

**Relicensing Study 3.4.1**

**BASELINE STUDY OF  
TERRESTRIAL WILDLIFE AND  
BOTANICAL RESOURCES**

**Study Report**

**Northfield Mountain Pumped Storage Project (No. 2485)  
and Turners Falls Hydroelectric Project (No. 1889)**

*Prepared for:*



*Prepared by:*



**FEBRUARY 2016**

## EXECUTIVE SUMMARY

FirstLight Hydro Generating Company (FirstLight) is the current licensee of the Northfield Mountain Pumped Storage Project (Northfield Mountain Project, FERC No. 2485) and the Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889). FirstLight has initiated with the Federal Energy Regulatory Commission (FERC, the Commission) the process of relicensing the Northfield Mountain and Turners Falls Projects using the FERC's Integrated Licensing Process (ILP). The current licenses for the Northfield Mountain and Turners Falls Projects were issued on May 14, 1968 and May 5, 1980, respectively, with both set to expire on April 30, 2018.

As part of the ILP, FERC conducted a public scoping process during which various resource issues were identified. On October 31, 2012, FirstLight filed its Pre-Application Document (PAD) and Notice of Intent with the FERC. The PAD included FirstLight's preliminary list of proposed studies. On December 21, 2012, FERC issued Scoping Document 1 (SD1) and preliminarily identified resource issues and concerns. On January 30 and 31, 2013, FERC held scoping meetings for the two Projects. FERC issued Scoping Document 2 (SD2) on April 15, 2013. On September 13, 2013, FERC issued a study plan determination for the Projects which, among other studies, required FirstLight to complete Study No. 3.4.1 *Baseline Study of Terrestrial Wildlife and Botanical Resources*.

The study area for Study No. 3.4.1 covers the following areas:

- Upland areas along the Turners Falls Impoundment, including areas within the Turners Falls Project Boundary and areas up to 200 feet from shore where the Turners Falls Project Boundary is along the shoreline;
- Upland areas adjacent to the bypass reach, defined as extending from the Turners Falls Dam to the Cabot Station tailrace; and,
- The Connecticut River from the Cabot Station tailrace to the Route 116 Bridge in Sunderland.

A wildlife and botanical inventory study was completed in the study area for the purpose of describing baseline information on terrestrial wildlife and botanical resources. This study also assesses the effects of Project operations on these resources.

The Turners Falls Project and Northfield Mountain Project provide habitat for a variety of wildlife and botanical species. An understanding of the terrestrial resources in the Project area provides information on the type and quantity of habitat. Data collected included plant and wildlife species that use representative habitats and invasive species infestations.

The dominant vegetation community types in the study area include remnant/transitional-floodplain forests, agricultural land, northern hardwood - hemlock - white pine forest, successional northern hardwood forest, hemlock-ravine, calcareous rock cliff and circumneutral cliff. Vegetative cover throughout much of the Project area occurs in narrow forest stands that buffer the Connecticut River from agricultural lands of the Pioneer Valley. Approximately 25% of the Turners Falls Project Boundary lands are forested, containing a recorded total of 335 plant species.

The study area along the Connecticut River provides quality habitat for a diverse wildlife community. A total of 64 bird species was recorded, including neo-tropical migrant songbirds, raptors, waterfowl, and shore birds that use the river as a migratory pathway, breed, or winter in the study area. Common mammals include white-tailed deer, fox, gray squirrel, and a variety of smaller mammals. Numerous salamanders, newts, frogs, turtles, and snakes were observed or may occur in the study area.

The Turners Falls and Northfield Mountain Projects have little effect on botanical and wildlife resources within the study area and bordering lands. The occurrence and distribution of wildlife and botanical resources in the study area are generally unrelated to the Turners Falls and Northfield Mountain Projects and/or Project operations. There is no evidence of any on-going adverse effects on upland wildlife and botanical resources. The upland invasive species occur outside the range of water level fluctuations.

