



Kevin Mooney
Senior Project Manager
Global Operations - Environment, Health & Safety

General Electric Company
1 Plastics Ave.
Pittsfield, MA 01201

T (413) 553-6610
kevin.mooney@ge.com

Via Electronic Mail

August 25, 2023

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

**Re: GE-Pittsfield/Housatonic River Site
Rest of River (GECD850)
Restoration Performance Objectives and Evaluation Criteria Report**

Dear Mr. Smith:

In accordance with Section II.B.1.c.(2)(b) of the Revised Final Permit issued by EPA for the Rest of River and Section 4.2.1.6 of the Final Revised Rest of River Statement of Work, enclosed for EPA's review and approval is GE's *Restoration Performance Objectives and Evaluation Criteria Report*, prepared for GE by Arcadis and AECOM.

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

Very truly yours,

Kevin G. Mooney
Senior Project Manager – Environmental Remediation

Enclosure

Cc: (via electronic mail)
Dean Tagliaferro, EPA
Anni Loughlin, EPA
Tim Conway, EPA
John Kilborn, EPA
Richard Fisher, EPA
Joshua Fontaine, EPA

Christopher Ferry, ASRC Federal
Thomas Czelusniak, HDR Inc.
Scott Campbell, Taconic Ridge Environmental
Izabella Zapisek, Taconic Ridge Environmental
Michael Gorski, MassDEP
John Ziegler, MassDEP
Ben Guidi, MassDEP
Michelle Craddock, MassDEP
Jeffrey Mickelson, MassDEP
Mark Tisa, MassDFW
Jonathan Regosin, MassDFW
Betsy Harper, MA AG
Traci Iott, CT DEEP
Susan Peterson, CT DEEP
Graham Stevens, CT DEEP
Carol Papp, CT DEEP
Lori DiBella, CT AG
Molly Sperduto, USFWS
Mark Barash, US DOI
Ken Finkelstein, NOAA
James McGrath, City of Pittsfield
Andrew Cambi, City of Pittsfield
Michael Coakley, PEDA
Melissa Provencher, BRPC
Christopher Ketchen, Town of Lenox
Town Administrator, Lee
Town Manager, Great Barrington
Town Administrator, Stockbridge
Town Administrator, Sheffield
Jim Wilusz, Tri Town Health Department
Andrew Silfer, GE
Andrew Thomas, GE
Matthew Calacone, GE
Adam Ayers and Douglas Partridge, Arcadis
Dennis Lowry, AECOM
Michael Werth, Anchor QEA
James Bieke, Sidley Austin
Public Information Repository at David M. Hunt Library in Falls Village, CT
GE Internal Repository

General Electric Company

Restoration Performance Objectives and Evaluation Criteria Report

Housatonic Rest of River

August 2023

Restoration Performance Objectives and Evaluation Criteria Report

Housatonic Rest of River

August 2023

Prepared for:

General Electric Company
1 Plastics Avenue
Pittsfield, MA 01201

Prepared by:

Arcadis
Two Huntington Quadrangle
Melville, NY 11747

and

AECOM
500 Enterprise Drive
Rocky Hill, CT 06067

This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.

Table of Contents

Abbreviations.....	iv
1 Introduction.....	1
1.1 Background.....	1
1.2 Applicable Report Requirements.....	3
1.3 Report Organization	3
2 Restoration Objectives.....	5
3 Stakeholder Concerns.....	6
4 Restoration Evaluation Criteria.....	7
4.1 Riverine Habitat	7
4.2 Riverbank Habitat	8
4.3 Backwater Habitat.....	9
4.4 Impoundment Habitat.....	10
4.5 Floodplain Wetland Habitat	11
4.6 Upland Floodplain Habitat	12
4.7 Vernal Pool Habitat.....	13
4.8 Rare Species	14
5 Preliminary Post-Construction Monitoring Program	15
5.1 Monitoring Frequency and Duration.....	15
5.2 Field Monitoring Methods.....	16
5.2.1 Riverine Habitat	16
5.2.1.1 Monitoring to Assess Restoration Evaluation Criteria.....	16
5.2.1.2 Monitoring to Assess Ecological Function.....	16
5.2.2 Riverbank Habitat	17
5.2.2.1 Monitoring to Assess Restoration Evaluation Criteria.....	17
5.2.2.2 Monitoring to Assess Ecological Function.....	18
5.2.3 Backwater Habitat.....	18
5.2.3.1 Monitoring to Assess Restoration Evaluation Criteria.....	18
5.2.3.2 Monitoring to Assess Ecological Function.....	18
5.2.4 Impoundment Habitat.....	19
5.2.4.1 Monitoring to Assess Restoration Evaluation Criteria.....	19
5.2.4.2 Monitoring to Assess Ecological Function.....	19

- 5.2.5 Floodplain Habitats (Excluding Vernal Pools)..... 19
 - 5.2.5.1 Monitoring to Assess Restoration Evaluation Criteria 19
 - 5.2.5.2 Monitoring to Assess Ecological Function 20
- 5.2.6 Vernal Pools 20
 - 5.2.6.1 Monitoring to Assess Restoration Evaluation Criteria 20
 - 5.2.6.2 Monitoring to Assess Ecological Function 21
- 5.2.7 Rare Species 21
- 5.3 Reporting 21
- 6 Preliminary Maintenance / Corrective Action Program 23
 - 6.1 Replanting and Reseeding 23
 - 6.2 Herbivory Control 24
 - 6.3 Invasive Species Control 24
 - 6.4 Erosion Repairs 24
 - 6.5 Repair / Replacement of Restoration Structures 24
- 7 Next Steps 26
- 8 References 27

Tables

Table 1. Field Parameters to be Measured or Characterized to Assess the Restoration Evaluation Criteria.

Table 2. Invasive Species of Concern.

Figure

Figure 1. Reaches 5 through 8, Housatonic River – Pittsfield, MA.

Appendices

Appendix A. Riverine Habitat Assessment Field Data Sheets.

Appendix B. Riverbank Habitat Inventory Form.

Appendix C. Backwater Habitat Inventory Form.

Appendix D. Impoundment Habitat Inventory Form.

Appendix E. Floodplain Habitat Inventory Data Sheets.

Appendix F. Vernal Pool Characterization Form and MNHESP Vernal Pool Field Observation Form.

Abbreviations

ARARs	Applicable or relevant and appropriate requirements
BRA	Baseline Restoration Assessment
CD	2000 Consent Decree for the GE-Pittsfield/Housatonic River Site
cfs	cubic feet per second
Confluence	Confluence of the East and West Branches of the Housatonic River
EPA	U.S. Environmental Protection Agency
GE	General Electric Company
GPS	global positioning system
IMM Plan	Inspection, Monitoring, and Maintenance Plan
ISCP	Invasive Species Control Plan
LiDAR	Light Detection and Ranging
MDEP	Massachusetts Department of Environmental Protection
MDFW	Massachusetts Division of Fisheries and Wildlife
MESA	Massachusetts Endangered Species Act
MIPAG	Massachusetts Invasive Plant Advisory Group
MNHESP	Massachusetts Natural Heritage & Endangered Species Program
NCD	Natural Channel Design
O&M	operation and maintenance
PCBs	polychlorinated biphenyls
PDI	pre-design investigation
RCMCP	Restoration/Corrective Measures Coordination Plan
RCRA	Resource Conservation and Recovery Act
Revised Permit	Revised Final RCRA Corrective Action Permit for the Housatonic Rest of River
ROR	Rest of River
RU	Remediation Unit
SOW	Statement of Work
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1 Introduction

1.1 Background

On December 16, 2020, pursuant to the 2000 Consent Decree (CD) for the GE-Pittsfield/Housatonic River Site, 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) located downstream of the confluence of the East and West Branches of the Housatonic River (the Confluence). The Revised Permit set forth a Remedial Action selected by EPA to address polychlorinated biphenyls (PCBs) in the ROR.

The Revised Permit required GE to develop and submit a Statement of Work 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* (Final Revised SOW) on September 14, 2021 (Anchor QEA et al. 2021), and EPA approved it on September 16, 2021.

Section II.B.1.c of the Revised Permit sets forth Performance Standards and other requirements for Restoration of Areas Disturbed by Remediation. The latter term is defined in the Revised Permit as follows: “[F]or all areas disturbed by remediation activities under this Permit, the implementation of measures to return such areas 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.” The defined Performance Standards for Restoration of Areas Disturbed by Remediation are to:

- (1) Implement a comprehensive program of restoration measures that addresses the impacts of the Corrective Measures (i.e., remediation activities)¹ on all 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 such areas 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), these Performance Standards are to be achieved through a program designed to address the potential impacts of remediation, which are to be specified in the following series of documents:

- (1) Baseline Restoration Assessment (BRA) Work Plan;
- (2) Restoration Performance Objectives and Evaluation Criteria Report to guide the design, remediation, restoration, construction, implementation of remedial activities, and evaluation of restoration success;

¹ The Revised Permit frequently uses the RCRA term “Corrective Measures” to refer to the remediation activities that comprise the ROR Remedial Action. The present report generally uses the term remediation or remedial activities to refer to those required activities.

Restoration Performance Objectives and Evaluation Criteria Report

- (3) Restoration/Corrective Measures Coordination Plan (RCMCP) to be performed during the implementation of the remediation actions; and
- (4) Restoration Plans specific to various remediation areas to return all areas disturbed by the remediation activities to pre-remediation conditions.

The above process and deliverables are also described in Sections 4.2.1.4, 4.2.1.6, 4.3.3.5, and 4.3.3.6 of the Final Revised SOW. As discussed there, the first two of the above-listed deliverables are intended to be site-wide documents, and the latter two will be specific to the various remediation areas, now referred to as Remediation Units (RUs), within the ROR, such that there would be an RCMCP and Restoration Plan for each identified RU. The RUs were identified in GE's Final Revised Overall Strategy and Schedule for Implementation of the Corrective Measures, submitted to, and approved by EPA in July 2022 (Anchor QEA 2022), based on the reaches of the ROR (described below). That document also noted that, at EPA's request, the BRA Work Plan had been divided into two – one for Reach 5A (the initial RU to be remediated) and another for the remaining RUs.

The ROR reaches and sub-reaches within which remedial activities will occur, and which are thus the focus of this Report, are as follows (from upstream to downstream) and are shown on Figure 1:

- Reach 5, from the Confluence downstream to Woods Pond (the first significant impoundment). This reach is further divided into the following sub-reaches:
 - Reach 5A (Confluence to the Pittsfield Wastewater Treatment Plant Discharge)
 - Reach 5B (Pittsfield Wastewater Treatment Plant Discharge to Roaring Brook)
 - Reach 5C (Roaring Brook to the start of Woods Pond)
- Reach 6, Woods Pond
- Reach 7, Woods Pond Dam to Rising Pond (the next significant impoundment). This reach is further divided into the following sub-reaches:
 - Reach 7A (Woods Pond Dam to the Columbia Mill Dam Impoundment)
 - Reach 7B (Columbia Mill Dam Impoundment)
 - Reach 7C (Former Eagle Mill Dam Impoundment)
 - Reach 7D (Former Eagle Mill Dam to the Willow Mill Dam Impoundment) – Reach 7E (Willow Mill Dam Impoundment)
 - Reach 7F (Willow Mill Dam to the Glendale Dam Impoundment)
 - Reach 7G (Glendale Dam Impoundment)
 - Reach 7H (Glendale Dam to Rising Pond)
- Reach 8, Rising Pond

GE has commenced the baseline restoration assessment process described in the Revised Permit and Final Revised SOW. GE's Revised BRA Work Plan for Reach 5A was submitted on July 14, 2022 (AECOM 2022) and approved by EPA on July 18, 2022. GE's Second Revised BRA Work Plan for Reaches 5B through 8 was submitted to EPA on February 20, 2023 (AECOM 2023a) and approved by EPA on March 8, 2023. GE

has completed the BRA activities in Reach 5A and has prepared a BRA Report for Reach 5A (AECOM 2023b), which is being submitted concurrently with the present report.

This *Restoration Performance Objectives and Evaluation Criteria Report* (Restoration Criteria Report or Report) is the second listed restoration-related report in the Revised Permit and has been prepared pursuant to Section II.B.1.c.(2)(b) of the Revised Permit. This Report has been prepared as a site-wide document and is intended to guide the design and implementation of remediation and restoration activities at the various RUs and the evaluation of restoration success at addressing the impacts of remediation activities on all affected ecological resources within the ROR.² Specific restoration actions for the RUs and measures to implement the restoration evaluation criteria outlined in this Report will be provided in the subsequent RU-specific RCMCPs and Restoration Plans.

