfly (*Danaus plexippus*)

Summary of Species Life Cycle and Habitat Requirements

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 2022b). Adult monarchs are pollinators, feeding on a variety of native wildflowers. Milkweed (*Asclepias syriaca*) is the only host plant used during the larval stage (caterpillars) for this species. The adults lay their eggs on the underside of the leaf and the larva feeds on the leaves as it grows before entering the pupa stage and eventually emerging as an adult butterfly. Over the last two decades, numbers have declined, and therefore this species is a candidate for listing by the USFWS. 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 (USFWS 2022b). The monarch butterfly is not currently a state-listed species in Massachusetts.

Monarch Butterfly Habitat in Reach 5A

Open meadows (both wetland and upland) in Reach 5A provide potentially suitable habitat for monarch butterflies. These habitats support several milkweed species which serve as the larval host plants for monarch butterflies. These habitats are most common in the Canoe Meadows area and just north of the Pittsfield WWTF.

Mustard White (*Pieris oleracea*)

Summary of Species Life Cycle and Habitat Requirements

The Mustard White (*Pieris oleracea*) is a medium-sized, white (pierid) butterfly member of the Pieridae family that is thought to belong to the *Pieris napi* complex (an Old World species). It is a Threatened Species under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020). The wings of the spring brood of the Mustard White are white with a small yellow spot on the underside of the hind wing at the humeral angle, and distinct gray to black scales outlining the wing veins that are only faintly seen in later broods. The only markings above are some gray to black shading along the costa and at the apex of the forewing. Its wingspan is 32-50 mm. Typically, there are three broods and three flight periods of the Mustard White. In Massachusetts, the spring brood flies from mid to late April through May, the second brood from July to early August, and a third brood flies in late August to early September. In some years, a fourth late season brood is possible (Nelson 2010). The flight of the Mustard White butterfly is considered weak or docile when compared to other butterfly species (Leahy et al. 2006).

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. The home range and travel patterns of the Mustard White appear to depend primarily on the availability and distribution of the host plants at the time of each brood. Two herbaceous woodland plants are essential larval hosts, the native two-leaved toothwort (*Cardamine diphylla*) found in deciduous forests and floodplains and introduced cuckoo-flower from Eurasia (*Cardamine pratensis*) growing in

forests and floodplains, meadows, lawns, and roadsides. Other larval hosts include rape (*Brassica rapa*), which is found in hayfields and on roadsides; watercress (*Nasturtium*), which is found only in wet areas with running water, and other mustard family plants (Brassicaceae), however these are typically only available for second and third broods making nearby forests with the early flowering toothwort a critical habitat requirement, as well as the early flowering cuckoo-flower (Stichter 2015). Females are also attracted to common winter cress (*Barbarea vulgaris*) and field pennycress (*Thlaspi arvense*) as potential host plants, however, these plants do not support larval growth (Leahy et al. 2006).

In Massachusetts, the largest known populations of Mustard White are found in open, damp meadows where larvae feed mainly on the introduced cuckoo-flower (*Cardamine pratensis*) as it is an early growth larval host plant available for the spring brood as well as later broods, and beneficially promotes a fast growth rate and high survivorship (Stichter 2015). With the spread of invasive garlic mustard, growth of host plants were inhibited, and female Mustard White butterflies began to lay their eggs on garlic mustard despite its effect of slow larval growth and poor survivorship (Courant et al. 1994). Observations in Lee, MA (1990), however, provided initial evidence that the Mustard White may be successfully adapting to effectively use the garlic mustard as a larval host with increasing survivorship, and other similar evidence has accumulated since then (Keeler & Chew 2008), inciting speculation that since garlic mustard (*Allaria*) is a prominent suitable host for the related *P. napi* species in Europe, it is feasible that the North American *P. napi oleracea* may be in the process of adapting to it (Stichter 2015). Adult butterflies feed on the nectar of the larval host plants and other flowers (Nelson 2010). Adult males will patrol open areas in search of receptive females during warm daylight hours. Females deposit single eggs on the underside of the leaves of host plants. The Mustard White overwinters in a chrysalis attached to a plant stem close to the ground.

Massachusetts is the southern range of the Mustard White, and it is currently only known in seven towns in central Berkshire County including Pittsfield, Lenox, and the southernmost town of Lee (MNHESP 2015). The Mustard White has been in decline in Massachusetts since about 1850. The focus of limitations for this species is primarily the loss of forest and meadow habitats and the host plants they support, with greatest emphasis on the host plants, toothwort and cuckoo-flower, that are critical to the success of the spring brood (Stichter 2015). Parasitism by the introduced braconid wasp, *Cotesia glomerata*, a parasite of the introduced Cabbage White butterfly, inhibited the Mustard White population as its caterpillars were found preferable over those of the Cabbage White, however, in recent years there has been a dramatic decline in the braconid wasp population in Massachusetts (Van Driesche et al 2003). Invasive garlic mustard spread inhibiting host plant growth and used instead by female Mustard White butterflies as host plants to lay eggs on. However, slow larval growth and poor survivorship on garlic mustard contributed to its decline. More recently in Massachusetts, however, there is evidence that larval growth rates and survivorship have improved, indicating adaptability of the Mustard White to effectively use garlic mustard as a host. The adaptability of the Mustard White has also been shown by populations in Massachusetts by using the introduced cuckoo-flower as a host which has proven to promote fast larval growth and high survivorship for all broods. Another limitation for the population of the Mustard White is hydrologic alteration in riparian floodplain habitat where periodic flooding maintains host plants.

Mustard White Habitat in Reach 5A

According to 2022 MNHESP database information, the Species Habitat of the Mustard White butterfly extends south contiguously through the southern two-thirds of Reach 5A below the Holmes Road bridge, covering 327.4 acres. The areal extent of the habitat includes the main stem of the Housatonic River and its backwaters, various habitats within the floodplain of the River (including floodplain forest, shrub and emergent marsh habitats, vernal pools, upland forest, and disturbed upland habitats). Although the Mustard White's primary habitat is moist deciduous woodlands, this species utilizes a diversity of habitats and could be found within or at the edges of all these communities. Literature reviews for this species indicate that the species uses a fairly diverse group of habitats, and most of the mapped Species Habitat would be acceptable habitat for the Mustard White during some stage of its life cycle (except for the purely aquatic habitats).

Northern Long-eared Bat (*Myotis septentrionalis*)

Summary of Species Life Cycle and Habitat Requirements

The Northern Long-eared Bat (*Myotis septentrionalis*) or Northern Myotis is a small, brown bat with unique large, long ears that distinguish it from other species in Massachusetts. The Northern Long-eared Bat is an Endangered Species under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020). Its long ears distinctively extend at least 4mm past its nose when pushed forward. Its light brown fur, wing membranes, and dark base to light tip hairs on its back give it an overall brown color. It averages 50-95 mm in total length with a tail of 34-42 mm, and 5-8 g in weight. 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. They may also be found in human made structures. Northern Long-eared Bats forage under canopies through complex strata of forest habitats, often feeding on insects above small ponds, vernal pools, and streams, or along gravel paths, roads and forest edges. After their daytime roosts, Northern Long-eared Bats emerge at dusk to begin feeding flights where they fly slowly, snatching up insects on the fly or resting insects on foliage while navigating through their complex forest environment with the aid of their specially adapted long tails and large wing membranes. They use passive listening and emit high frequency echolocation calls to locate resting insects. The Northern Long-eared Bat's body weight increases up to 45% between August and October, preparing a winter fat reserve for hibernation. Typical winter hibernacula are in natural caves and abandoned mines meeting their preference for sites with high humidity where water droplets may accumulate on their fur. They swarm the entrances of caves in late summer, possibly testing the air for suitable winter hibernacula, and mate at this time with sperm stored within females until spring. Northern Long-eared Bats enter their winter hibernacula sites by early November after migrating up to 56 km from their foraging habitat. They share caves with other species and typically hibernate singly or in small groups in deep cracks or crevices of the caves. Once the Northern Long-eared Bat is settled in its winter hibernacula, its metabolism slows and it enters torpor, although able to stir occasionally to drink water throughout the winter. They return year after year to the same winter hibernacula, but do not necessarily hibernate in the same location. Females bear their single young and rear them from mid-May through July. The longevity record of the Northern Long-eared Bat is 18 years.