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## LIST OF ABBREVIATIONS

cfs	cubic feet per second
FERC	Federal Energy Regulatory Commission
FirstLight	FirstLight Hydro Generating Company
GIS	Geographic Information Systems
GPS	Global Positioning System
ILP	Integrated Licensing Process
MADFW	Massachusetts Department of Fish and Wildlife
MESA	Massachusetts Endangered Species Act
Northfield Mountain Project	Northfield Mountain Pumped Storage Project
MIPAG	Massachusetts Invasive Plant Advisory Group
NHESP	Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program
PAD	Pre-Application Document
PSP	Proposed Study Plan
Project	Turners Falls and Northfield Mountain Projects
RSP	Revised Study Plan
RTE	Rare, Threatened and Endangered Species
SD1	Scoping Document 1
SD2	Scoping Document 2
TFI	Turners Falls Impoundment
Turners Falls Project	Turners Falls Hydroelectric Project
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Service
USFWS	United States Fish and Wildlife Service
WNS	White-Nose Syndrome

# 1 INTRODUCTION

FirstLight Hydro Generating Company (FirstLight) is the current licensee of the Northfield Mountain Pumped Storage Project (Northfield Mountain Project, FERC No. 2485) and the Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889). FirstLight has initiated with the Federal Energy Regulatory Commission (FERC, the Commission) the process of relicensing the Northfield Mountain and Turners Falls Projects using the FERC's Integrated Licensing Process (ILP). The current licenses for Northfield Mountain and Turners Falls Projects were issued on May 14, 1968 and May 5, 1980, respectively, with both set to expire on April 30, 2018.

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FirstLight filed its Proposed Study Plan (PSP) on April 15, 2013 and, per the Commission regulations, held a PSP meeting at the Northfield Visitors Center on May 14, 2013. Thereafter, FirstLight held ten resource-specific study plan meetings to allow for more detailed discussions on each PSP and on studies not being proposed. On June 28, 2013, FirstLight filed with the Commission an Updated PSP to reflect further changes to the PSP based on comments received at the meetings. On or before July 15, 2013, stakeholders filed written comments on the Updated PSP. FirstLight filed a Revised Study Plan (RSP) on August 14, 2013 with FERC addressing stakeholder comments ([FirstLight, 2013](#)). Study No. 3.4.1 *Baseline Study of Terrestrial Wildlife and Botanical Resources* was included in the RSP. On September 13, 2014, FERC issued its first Study Plan Determination Letter approving Study Plan No. 3.4.1 with no modifications.

## 1.1 Existing Information

The PAD provided a list of plant and wildlife species, as well as dominant vegetative communities in the study area<sup>1</sup>, but did not provide any site-specific information on the known occurrences of species within the upland habitats of the study area. This report supplements existing information regarding vegetation mapping, wildlife occurrences and associated habitats, and invasive plant species.

In preparation of the PAD, federal and state agencies were contacted by FirstLight via letter ([Howard, 2011](#)) regarding the potential presence of rare, threatened and endangered (RTE) species and critical habitats within the Turners Falls Project and Northfield Mountain Project boundaries. Agencies contacted were the United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service, Massachusetts Natural Heritage and Endangered species Program (NHESP), Vermont Department of Fish and Wildlife, and New Hampshire Fish and Game Department. The consultation resulted in the identification of three federally-listed threatened and/or endangered species (Section 4.7.1 of the PAD), 39 state-listed threatened and/or endangered species (Section 4.7.2 of the PAD), 21 state-listed species of special concern (Section 4.7.3 of the PAD) and USFWS designated critical habitats (Sections 4.7.4 of the PAD) that are likely or known to occur within the Turners Falls Project Boundary and are detailed in Section 4.7 of the PAD. No special status mammals were identified during consultation with state and federal agencies. However, on April 2, 2015 the northern long-eared bat (*Myotis septentrionalis*) was listed as federally threatened. In January 2016, USFWS published the final 4(d) rule regarding prohibited take of these species which will become effective on February 16, 2016.

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<sup>1</sup>The study area is defined in Section 2.0.

Agency consultation revealed no federally designated critical habitat areas within the Turners Falls Project and Northfield Mountain Project areas. Detailed information regarding habitat preferences and life histories of these species can be found in Section 4.7 of the PAD.