1.2 Applicable Report Requirements

The Revised Permit and Final Revised SOW require that this Report contain the following:

- Definition of restoration objectives, including minimization of the impacts of remediation activities on ecological resources and habitats and restoration of impacted resources and habitats. Restoration objectives are to include general goals, such as no net loss of wetland functions, no significant erosion on riverbanks, and maintenance of overall flood storage capacity.
- Identification of measurable evaluation criteria and applicable methods or specifications, including criteria and methods or specifications for evaluating success in achieving restoration objectives. These are to include measurable, quantifiable, or observable parameters that are amenable to being designed, controlled, and managed as part of a restoration program and are generally structurally based parameters.
- Identification of stakeholder concerns.
- Development of a Preliminary Monitoring Program, including monitoring protocols geared specifically to the established Performance Standards and restoration evaluation criteria.
- Development of a Preliminary Maintenance Program.
- Specification of corrective actions and circumstances – a process that is to be integrated with the Adaptive Management Plan to be developed for the ROR Remedial Action.

1.3 Report Organization

This Report has been organized to address impacts from remediation activities on all affected habitats, including:

- Riverine habitats;
- Riverbank habitats;
- Backwater habitats;
- Impoundment habitats;

² In this Report, “remediation activities” include supporting activities such as the construction and use of access roads and staging areas.

Restoration Performance Objectives and Evaluation Criteria Report

- Floodplain wetland habitats;
- Floodplain upland habitats;
- Vernal pools; and
- Rare species habitat.

To satisfy the requirements of the Revised Permit and the Final Revised SOW, the remainder of this Report has been organized in the following sections:

- *Section 2: Restoration Objectives* – specifies the overall objectives of habitat restoration actions following implementation of the remediation.
- *Section 3: Stakeholder Concerns* – describes stakeholder concerns relating to restoration objectives and criteria and how those concerns will be considered in restoration planning.
- *Section 4: Restoration Evaluation Criteria* – identifies the restoration evaluation criteria that will be used to evaluate success of habitat restoration and applicable methods for implementing those criteria.
- *Section 5: Preliminary Post-Construction Monitoring Program* – provides a preliminary overview of post-remediation monitoring activities to be implemented to evaluate achievement of, progress towards, or deviation from the defined restoration evaluation criteria, as well as additional data collection efforts to document the functioning of the restored habitats for informational purposes.
- *Section 6: Preliminary Maintenance Program* – provides preliminary overview of the maintenance/corrective actions to be implemented if the monitoring shows a need for such actions to maintain progress toward the defined restoration evaluation criteria.
- *Section 7: Next Steps* – outlines next steps in the restoration process to support restoration of the affected habitats in the ROR.
- *Section 8: References.*

2 Restoration Objectives

The overarching restoration objective of the ROR Remedial Action is to meet the Revised Permit's Performance Standards for Restoration of Areas Disturbed by Remediation Activities, as provided in Section II.B.1.c.(1)) of the Revised Permit and quoted in Section 1.1 of this Report. More specifically, given that overarching objective, the general restoration objectives for this project are as follows:

- To the extent feasible and consistent with remediation requirements, minimize impacts on all ecological resources and habitats resulting from implementation of the remedial activities.
- Return affected habitats, as defined in Section 1.2, to pre-remediation conditions (as documented during BRA activities) to the extent practicable.
- In particular, return the affected habitat of federally or state-listed threatened, endangered, or special concern species (collectively referred to as rare species), including vernal pools, to pre-remediation conditions (as documented during BRA activities) to the extent practicable.³
- Restore natural channel morphology to the Housatonic River channel system, consistent with Natural Channel Design (NCD) principles⁴ and with riverbank and aquatic habitats characteristic of pre-remediation conditions to the extent practicable.
- Prevent significant erosion on the restored riverbanks and restored floodplain areas that could adversely impact vegetation establishment and ecological functioning.⁵
- Restore floodplain hydrology necessary to support wetland vegetated habitats impacted by the remediation activities to ensure no net loss of wetland area and functions.
- Restore nature channel morphology and associated floodplain characteristics to ensure no significant loss of flood storage capacity.
- Restore a mosaic of native plant communities across applicable vegetated habitat types comparable to that existing prior to remediation and establish a monitoring and adaptive management program to minimize, to the extent practicable, the growth and spread of invasive plant species, as a result of the remediation, that could adversely impact the establishment of native plant communities.

³ As stated in the Revised Permit, this restoration objective does not alter or modify GE's obligation to satisfy the separate net benefit mitigation standard in the Massachusetts Endangered Species Act.

⁴ It is noted that river restoration, as defined in this NCD approach, has the goal to establish the physical, chemical and biological functions of the river system that are self-regulating and emulate the natural stable form within the constraints imposed by the larger landscape conditions. NCD methods are described in Chapter 11, Rosgen Geomorphic Channel Design, of the Stream Restoration Handbook (Part 654) (United States Department of Agriculture [USDA] 2007) and in the Natural Channel Design Review Checklist Manual (Harman and Starr 2011).

⁵ Erosion of the engineered caps to be installed in aquatic areas where such caps are part of the Remedial Action will be addressed as part of the inspection and maintenance of those caps and will be covered as part of the operation and maintenance (O&M) program to be described in the Post-Construction Inspection, Monitoring, and Maintenance (IMM) Plans (described in Section 5.1 of the Final Revised SOW) for the RUs containing capped areas.

3 Stakeholder Concerns

Potential stakeholders with an interest in the restoration evaluation criteria for the ROR Remedial Action likely include the following:

- Commonwealth of Massachusetts, including the Department of Environmental Protection (MDEP), Division of Fisheries and Wildlife (MDFW), and Natural Heritage & Endangered Species Program (MNHESP);
- City of Pittsfield and Towns of Lenox, Lee, Stockbridge, Great Barrington, and Sheffield;
- United States Fish and Wildlife Service (USFWS);
- Native American tribes – specifically, the Stockbridge Munsee Band of Mohican Indians, the Wampanoag Tribe of Gay Head (Aquinnah), the Schaghticoke Tribal Nation, and the Schaghticoke Indian Tribe;
- Massachusetts Audubon Society; and
- Other non-governmental organizations with an interest in the ROR.

In developing this Restoration Criteria Report, GE has considered the likely concerns of these stakeholders, which would be expected to be consistent with the restoration objectives listed in Section 2. In any case, under the CD, EPA provides the Commonwealth of Massachusetts (as well as the State of Connecticut) with an opportunity for review and comment on GE's submittals under the Revised Permit. Further, although there is no formal public comment process for those submittals, EPA has committed to making key project submittals available to the public and other stakeholders prior to providing formal responses to GE, whenever practicable. Thus, the above-listed stakeholders and others will have the opportunity to provide comments to EPA on this Restoration Criteria Report. Moreover, when GE develops and submits RU-specific RCMCPs and Restoration Plans, stakeholders can provide comments to EPA on them, so that their concerns can be considered in connection with the restoration at each RU. In addition, to the extent requested by EPA, GE will participate in public meetings or information sessions scheduled by EPA to discuss restoration evaluation criteria or RU-specific restoration activities.

4 Restoration Evaluation Criteria

This section identifies the restoration evaluation criteria for each of the habitat types identified in Section 1.2. In accordance with the Final Revised SOW, these criteria consist of measurable, quantifiable, or observable parameters that are amenable to being designed, controlled, and managed and are generally structurally based. They will be used to evaluate success in achieving the restoration objectives described in Section 2, including an evaluation of whether the affected habitats have been returned to pre-remediation conditions. Progress towards meeting restoration evaluation criteria following implementation of the remedial activities as documented through the monitoring program, described in Section 5, will provide a framework for any necessary adaptive habitat management to maintain, repair, or direct another response necessary to achieve restoration evaluation criteria, as described in Section 6.

The restoration evaluation criteria are founded on the range of conditions prior to remedial activities, and their application will take account of those conditions, as documented in the BRA Report for Reach 5A (being submitted concurrently with this Report), in the subsequent BRA Report for Reaches 5B through 8, and in any supplemental RU-specific BRA reports. They will reflect the characteristics of each habitat type, which consist of parameters that represent structure important to ecological functions and values.

The following subsections identify the restoration evaluation criteria for each impacted habitat or resource in the ROR, along with general methods for applying those criteria. The criteria identified in those subsections are subject to revision, with EPA approval, in the RU-specific Restoration Plans. It is also recognized that the specific measures or specifications to be used to implement these criteria may differ for the various RUs. Those for a given RU will be based on the baseline habitat information documented in the RU-specific BRA Reports and will be incorporated into the subsequent RU-specific Restoration Plans to the extent appropriate and practicable.⁶

The following subsections contain some text that is repeated through the various subsections. This was done intentionally so that the restoration evaluation criteria and associated data collection activities for each habitat are clear.

4.1 Riverine Habitat

The overall restoration evaluation criterion for riverine habitats affected by sediment removal and/or the installation of engineered caps is that such habitats have been restored in accordance with the approved design details and contract specifications and in consideration of the principles of NCD. The type of aquatic riverine habitat to be restored or replaced will be specific to the RU (Section 1.1); these may include habitats such as riffles, runs, and pools, and include consideration of the channel cross-sectional area, longitudinal slope, and thalweg. Physical features and characteristics of aquatic habitats prior to remedial activities will be documented in the applicable RU-specific BRA Reports (already completed for Reach 5A) and will be taken into account in the subsequent RU-specific Restoration Plans to the extent appropriate and practicable. Following completion of the remedial activities and subsequent habitat restoration actions in each such RU, documentation and verification that the riverine aquatic habitats were restored or reconstructed in accordance

⁶ In addition to assessing achievement of the restoration evaluation criteria, data will be collected during the monitoring period to document specific functions of the restored habitats. These additional data collection efforts are discussed in Section 5. The data from these activities will be collected solely for informational purposes and will not be used in assessing achievement of the restoration evaluation criteria.

with the contract specifications will demonstrate successful achievement of the overall restoration evaluation criterion.

In addition to this overall restoration evaluation criterion, a secondary restoration evaluation criterion for riverine habitats, to be documented during the monitoring period, is that specific aquatic habitat structures and features installed as part of the restoration (e.g., in-channel coarse wood, vanes, weirs) are present in accordance with Restoration Plans or, if not present, changes do not negatively affect river hydrology or stability, floodplain connectivity, in-river habitat, and/or bordering vegetative conditions.⁷

The data collection to assess achievement of or progress toward achieving the latter criterion will occur as part of the overall monitoring program described in Section 5. The relevant field parameter for such data collection is listed in Table 1, which identifies the field parameters to be sampled or characterized in the various restored habitats to assess the restoration evaluation criteria, apart from the verification that the designed habitats were successfully restored or reconstructed in accordance with the contract specifications. The details of this data collection program, including the number of sampling locations, will be specified in the RU-specific Restoration Plans.

4.2 Riverbank Habitat

The overall restoration evaluation criterion for riverbank habitats is that the affected riverbanks have been restored and stabilized (where applicable) in accordance with the approved design details and contract specifications and in consideration of the principles of NCD.⁸ The type of riverbank habitats and habitat features to be restored or replaced will be specific to the RUs that contain riverbanks subject to remediation (i.e., Reaches 5A and 5B) and will be addressed in the Restoration Plans for those RUs. Physical features and characteristics of riverbank habitats prior to remedial activities will be documented in the applicable RU-specific BRA Reports (already completed for Reach 5A) and will be taken into account in the subsequent RU-specific Restoration Plans to the extent appropriate and practicable. Following completion of the remediation and subsequent habitat restoration actions in these RUs, documentation and verification that the riverbank morphology and habitat characteristics were restored in accordance with the contract specifications will demonstrate successful achievement of the overall restoration evaluation criterion.

In addition to this overall restoration criterion, the restoration evaluation criteria for riverbank habitats that have been affected by remediation and restoration activities will include the following, to be documented during the monitoring period:

- Restored topsoil characteristics and composition in accordance with the contract specifications.⁹

⁷ As noted in Section 2, erosion or scouring of the restored channel bed subject to engineered caps will be addressed as part of the post-construction O&M programs for the engineered caps, to be described in the IMM Plans for the subject RUs (as described in the Final Revised SOW).

⁸ As noted in the BRA Work Plans, riverbanks were previously defined 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 pre-design investigation (PDI) of Reach 5A, the toe of the bank was defined based on the water surface elevation observed during the April 2022 topographic survey (with a river flow rate between 130-150 cubic feet per second [cfs]) and the top-of-bank was the first observable break in slope based on the a Light Detection and Ranging [LiDAR] survey data collected in 2021 and 2022, but no higher than the elevation of the adjacent 1 mg/kg PCB isopleth. This Report follows that same definition, which is consistent with the definition used in the conceptual design for Reach 5A to be included in the upcoming Conceptual RD/RA Work Plan for Reach 5A.