Northern Long-eared Bat populations, once common in the northern United States, have been devastated by the spread of the White-nose Syndrome fungus. Infected hibernacula in caves in the Northeast have caused catastrophic population losses of 90-100%. During hibernation, the fungus grows and spreads over the bats causing them to rouse frequently from dormancy and use valuable stored fat needed to survive the winter, resulting in death. The movements of breeding male bats are believed to be primarily responsible for passing the fungus from cave to cave, but transport by humans is also thought to infect some hibernacula. Northern Long-eared Bats are widespread in Massachusetts and have been found in 11 of 14 Counties. Winter hibernacula have been reported in Berkshire, Franklin, Hampden, Middlesex, and Worcester Counties. (MNHESP 2019).

Northern Long-Eared Bat Habitat in Reach 5A

MNHESP did not provide Species Habitat mapping of the Northern Long-eared Bat. However, the USFWS IPaC consultation indicates that potential habitat for NLEB occurs throughout all of Reach 5A. The full 410 acres of Reach 5A appears to contain suitable habitat including forested and forest edge areas for roosts as well as foraging, small pond areas, areas of vernal pools, along streams, gravel paths or roads that are frequently used by this species for foraging.

Ocellated Darner (*Boyeria grafiana*)

Summary of Species Life Cycle and Habitat Requirements

The Ocellated Darner (*Boyeria grafiana*) is an insect member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Aeshnidae family known as the darners. The Ocellated Darner is a Species of Special Concern under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020). Its long, slender abdomen, the dense venation of its wings, and its large head with huge eyes and powerful mouth parts are characteristic of all dragonflies. The darners are further characterized by being one of the largest dragonflies, 2.4 to 2.6 inches long with an average wingspan approximately 3.4 inches, and by its unusually large eyes positioned to wrap around the head to meet along a seam on top of the head. The Ocellated Darner has an overall dull brown coloration with distinguishing markings of yellow or greenish spots on the sides of the thorax, green or greenish-yellow stripes on the top of the thorax, and small dull green to yellow lateral markings on the abdomen. Brighter markings that are more distinct are typical of the male, otherwise appearance is similar to the female. The Ocellated Darner is one of two spotted darner species in North America, both distinguished by the two pale spots on the sides of the thorax from the other groups of darners.

Limited information exists on the life history of the Ocellated Darner, however, published information of the closely related Fawn Darner species is presumed representative of a similar life history and relied on to supplement the knowledge of the Ocellated Darner. Two distinct stages complete the life cycle of the dragonfly after the egg hatches known as the larval or nymph aquatic and adult flying stages. The Ocellated Darner nymph is long and slender, 1.5 inches in length when fully developed and has a dark coloration with a pale spot on the top of the seventh abdominal segment. It is known to inhabit clear, shallow, swift-flowing streams and large, rocky, poorly vegetated lakes. In Massachusetts, it has been observed only in shaded, clear, cold, rocky streams and rivers. Most of

the Ocellated Darner nymph cycle is spent hanging upside-down, clinging under rocks and sunken sticks. The nymphs are voracious and typically dominant predators of their aquatic habitats. Although the time required is unknown for the Ocellated Darner nymph to fully develop to the final step of emergence or eclosion from the nymphal exoskeleton (exuviae) to become a free-flying adult, other species in the family comparatively are known to take one to four years developing. In preparation for the eclosion, the nymph of the Ocellated Darner crawls out of the water onto exposed rocks, emergent vegetation or onto bank vegetation to find a secure perch where the new adult emerges from the exuviae in a very soft form (teneral dragonfly), vulnerable to damage by rain showers, falling debris, or predators. As soon as its wings are dry and strong enough, the Ocellated Darner adult flies to nearby upland areas to find shelter where it can continue to mature. It often inhabits upland woodland with mixed coniferous and deciduous trees. During maturation, Ocellated Darner adults feed on aerial insects captured in flight with the grasping aid of spines on their legs. When resting in the adjacent woodland, the adults hang vertically from the woodland vegetation. Being crepuscular, Ocellated Darner activity peaks late in the day, often flying well after sunset, unlike most Odonates. Unlike many darners, they rarely leave their water habitat, and also do not partake in feeding swarms characteristic of most species in the family. Ocellated Darners prefer shady areas and are often observed active on overcast days. With completion of the maturation process, the males return to the stream to breed. The flight of the male Ocellated Darner is swift and very erratic as it patrols the irregular shoreline, circling emerged rocks and vegetation to search for potential mates. In Massachusetts, males have been observed patrolling early in the morning. Females return to the stream only briefly when they are ready to mate and lay eggs. After mating, females in Massachusetts have been observed flying along rivers dipping their abdomens into the water and into the mud along riverbanks, presumably releasing eggs from the long, thin ovipositor characteristic of darners. Ocellated Darner females further use the ovipositor to slice into emergent vegetation and rotting, submerged logs where they also lay eggs. Once the eggs develop over an unknown length of time, the eggs hatch, and the nymphs re-initiate the life cycle. The Ocellated Darner has a late flight season from mid-July to mid-October with most records occurring from August to mid-September.

The Ocellated Darner in Massachusetts is recorded in 28 towns of Berkshire, Hampden, Hampshire and Franklin Counties. Most reports to date come from the Green, Deerfield, and Westfield river systems, all tributaries of the Connecticut River (MNHESP 2020). Despite the current Ocellated Darner Species Habitat mapping from MNHESP extending throughout Reach 5A of the ROR, the MNHESP (2015) Ocellated Darner fact sheet shows this species to be distributed only in towns to the east of the Housatonic River Valley on the MNHESP distribution map. However, MNHESP states in its fact sheet that there are streams and lakes in western Massachusetts with suitable habitat for the Ocellated Darner and additional population sites will likely be revealed, particularly in Berkshire County.

Ocellated Darner Habitat in Reach 5A

According to the 2022 MNHESP database information, the Species Habitat of the Ocellated Darner in Reach 5A occurs from the confluence of the East and West Branches through to the southern extent of the Pittsfield Wastewater Treatment Plant (WWTP). The mapped Species Habitat for this species totals 276.78 acres. Within the Species Habitat, the areal extent of the larval habitat includes the main stem of the river, plus the banks for eclosion (emergence as adults). The areal extent of adult

habitat is broader and includes the main stem of the river, riverbanks, backwaters, the floodplain and some adjacent upland forests or scrubland. Since this species needs large trees in the adult stage, areas where the stream corridor is densely forested offer the best habitat for this species.

Ostrich Fern Borer (*Papaipema sp. 2 near pterisi*)

Summary of Species Life Cycle and Habitat Requirements

The Ostrich Fern Borer (*Papaipema sp.2 near pterisi*) is a noctuid moth from the Noctuidae (owlet moth) family associated with mature floodplain forests and wooded swamps with stands of Ostrich Fern (*Matteucia struthiopteris*). The Ostrich Fern Borer is a Species of Special Concern under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). It flies at night, typically appearing a couple of hours after sunset. The color of the Ostrich Fern Borer may vary but it typically has bright, orange-yellow forewings overlaid with darker, brownish-orange, and may have pink shading towards the outer wing margins. These moths may also be a lighter, more faded yellowish-orange, or a darker, more brownish-orange. Markings include the large, white with orange center reniform spot, and the white orbicular spot with two identical, merged spots directly below. The hind wings are a solid pinkish-tan, and overall wingspan is 32-36 mm. The larva is orange to orangish-brown on its head and prothorax and its body is cream-color with small black spots and spiracles. It grows to about 1.4 inches.

The Ostrich Fern Borer moth inhabits mature floodplain forests and wooded swamps where Ostrich Fern grows in moderate to dense stands, preferably in a shaded or partially shaded microhabitat. Though the adults may be found along streamsides or any forested or edge habitat (e.g., adjacent to wet meadows, shallow marshes, open fields), they do not utilize aquatic habitats, and are more likely to be found in shaded to partially shaded forested floodplain habitats or red maple swamps containing Ostrich Fern. The Ostrich Fern Borer is monophagous, using the Ostrich Fern (*Matteucia struthiopteris*) as its only host food plant. Eggs overwinter on the Ostrich Fern and larvae hatch in the spring. Larvae are typically found at the base of the frond where they bore into the Ostrich Fern and feed on its lower stalks and roots; pupae are found in the soil near the roots (Wagner et al. 2011). Larvae become fully grown and pupate into adults by August. In Massachusetts, Ostrich Fern Borer moths fly from late August through late September. They fly readily to a black light with its abundance of UV light that helps the moths navigate at night as the light reflects off objects and helps the moth to see where it is going. Ostrich Fern Borer moth occurrences have been recorded in Massachusetts in Berkshire County in the towns of Pittsfield, Lee, Great Barrington, and Sheffield; western Hampshire County in the town of Huntington; and western Hampden County in the town of Chester. These Massachusetts populations form the eastern edge of the relatively small Ostrich Fern Borer moth range that extends north to Vermont, south to Pennsylvania, and west to Wisconsin (MNHESP 2012).