In 2006, FirstLight, operating under the NE Hydro Generating Company name, contracted Tighe & Bond to complete a botanical survey on Project lands where land management and recreational activities occurred. The areas surveyed included Bennett Meadow Wildlife Management Area, Barton Cove Campground, and recreational picnic areas on the Turners Falls Impoundment (TFI). The Tighe & Bond report provided baseline information and insight as to which species are within those areas surveyed and what could potentially be present throughout the study area. The Massachusetts Division of Fish and Wildlife (MADFW) reviewed Tighe & Bond's 2006 botanical survey and indicated that the Project is not located within Priority Habitat or Estimated Habitat. Priority Habitats are designated by the Massachusetts Endangered Species Act (MESA) and include the known geographical extent for state-listed rare plant and animal species. Estimated Habitats are a subcategory of Priority Habitats, designated by the Wetlands Protection Act, and include the geographical extents of habitat of state-listed rare wetlands wildlife. In its review letter dated April 25, 2007 ([French, 2007](#); NHESP Tracking Number: 06-19884), MADFW concluded that existing uses of the recreational facilities described in the Operation and Maintenance Plan would not require review under the MESA; however, select activities that are regulated by FERC licenses could require review by NHESP during the FERC review process.

## **1.2 Study Goals and Objectives**

This study encompasses the terrestrial and wildlife resources in the study area. The goal of this study is to characterize and describe the terrestrial wildlife and botanical resources that use representative upland habitats within and adjacent to the Turners Falls Project Boundary. Specific objectives are:

- Survey and inventory overall upland wildlife habitats;
- Note the occurrence of wildlife sighting during the course of the surveys;
- Survey and inventory vegetation communities and land use;
- Survey and evaluate the presence of targeted RTE species or associated habitats<sup>2</sup>; and
- Survey and inventory the nature and extent of upland invasive, exotic vegetation species.

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<sup>2</sup> The presence of targeted RTE species and associated habitats was surveyed and evaluated as part of Study No. 3.5.1 and is described in Study Report No. 3.5.1.