⁹ Verification that the placed soil meets the design contract specifications will demonstrate successful achievement of this restoration evaluation criterion.

Restoration Performance Objectives and Evaluation Criteria Report

- There is no observed significant riverbank erosion that would negatively affect bank integrity or vegetation establishment due to remediation or restoration activities.
- Mean percent cover of native target species is equal to or greater than 80 percent in each design plant community type.¹⁰
- Mean percent cover of invasive or likely invasive plant species (as listed in Table 2) is equal to or less than 10 percent in each design plant community type or equal to or less than a percent cover documented at reference sites (if documented in RU-specific Restoration Plans).¹¹
- Restored forested areas on the riverbanks have stem densities to reflect a minimum of 80 percent surviving, established, or naturally recruited native tree species per acre.
- Restored scrub-shrub communities on the riverbanks have stem densities to reflect a minimum of 80 percent surviving, established, or naturally recruited native shrub species per acre.
- Specific habitat structures that were installed on the banks as part of the restoration, such as coarse woody debris, are generally present in accordance with the RU-specific Restoration Plans or, if not present, changes do not negatively affect riverbank stability or planted vegetation.

The data collection to assess these restoration evaluation criteria will occur as part of the overall monitoring program described in Section 5. The field parameters that will be sampled or characterized on the restored riverbanks as part of that data collection are listed in Table 1. The details of this data collection program, including the number of sampling locations, will be included in the RU-specific Restoration Plans.

4.3 Backwater Habitat

Backwater habitat refers more to a hydrologic condition than a distinct habitat type and encompass both riverine and floodplain natural community types. The critical habitat characteristic is a direct surface water connection to the main stem of the Housatonic River. Backwaters in Reach 5A have been identified in the Reach 5A BRA Report, and those in other RUs will be identified in the BRA Report for Reaches 5B through 8.

The overall restoration evaluation criterion for backwater habitats is that the impacted backwater areas have been restored in accordance with the approved design details and contract specifications, specifically to restore the physical and hydrologic characteristics (i.e., size, depth, and hydrologic surface water connection to the river) of each affected backwater area. The type of backwater habitats and habitat features to be restored will be specific to each RU containing backwaters. Physical features and characteristics of backwater habitats prior to remedial activities will be documented in the RU-specific BRA Reports (already completed for Reach 5A) and will be taken into account in the subsequent RU-specific Restoration Plans to the extent appropriate and practicable. Following completion of remedial activities and subsequent restoration actions,

¹⁰ Target species are defined as those planted or seeded species included in contract specifications or other native species that naturally establish within the restoration area.

¹¹ This list of invasive species consists of the non-native species listed by the Massachusetts Invasive Plant Advisory Group (MIPAG) as “invasive” or “likely invasive” (MIPAG 2023) and those listed by the United States Army Corps of Engineers (USACE) New England District as invasive and requiring control if identified within a mitigation site (USACE 2020). (Note that the USACE New England District also identifies other “unacceptable” plant species that should not be affirmatively planted on the project site, but are not included in Table 2.)

The condition that invasive species cover would be equal to or less than a percent cover documented at reference sites within or outside of the ROR recognizes that certain habitats will be dominated by invasive species prior to remediation and that the remedial activities may not be sufficient to control and restrict future establishment of non-native invasive species that currently dominate those habitats.

documentation and verification that the restored backwater habitats have physical characteristics and a direct hydrologic surface water connection to the river in accordance with the contract specifications will demonstrate successful achievement of the overall restoration evaluation criterion.

In addition to this overall restoration criterion, the specific restoration evaluation criteria for backwater habitats will include the following, to be documented during the monitoring period:

- Backwater habitats maintain hydrologic connection to the river channel in comparable form and function to the pre-remediation condition or conditions specified in design drawings and specifications.
- Backwater habitats maintain seasonal water depths (under normal climatic conditions) consistent with pre-remediation conditions or conditions specified in design drawings and specifications.
- Specific habitat structures installed as part of the restoration (e.g., coarse woody structures) are present in accordance with Restoration Plans or, if not present, changes do not negatively affect river hydrology, floodplain connectivity, in-river habitat, and/or planted vegetative conditions.

The data collection to assess these restoration evaluation criteria will occur as part of the overall monitoring program described in Section 5. The field parameters that will be sampled or characterized in the restored backwater habitats as part of that data collection are listed in Table 1. The details of this data collection program, including the number of sampling locations, will be included in the RU-specific Restoration Plans.

4.4 Impoundment Habitat

This section addresses the six impoundments in the ROR in Massachusetts: Woods Pond (Reach 6), Columbia Mill Dam Impoundment (Reach 7B), the Former Eagle Mill Dam Impoundment (Reach 7C), Willow Mill Dam Impoundment (Reach 7E), Glendale Dam Impoundment (Reach 7G), and Rising Pond (Reach 8).

The overall restoration evaluation criterion for impoundment habitats is that these impoundments have been restored in accordance with the approved design details and contract specifications, specifically to restore the physical and hydrologic characteristics (i.e., size, depth, and hydrologic surface water characteristics) of each affected impoundment. The type of aquatic habitats and habitat features to be restored will be specific to the impoundment. Physical features and characteristics of each impoundment prior to remediation will be documented in the applicable RU-specific BRA Reports and will be taken into account in the subsequent Restoration Plans for Reaches 6, 7, and 8 as appropriate and practicable.¹² Following completion of the remedial activities and subsequent restoration actions in each impoundment, documentation and verification that the restored aquatic habitats will have physical and hydrological characteristics in accordance with the contract specifications will demonstrate successful achievement of the overall restoration evaluation criterion. No other specific restoration evaluation criteria have been determined to be necessary or appropriate for the impoundment habitats.

¹² It is recognized that the removal of the Columbia Mill and Former Eagle Mill Dams will likely result in a change of habitat type from the pre-remediation condition. The Restoration Plan for Reach 7 will account for this change in habitat type, and the approved designs for the remediation of Reaches 7B and 7C will inform subsequent monitoring and adaptive management.

4.5 Floodplain Wetland Habitat

The restoration evaluation criteria for floodplain wetland habitats will be focused on the restoration of wetland hydrology necessary to support and sustain target native plant communities in floodplain wetlands affected by remediation and support activities (including access roads and staging areas). The type of native plant communities will be specific to the floodplain wetlands in each RU that includes such wetlands. Physical features and characteristics of floodplain wetland habitats prior to remediation will be documented in the applicable RU-specific BRA reports (already completed for Reach 5A) and will be taken into account in the RU-specific Restoration Plans as appropriate and practicable.

The restoration evaluation criteria for floodplain wetland habitats are as follows, to be documented during the monitoring period:

- The affected wetland acreage has been restored consistent with conditions prior to remedial activities to ensure no net loss in wetland area.
- Restored topsoil characteristics are in accordance with the contract specifications.¹³
- There is no erosion that is negatively affecting vegetation establishment or floodplain hydrology necessary to support design wetland plant communities.
- Mean percent cover of native target species is equal to or greater than 80 percent in each design plant community type.
- Mean percent cover of invasive or likely invasive plant species (listed in Table 2) is equal to or less than 10 percent in each design plant community type or equal to or less than a percent cover documented at reference sites (to be documented in RU-specific Restoration Plans).¹⁴
- Restored forested communities have stem densities to reflect a minimum of 80 percent surviving, established, or naturally recruited native tree species per acre.
- Restored scrub-shrub communities have stem densities to reflect a minimum of 80 percent surviving, established, or naturally recruited native shrub species per acre.
- Indicators of floodplain wetland hydrology and hydric soil development are present¹⁵
- Specific habitat structures that were installed in the floodplain as part of the restoration (e.g., coarse woody debris, rock piles) are present in accordance with the RU-specific Restoration Plans or, if not present, changes would not be expected to negatively affect the wetlands habitat support for wildlife.

¹³ Verification that the characteristics and placement of soil meet the design contract specifications will demonstrate successful achievement of this restoration evaluation criterion.

¹⁴ As with the riverbanks, the condition that invasive species cover would be equal to or less than a percent cover documented at reference sites, within or outside of the ROR, recognizes that certain habitats will be dominated by invasive species prior to remediation and that the remedial activities may not be sufficient to control and restrict future establishment of non-native invasive species that currently dominate those habitats. For example, the remediation may not have the ability to address invasive species within the existing soils seed bank or provide protective measures from non-native habitats that may surround the areas addressed by remedial action.

¹⁵ Indicators of wetland hydrology and hydric soils will be consistent with guidance and protocols presented in the USACE Wetland Delineation Manual (Environmental Laboratory 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0; USACE 2012).

The data collection to assess these restoration evaluation criteria will occur as part of the overall monitoring program described in Section 5. The field parameters that will be sampled or characterized in the restored floodplain wetland habitats as part of that data collection are listed in Table 1. The details of this data collection program, including the number of sampling locations, will be included in the RU-specific Restoration Plans.

4.6 Upland Floodplain Habitat

The restoration evaluation criteria for upland floodplain habitats will focus on the restoration of target native plant communities in upland portions of the restored floodplain affected by remediation and support activities (including access roads and staging areas). The type of native plant communities will be specific to the upland floodplain in RU with upland floodplain habitat. Physical features and characteristics of upland floodplain habitats prior to remediation will be documented in the applicable RU-specific BRA Reports (already completed for Reach 5A) and will be taken into account in the RU-specific Restoration Plans as appropriate and practicable.

The restoration evaluation criteria for upland floodplain habitats are as follows, to be documented during the monitoring period:

- The affected floodplain upland acreage has been restored consistent with conditions prior to remedial activities and consistent with the Restoration Plan and specifications.
- Restored topsoil characteristics are in accordance with the contract specifications.¹⁶
- There is no erosion that is negatively affecting vegetation establishment or floodplain hydrology necessary to support design plant communities.
- Mean percent cover of native target species is equal to or greater than 80 percent in each design plant community type.
- Mean percent cover of invasive or likely invasive plant species is equal to or less than 10 percent in each design plant community type or equal to or less than a percent cover documented at reference sites (to be documented in RU-specific Restoration Plans).¹⁷
- Restored forested communities have stem densities to reflect a minimum of 80 percent surviving, established, or naturally recruited native tree species per acre.
- Restored scrub-shrub communities have stem densities to reflect a minimum of 80 percent surviving, established, or naturally recruited native tree species per acre.
- Specific habitat structures that were installed in the floodplain as part of the restoration (e.g., coarse woody debris, rock piles) are present in accordance with the RU-specific Restoration Plans or, if not present, changes would not be expected to negatively affect the wetlands habitat support for wildlife.

The data collection to assess these restoration evaluation criteria will occur as part of the overall monitoring program described in Section 5. The field parameters that will be sampled or characterized in the restored

¹⁶ Verification that the characteristics and placement of soil meet the design contract specifications will demonstrate successful achievement of this restoration evaluation criterion.

¹⁷ The latter condition is included for the same reason given for the invasive species criterion for floodplain wetlands.

upland floodplain habitats as part of that data collection are listed in Table 1. The details of this data collection program, including the number of sampling locations, will be included in the RU-specific Restoration Plans.

4.7 Vernal Pool Habitat

The overall restoration evaluation criterion for vernal pools is that the physical characteristics of the pool meet the MNHESP's physical criteria for formal certification of vernal pools. The type and acreage of vernal pool habitats will be specific to vernal pools determined to occur within the floodplain in each specific RU that contains vernal pools. Physical features and characteristics of vernal pools prior to remediation will be documented in the applicable RU-specific BRA reports (already completed for Reach 5A) and will be taken into account in the subsequent RU-specific Restoration Plans as appropriate and practicable.

To implement the overall restoration evaluation criterion described above, the specific restoration evaluation criteria for vernal pool habitats are as follows, to be documented during the monitoring period:

- The affected vernal pool density and acreage has been restored consistent with conditions prior to remedial activities or consistent with restoration drawings and specifications to ensure no net loss of wetlands in the vernal pool area.
- Restored topsoil characteristics are in accordance with the contract specifications.¹⁸
- The physical parameters of the pool (i.e., size, depth, microrelief, wood debris) are consistent with pre-remediation conditions or would otherwise allow the pool to meet the MNHESP physical criteria for certification as a vernal pool.
- The hydrology of the pool (i.e., hydroperiod, lack of permanently flowing outlet) is consistent with pre-remediation conditions or would otherwise allow the pool to meet the MNHESP physical criteria for certification as a vernal pool.
- The vernal pool has no evidence of an established, reproducing fish population.
- Mean percent cover of native target species is equal to or greater than 80 percent in each design plant community type.¹⁹
- Mean percent cover of invasive or likely invasive plant species is equal to or less than 10 percent in each design plant community type or equal to or less than a percent cover documented at reference sites (to be documented in RU-specific Restoration Plans).²⁰
- Specific habitat structures that were installed as part of the restoration (e.g., coarse woody debris) are present in accordance with the RU-specific Restoration Plans or, if not present, changes would not be expected to negatively affect the physical criteria for certification as a vernal pool.