Ostrich Fern Borer Habitat in Reach 5A

According to 2022 MNHESP database information, Species Habitat of the Ostrich Fern Borer moth occurs in the northcentral portion of Reach 5A, just downstream of the Holmes Road Bridge. The Species Habitat area of the Ostrich Fern Borer moth in Reach 5A comprises 171.26 acres. This Species Habitat area includes approximately 1.3 miles of the main stem of the Housatonic River, several large

backwaters, and an extensive wetland system associated with Sackett Brook, a perennial tributary stream. The dominant habitats are transitional floodplain forest and red maple swamp (both of which are forested floodplain habitats in this area), with interspersed patches of wet meadow, shrub swamp, emergent marsh, and vernal pools. The mapped floodplain habitat adjacent to the River is dominated by deciduous wooded swamp and shrub swamp, and ostrich fern is often a dominant understory species in all the floodplain wetland forested habitat in this area of Reach 5A.

Rapids Clubtail (*Phanogomphus quadricolor*)

Summary of Species Life Cycle and Habitat Requirements

The long, slender Rapids Clubtail (*Phanogomphus quadricolor*) is an insect member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Gomphidae family, specifically clubtails, which are typically burrowers and predators. It is an Endangered Species under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). Clubtails have small, widely separated compound eyes that distinguish it from most other dragonflies. Their name, clubtail, derives from the lateral swelling near the end of the abdomen that appears “club-like”. The small “club” and the dull coloring of grays, greens, browns, and blacks of the Rapids Clubtail are characteristics of the clubtails belonging to the genus *Phanogomphus*. Rapids Clubtails have blue-green eyes, black legs, yellow to gray-green dorsal and lateral stripes on the sides of the thorax, and a black abdomen. Adult Rapids Clubtails range from about 1.6-1.8 inches in length.

Limited information exists on the life cycle of the Rapids Clubtail, however, the published information of similar species is relied on to supplement the knowledge of the Rapids Clubtail in Massachusetts. The Rapids Clubtail inhabits clear, cold streams and rivers with intermittent sections of rocks and rapids. Two distinct life stages complete the life cycle of the dragonfly after hatching from the egg including an aquatic larval or nymph stage and a flying adult stage. The first major stage begins with the nymph or larva hatching from an egg to an entirely aquatic stage. The nymph of the Rapids Clubtail can typically be found in shallow pools located downstream of rapids, and these pools often contain emergent plants (Walker 1958). In the quiet pools of streams or rivers, Rapids Clubtail nymphs spend most of their time burrowing in the bottom sediment which protects them from predators. It also camouflages them as they are voracious, ambush predators, attacking a variety of aquatic life including passing insects to small fish and tadpoles as dragonfly nymphs have a unique moveable, hinged lower lip that can extend to enhance capture of prey. Although unknown as to the time required for the Rapids Clubtail nymph to fully develop to the final step of emergence or eclosion from the nymphal exoskeleton (exuviae) before becoming a free-flying adult, comparatively it takes about a year for similarly sized dragonflies. In preparation for the eclosion, the nymph of the Rapids Clubtail crawls up onto the bank or exposed rocks or logs to find a secure perch less than a few feet above the water where the new adult emerges from the exuviae in a very soft form (teneral adult), vulnerable to damage by rain showers, falling debris, or predators. As soon as the wings are dry and strong enough, the Rapids Clubtail adult flies into adjacent woodland that surround the breeding habitat to find safe shelter and hide among the leaves and branches of trees where it can continue to mature. During maturation, Rapids Clubtail adults wander from woodland to forest clearings and fields, feeding on small aerial insects such as flies and mosquitos captured with the aid of spines on their legs. With completion of the maturation process, the adults return to the

stream to breed. Adults prefer the swifter sections of rivers, while the nymphs are found in the quiet pools below areas of rapids. The male Rapids Clubtail patrols the water and stream banks to search for potential mates and to drive out competing males, often returning to the same or nearby perch. Females return to the stream only briefly when they are ready to mate and lay eggs. After mating, females fly back and forth touching their abdomens to the water surface in the faster sections of the stream where there are rapids, releasing eggs every few feet. The eggs are then carried downstream from the rapids to shallow pools, where the eggs incubate for a period of at least 5 days and possibly up to a month (COSEWIC 2008) to hatch into larvae which re-initiate the life cycle.

In Massachusetts, the Rapids Clubtail adult breeds through the month of June and flies during the months of June and early July. Although population densities of Rapids Clubtail appear to be low, there may be an impact caused by the elusiveness of the adults, and therefore, focus on the easier to find Rapids Clubtail nymphs may provide a more accurate species population status in Massachusetts. Despite the current Rapids Clubtail Species Habitat mapping from MNHESP extending through the southern portion of Reach 5A of the ROR, the MNHESP (2019) Rapids Clubtail fact sheet shows this species to be distributed only to the east of the Housatonic River Valley with no towns in Berkshire County indicated in the MNHESP distribution map (MNHESP 2019).

Rapids Clubtail Habitat in Reach 5A

According to the 2022 MNHESP database information, Species Habitat of the Rapids Clubtail comprises the southern portion of Reach 5A. The overall mapped Species Habitat of the Rapids Clubtail dragonfly in Reach 5A is 55 acres. The areal extent of the nymph habitat includes the main stem of the river, plus the banks for eclosion (emergence as adults). The areal extent of adult habitat is broader and includes the main stem of the river, backwaters, floodplain and some adjacent upland forests or scrubland. The MNHESP Species Habitat designation extends into these areas, and suitable habitat appears to occur in these areas of Reach 5A, although the extent of riffle habitat is somewhat limited. This species needs trees in the adult stage, so areas where the stream corridor is densely forested offer the best habitat for this species, however, they can also be found in fields and open areas.

Riffle Snaketail (*Ophiogomphus carolus*)

Summary of Species Life Cycle and Habitat Requirements

The Riffle Snaketail (*Ophiogomphus carolus*), is a large and stocky insect member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Gomphidae family or clubtails, which are typically burrowers and predators. It is a Threatened Species under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020). Clubtails have small, widely separated compound eyes that distinguish it from most other dragonflies. The name clubtail derives from the lateral swelling near the end of the abdomen that appears “club-like”. The extent of the swelling or club varies greatly depending on the species. Males generally have a larger club than females. Although unknown, the club may have use in courtship displays or enhance the aerodynamics of flight. The Riffle Snaketail belongs to the genus *Ophiogomphus* which are snaketails that characteristically exhibit a brilliant green thorax, eyes, and face. The club of the Riffle Snaketail is over half the width of its thorax. Pale green to yellow markings that run down the sides of the black to dark brown abdomen are largest at the club, while

wide, yellow, dagger shaped markings run down the center of the top of the abdomen. The clear wings display a dense network of veins and are held horizontally in the characteristic horizontal perching stance of the Riffle Snaketail on rocks, logs, vegetation, and the ground. Adult Riffle Snaketails are 1.6-1.7 inches in length. The female is larger and has a smaller club near the tip of the abdomen than the male.