The data collection to assess these restoration evaluation criteria will occur as part of the overall monitoring program described in Section 5. The field parameters to be sampled or characterized in the restored vernal

¹⁸ Verification that the characteristics and placement of soil meet the design contract specifications will demonstrate successful achievement of this restoration evaluation criterion.

¹⁹ It is recognized that restored vernal pools will also include open water habitat. Restoration evaluation criteria specific to vegetative cover will be assessed only for portions of the vernal pool for which the approved design specifies native planting and/or seeding.

²⁰ The latter condition is included for the same reason given for the invasive species criterion for floodplain wetlands.

pools as part of that data collection are listed in Table 1.²¹ The details of this data collection program, including the number of sampling locations, will be included in the RU-specific Restoration Plans.

4.8 Rare Species

The overall restoration evaluation criteria for rare species impacts are that: (a) the impacted habitat for such species has been restored to pre-remediation conditions or other conditions that would support such species or that mitigation for such impacts has been provided; and (b) the applicable or relevant and appropriate requirements (ARARs) relating to state-listed species – namely, those established by the Massachusetts Endangered Species Act (MESA) – have been met. Regarding the latter, the ARARs table in the Revised Permit (Attachment C) states: “To the extent that unavoidable impacts result in a take of a state-listed species, EPA would follow the regulatory requirements [of the MESA regulations] with respect to implementing a conservation and management plan providing for a long-term net benefit to the affected state-listed species” (page C-15).

Rare species habitat and potential species presence in the various RUs prior to remediation will be documented and evaluated in the applicable RU-specific BRA reports (already completed for Reach 5A) and will be taken into account in the RU-specific Restoration Plans as appropriate and practicable for RUs containing rare species and/or their associated habitat. Based on consideration of such information, more specific restoration evaluation criteria for rare species habitats, including the need for and a scope of conservation and management plan for federal- and/or state-listed species for which a take will occur, will be specific to each RU, taking into account the determined unavoidable impacts to rare species or associated habitats, and will be presented in the RU-specific Restoration Plans.

Similarly, since the rare species in each RU except Reach 5A have not been identified to date and since the rare species will vary among RUs, the data collection to assess achievement of the restoration evaluation criteria relating to rare species will be described in the RU-specific Restoration Plans.

²¹ Post-restoration surveys to assess the biological as well as physical criteria for vernal pool certification are described in Section 5.

5 Preliminary Post-Construction Monitoring Program

This section provides a preliminary overview of the post-construction monitoring activities for each affected habitat type or resource to assess achievement of or progress toward the restoration evaluation criteria specified in Section 4. It also provides an overview of likely additional data collection activities to document specific functions of the restored habitats following remediation and restoration (e.g., fish presence in waterbodies, obligate species presence in vernal pools). These additional data will be collected solely for informational purposes and will not be used in assessing achievement of the restoration evaluation criteria.²²

This post-construction monitoring program does not include any monitoring to be conducted during remedial construction and/or restoration activities, which will be addressed in the RU-specific Remedial Design/Remedial Action Work Plans and/or Supplemental Information Packages. This preliminary post-construction monitoring program will be refined in the RU-specific Restoration Plans, as appropriate. Post-construction maintenance and corrective actions are discussed in Section 6.

5.1 Monitoring Frequency and Duration

Unless otherwise provided below for a specific habitat or in the applicable RU-specific Restoration Plan, the post-construction restoration monitoring program for each RU will consist of (a) a near-term post-installation monitoring visit to verify installation in accordance with applicable plans and specifications and (b) the following site visits over a seven-year period:

- Two monitoring visits per year for the first three years after completion of restoration actions; and
- One monitoring visit per year in the fourth, fifth, and seventh year after completion of restoration.

For the first three years (when two monitoring visits are required), the first site visit will occur in spring and will be timed after the first leaf flush. The spring visit will focus on qualitatively evaluating progress of native vegetation establishment, identifying any erosion control issues (if they exist), and documenting presence of non-native invasive species that have established within the restoration site. For the first five years and the seventh year, the summer site visit will occur toward the end of the flowering season and will be focused on quantitative data collection.

If the restoration evaluation criteria have still not been met after seven years, GE will propose a type, period, frequency, and location(s) of continued monitoring for EPA approval.

In addition, it is recognized that severe storm events (i.e., storms equal or greater than a 10-year flow event) may impact the restoration. The extent of any damage will be determined through post-storm event inspections through a site visit after every storm equal to or greater than a 10-year flow event at the nearest

²² This additional data collection is comparable to the types of post-restoration data collection at other portions of the CD Site (e.g., the 1½-Mile Reach of the Housatonic River) to document the functioning of the restored habitat for informational purposes.

United States Geological Survey (USGS) river gage station during the seven-year monitoring period.²³ These inspections will be conducted after the river flows return to typical seasonal flow conditions.

5.2 Field Monitoring Methods

The areas to be evaluated for achievement of or progress towards achieving the defined restoration evaluation criteria will be defined by as-built plans that delineate the final extent of restored habitats following completion of RU-specific restoration actions. This monitoring framework will be based upon habitat type and is described generally for each habitat in the following subsections.²⁴ However, the specific provisions of each RU-specific monitoring program, including the number of sampling locations and frequency of sampling (if different from the frequency outlined in Section 5.1), will be included in the RU-specific Restoration Plans. Recommended changes to the monitoring protocols (if any) during the monitoring period will be proposed in the annual monitoring reports described in Section 5.3.

5.2.1 Riverine Habitat

5.2.1.1 Monitoring to Assess Restoration Evaluation Criteria

Following completion of remedial activities in each RU with riverine habitat, verification that the riverine aquatic habitats were successfully restored or reconstructed in accordance with the contract specifications will demonstrate successful achievement of the overall restoration evaluation criterion. Verification of these conditions will be achieved through preparation and review of as-built drawings that will be included in the Interim Remedial Action Completion Reports for the subject RUs (as described in Section 5.5 of the Final Revised SOW). In addition, annual monitoring will be required to assess the additional restoration evaluation criterion for riverine habitats, identified in Section 4.1.

This annual monitoring will be completed through qualitative surveys during all site visits identified in Section 5.1. Field teams will traverse by land or water all restored riverine habitats to identify any changes in aquatic habitat features that could be adversely affecting the river ecosystem. If areas of concern are identified, they will be photo documented and their location logged with a sub-meter accurate global positioning system (GPS) unit.

5.2.1.2 Monitoring to Assess Ecological Function

In addition to the monitoring described above, it is anticipated that field data collection will be conducted to document the function of the restored riverine habitats on at least one occasion during the monitoring period – typically, in the seventh year of monitoring or as otherwise provided in the Restoration Plans. The scope of such data collection efforts will be specified in the RU-specific Restoration Plans (as provided in the Final Revised SOW), but is expected to include the following:

²³ There are three USGS river gages in the vicinity of Reaches 5A-8: (1) Coltsville (#01197000), (2) Lenoxdale (#01197145), and (3) Great Barrington (#01197500). The updated HEC-RAS modeling conducted for the Reach 5A Conceptual RD/RA Work Plan has documented a 10-year return internal event at the Coltsville station corresponding to 3,950 cfs and estimated a 10-year return internal event at the Lenoxdale station to correspond to approximately 9,050 cfs. An updated return frequency analysis has not been performed for the Great Barrington gage station and will be updated in a future BRA Report or Restoration Plan.

²⁴ As in Section 4, the following subsections contain some text that is repeated through the various subsections. This was done intentionally so that the monitoring framework for each habitat is clear.

- Completion of the Riverine Habitat Assessment Field Data Sheets (provided in Appendix A) at a number of specified riverine segments to collect data primarily on structural and physical parameters that are related to, and can be used to evaluate, the functioning of restored riverine habitats;²⁵
- A survey of the benthic macroinvertebrate community (with the number of sampling locations to be specified in the RU-specific Restoration Plans) to obtain information on the general species composition and relative abundance following remediation and restoration; and
- Additional qualitative surveys of fish use and species composition (with the number of sampling locations to be specified in the RU-specific Restoration Plans) to obtain data on the post-restoration fish community. (Note that such fish surveys will be coordinated with any required fish tissue sampling for PCBs and may not specifically occur in the seventh year of monitoring, but they will occur once during the seven-year monitoring period.)

5.2.2 Riverbank Habitat

5.2.2.1 Monitoring to Assess Restoration Evaluation Criteria

Monitoring to assess achievement of or progress toward the restoration evaluation criteria for riverbank habitat in the RUs with such restored banks will focus on assessment of: (1) consistency of the restored riverbank conditions with the design and specifications; (2) erosion (if any) that is negatively affecting bank stability and vegetation establishment; and (3) successional development of restored plant communities and other riverbank habitat features that may have been incorporated into the Restoration Plan. The integrity of all restored riverbank habitats for erosion concerns will be inspected during all site visits identified in Section 5.1. Vegetation establishment will be quantified in summer site visits identified in Section 5.1.

Field protocols for vegetation monitoring in all restored vegetated riverbanks will generally include the following:

- Establishment of transects through each restored vegetated riverbank for monitoring at a frequency to be determined in RU-specific Restoration Plans; and
- Data collection at each transect, including some or all of the following: total percent vegetative cover, total percent herbaceous cover, total percent shrub and tree cover, general cover type characterization, species identification and percent coverage by species, identification of invasive species, height of vegetation, observations of stress and/or herbivory, and characterization of soil texture and moisture.

If areas of concern are identified, they will be photo documented and their location logged with a sub-meter accurate GPS unit. Based upon documented conditions, subsequent recommended monitoring efforts could include increased qualitative monitoring for a pre-determined time or quantitative data collection (e.g., completion of Riverbank Habitat Inventory Forms, surveyed cross-sections of riverbank habitats, or a Light Detection and Ranging [LiDAR] topographic-bathymetric survey).

²⁵ These data sheets have been derived from EPA's Rapid Bioassessment Protocols (Barbour et al. 1999). The relationship of these field parameters to identified riverine functions is described in the BRA Work Plans for Reach 5A (AECOM 2022) and Reaches 5B through 8 (AECOM 2023a), as well as the BRA Report for Reach 5A (AECOM 2023b).

5.2.2.2 Monitoring to Assess Ecological Function

In addition to the monitoring described above, it is anticipated that data will be collected to evaluate the function of the restored riverbank habitats on at least one occasion during the monitoring period – specifically, in the seventh year of monitoring or as otherwise provided in the Restoration Plans. The scope of such data collection efforts will be specified in the RU-specific Restoration Plans, but is expected to include, at a minimum, completion of the Riverbank Habitat Inventory Forms (provided in Appendix B) at a number of specified riverbank segments to document the following conditions on the banks that affect the functioning of the riverbank habitats: 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). In addition, incidental wildlife observations will be recorded.

5.2.3 Backwater Habitat

5.2.3.1 Monitoring to Assess Restoration Evaluation Criteria

Following completion of remedial activities in each RU containing backwaters, verification that the restored backwater habitats have the physical conditions represented in design plans and contract specifications, including a direct hydrologic surface water connection to the river, will demonstrate successful achievement of the overall restoration evaluation criterion. Verification of these conditions will be achieved through preparation and review of as-built drawings that will be included in the Interim Remedial Action Completion Reports for the subject RUs. In addition, annual monitoring will be required to assess the additional restoration evaluation criteria for backwater habitats, identified in Section 4.3.

This annual monitoring will be completed through qualitative surveys during all site visits identified in Section 5.1. Field teams will traverse by land or water all restored backwater habitats to confirm hydrologic connections to river, seasonal water depths consistent with pre-remedial condition, or changes in habitat features that could be adversely affecting the river ecosystem. If areas of concern are identified, they will be photo documented and their location logged with a sub-meter accurate GPS unit. Based upon documented conditions, subsequent recommended monitoring efforts could include increased qualitative monitoring for a pre-determined time or quantitative data collection (e.g., completion of Backwater Habitat Inventory Forms, LiDAR topographic-bathymetric survey).