Limited information exists on the life cycle of the Riffle Snaketail, however, published information of similar species is relied on to supplement the knowledge of the Riffle Snaketail. The Riffle Snaketail inhabits clear, cold, rocky streams that are fast flowing with few pools and fine gravel or sand sediment. Two distinct life stages complete the life cycle of the dragonfly after hatching from the egg including an aquatic larval or nymph stage and a flying adult stage. The first major stage begins with the nymph or larva hatching from an egg to an entirely aquatic stage. Riffle Snaketail nymphs burrow in the bottom sediment which protects them from predators. Burrowing also camouflages them as they are ambush predators that attack a variety of aquatic life such as passing aquatic invertebrates, small fish and tadpoles using a moveable, hinged lower lip unique to dragonfly (and damselfly) nymphs that extend to capture prey. Although unknown as to the time required for the Riffle Snaketail nymph to fully develop to the final step of emergence or eclosion from the nymph exoskeleton (exuviae) before becoming a free-flying adult, comparatively it takes about a year for similarly sized dragonflies. In preparation for eclosion, the nymph of the Riffle Snaketail crawls up onto exposed rocks in the stream bed, or onto the stream bank or protruding logs to find a secure perch less than a foot above the water where the new adult emerges from the exoskeleton or exuviae in a very soft form (teneral dragonfly) vulnerable to damage by rain showers, falling debris, or predators. As soon as the wings are dry and strong enough, the Riffle Snaketail adult dragonfly flies into adjacent woodland that surround the breeding habitat to find safe shelter among the leaves and branches of trees where it can continue to mature. During maturation, Riffle Snaketail adults wander from woodland to forest clearings and fields, feeding on small aerial insects such as flies and mosquitos. With completion of the maturation process, the adults return to the stream to breed. From exposed rock perches in the middle of the stream, the male Riffle Snaketail patrols over water to search for potential mates and to drive out competing males, often returning to the same or nearby perch. This family is typically a “short flight” species requiring substantial perching places as they move along the stream, usually woody debris, live woody plants, and rocks. Females return to the stream only briefly when they are ready to mate and lay eggs. Once mating occurs, females fly back and forth touching their abdomens to the water surface in sections of the stream where there are riffles, releasing eggs every few feet. The eggs may then be carried downstream and deposited in pools where they hatch, and the nymphs re-initiate the life cycle.

In Massachusetts, the Riffle Snaketail is thought to breed from early June through late July. Although population densities of clubtails appear low, there may be an impact caused by the elusiveness of the adults, and therefore focus on the easier to find Riffle Snaketail nymphs may provide a more accurate species population status in Massachusetts. In Massachusetts, the Riffle Snaketail has been reported in Berkshire County in the towns of Pittsfield and Windsor; and seven towns from Hampden, Hampshire, and Franklin Counties (MNHESP 2015).

Riffle Snaketail Habitat in Reach 5A

According to 2022 MNHESP database information, the Species Habitat of the Riffle Snaketail occurs only in the upstream portion of Reach 5A, from the confluence of the East and West Branches to a point just upstream of the Joseph Road housing development off East New Lenox Road. The Woodlot Alternatives (2002) ecological characterization also documented the presence of this species in this area. The area of Species Habitat associated with Reach 5A is 191.68 acres. The areal extent of the nymph habitat includes the main stem of the river, plus the banks for eclosion (emergence as adults). The areal extent of adult habitat is broader and includes the main stem of the river, backwaters, floodplain and some adjacent upland forests or scrubland.

Spine-crowned Clubtail (*Hylogomphus abbreviatus*)

Summary of Species Life Cycle and Habitat Requirements

The Spine-crowned Clubtail (*Hylogomphus abbreviatus*) is a large insect (Order Odonata) and member of the dragonflies (Order Odonata, Suborder Anisoptera) in the Gomphidae family, the clubtails, which are typically burrowers and predators. It is listed as a species of Special Concern under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). Clubtails have small, widely separated compound eyes that distinguish it from other dragonflies (with exception of Petaluridae and Damselflies), as well as its characteristic wing venation. The name clubtail derives from the lateral swelling near the end of the abdomen that appears “club-like”. The extent of the swelling or club varies greatly depending on the species. Males generally have a larger club than females. The club may have use in courtship displays or enhance the aerodynamics of flight. The Spine-crowned Clubtail belongs to the subgenus *Hylogomphus* characterized by the medium-sized club on the tip of the abdomen. The dark brown/black Spine-crowned Clubtail dragonfly body has pale yellow stripes on top of the thorax and lateral stripes on the sides of the thorax. Abdomen segments one through seven have yellow markings on top, and two large bright yellow patches mark each side of the club. The face is a varying yellowish in color, and it has black legs. Adult Spine-crowned Clubtails range in length from 1.3 to 1.4 inches in length (34 mm - 35 mm) and have a wingspan averaging 2.6 inches (66 mm). Fully developed nymphs average just under one inch in length (23 mm – 24 mm). Spine-crowned Clubtails inhabit large streams and rivers.

In Massachusetts, Spine-crowned Clubtails have been found on the Connecticut River and other medium to large rivers that have silty and sandy bottoms. Two distinct stages complete the life cycle of the dragonfly including an aquatic larval or nymph stage and a flying adult stage. The first major stage begins with the nymph or larva hatching from an egg to an entirely aquatic stage. The aquatic nymphs burrow under the river bottom sediment, while the flying adults inhabit riparian areas, forested uplands, and fields. The Spine-crowned Clubtail nymphs burrow in the bottom sediment which protects them from predators. Burrowing also camouflages them as they are ambush predators that attack a variety of aquatic life including passing aquatic invertebrates, small fish and tadpoles using a moveable, hinged lower lip unique to the dragonfly (and damselfly). It takes at least a year for the nymphs to fully develop, which involves several molts, to reach the final step of emergence or eclosion from the nymph exoskeleton (exuviae) before becoming a free-flying adult. In preparation for eclosion, the nymph of the Spine-crowned Clubtail crawls up onto exposed rocks in the river, emergent vegetation, partially submerged logs, or steep river banks to find a secure perch

where the new adult emerges from the exoskeleton or exuviae in a very soft form (teneral dragonfly) vulnerable to damage by rain showers, falling debris, or predators. Typically, emergence occurs very early in the morning, and presumed to be in response to predation exposure during this vulnerable period. The nymphal exuviae, or cast exoskeletons, may be used to reliably identify a species and determine its presence. As soon as the wings are strong enough, the Spine-crowned Clubtail adult flies into adjacent woodland that surround the breeding habitat to find safe shelter among the leaves and branches of trees where it can continue to mature. During maturation, Spine-crowned Clubtail adults fly from woodland to forest clearings and fields, feeding on small aerial insects such as flies and mosquitos. They are rarely observed during this time and thought to spend much of this stage in tree tops. After completion of the maturation process, which takes several days or more, the adult males return to the river to breed, perching on sandy shorelines or overhanging vegetation. From there, the male Spine-crowned Clubtail patrols about a foot over the surface of the water, hovering at times, to search for potential mates and to drive out competing males. Females return to the stream only briefly when they are ready to mate and lay eggs. After mating, females fly back and forth touching their abdomens to the water surface to release the eggs. The eggs develop over an unknown length of time, and nymphs hatch to re-initiate the life cycle. In Massachusetts, the flight season of the Spine-crowned Clubtail starts with emergence beginning in late May and early June and the adults flying through July.

In Massachusetts, the Spine-crowned Clubtail has been recorded from several rivers, and reports include Berkshire County in the towns of Pittsfield, Great Barrington, Sheffield, and Sandisfield; 16 towns from Hampden, Hampshire and Franklin Counties; and 11 towns from Worcester, Middlesex and Plymouth Counties (MNHESP 2019).

Spine-Crowned Clubtail Habitat in Reach 5A

According to the 2022 MNHESP database information, the Species Habitat of the Spine-crowned Clubtail in Reach 5A occurs from the confluence of the East and West Branches to the southern extent of the Pittsfield Wastewater Treatment Plant (WWTP). The mapped Species Habitat for this species totals 256.2 acres. Within the Species Habitat, the areal extent of the nymphal habitat includes the main stem of the river, plus the banks for eclosion (emergence as adults). The areal extent of adult habitat is broader and includes the main stem of the river, riverbanks, backwaters, the floodplain and some adjacent upland forests or scrubland. Since this species needs large trees in the adult stage, areas where the stream corridor is densely forested offer the best habitat for this species.

Tuckerman's Sedge (*Carex tuckermanii*)

Summary of Species Life Cycle and Habitat Requirements

Tuckerman's sedge (*Carex tuckermanii*) is a perennial herbaceous wetland sedge (family Cyperaceae) that grows in loose clumps up to a meter tall in habitats including river and lake shores, swamps, and vernal pools. It is an Endangered Species under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). Tuckerman's sedge has short rhizomes, and erect to arching stems with flat, slender linear leaves and reddish-purple basal sheaths. Its triangular reproductive stems or culms have both staminate spikes that are terminal and pistillate spikes having cylindrical rows of ascending perigyna that typically droop pendulously from the stalk. Its most recognizable feature is the distinctive

female flowering spike comprised of clusters of pendulous, inflated teardrop-shaped perigynia that encase the achenes, its one seeded fruit. Perigynia are mature throughout most of the summer, from June through August.

In Massachusetts, Tuckerman's Sedge inhabits the rich soils of lowland river floodplain habitats such as oxbows (C-shaped wetlands adjacent to river channels), low depressions, forests, meadows, swales, and vernal pools in the western and central part of the state. Populations that have persisted over time in Massachusetts are found in low depressions or swales within forested floodplains, and apparently thrive with periodic inundation, also benefiting from flooding as a dispersal mechanism. Reported occurrences of Tuckerman's Sedge are from Berkshire County in the towns of Pittsfield, Stockbridge, Tyringham, Sheffield and New Marlboro; and from four towns in Franklin, Hampshire and Worcester Counties (MNHESP 2019).

Tuckerman's Sedge Habitat in Reach 5A

According to 2022 MNHESP database information, Species Habitat of Tuckerman's Sedge occurs in the central portion of Reach 5A northeast of the City of Pittsfield Wastewater Treatment Facility on the west side of the Housatonic River. Tuckerman Sedge Species Habitat comprises approximately .86 acres. This area contains a seasonal pool which has a closed canopy and is bordered by shrub swamp habitat to the north and high terrace floodplain forest on the other three sides. All of the area within the mapped Species Habitat in Reach 5A would be suitable for this species.

Wapato (*Sagittaria cuneata*)

Summary of Species Life Cycle and Habitat Requirements

The aquatic Wapato (*Sagittaria cuneata*) is an herbaceous perennial of the water-plantain or arrowhead family (Alismataceae) found in nearly neutral to slightly basic, open-water habitats. The Wapato is a Threatened Species under the Massachusetts Endangered Species Act (MESA) (NHESP 2020). 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 entirely submerged plant depending on its growth conditions. Wapato typically has basal rosettes of leaves with expanded blades with sagittate or arrow-head shaped leaves growing from stoloniferous corms, however, Wapato leaves display great variance (or phenotypic plasticity) having three different leaf morphologies depending on the hydrology and prevailing water level of its habitat. Emersed plants have leaf blades that are linear to sagittate with a central lobe that is broad-lanceolate to triangular-ovate, on top of recurved petioles. Floating plants in moderate to deep water have heart-shaped or sagittate leaf blades with long triangular petioles. Entirely submerged plants in deep water have long narrow, ribbon-like, bladeless, expanded leaf-like petioles (phyllodia). The long-stalked flowering raceme has 2 to 10 whorls of three-lobed white flowers that produce achenes, or one-seeded fruit, that are flattened and encased in dense spheres. Wapato flowers beginning July to mid-September, and fruits mid-July through September. Distinct to the identification of Wapato is a tiny erect beak on its achene, as well as the phenotypic plasticity of its leaf morphology. The average height of Wapato is about 1.5 feet but may reach over 3.5 feet. In Massachusetts, Wapato is reported in Berkshire County in the

towns of Pittsfield, Lenox, Lanesboro, Great Barrington and Sheffield; and Hampden County in the town of Holyoke (MNHESP 2015).

Wapato Habitat in Reach 5A

According to the 2022 MNHESP database information, the Species Habitat of Wapato extends from the Confluence of the East and West Branches of the Housatonic River south along the river corridor through Reach 5A. The total mapped Species Habitat for this species in Reaches 5A comprises 171 acres. Principal natural communities identified within the mapped Species Habitat include muddy substrates along the shallow edges of the main stem of the river, backwater habitats, and a variety of floodplain habitats, including emergent marsh, floodplain forest, and shrub swamps bordering the river channel. This species requires total to partial submersion in water during most of its life cycle. Thus, seasonally exposed muddy substrates along the river channel, toe of the riverbank slopes, backwater areas, emergent marshes, and seasonal pools in the floodplain forest constitute the primary habitat for this species.

White Adder's-mouth (*Malaxis monophyllos* var. *brachypoda*)

Summary of Species Life Cycle and Habitat Requirements

White Adder's-mouth (*Malaxis monophyllos* var. *brachypoda*) is a single-leaved orchid member of the family Orchidaceae found in small, shaded, calcareous wetland habitats. It is classified as an Endangered Species under the Massachusetts Endangered Species Act (MESA) (MNHESP 2020).

White Adder's-mouth is identified by its slender stem, a 1.2 to 12 inch tall raceme, displaying one loosely sheathed elliptical leaf (rarely two) up to 3.7 inches long and a stalked inflorescence of up to fifty tiny greenish-white flowers held by tiny 2 to 4.5 mm pedicels (giving its name *brachypoda* meaning "short-footed") on the upper part of the stem. Each flower has a species identifying heart-shaped lip tapering to the bottom of the flower. In Massachusetts, White Adder's-mouth flowers at the beginning of June through mid-August. White-Adder's mouth prefers habitats with accumulations of incompletely decomposed organic material, or peat, dominated by coniferous trees and influenced by highly calcareous water (Schultz 2003). In Massachusetts, White Adder's-mouth is found in calcareous wetlands that may include hillside seeps, but it prefers rich shady bogs and fens in mossy depressions in hummocky, sphagnum moss-dominated habitats shaded by Eastern Hemlock. White-Adder's mouth is currently reported in western Massachusetts in Berkshire County in the towns of Pittsfield and Williamstown; and in Franklin County (MNHESP 2019).

White Adder's-mouth Habitat in Reach 5A

According to 2022 MNHESP database information, the Species Habitat for White Adder's-mouth occurs in the northern section of Reach 5A comprising approximately 1.62 acres. Mapped Species habitat consists of floodplain forests and a backwater area associated with an unnamed stream system which flows into Sackett Brook and from there to the Housatonic River.

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MNHESP 2015. MA Natural Heritage and Endangered Species Program Fact Sheet: Mustard White (*Pieris oleraceae*) Fact Sheet. Westborough, MA.

MNHESP 2015. MA Natural Heritage and Endangered Species Program Fact Sheet: Ocellated Darner (*Boyeria grafiana*). Westborough, MA.

MNHESP 2015. MA Natural Heritage and Endangered Species Program Fact Sheet: Riffle Snaketail (*Ophiogomphus carolus*) Fact Sheet. Westborough, MA.

MNHESP 2015. MA Natural Heritage and Endangered Species Program Fact Sheet: Wapato (*Sagittaria cuneata*) Fact Sheet. Westborough, MA.

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MNHESP 2019. MA Natural Heritage and Endangered Species Program Fact Sheet: Spine-crowned Clubtail (*Hylogomphus abbreviatus*) Fact Sheet. Westborough, MA.

MNHESP 2019. MA Natural Heritage and Endangered Species Program Fact Sheet: Tuckerman's Sedge (*Carex tuckermanii*) Fact Sheet. Westborough, MA.

MNHESP 2019. MA Natural Heritage and Endangered Species Program Fact Sheet: White Adder's-mouth (*Malaxis monophyllos* var. *Brachypoda*) Fact Sheet. Westborough, MA.

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<http://plants.usda.gov/>

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

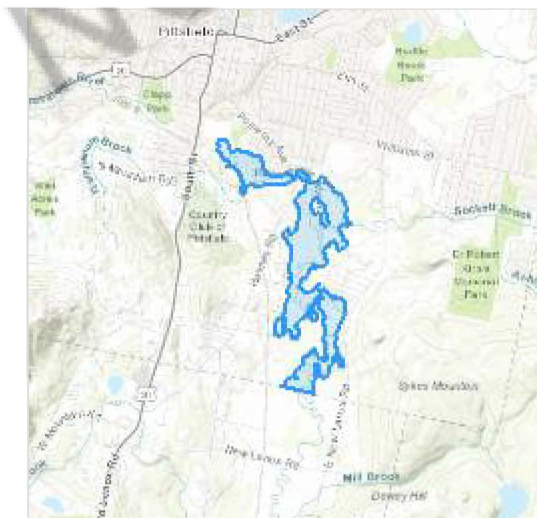
Project information

NAME

Housatonic River Floodplain Restoration

LOCATION

Berkshire County, Massachusetts



DESCRIPTION

Some(Floodplain preservation and restoration.)