5.2.3.2 Monitoring to Assess Ecological Function

In addition to the monitoring described above, it is anticipated that field data will be collected to evaluate the function of the restored backwater habitats on at least one occasion during the monitoring period – specifically, in the seventh year of monitoring or as otherwise provided in the Restoration Plans. The scope of such data collection efforts will be specified in the RU-specific Restoration Plans, but is expected to include, at a minimum, completion of the Backwater Habitat Inventory Forms (provided in Appendix C) to document the following conditions that affect the functioning of the backwaters: physical connectivity with the river, sediment composition, aquatic biota, rare species habitat, and invasive species presence. In addition, incidental wildlife observations will be recorded.

5.2.4 Impoundment Habitat

5.2.4.1 Monitoring to Assess Restoration Evaluation Criteria

Following completion of remedial activities in each impoundment, verification that the restored impoundment habitats have the physical conditions represented in design plans and contract specifications will demonstrate successful achievement of the overall restoration evaluation criterion. Verification of these conditions will be achieved through preparation and review of as-built drawings that will be included in the Interim Remedial Action Completion Reports for the subject RUs. As noted above, no other specific restoration evaluation criteria have been identified for the impoundment habitats.

5.2.4.2 Monitoring to Assess Ecological Function

It is anticipated that field data will be collected to evaluate the function of the restored impoundment habitats on at least one occasion during the monitoring period – typically, in the seventh year of monitoring or as otherwise provided in the Restoration Plans. The scope of such data collection efforts will be specified in the RU-specific Restoration Plans, but is expected to include the following:

- Completion of Impoundment Habitat Inventory Forms (provided in Appendix D) to document the following conditions as they affect the functioning of the restored impoundment habitats: sediment composition, aquatic biota, rare species habitat, and invasive species presence, as well as incidental wildlife observations.
- A survey of the benthic macroinvertebrate community (with the number of sampling locations to be specified in the RU-specific Restoration Plans) to obtain information on the general species composition and relative abundance following remediation and restoration; and
- Additional qualitative surveys of fish use and species composition (with the number of sampling locations to be specified in the RU-specific Restoration Plans) to obtain data on the post-restoration fish community. (Note that, as with riverine habitats, such fish surveys will be coordinated with any required fish tissue sampling for PCBs and may not specifically occur in the seventh year of monitoring, but they will occur once during the seven-year monitoring period.)

5.2.5 Floodplain Habitats (Excluding Vernal Pools)

5.2.5.1 Monitoring to Assess Restoration Evaluation Criteria

Monitoring to assess achievement of or progress toward the restoration evaluation criteria for restored floodplain habitats (including both wetland and upland habitats but excluding vernal pools) will focus on assessment of: (1) whether the affected wetland or upland acreage has been restored consistent with pre-remediation conditions (or consistent with design and specifications), (2) whether erosion and invasive species are negatively affecting vegetation establishment; and (3) successional development of restored plant communities. The integrity of all restored floodplain habitats for erosion concerns will be inspected during all site visits, and vegetation establishment will be quantified during summer site visits identified in Section 5.1. For purposes of this monitoring program, floodplain habitats will be separated into wetland and upland categories (excluding vernal pools), which will be assessed separately in the field.²⁶

²⁶ The delineation between upland and wetland floodplain habitats will be based upon as-built drawings.

To evaluate erosion and invasive species within the restoration area, qualitative surveys will occur during all site visits identified in Section 5.1. Field teams will traverse by land or water all restored riverine habitats to identify any erosive areas of concern or invasive species establishment or spread. To evaluate establishment of vegetation within restored floodplains, field protocols will generally include:

- Establishment of transects or sample plot locations throughout each restored floodplain habitat type for monitoring at a frequency to be determined in RU-specific Restoration Plans; and
- Data collected at each transect or sample plot, including some or all of the following: total percent vegetative cover, total percent herbaceous cover, total percent shrub and tree cover, general cover type characterization, species identification and percent coverage by species, identification of invasive species, height of vegetation, observations of stress and/or herbivory, and characterization of soil texture and moisture.

If areas of concern are identified, they will be photo documented and their location logged with a sub-meter accurate GPS unit. Based upon documented conditions, subsequent recommended monitoring efforts could include increased qualitative monitoring for a pre-determined time or quantitative data collection (e.g., completion of Floodplain Habitat Inventory Data Sheets, LiDAR topographic-bathymetric survey).

5.2.5.2 Monitoring to Assess Ecological Function

In addition to the monitoring described above, it is anticipated that field data will be collected to evaluate the function of the restored floodplain habitats on at least one occasion during the monitoring period – specifically, in the seventh year of monitoring or as otherwise provided in the Restoration Plans. The scope of such data collection efforts will be specified in the RU-specific Restoration Plans, but is expected to include, at a minimum, completion of Floodplain Habitat Inventory Data Sheets (provided in Appendix E) at a number of evaluation segments to be specified in the Restoration Plans for the pertinent RUs. The floodplain habitat inventory characterization for wetland areas will collect information on a broad range of floodplain wetland parameters that collectively contribute to wetland functional capacity. These parameters include wetland hydrology, vegetative conditions, soils, rare species habitat, invasive species, surrounding habitats, and juxtaposition with other wetland and surface water systems. The floodplain habitat inventory characterization for upland areas will include the following parameters: vegetative community type and composition, soil conditions, wildlife habitat including rare species, invasive species, and observations of habitat degradation. Through this inventory, these field parameters will be used to evaluate the functioning of restored floodplain habitats. In addition, incidental wildlife observations will be recorded.

5.2.6 Vernal Pools

5.2.6.1 Monitoring to Assess Restoration Evaluation Criteria

Monitoring to assess achievement of or progress toward of the restoration evaluation criteria for vernal pools will focus on restoration of the physical conditions necessary to meet the MNHESP's physical criteria for certification of vernal pools. Specifically, restored vernal pools will be inspected throughout the monitoring period during site visits identified in Section 5.1. Spring surveys will focus on qualitative observations that each vernal pool has no permanently flowing outlet and that there are no fish present within the pool. The summer site visits will evaluate seasonal hydrology of the pools, including lack of a permanently flowing outlet, and establishment of native vegetation. During each of the summer site visits, the Vernal Pool Characterization Form included in Appendix F, which focuses on the physical attributes of the vernal pools, will be completed for all restored vernal pools.

To evaluate establishment of vegetation within and around restored vernal pools, field protocols to be employed during the summer visits identified in Section 5.1 will generally include:

- Establishment of permanent sample plot locations at the restored vernal pools, with the number of such sample plots to be determined in RU-specific Restoration Plans, considering anticipated sample plot size, avoiding overlap of sample plots, and assessment coverage of total restoration area; and
- Data collected at each sample plot, potentially including (but not limited to): total percent vegetative cover, total percent herbaceous cover, total percent shrub and tree cover, general cover type characterization, species identification and percent coverage by species, identification of invasive species, height of vegetation, observations of stress and/or herbivory, and characterization of soil texture and moisture.

If areas of concern (e.g., erosion that adversely affects vernal pool hydrology and connection to the river, absence of established native vegetation) are identified, they will be photo documented and their location logged with a sub-meter accurate GPS unit. Based upon documented conditions, subsequent recommended monitoring efforts could include increased qualitative monitoring for a pre-determined time or potentially quantitative data collection.

5.2.6.2 Monitoring to Assess Ecological Function

In addition to the monitoring described above, vernal pool surveys to evaluate both the MNHESP biological and physical criteria will be conducted at each restored vernal pool. Specifically, in addition to the annual completion of the Vernal Pool Characterization Form (in Appendix F) as discussed above, surveys will be conducted in both the spring and the summer of the fifth and seventh years after vernal pool restoration to assess whether the restored pools meet the biological as well as physical criteria for vernal pools certification. During each of those years, the separate MNHESP Vernal Pool Field Observation Form (also included in Appendix F), which focuses on the biological use specific to MNHESP-defined obligate and facultative vernal pool species as well as the physical criteria, will be completed. For vernal pools that are determined to meet both the biological and physical criteria in the fifth year after restoration, if the spring surveys in the seventh year do not identify items of concern (i.e., erosion, fish, invasive species), then a repeated formal vernal pool assessment using the MNHESP form will not be required in the seventh year. Through this additional data collection process, the data collected will be used to evaluate the functioning of restored vernal pool habitats.

5.2.7 Rare Species

As discussed in Section 4.8, the overall restoration evaluation criteria for rare species impacts are that the impacted habitat for such species has been restored to pre-remediation conditions or other conditions that would support such species or that mitigation for such impacts has been provided, and that the applicable requirements of MESA for state-listed species have been met. However, the specific rare species in each RU, specific restoration evaluation criteria for restoration of those species' habitats, and any required conservation and management plan for state-listed species are RU-specific and will be presented in the RU-specific Restoration Plans. Correspondingly no monitoring methods are identified at this time; such methods will likewise be included in the RU-specific Restoration Plans.

5.3 Reporting

Following completion of restoration in each RU. GE will submit an annual report on the post-construction restoration monitoring conducted during the prior year. The annual monitoring report will provide suitable

Restoration Performance Objectives and Evaluation Criteria Report

information to evaluate the existing condition of the restored areas and achievement of or progress towards achieving the restoration evaluation criteria, as well as the functioning of the restored habitats. The report will be submitted by the end of February of the year following the year in which monitoring is conducted.

Understanding that monitoring will occur on different time schedules for different RUs, GE will attempt to consolidate the monitoring at the various RUs into a single annual report.

A typical monitoring report will include the following to best describe existing conditions and progress towards defined performance criteria:

- Introduction, including restoration evaluation criteria and objectives of annual monitoring;
- Methods used to conduct monitoring;
- Results of annual monitoring and comparison to as-built conditions and defined restoration evaluation criteria;
- Discussion of habitat performance and/or condition;
- Summary of implemented adaptive management actions (see Section 6), and recommendations for the following year;
- Summary;
- Attachment 1 – Photo documentation of restored areas in both spring and summer;
- Attachment 2 – Data sheets and/or raw data tables, if useful; and
- Attachment 3 – USB flash drive including relevant digital mapping files (i.e., ArcGIS compatible).

6 Preliminary Maintenance / Corrective Action Program

This section provides a preliminary overview of the maintenance/corrective action program to be implemented in the event that the monitoring shows a need for replanting, reseeding, erosion repairs, or other maintenance in an effort to achieve the restoration evaluation criteria described in Section 4. The maintenance/corrective action process for the RUs will be integrated with the Adaptive Management Plan to be submitted in November 2023 in accordance with the Revised Permit and Section 4.3.1.4 of the Final Revised SOW and discussions between GE and EPA. This proactive adaptive management strategy uses information gathered over time through the monitoring program (Section 5) to identify successful management practices and opportunities for improvement that will help guide the restored area toward achieving its restoration objectives (Section 2). When field data collected during the monitoring program indicate that restoration evaluation criteria are not being met, the first response is to evaluate the existing data and determine whether additional data collection can help address the issue. When it is determined that sufficient data exist, then the field data are intended to direct adaptive habitat management and corrective actions. Use of an adaptive management approach will also allow the maintenance and corrective actions to be used for conditions or items not achieving the restoration evaluation criteria to take into account management, maintenance, and corrective action practices that have proved to be successful in other applications, as well as any new or innovative restoration techniques developed in the meantime.

Adaptive management activities and corrective actions will be implemented as appropriate through the duration of the required monitoring period to address items or conditions identified during the monitoring visits (or otherwise) as needing maintenance or corrective action.

The following subsections describe a number of key components of the maintenance/corrective action program. A more specific maintenance/corrective action program for each RU will be set forth in the RU-specific Restoration Plans.

6.1 Replanting and Reseeding

Following restoration planting and seeding, GE will be responsible to ensure plant survival and seed establishment for the applicable monitoring period in accordance with the restoration evaluation criteria. In particular, if monitoring results do not demonstrate progress to achieving 80% cover of native cover in each restored vegetated habitat type, then areas to be reseeded will be identified. Methods for reseeding will be evaluated on a case-by-case basis and will likely focus on broadcast application of native seed. Seed mixes will remain consistent with contract specifications unless there is a sound basis for a change determined in consultation with EPA. Similarly, if monitoring results do not demonstrate tree and shrub densities that meet restoration evaluation criteria (i.e., 80% surviving, established, or naturally occurring native species), then GE will install replacement plantings in the subsequent spring or fall as necessary. The need for replacement plantings will consider the diversity of the existing community and evidence of natural recruitment of native trees and shrubs. Planted species will remain consistent with contract specifications unless there is a sound basis for a change determined in consultation with EPA. It is recognized that unanticipated site conditions may not be favorable for all trees and shrubs included in restoration design, and that alternative species may be required.

6.2 Herbivory Control

The obligation to maintain plant survival and herbaceous cover will include, as necessary, maintenance and repairs of herbivory controls installed to promote establishment of trees, shrubs, and potentially herbaceous cover. Herbivory controls could include, but are not limited to, deer fences, tree cages, tree guards or collars, and/or waterfowl exclusion barriers.

Unless otherwise provided, these herbivory controls will remain in place and continue to be maintained until they are determined to be no longer necessary. It is assumed that waterfowl exclusion barriers, if required, can be removed following achievement of herbaceous cover greater than 60 percent. Deer fencing and/or tree cages, guards, and collars, if installed, will be maintained through the monitoring program unless tree heights are determined to be sufficient to provide the necessary protection. GE will be responsible for their removal at the conclusion of the monitoring program.

6.3 Invasive Species Control

As noted above, the current list of target invasive plant species of concern, based on MIPAG and USACE New England District lists, is provided in Table 2. The invasive species list for a given RU, including any changes to the list in Table 2, will be identified in each RU-specific Restoration Plan. Following remediation and restoration, appropriate controls for the invasive species in that RU will be implemented as necessary to meet the restoration evaluation criteria relating to invasive species, as identified in Section 4. To assist in that effort, each RU-specific Restoration Plan will include an Invasive Species Control Plan (ISCP) that will identify control strategies for identified target invasive species and provide recommendations for preferred management tools. For the most part, many of these species have been researched for decades by universities, state and federal agencies, and land management groups. GE will implement the most appropriate invasive control strategy for the species involved, as necessary and appropriate to meet the applicable restoration evaluation criteria. Potential invasive species control techniques include chemical, mechanical, and biological control methods.

6.4 Erosion Repairs

Monitoring for areas of erosion on the riverbanks or in the floodplain (including vernal pools) will be completed during all site visits to those habitats.²⁷ In this regard, it will be important to recognize the difference between natural processes and processes that threaten the project targets and objectives of habitat restoration. Erosion repairs will be completed if conditions are observed to be directly impacting either (1) vegetation establishment, or (2) functioning of a restored riverbank. The approach to implement erosion controls will be done on a case-by-case basis and evaluated to minimize impacts on restored vegetation.

6.5 Repair / Replacement of Restoration Structures

Restoration will likely include the installation of structures (e.g., coarse woody debris structures, vanes, weirs, bird boxes, rock piles, etc.) throughout the restored RUs, with their location and density to be specified in the RU-specific Restoration Plans. Monitoring of these restoration structures will be conducted during site visits

²⁷ As noted above, erosion and scour within the restored aquatic areas subject to engineered caps will be addressed as part of the inspection and maintenance of the engineered caps in those areas and covered as part of the O&M programs to be described in the IMM Plans for the relevant RUs.

Restoration Performance Objectives and Evaluation Criteria Report

identified in Section 5.1. Again, it will be important to recognize the difference between natural processes and processes that threatened the project targets and objectives of habitat restoration. In the event that the restoration evaluation criteria relating to restoration structures, as identified in Section 4, are not met, repair or replacement of such structures will be conducted. The approach to implement such repairs or replacement to restoration structures will be determined on a case-by-case basis.

7 Next Steps

This Restoration Criteria Report sets forth the restoration objectives, restoration evaluation criteria, and associated monitoring and maintenance activities for the Rest of River Remedial Action. It has been prepared to guide the design, construction, implementation, and post-construction monitoring and maintenance of restoration activities and evaluation of restoration success. As noted herein, the restoration evaluation criteria and associated monitoring and maintenance activities identified in this Report are subject to modification, with EPA approval in the RU-specific Restoration Plan. The restoration activities for each RU will build upon baseline ecological conditions. As previously noted, the BRA Report for Reach 5A (AECOM 2023b) is being submitted concurrently with this Report. The following additional pre-remediation deliverables will be submitted in the future to complete the restoration planning process:

- BRA Report for Reaches 5B through 8;
- RU-specific Supplemental BRA Reports;
- RU-specific RCMCPs; and
- RU-specific Restoration Plans.

8 References

- AECOM, 2022. Reach 5A Baseline Restoration Assessment Work Plan. Prepared for General Electric Company. May 2022.
- AECOM, 2023a. Second Revised BRA Work Plan for Reaches 5B through 8. Prepared for General Electric Company. February 2023.
- AECOM, 2023b. Baseline Remediation Assessment Report for Reach 5A. Prepared for General Electric Company. August 2023.
- Anchor QEA, 2022. Final Revised Overall Strategy and Schedule for Implementation of the Corrective Measures. Prepared for the General Electric Company. July 2022.
- Anchor QEA, AECOM, and Arcadis. 2021. Final Revised Rest of River Statement of Work. Prepared for the General Electric Company. September 2021.
- Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stibling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition. EPA 841-B-99-002. USEPA Office of Water, Washington, DC.
- Environmental Laboratory. 1987. USACE Wetlands Delineation Manual. January 1987.
- EPA, 2020. Revised Final Permit Modification to the 2016 Reissued RCRA Permit and Selection of CERCLA Remedial Action and Operation & Maintenance for Rest of River. December 2020.
- EPA and GE (General Electric Company), 2000. Consent Decree (CD) in United States of America et al. v. General Electric Company, Civil Action Nos. 99-30225-MAP et seq., entered by the United States District Court for the District of Massachusetts. October 27, 2000.
- Harman, W., and R. Starr, 2011. Natural Channel Design Review Checklist. US Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, MD and US.
- MIPAG (Massachusetts Invasive Plant Advisory Group), 2023. List of Invasive and Likely Invasive Species. <https://www.massnrc.org/MIPAG/invasive.htm>.
- USACE. 2020. New England District Compensatory Mitigation Standards Operating Procedures. December 29, 2020.
- USACE. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. Version 2.0
- USDA, 2007. Natural Resources Conservation Service Stream Restoration Design Handbook. National Engineering Handbook, Part 654. Issued August 2007. Specific reference to Chapter 11, Chapter 11, Rosgen Geomorphic Channel Design.

Tables

Table 1. Field Parameters to be Measured or Characterized to Assess the Restoration Evaluation Criteria.¹

Habitat	Field Parameters to be Measured or Characterized
Riverine Habitat	
	Aquatic Habitat Features (e.g., in-channel coarse wood, vanes, weirs)
Riverbank Habitat	
	No Observed Erosion Affecting Bank integrity and Vegetation Establishment
	Soil Properties
	Vegetative Cover / Stem Density of Planted Trees and Shrubs
	Survival of Plant Material
	Invasive Plant Species Cover
	Habitat Features (e.g., coarse woody debris structures)
Backwater Habitat	
	Connectivity to Main Stem of River
	Water Depths
	Habitat Features (e.g., coarse woody debris structures)
Floodplain Wetland Habitat	
	Area (acreage)
	Soil Properties
	No Observed Erosion Affecting Vegetation Establishment or Floodplain Hydrology
	Vegetative Cover / Stem Density of Planted Trees and Shrubs
	Survival of Plant Material
	Invasive Plant Species Cover
	Indicators of Floodplain Hydrology and Hydric Soils
	Habitat Features (e.g., coarse woody debris structures)
Upland Floodplain Habitat	
	Area (acreage)
	Soil Properties
	No Observed Erosion Affecting Vegetation Establishment or Floodplain Hydrology
	Vegetative Cover / Stem Density of Planted Trees and Shrubs
	Survival of Plant Material

Restoration Performance Objectives and Evaluation Criteria Report

Habitat	Field Parameters to be Measured or Characterized
	Invasive Plant Species Cover
	Habitat Features (e.g., coarse woody debris structures)
	Vernal Pools
	Area (acreage)
	Soil Properties
	Vegetative Cover
	Survival of Plant Material
	Invasive Plant Species Cover
	Evidence of No Permanently Flowing Outlet
	Evidence of No Established, Reproducing Fish Populations
	Habitat Features (e.g., coarse woody debris structures)

Note:

¹ These field parameters are in addition to the verification process that the designed habitats were successfully restored or reconstructed in accordance with the contract specifications to demonstrate successful achievement of the overall restoration evaluation criteria for the various habitats.

Table 2. Invasive Species of Concern.

Scientific Name	Common Name	MA Invasive Plant Advisory Group*	United States Army Corps of Engineers**
<i>Acer platanoides</i>	Norway maple	X	
<i>Acer pseudoplatanus</i>	Sycamore maple	X	
<i>Actinidia arguta</i>	Hardy kiwi	X	
<i>Aegopodium podagraria</i>	Bishop's goutweed	X	
<i>Ailanthus altissima</i>	Tree of heaven	X	
<i>Alliaria petiolata</i>	Garlic mustard	X	
<i>Ampelopsis brevipedunculata</i>	Porcelain-berry	X	
<i>Anthriscus sylvestris</i>	Wild chervil	X	
<i>Berberis thunbergii</i>	Japanese barberry	X	X
<i>Berberis vulgaris</i>	Common barberry	X	
<i>Butomus umbellatus</i>	Flowering rush	X	
<i>Cabomba caroliniana</i>	Carolina fanwort	X	
<i>Cardamine impatiens</i>	Bushy rock-cress	X	
<i>Celastrus orbiculatus</i>	Oriental bittersweet	X	X
<i>Centaurea stoebe</i>	Spotted knapweed	X	
<i>Cynanchum louiseae</i>	Black swallow-wort	X	X
<i>Cynanchum rossicum</i>	European swallow-wort	X	
<i>Cytisus scoparius</i>	Scotch broom	X	
<i>Egeria densa</i>	Brazilian waterweed	X	
<i>Elaeagnus angustifolia</i>	Russian olive	X	X
<i>Elaeagnus umbellata</i>	Autumn olive	X	X
<i>Epilobium hirsutum</i>	Hairy willow-herb	X	
<i>Eragrostis curvula</i>	Weeping lovegrass	X	
<i>Euonymus alatus</i>	Burning bush	X	X
<i>Euphorbia cyparissias</i>	Cypress spurge	X	
<i>Euphorbia esula</i>	Leafy spurge	X	

Restoration Performance Objectives and Evaluation Criteria Report

Scientific Name	Common Name	MA Invasive Plant Advisory Group*	United States Army Corps of Engineers**
<i>Fallopia japonica</i>	Japanese knotweed	X	X
<i>Festuca filiformis</i>	Hairy fescue	X	
<i>Ficaria verna</i>	Lesser celandine	X	
<i>Frangula alnus</i>	Glossy buckthorn	X	X
<i>Glaucium flavum</i>	Sea or horned poppy	X	
<i>Glyceria maxima</i>	Tall mannagrass	X	
<i>Heracleum mantegazzianum</i>	Giant hogweed	X	
<i>Hesperis matronalis</i>	Dame's rocket	X	
<i>Humulus japonicus</i>	Japanese hops	X	
<i>Hydrilla verticillate</i>	Hydrilla	X	
<i>Iris pseudacorus</i>	Yellow iris	X	
<i>Lepidium latifolium</i>	Broad-leaved pepperweed	X	
<i>Ligustrum obtusifolium</i>	Border privet	X	
<i>Lonicera japonica</i>	Japanese honeysuckle	X	
<i>Lonicera morrowii</i>	Morrow's honeysuckle	X	
<i>Lonicera tatarica</i>	Titarian honeysuckle	X	
<i>Lonicera x bella</i>	Bell's honeysuckle	X	
<i>Lysimachia nummularia</i>	Creeping jenny	X	
<i>Lythrum salicaria</i>	Purple loosestrife	X	X
<i>Microstegium vimineum</i>	Japanese stilt grass	X	
<i>Miscanthus sacchariflorus</i>	Plume grass	X	
<i>Mycelis muralis</i>	Wall lettuce	X	
<i>Myosotis scorpioides</i>	Forget-me-not	X	
<i>Myriophyllum aquaticum</i>	Parrot-feather	X	
<i>Myriophyllum heterophyllum</i>	Variable water milfoil	X	
<i>Myriophyllum spicatum</i>	Eurasian water-milfoil	X	