Local office

New England Ecological Services Field Office

☎ (603) 223-2541

📠 (603) 223-0104

70 Commercial Street, Suite 300
Concord, NH 03301-5094

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species¹ and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries²).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Endangered

Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Appendix H

Invasive Species Information

Appendix H-1: Identification of Invasive Plant Species in Reach 5A

For the assessment of invasive species in Reach 5A, the definition of invasive plant species was based on the plant species listed by recognized organizations – notably, the Massachusetts Invasive Plant Advisory Group (MIPAG) (considering both “invasive” or “likely invasive” species), the USACE New England District, and the Invasive Plant Atlas of New England (IPANE).

MIPAG defines invasive plants as “non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems” (MIPAG 2005). Its list includes species determined to be “invasive,” “likely invasive,” and “potentially invasive.” For a species to be included on the MIPAG list, it must be substantiated by scientific investigation (including herbarium specimens, peer-reviewed papers, published records and other data available for public review) to meet specific criteria. The process of reviewing individual plant species for their invasiveness in Massachusetts is ongoing and may result in a change in status pending new data and further review. As noted above, for the purposes of assessing invasive species in Reach 5A, the species rated by MIPAG as “invasive” or “likely invasive” were included.

IPANE similarly defines invasive species as “any species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. These invasive species aggressively compete with and displace the associated flora and fauna communities” (IPANE 2007). Originally based at the University of Connecticut and specific to New England invasive plant species, IPANE now collaborates with the broader Invasive Plant Atlas of the United States at: [Invasive Plant Atlas of the United States - Database of Plants Invading Natural Areas: Invasive Plant Atlas of the United States](#). Connecticut now provides state-specific invasive species information via the Connecticut Invasive Plant Working Group at [Connecticut Invasive Plant List | Connecticut Invasive Plant Working Group \(uconn.edu\)](#). For the purposes of assessing invasive species in Reach 5A, the list of invasive species published by IPANE at www.ipane.org has been used.

The USACE New England District address invasive plant species in its wetland mitigation standard operating procedures document, available at: [NEW ENGLAND DISTRICT REGULATORY DIVISION COMPENSATORY \(army.mil\)](#). This document provides a focused list of 13 invasive species which the Corps considers invasive at wetland mitigation sites and “must be controlled” at mitigation sites. This list of species has been used in this current assessment as “ACOE Invasive” (see Table H1). This list of invasive species does not include any species that are not listed as invasive or likely invasive by MIPAG or IPANE. Note that the Corps also provides a more extensive list of “unacceptable” species in Appendix K of its mitigation document; these are species which the Corps finds unacceptable to include in wetland planting plans as part of the Section 404 CWA permit program. Table H1 notes the species observed in Reach 5A that are on this expanded list of “unacceptable” species, but these

species are not included as invasive plants for this current assessment, which relies on the MIPAG and IPANE definitions and criteria of invasive plant species.

The methods used in the identification of invasive species in Reach 5A are described in Section 9.1 of the main Baseline Restoration Assessment (BRA) Report for Reach 5A, and the results are discussed in Section 9.2 of that report.

In addition, Table H1 provides a listing of all invasive plant species identified in Reach 5A during the 2022-2023 field investigations. This table identifies where these species were observed among the riverine, riverbank, backwater, floodplain, and vernal pool habitats. It also clarifies the status of each species relative to whether it is listed as MIPAG invasive (or likely invasive), IPANE invasive, ACOE invasive (as described above), or ACOE “unacceptable” (i.e., not invasive as used here, but unacceptable for use in wetland planting plans).

Table H1: Reach 5A Invasive and Other Unacceptable Plant Species Summary Data

Layer	Common Name	Scientific Name	Status ¹	Occurrence*
Tree	Norway maple	<i>Acer platanoides</i>	ABE	FP
	Catalpa	<i>Catalpa speciosa</i>	E	B
Shrub	Japanese barberry	<i>Berberis thunbergii</i>	ABC	FP; VP
	Autumn olive	<i>Elaeagnus umbellata</i>	ABC	FP
	Burning bush	<i>Euonymus alatus</i>	ABC	FP; B; VP
	Glossy buckthorn	<i>Frangula alnus</i>	ABC	FP; VP
	Border privet	<i>Ligustrum obtusifolium</i>	DE	FP; B; VP
	Morrow's honeysuckle	<i>Lonicera morrowii</i>	ABE	FP; B; VP
	European buckthorn	<i>Rhamnus cathartica</i>	ABC	FP; B; VP
	Multiflora rose	<i>Rosa multiflora</i>	ABC	FP; VP
Woody Vine	Asian bittersweet	<i>Celastrus orbiculatus</i>	ABC	FP; B; VP
Herb	Bishop's goutweed	<i>Aegopodium podagraria</i>	ABE	FP; B
	Garlic mustard	<i>Alliaria petiolata</i>	ABE	FP; B
	Japanese knotweed	<i>Fallopia japonica</i>	ABC	FP; B
	Gill-over-the-ground	<i>Glechoma hederacea</i>	BE	B
	Dame's-rocket	<i>Hesperis matronalis</i>	ABE	FP
	Yellow iris	<i>Iris pseudacorus</i>	ABE	FP; B; BW; VP
	Moneywort	<i>Lysimachia nummularia</i>	AE	FP; BW; VP
	Purple loosestrife	<i>Lythrum salicaria</i>	ABC	FP; BW
	Water forget-me-not	<i>Myosotis scorpioides</i>	DE	FP; B; BW; VP
	Giant chickweed	<i>Myosoton aquaticum</i>	E	B
	Eurasian water-milfoil	<i>Myriophyllum spicatum</i>	ABE	FP; B; BW; R
	Japanese mountain-spurge	<i>Pachysandra terminalis</i>	E	FP
	Reed canary grass	<i>Phalaris arundinacea</i>	ABC	FP; B; BW; VP
	Common reed	<i>Phragmites australis</i>	ABC	FP; VP

Appendix H Invasive Species Information

Layer	Common Name	Scientific Name	Status ¹	Occurrence*
	Curly pondweed	<i>Potamogeton crispus</i>	ABE	B; R
	Water chestnut	<i>Trapa natans</i>	ABC	BW
	Narrow-leaved cattail	<i>Typha angustifolia</i>	E	FP
	Broad-leaved cattail	<i>Typha latifolia</i>	E	FP
	Rough cocklebur	<i>Xanthium strumarium</i>	E	FP; B; VP

¹Invasive Ratings: A= MIPAG Invasive; B=IPANE Invasive; C=ACOE Invasive; D=MIPAG Likely Invasive; E=ACOE Not Invasive, but Unacceptable (for use in wetland mitigation plans)

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

Appendix H-2: General Information on Primary Invasive Species Identified

Common (or European) Buckthorn (*Rhamnus cathartica*)

While buckthorn was apparently introduced to the United States in Massachusetts in late 1800s. Its occurrence as an invasive species affecting habitat quality has been noted more prominently in the upper Midwest, leading to extensive research and control efforts in those states versus the Northeast. However, the information and experience gained from the upper Midwest are directly applicable to the Northeast given the ecological similarities between these regions. In New England, buckthorn is found most often on disturbed, open, moist sites and successfully invades abundant habitats including “*abandoned fields and pastures, open woods, early successional forests, edges, planted forests, floodplain and riparian forests, wet meadows, ravines, open disturbed areas, roadsides, fencerows, vacant lots, and yards or gardens*” (IPANE 2007). Buckthorn outcompetes native understory species for light, nutrients, and moisture, potentially forming monotypic stands that suppress plant and animal diversity. Old field areas of this region most often show buckthorn abundance and preference on sites that had a history of plowing compared to former pastures or continuously forested woodlots (McDonald et al. 2008). As buckthorn continues to persist and establish, further invading a forested area to become increasingly dominant, it creates shadier areas throughout the growing season than forested areas not invaded by buckthorn, thus progressively shading out the native seedlings and saplings of herbaceous, shrub and tree layers and outcompeting most plants that try to grow beneath it.