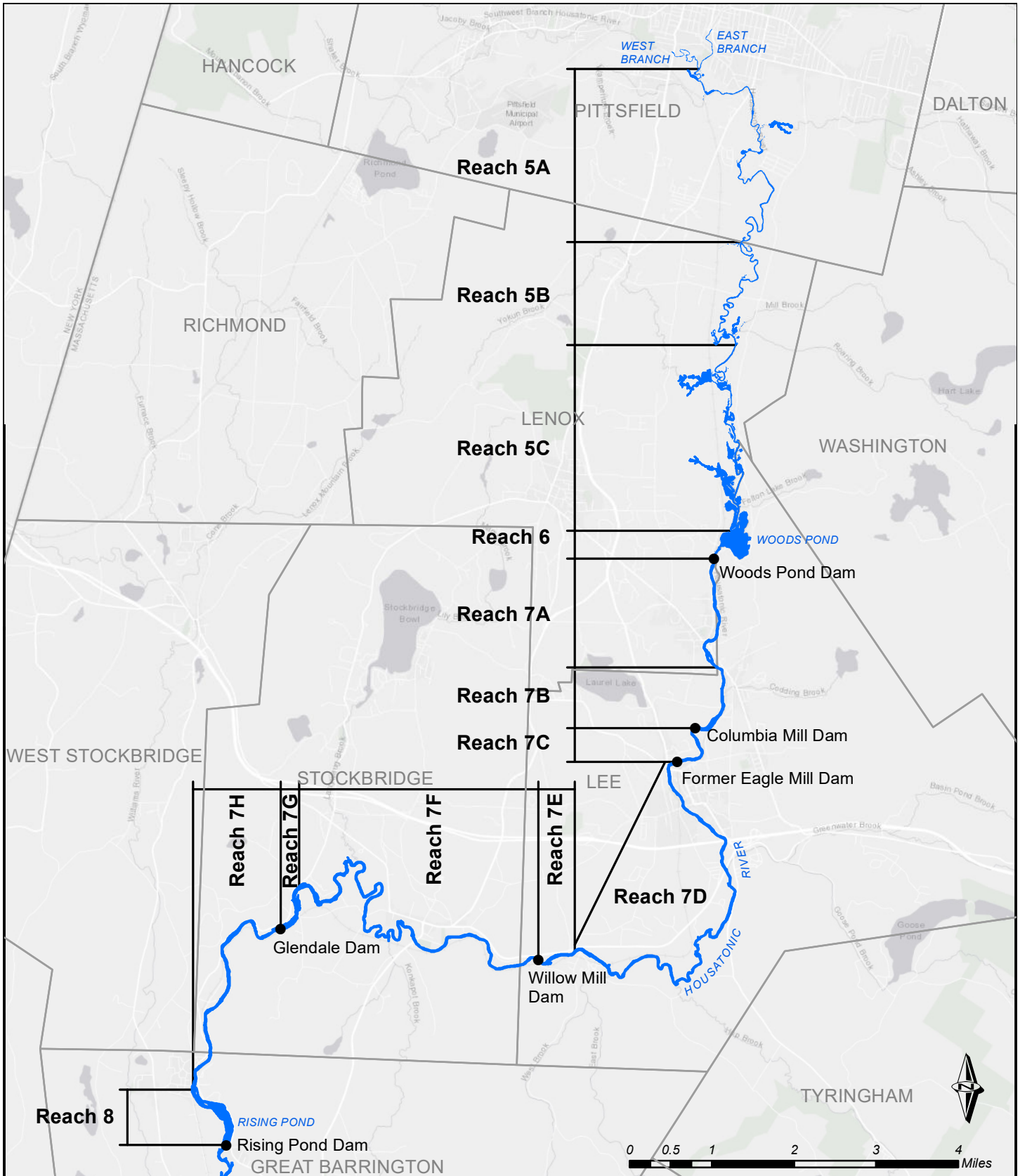
Restoration Performance Objectives and Evaluation Criteria Report

Scientific Name	Common Name	MA Invasive Plant Advisory Group*	United States Army Corps of Engineers**
<i>Najas minor</i>	<i>Brittle water-nymph</i>	X	
<i>Nymphoides peltata</i>	<i>Yellow floating heart</i>	X	
<i>Phalaris arundinacea</i>	<i>Reed canary grass</i>	X	X
<i>Phellodendron amurense</i>	<i>Amur cork-tree</i>	X	
<i>Phragmites australis</i>	<i>Common reed</i>	X	X
<i>Pinus thunbergia</i>	<i>Japanese jack pine</i>	X	
<i>Polygonum perfoliatum</i>	<i>Mile-a-minute vine</i>	X	
<i>Potamogeton crispus</i>	<i>Crisped pondweed</i>	X	
<i>Pueraria montana</i>	<i>Kudzu</i>		
<i>Pyrus calleryana</i>	<i>Callery Pear</i>	X	
<i>Ranunculus repens</i>	<i>Creeping buttercup</i>	X	
<i>Rhamnus cathartica</i>	<i>Common buckthorn</i>	X	X
<i>Rorippa amphibia</i>	<i>Water yellow-cress</i>	X	
<i>Robinia pseudoacacia</i>	<i>Black locust</i>	X	
<i>Rosa multiflora</i>	<i>Multiflora rose</i>	X	X
<i>Rubus phoenicolasius</i>	<i>Wineberry</i>	X	
<i>Salix cinerea</i>	<i>Large gray willow</i>	X	
<i>Senecio jacobaea</i>	<i>Tansy ragwort</i>	X	
<i>Trapa natans</i>	<i>Water chestnut</i>	X	
<i>Tussilago farfara</i>	<i>Coltsfoot</i>	X	

* Massachusetts Invasive Plants Advisory Group (MIPAG) (“invasive” and “likely invasive” species).

** United States Army Corps of Engineers (USACE) New England District Compensatory Mitigation Standard Operating Procedures (USACE 2020) identifies these species as invasive and requiring control if identified within a mitigation site.

Figure



Legend

- Dams
- Housatonic River
- Municipal Boundaries

NOTE:
Basemap "Light Gray Canvas" from ESRI

Reaches 5-8		
Housatonic River - Pittsfield, MA		
SCALE	DATE	PROJECT NO.
1:104,000	2/14/2023	60670015

AECOM

Figure 1

Appendix A

Habitat Assessment Field Data Sheets

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Other _____ <input type="checkbox"/> Residential	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources Local Watershed Erosion <input type="checkbox"/> None <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present _____	
INSTREAM FEATURES	Estimated Reach Length _____m Estimated Stream Width _____m Sampling Reach Area _____m ² Area in km ² (m ² x1000) _____km ² Estimated Stream Depth _____m Surface Velocity (at thalweg) _____m/sec	Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark _____m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle _____% <input type="checkbox"/> Run _____% <input type="checkbox"/> Pool _____% Channelized <input type="checkbox"/> Yes <input type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input type="checkbox"/> No
LARGE WOODY DEBRIS	LWD _____m ² Density of LWD _____m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation _____%	
WATER QUALITY	Temperature _____° C Specific Conductance _____ Dissolved Oxygen _____ pH _____ Turbidity _____ WQ Instrument Used _____	Water Odors <input type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globs <input type="checkbox"/> Flecks <input type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____
SEDIMENT/SUBSTRATE	Odors <input type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Oils <input type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	
		Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input type="checkbox"/> 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			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

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

STREAM NAME		LOCATION	
STATION # _____ RIVERMILE _____		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS			
FORM COMPLETED BY		DATE _____ TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category																				
		Optimal	Suboptimal	Marginal	Poor																	
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).		40-70% 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).		20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.														
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.		Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.		Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.		Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.														
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)		Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).		Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).		Dominated by 1 velocity/depth regime (usually slow-deep).														
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.		Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% 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 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.														
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.		Water fills >75% of the available channel; or <25% of channel substrate is exposed.		Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.		Very little water in channel and mostly present as standing pools.														
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH 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	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
Note: determine left or right side by facing downstream.																					
SCORE ____ (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0			
SCORE ____ (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0			
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.					
SCORE ____ (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0			
SCORE ____ (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0			
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.					
SCORE ____ (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0			
SCORE ____ (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0			

Total Score _____

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

STREAM NAME	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

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	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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

Habitat Parameter	Condition Category				
	Optimal	Suboptimal	Marginal	Poor	
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____

Appendix B

Riverbank Habitat Inventory Form

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

I. General Information

Site Name and Evaluation Segment _____

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. Bank Characterization

Physical Dimensions (ft):

Length _____ Width _____ Bank Height _____ Slope _____

Sediment / Substrate composition:

% Sand _____ % Silt _____ % Clay _____ % Gravel/cobble _____

% Boulder Bedrock _____ % Organic matter _____

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: _____

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Percent Cover of Riparian Vegetation by Strata

Trees (> 20') Shrubs (< 20') Woody vines Mosses Herbaceous

Bank and overhanging vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Riparian vegetation plant list (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Strata: T=Tree, S=Shrub, L=Liana (vine), H=Herb (Includes grasses, herbs, pterophytes [ferns], lichens, woody seedlings, and mosses)

Notes:

III. Important Habitat Features

Wildlife Food

Important wetland/aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

- Abundant Present Absent Not Applicable

Important upland food plants (hard mast and fruit/berry producers)

- Abundant Present Absent Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live or dead) > 30" DBH

- Abundant Present Absent Not Applicable

Standing dead trees (potential for cavities and perches)

- Abundant Present Absent Not Applicable

Tree cavities in trunks or limbs

- Abundant Present Absent Not Applicable

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

Small mammal burrows:

Abundant Present Absent Not Applicable

Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

Abundant Present Absent Not Applicable

Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

Abundant Present Absent Not Applicable

Rocks, crevices, logs, tree roots or hummocks at water's edge or under water's surface (turtles, snakes, frogs)

Abundant Present Absent Not Applicable

Overhanging branches at or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

Abundant Present Absent Not Applicable

Rock piles, crevices, or hollow logs suitable for various mammals (otter, mink, porcupine, racoon):

Abundant Present Absent Not Applicable

Live or dead tall standing vegetation overhanging or near water offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

Abundant Present Absent Not Applicable

Other Important Habitat Characteristics:

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

Abundant Present Absent Not Applicable

Undercut or overhanging banks (small mammals, mink, weasels, turtles)

Abundant Present Absent Not Applicable

Vertical sandy banks (bank swallow, kingfisher)

Abundant Present Absent Not Applicable

Mud flats

Abundant Present Absent Not Applicable

Exposed areas of well-drained, sandy soil suitable for turtle nesting

Abundant Present Absent Not Applicable

Wildlife Dens/Nests (if observed)

Turtle nesting sites

Abundant Present Absent Not Applicable

**General Electric Housatonic Rest of River
Form RB-1: Riverbank Habitat Inventory Form**

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):

- State-listed species habitat (including species with known overlapping Priority Habitat):

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
- Occurrence of invasive plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn); identify plants and estimate approximate percent coverage: _____

- 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: _____

- Other restoration opportunities:

Appendix C

Backwater Habitat Inventory Form

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

I. General Information

Site Name and Backwater Number _____

Location/Physical Description _____

Date(s) of Site Visit(s) and Data Collection _____

Weather Conditions During Site Visit _____

Field Staff Performing Evaluation _____ Date this form was completed _____

II. Site Description

A. Backwater Characterization

Physical Dimensions (ft): Length _____ Width _____ Depth _____ Area _____

Sediment / Substrate composition: % Sand _____ % Silt _____ %Organic _____ Other _____

Bank stability / Observed erosional conditions: _____

B. Bordering Habitat Types

Wetland

- Transitional floodplain forest
- High terrace floodplain forest
- Red maple swamp
- Vernal pool
- Black ash-red maple-tamarack calcareous seepage swamp
- Deep emergent marsh
- Shallow emergent marsh
- Shrub swamp
- Wet meadow
- Other _____

Upland

- Northern Hardwoods-Hemlock-White Pine Forest
- Rich mesic forest
- Red Oak-Sugar Maple Transition Forest
- Agricultural fields
- Cultural grassland
- Successional northern hardwoods
- Spruce-fir-northern hardwood forest
- Developed/disturbed cover types
- Other _____

Notes:

**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: _____

Water level fluctuation: _____

Field-Derived Evidence of Hydrologic Conditions

- Clear natural line impressed on bank
- Bed and banks
- Shelving
- Wrack lines (litter and debris)
- Scour and/or Deposition
- Line of mud or silt on tree trunks/vegetation
- Other _____
- Changes in character of soil
- Water staining
- Vegetation matted down, bent or absent
- Changes in plant community
- Destruction of terrestrial vegetation
- Debris stuck on overhanging tree limbs

D. Inventory of Aquatic Plant Community

% Cover:

Overall Aquatic Vegetation	Floating -Leaved Cover	Emergent Cover

Plant Lists (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Strata: AL=Algal, AM=Aquatic Moss, RV=Rooted Vascular, FV=Floating Vascular, PE=Persistent Emergent, NE=Non-persistent Emergent

III. Important Habitat Features

Wildlife Food

Important aquatic food plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

Abundant Present Absent Not Applicable

Cover/Perches/Basking/Denning/Nesting Habitat

Trees (live) > 30" DBH adjacent to backwater

Abundant Present Absent Not Applicable

Standing dead trees in or adjacent to backwater (potential for cavities and perches)

Abundant Present Absent Not Applicable

Tree cavities in trunks or limbs in or adjacent to backwater

Abundant Present Absent Not Applicable

Small mammal burrows on banks of backwater

Abundant Present Absent Not Applicable

Dense herbaceous cover on banks of backwater (voles, small mammals, amphibians & reptiles)

Abundant Present Absent Not Applicable

Large woody debris in contact with the water (fish & turtles)

Abundant Present Absent Not Applicable

Rocks, crevices, logs, tree roots or hummocks under water's surface (turtles, snakes, frogs)

Abundant Present Absent Not Applicable

Rocks, crevices, fallen logs, overhanging branches or hummocks at, or within 1 m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

Abundant Present Absent Not Applicable

Live or dead tall standing vegetation overhanging water or offering good visibility of open water (e.g., bald eagle, osprey, kingfisher, flycatchers, cedar waxwings)

Abundant Present Absent Not Applicable

Other Important Habitat Characteristics

Flat rocks and logs on banks or within exposed portions of the backwater (cover and basking for herpetofauna)

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

State-listed species habitat (including species with known overlapping Priority Habitat):

Rare species direct observations during current field surveys (list):

VI. Incidental Direct Wildlife Observations

VII. Habitat Degradation (identify specific location within backwater if applicable)

Evidence of significant levels of dumping

Evidence of significant erosion or sedimentation problems

Presence of invasive plants (e.g., purple loosestrife, *Phragmites*, Eurasian water-milfoil) or aquatic animals (e.g., zebra mussels, Asian clams); identify and estimate approximate percent coverage of invasive plants; identify invasive aquatic animals: _____

Evidence of other human disturbance; describe: _____

VIII. Restoration Opportunities

Presence of potential restoration resources (e.g., boulders, large downed trees or woody debris, plant propagation source material). Identify specific items: _____

**General Electric Housatonic Rest of River
Form BW-1: Backwater Habitat Inventory**

Other restoration opportunities: _____

Notes:

IX. General Water Chemistry

Record data at multiple locations at least three times during the growing season.

Location 1 (describe): _____

pH _____
Temperature _____
Conductivity _____
Dissolved Oxygen _____
Chlorophyll-a (or other measure of photosynthetic organisms) _____

Location 2 (describe): _____

pH _____
Temperature _____
Conductivity _____
Dissolved Oxygen _____
Chlorophyll-a (or other measure of photosynthetic organisms) _____

Location 3 (describe): _____

pH _____
Temperature _____
Conductivity _____
Dissolved Oxygen _____
Chlorophyll-a (or other measure of photosynthetic organisms) _____

Appendix D

Impoundment Habitat Inventory Form

**General Electric Housatonic Rest of River
Form IMP-1: Impoundment Habitat Inventory**

I. General Information

Impoundment Name _____

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. Impoundment Characterization

Physical Dimensions (ft): Length _____ Width _____ Depth _____ Area _____

Sediment / Substrate composition: % Sand _____ % Silt _____ %Organic _____ Other _____

Bank stability / Observed erosional conditions: _____

B. Bordering Habitat Types

Wetland

- Transitional floodplain forest
- High terrace floodplain forest
- Red maple swamp
- Vernal pool
- Black ash-red maple-tamarack calcareous seepage swamp
- Deep emergent marsh
- Shallow emergent marsh
- Shrub swamp
- Wet meadow
- Other _____

Upland

- Northern Hardwoods-Hemlock-White Pine Forest
- Rich mesic forest
- Red Oak-Sugar Maple Transition Forest
- Agricultural fields
- Cultural grassland
- Successional northern hardwoods
- Spruce-fir-northern hardwood forest
- Developed/disturbed cover types
- Other _____

Notes: _____

C. Hydrology

Stream gradient adjacent to Impoundment: Low Gradient Mid-Gradient High-Gradient

**General Electric Housatonic Rest of River
Form IMP-1: Impoundment Habitat Inventory**

Impoundment Hydrology

Dam Controlled (describe dam): _____

Describe any other inlets, outlets, and other surface water inputs to
Impoundment: _____

Water level fluctuation: _____

Field-Derived Evidence of Hydrologic Conditions

- | | |
|--|---|
| <input type="checkbox"/> Clear natural line impressed on bank | <input type="checkbox"/> Changes in character of soil |
| <input type="checkbox"/> Bed and banks | <input type="checkbox"/> Water staining |
| <input type="checkbox"/> Shelving | <input type="checkbox"/> Vegetation matted down, bent or absent |
| <input type="checkbox"/> Wrack lines (litter and debris) | <input type="checkbox"/> Changes in plant community |
| <input type="checkbox"/> Scour and/or Deposition | <input type="checkbox"/> Destruction of terrestrial vegetation |
| <input type="checkbox"/> Line of mud or silt on tree trunks/vegetation | <input type="checkbox"/> Debris stuck on overhanging tree limbs |
| <input type="checkbox"/> Other _____ | |

D. Inventory of Aquatic Plant Community

% Cover: _____
Overall Aquatic Vegetation Floating -Leaved Cover Emergent Cover

Plant Lists (species that comprise 10% or more of the vegetative cover in each strata, or any amount of an
invasive plant species; "*" designates a dominant plant species for the strata):

Strata	Plant Species	Strata	Plant Species
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Strata: AL=Algal, AM=Aquatic Moss, RV=Rooted Vascular, FV=Floating Vascular, PE=Persistent Emergent,
NE=Non-persistent Emergent

**General Electric Housatonic Rest of River
Form IMP-1: Impoundment Habitat Inventory**

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 impoundment

Abundant Present Absent Not Applicable

Tree cavities in trunks or limbs in or adjacent to impoundment

Abundant Present Absent Not Applicable

Small mammal burrows on banks of impoundment

Abundant Present Absent Not Applicable

Dense herbaceous cover on banks of impoundment (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 (fish, 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 (fish, 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 impoundment (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 (fish, small mammals, mink, weasels, turtles)

Abundant Present Absent Not Applicable

**General Electric Housatonic Rest of River
Form IMP-1: Impoundment Habitat Inventory**

Mud flats

- Abundant Present Absent Not Applicable

Wildlife Dens/Nests (if observed)

Bank swallow colony(ies) (adjacent to impoundment)

- 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 Impoundment (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)
- Impoundment has a limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)
- Impoundment is embedded in a large area of natural habitat with unimpeded connection between Impoundment 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):

**General Electric Housatonic Rest of River
Form IMP-1: Impoundment Habitat Inventory**

VI. Incidental Direct Wildlife Observations

VII. Habitat Degradation (identify specific location within impoundment 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;
- 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:

Appendix E

Floodplain Habitat Inventory Data Sheets

**General Electric Housatonic Rest of River
Form FP-1: Floodplain Habitat Inventory Form**

I. General Information

Site Name and Evaluation Area (including whether wetland or upland)

Location/Physical Description

Date(s) of Site Visit(s) and Data Collection

Weather Conditions During Site Visit

Field Staff Performing Evaluation

Date this form was completed

II. Site Description

A. Hydrology/Water Regime

- Permanently flooded
- Intermittently exposed
- Semi-permanently flooded
- Seasonally flooded
- Upland
- Saturated
- Temporarily flooded
- Intermittently flooded
- Artificially flooded

Estimated Flooding Regime: __Flooded Annually __2-Year Flood __10-Year __100-Year Flood

Notes:

B. Community Cover Type(s)

Wetland

- Transitional floodplain forest
- High terrace floodplain forest
- Red maple swamp
- Vernal pool
- Black ash-red maple-tamarack calcareous seepage swamp
- Deep emergent marsh
- Shallow emergent marsh
- Shrub swamp
- Wet meadow
- Other _____

Upland

- Northern Hardwoods-Hemlock-White Pine Forest
- Rich mesic forest
- Red Oak-Sugar Maple Transition Forest
- Agricultural fields
- Cultural grassland
- Successional northern hardwoods
- Spruce-fir-northern hardwood forest
- Developed/disturbed cover types
- Other _____

**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)

VIII. Restoration Opportunities

Potential suitability of area for access road or staging area

Presence of potential restoration resources (e.g., boulders, large trees or woody debris, plant propagation source material). Identify specific items: _____

Other restoration opportunities: _____

Appendix F

Vernal Pool Characterization Form and MNHESP Vernal Pool Field Observation Form

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

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

2. Soil

- pH _____
- Temperature _____
- Conductivity _____
- Dissolved Oxygen _____

- pH _____
- Organic Carbon Content _____

² As defined by Calhoun and Klemens (2002).

³ As defined by Calhoun and Klemens (2002).

Instructions (continued)
 4. Certification by the Facultative Amphibian Method - provide photo, video, or audio (chorusing) of the required breeding evidence and photo(s) or video of the pool holding water **AND** dry.
 6. Provide information to help distinguish the pool & assess its features.
 7. All required biological & physical evidence must be documented by good quality photos, video, or audio.
 8. Indicate the 3 required maps submitted.

4. Biological Evidence: *Facultative Amphibians*

Breeding evidence¹ of ≥ 2 species must be documented by photos, video, or audio.

BREEDING AMPHIBIANS	DATE OBSERVED month/day/year	BREEDING EVIDENCE ¹ OBSERVED
Spring peeper		
Gray treefrog		
American toad		
Fowler's toad		

Breeding evidence¹ includes: full breeding choruses (call constant & overlapping), ≥ 5 adults in amplexus, any # of egg masses, tadpoles, and/or transforming juveniles in pool.

5. Rare Wetland Species

Were MESA-listed species observed using this pool?

Yes No

If yes, please submit a Rare Animal Observation Form with photo & map to the NHESP (available at www.nhesp.org).

6. Description of Pool and Surroundings ~ Please describe to the best of your ability and knowledge.

Dimensions (please include measurements or estimates):

Approx. Length: _____ Approx. Width: _____ Approx. Maximum Depth: _____

Describe distinctive features (roads, structures, boulders, foot trails, vegetation types, etc.) which are visible from or near the pool that would help someone recognize it.

Origin of the pool (check): Natural depression Human-made pool/ditch Created wetland/pool Other or Unknown (describe) _____

The pool's hydroperiod is most likely: Seasonal (drying out in most years) Semi-permanent (drying partially in most years) Permanent

Describe any inlet or outlets to/from the pool and their permanence (e.g., streams, culverts, etc).

Land use in vicinity of pool (approx. 100 ft from pool edge – check all that apply): upland forest forested wetlands emergent marsh/scrub-shrub wetland
 agricultural/grassland/meadow residential/commercial other _____

7. Documentation Submitted – Label with pool name or tracking #, town, date taken, observer's name.

- Photo(s) Video Audio
 Obligate Species Facultative Species Pool Holding Water Dry Pool

9. Property Owner Information - Landowner information is optional & is available from local tax assessor's offices.

Name _____

Address _____

Town _____ State _____ Zip _____ Assessors Map/Pcl# _____ (if known)

10. Observer Information & Signature – Must be filled out & signed.

Name _____

Address _____

Town _____ State _____ Zip _____

Telephone _____ E-mail _____

I hereby certify under the pains and penalties of perjury that the information contained in this report is true and complete to the best of my knowledge.

Signature _____ Date _____

Signature of Adult, if Observer is under 18 years of age _____

All submissions and supporting documents will be retained by the NHESP and, with the exception of information for MESA-listed species and the identity of minors, are available to interested parties under the Public Records Law.

8. Maps Submitted

Pool locus must be delineated & identified with your pool name or tracking #.

3 REQUIRED MAPS:

- USGS Topographic Map - 1:24,000 or 1:25,000 or better
 Color orthophoto - 1:12,000 or better

and ≥1 of the following:

- Assessor's map (Map and Plot #)
 Professional survey
 Sketch map - with directions and distances from permanent landmarks
 GPS longitude/latitude coordinates:
 Latitude = _____
 Longitude = _____

SEND COMPLETED, SIGNED FORM & SUPPORTING DOCUMENTATION TO:

**NHESP - Vernal Pool Certification
 MA Division of
 Fisheries & Wildlife
 1 Rabbit Hill Rd.
 Westborough, MA 01581**

For questions call 508-389-6360

Arcadis of New York, Inc.
Two Huntington Quadrangle, Suite 1S10
Melville
New York 11747
Phone: 631 249 7600
Fax: 631 249 7610
www.arcadis.com