Morrow’s Honeysuckle (*Lonicera morrowii*)

Morrow’s honeysuckle is a deciduous shrub that was imported from Japan and South Korea in the 1800s for use as an ornamental, wildlife food and cover, and soils erosion control. After wide planting through the 20th century, its progressive destructive impact on native species in natural areas, and parks and gardens prompted its recognition as a highly invasive species. It is shade tolerant but prefers full sun where it produces more flowers and fruit, and invades forest edges and interiors, floodplains, pastures, old fields, roadsides and other disturbed areas through the help of rapid seed dispersal by birds and mammals. It also spreads vegetatively promoting its ability to form dense thickets by outcompeting native trees, shrubs and herbaceous plants, thereby displacing them. The branching structure of Morrow’s honeysuckle promotes nest predation of birds. Its fruit provides some nutrition for birds and mice in winter, however, is overall insufficient for the nutrition needed to sustain birds, particularly migrating birds, naturally provided by the nutrition rich fruit of native species. Its prevention and control are the same as for buckthorn by pulling (seedlings), cutting larger stems, and applying herbicides containing glyphosate or triclopyr to foliage or cut stems.

Multiflora Rose (*Rosa multiflora*)

Multiflora rose is an invasive shrub introduced to the United States in 1866 from east Asia as rootstock for its aesthetic ornamental roses, and use as a fence, as well as for erosion control and wildlife food and cover. It is found in abandoned fields, hedgerows, forest edges and roadsides with its preference

Appendix H: Invasive Species Summaries

for full sun to moderate shade environments, but can also endure the shade of mature forests. It flourishes on sites having general poor growth conditions involving light, moisture, salinity, or pH, but does not tolerate extreme cold below -28 degrees F. Multiflora rose spreads by seed, root sprouting and layering, a process where a stem, or cane, comes in contact with the soil as it grows, and produces roots to become a functionally independent plant. The fruit, or hips, persist on branches through winter providing a continuous food source as they are commonly found among the next year's flowers. Birds facilitate seed dispersal and seeds can remain viable in the soil for up to 20 years. After an initial slow growth period the first 1-2 years, the plant reproduces aggressively by seeds and sprouts, and expands through layering to form dense thickets, establishing monocultures that deteriorate natural environments and inhibit plant and wildlife diversity. Native invertebrates rarely consume its leaves creating a change in the chemical composition of the decomposing leaf litter that enhances the shrub's growth and dominance of the site, particularly in riparian areas. Treatment for control of multiflora rose includes the cut with herbicide application method as with buckthorn.

Garlic Mustard (*Alliaria petiolata*)

Garlic mustard is an invasive biennial herb likely introduced to North America from Europe and western Asia for medicinal and herbal uses, and erosion control. It was first recorded in 1868 in Long Island, NY. It is shade tolerant and thrives in forest understories, but also grows in open sun. It grows best on moist, well drained soils, and found in upland and floodplain forests, savannas, along trails, roadsides, and disturbed areas. It reproduces only from seed, seed production is very high, and seeds remain viable in the seedbank for many years. Garlic mustard outcompetes native species for sunlight, moisture, nutrients and space to form dense populations by emerging and growing earlier than native species in the spring, and by releasing chemicals from its roots (allelopathy) which impact mycorrhizal communities critical to native species subsistence, including economically valuable trees. Control and prevention of garlic mustard are the same as for buckthorn by pulling (seedlings) and applying herbicides containing glyphosate or triclopyr to foliage. The primary goals are to prevent second-year plants from producing seed, prevent new seeds from arriving from nearby populations and deplete the seed bank.

Asiatic Bittersweet (*Celastrus orbiculatus*)

Asiatic (or Asian) bittersweet is an invasive deciduous, woody, twining vine native to China, Japan, and Korea which was introduced into the United States around 1860 as an ornamental plant. Although hybridization with native American bittersweet has been observed in the laboratory, it is unclear how commonly it may occur naturally. It is most productive in full sun, however it easily germinates in shade and its seedlings are extremely shade tolerant. It is found in grasslands, open woods, woodland edges, closed-canopy forest, roadsides and fence rows, although also a problem on beaches and dunes in some states. Its growth by climbing any available support significantly threatens plant communities. It grows rapidly and shades out the vegetation supporting it, while encircling and girdling trees and shrubs, cutting off water and nutrients. Having a deep, extensive root system, it grows to 30 m (98.5 ft) in length and 18 cm (7 in) in diameter. It reproduces by seed and vegetatively by spreading underground roots

that form new stems, as well as sprouting from the root crown and small root fragments, thereby forming abundant clones from one or few seedlings. Flowers are produced by male (for pollen) and female plants by two years of age, and prolific fruit is produced by mature female plants with highest fruit production in full sun. Fruits are eaten and dispersed by birds and mammals, where the seed has been observed to remain in the gut of birds for extended time (14-42 days) promoting long distance dispersal of the species. Humans also contribute significantly to its dispersal through planting, and the use of its fruiting clustered scarlet berries with yellow-orange outer covering in fall decoration, facilitating its spread. Asian bittersweet vines and leaves may become a massive weight burdening and weakening trees, causing them to become vulnerable to wind and ice storms. Trees attached by these vines may also be pulled down when one tree falls or is cut down. The destructive impacts of invasive Asian bittersweet on trees and shrubs requires its prevention and control with the help of mechanical and chemical methods in meeting these goals, as with the prevention and control of buckthorn.

Bishop's Goutweed (*Aegopodium podagraria*)

Bishop's goutweed was introduced to North America by European settlers as an ornamental groundcover and was established in the United States by 1863. Its use has been as a low maintenance ground cover. It is an invasive, aggressive, creeping herbaceous perennial that forms dense, impenetrable patches that inhibit germination and/or establishment of native tree, shrub and herbaceous seedlings thereby displacing native species and greatly reducing species diversity. It prefers full sun, however it is highly shade tolerant and easily invades forests and dominates understories. It does very well in light to moderate shade and will flower least in dense shade. Seedlings grow best on disturbed, sunny sites, but leaves will die under intense heat or drought conditions. It is found in abandoned fields, pastures, gardens, forests, forest edges, riverbanks, streambanks, meadows, and disturbed areas. Bishop's goutweed tolerates a wide range of soil quality and pH. It changes soil chemistry by altering decomposition and nutrient cycling as well as other ecological processes in forests and woodlands, such as raising humidity and increasing shade near the forest floor which also reduces seedling recruitment of shade tolerant tree species. It reproduces primarily vegetatively by fast growing rhizomes, and spreads quickly as even a small rhizome fragment can resprout. It produces seeds that require cold stratification to germinate, therefore seeds germinate the following year after initial dispersal. Its seedbank is short-lived. It can grow to be 15-40 inches tall. Bishop's goutweed is quickly dispersed as populations grow, increase and spread rapidly through the rhizome system. Humans also are significant in its long-range dispersal through its use as a popular garden plant and sold as an ornamental groundcover. It also spreads through waterways. The destructive impact of bishop's goutweed on native plant species emphasizes the need for its control. The most effective control for an herbaceous, prolific rhizome forming and sprouting plant like bishop's goutweed are systemic herbicides, such as glyphosate, because they are translocated to the roots. Manual treatments are not recommended for bishop's goutweed.

Japanese Knotweed (*Fallopia japonica*)

Japanese knotweed is native to China, Japan, and Korea. It was originally introduced from Japan to the United Kingdom and by around 1855, had become increasingly popular and distributed there through garden catalogs. It was brought to the United States from the United Kingdom by the late 1800s for use in ornamental gardens. By 1894, it was reported as naturalized near Philadelphia, Pennsylvania, Schenectady, NY and Atlantic Highlands, NJ. By 1910, Japanese knotweed was promoted in garden catalogs in the United States, despite the recognition of its aggressive growth and decline in popularity by this time in the United Kingdom. By 1938, published information on how to get rid of Japanese Knotweed in gardens in the United States was available. Japanese knotweed is an upright, shrubby, woody appearing herbaceous perennial plant. It spreads primarily through long rhizomes, although it may produce some viable winged seeds that can spread distances through wind dispersal. New Japanese knotweed plants can sprout from stem nodes or rhizome fragments. Rhizome fragments can be easily dispersed naturally and are particularly problematic along larger rivers where flooding transports rhizomes downstream. They can also be dispersed through human actions. Japanese knotweed is extremely tolerant of dry to seasonally saturated soils as it flourishes in a variety of habitats including open uplands, riverbanks, lake shores, forest edges, and disturbed areas. It prefers full sunlight and thrives in riparian areas and wetlands, but can tolerate moderate shade, dry soil, high temperatures, and high soil salinity. It is found along roadsides, in vacant lots and yards or gardens. It is not tolerant of frost and dies back immediately for the season. It's quite successful in reproducing vegetatively to quickly form dense, persistent thickets that can grow up to 15 feet tall and inhibit growth of native vegetation to their exclusion, to form monoculture stands of Japanese knotweed. Due to its ability to easily grow and disperse new plants from its cut stem and rhizome if in contact with moist soil, its removal is difficult and it is extremely persistent.

Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife, a native plant of Eurasia, was first reported in North America in 1814. Its introduction is unclear and involves multiple likely theories possibly involving multiple introductions. These include being introduced accidentally through ship ballasts or seeds that were transported in imported raw wool or on sheep, or deliberately brought over as an ornamental plant, a source of nectar for beekeeping or for medicinal reasons. The recognized presence of purple loosestrife populations established in estuaries between Massachusetts and New Jersey before 1900 is thought to indicate the area of its original introduction. More inland populations were reported by the 1900s with continual spread through garden plantings and waterways. Purple loosestrife is a striking herbaceous perennial wetland plant, standing 3 to 10 feet tall but 5 feet tall on average, with beautiful purple flowers adorning the 4-16 inch spikes at the tips. Its beauty is deceptive, however, as its rapid, spreading growth forms a monotypic stand that no bird, mammal, or fish depends on. A purple loosestrife plant produces 2.5 to 2.7 million seeds annually that are viable for years remain dormant until germination conditions are suitable, and are easily dispersed and transported by water, wind, birds, mammals, and humans. Purple loosestrife also spreads by resprouting from broken stems, underground roots, and plant fragments. It

Appendix H: Invasive Species Summaries

has no natural predators, disease or insect, on this continent which only strengthens its prevailing ability to out-compete native vegetation and form monotypic stands. It prefers moist organic soils, fluctuating water levels and full sunlight, conditions under which many native plants are stressed. Purple loosestrife tolerates a wide range of environmental conditions such as temperature, sunlight, pH and nutrient levels, and has the ability to grow and establish on a wide range of substrates including gravel, sand, clay, and organic soil. Its favored habitats are freshwater marshes, open stream margins, and alluvial floodplains, however it successfully invades wet meadows, pasture wetlands, cattail marshes, stream and river banks, lake shores, irrigation ditches, drainage ditches and stormwater retention basins, and disturbed areas such as construction sites. Purple loosestrife displaces and replaces native flora and fauna causing habitat devastation resulting in elimination of food, nesting, and shelter for wildlife, and diminished habitat availability. It threatens wetlands and waterways, and fish spawning and waterfowl habitat. It fills in wetlands and reduces the water flow and flood retention. Although no control method will completely eliminate purple loosestrife, the use of physical, biological, and chemical controls help to stabilize populations within ecologically acceptable limits. Loosestrife-feeding beetles (*Galerucella* spp.) from Europe have been introduced to North America in the 1990s as a potential biological control. There has been considerable success in using these beetles to control purple loosestrife levels in marshes throughout the Northeast, including in Massachusetts.

Reed Canary-Grass (*Phalaris arundinaceae*)

Reed canary-grass is native to Europe, Asia, and North America; however, the European cultivar was introduced to the United States in the early 1800s for forage grasses and revegetation of eroded stream banks. The growth of the European reed canary-grass is more aggressive and is believed to have been cross-bred for this trait, resulting in the invasive reed canary-grass cultivars. Reed canary-grass is a perennial sod-forming grass that grows 2-9 feet tall. It inhabits areas typical of wet soils, preferably wetlands and floodplains adjacent to rivers and streams that are found in cool-season regions. It is also found thriving along lakesides, and in marshes and ditches. Although it favors wet soils, it can also grow in dry soils in wooded areas that are shaded, and along roadways. Reed canary-grass invades and spreads rapidly through rhizomes and runners and its dense growth eliminates other native vegetation, including tree growth in floodplain forests. It forms dense monotypic colonies that may grow to cover acres, severely diminishing available wildlife or waterfowl habitat. It is difficult to eradicate established colonies and various mechanical and chemical methods are required for control.

Common Reed (*Phragmites australis*)

Common reed, commonly referred to as *Phragmites*, is native to some parts of the United States. It is known to have been present in New England for at least 4000 years. *Phragmites* remains in 3000 year-old peat moss samples have been found in Connecticut. At least three strains of *Phragmites* are found in the United States with one known strain native to the United States. With the recognition of genetically different *Phragmites* populations, a newer non-native invasive strain was found and determined accidentally introduced to North America from Europe in the late 1700s or early 1800s in ship ballast. This non-native invasive *Phragmites* first established along the Atlantic coast and spread

across the continent during the 20th century. It currently occurs throughout the eastern half of the United States and is the most common *Phragmites* strain found in New York and the Northeast. There is no evidence of hybridization between native and introduced strains in the field. *Phragmites* is a tall, very hardy, sun-loving, perennial grass that grows up to 16 feet high. Its growth forms a large, thick impenetrable wall (as in its name *Phragma*, Greek meaning fence). It reproduces primarily vegetatively through profuse growth of rhizomes and runners which provide broken fragments that may be transported and grow new plants. *Phragmites* also reproduces through seeds that are successfully dispersed, however, often experience inhibited germination by environmental conditions resulting in low seed viability. *Phragmites* is most often found in wet or marshy areas but can thrive in a variety of conditions including fresh or brackish water, an acid to alkaline pH range, and high salinity. *Phragmites* habitats include freshwater and brackish marshes; tidal and non-tidal wetlands; river, lake, or pond edges; roadside ditches and swales; and disturbed areas. It is an aggressive wetland invader that spreads for acres forming huge monocultures that exclude native vegetation and wildlife, fill in wetlands reducing water flow and flood retention of the wetland, and trap sediments that cause the waterbody to become increasingly shallow. Methods to eliminate and control *Phragmites* include mechanical removal, chemical herbicide application, hydrologic fluctuation (water level), and prescribed burns.

References

IPANE (Invasive Plant Atlas of New England), 2007. European Buckthorn. Department of Ecology and Evolutionary Biology. University of Connecticut. Storrs, CT, USA. Available: <https://www.invasive.org/weedcd/html/ipane.html>.

MIPAG, 2005. The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts (with annotated list). Massachusetts Invasive Plant Advisory Group. April 1, 2005. Updates on-line at: [MIPAG - Massachusetts Invasive Plant Advisory Group \(massnrc.org\)](http://massnrc.org).

USACE, 2020. New England District Compensatory Mitigation Standard Operating Procedures. December 29, 2020. [NEW ENGLAND DISTRICT REGULATORY DIVISION COMPENSATORY \(army.mil\)](https://www.usace.army.mil/new-england-district-regulatory-division-compensatory/).

The following websites have also provided information in assembling the invasive species summaries:

<https://www.invasive.org/weedcd/pdfs/ipane/Phalaris-arundinacea.pdf>

<https://www.mass.gov/doc/phragmites/download>

https://nyis.info/invasive_species/common-reed/

<https://www.invasive.org/alien/pubs/midatlantic/phau.htm>

<https://www.invasive.org/alien/pubs/midatlantic/lomo.htm>

<https://www.invasive.org/weedcd/pdfs/ipane/Lythrum-salicaria.pdf>

www.des.nh.gov

Appendix H: Invasive Species Summaries

www.mass.gov/doc/purple-loosestrife-0/download

<https://www.invasive.org/weedcd/pdfs/ipane/Phalarisarundinacea.pdf>

<https://naturalresources.extension.iastate.edu/encyclopedia/reed-canary-grass-invasive-species-profile>

<https://dnr.wisconsin.gov/sites/default/files/topic/invasives/ReedCanaryGrass.pdf>

[IPANE - Catalog of Species Search Results \(invasive.org\)](#)

http://nyis.info>invasive_species>japanese-knotweed

http://maine.gov>invasive_plants>fallopia-japonica

<https://extension.psu.edu/multiflora-rose>).

<https://www.vtinvasives.org/invasive/goutweed-or-bishops-weed>

https://www.vtinvasives.org/sites/default/files/2016-10/Goutweed_finalTREATMENT.pdf

https://www.maine.gov/dacf/mnap/features/invasive_plants/aegopodium.html

<https://www.michigan.gov/invasives/id-report/plants/herbs/garlic-mustard>

<https://www.michigan.gov/invasives/id-report/plants/vines/oriental-bittersweet>