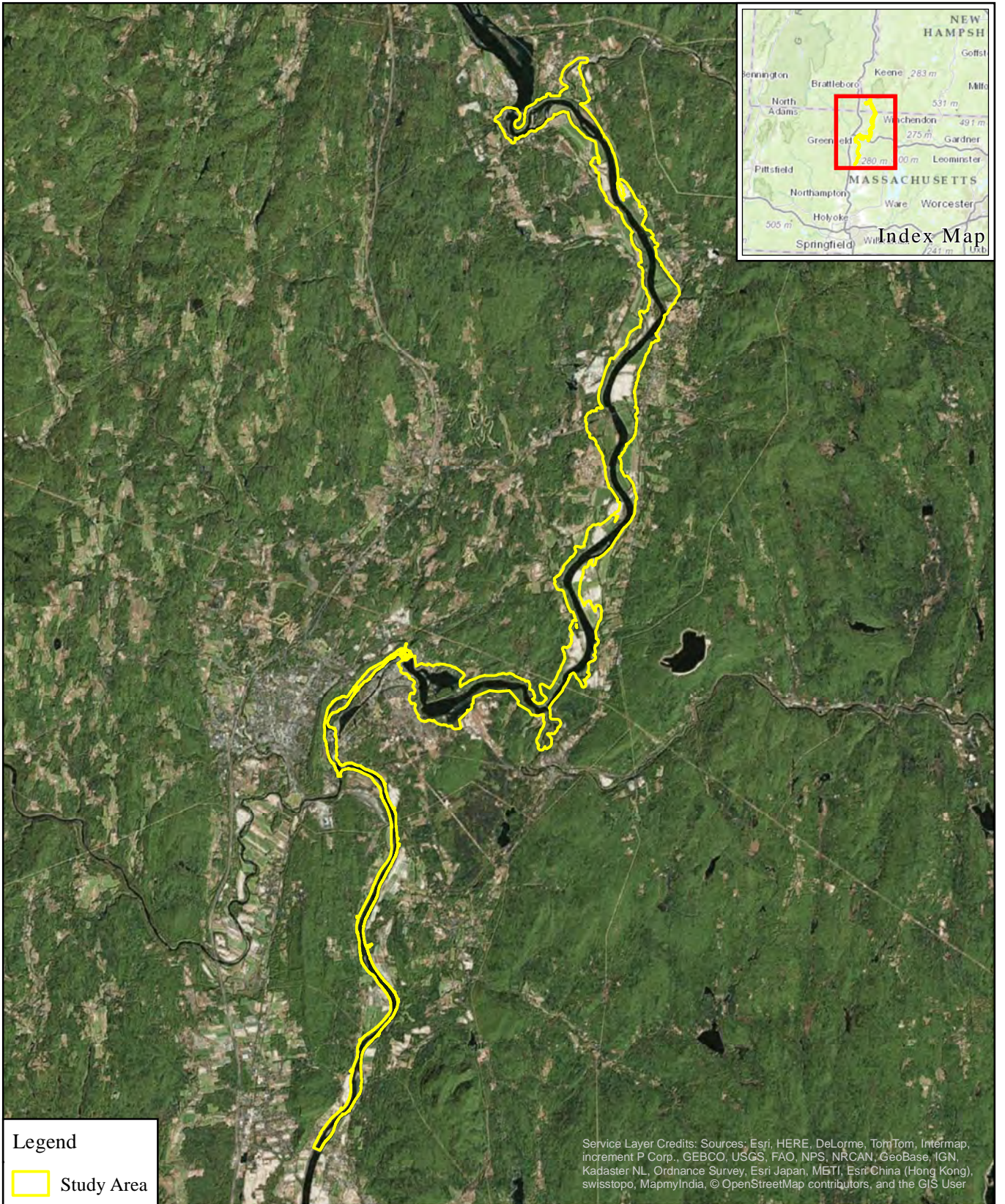
## **2 STUDY AREA**

Field surveys were completed within the uplands adjacent to the shoreline of the TFI, the Bypass Reach, and below Cabot Station to the Route 116 Bridge in Sunderland to document the type and distribution of terrestrial wildlife habitats, including vegetation communities and plant species, present in the study area.

The geographic area for this study included:

- upland areas along the TFI, including areas within the Project Boundary and areas up to 200 feet from shore where the Project Boundary is along the shoreline;
- upland areas adjacent to the bypass reach, defined as extending from the Turners Falls Dam to the Cabot tailrace, and;
- the Connecticut River from the Cabot tailrace to the Route 116 Bridge in Sunderland. Riparian areas were surveyed up to the top of bank in this segment of the study area.

[Figure 2.0-1](#) illustrates the study area.



**Legend**

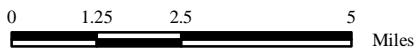
 Study Area

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User



**Northfield Mountain Pumped Storage Project (No. 2485)  
and Turners Falls Hydroelectric Project (No. 1889) Figure 2.0-1 Study Area**  
Study 3.4.1.

**Baseline Study of Terrestrial and Botanical Resources**



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### **3 METHODS**

The study approach followed the approved RSP ([FirstLight, 2013](#)) and consisted of the elements described in the following sections.

#### **3.1 Review of Existing Information**

Task 1 of the RSP required a literature review. As part of Task 1, existing wildlife and botanical resources for the study area were described based on review of existing literature and information sources, inspection of aerial photography, geographic information system (GIS) databases, and field observations of vegetation, wildlife and habitat communities recorded during reconnaissance surveys. Sources of existing information that were reviewed included:

- NHESP Classification of the Natural Communities of Massachusetts (Swain & Kersey, 2011);
- Tighe & Bond (2006); Rare Plant Species Survey Report to NHESP summarizing surveys completed at select Northeast Generation Services Properties;
- MADFW April 25, 2007: MADFW / NHESP Tracking No: 06-19884 - letter to Tighe & Bond, review of FirstLight operation and maintenance facilities for compliance with MESA (French, 2007);
- FirstLight Pre-Application Document for the Turners Falls Hydroelectric Project (No. 1889) and Northfield Mountain Pumped Storage Project (No. 2485) (2012);
- FirstLight Relicensing Study 3.6.2; Recreation Facilities Inventory and Assessment (2014);
- MADFW / NHESP Priority Habitat and Estimated Habitat maps (2008);
- NHESP Massachusetts Natural Heritage Atlas 13th Edition;
- National Wetland Inventory Mapping (USFWS);
- GIS data bases including MassGIS data layers (2012);
- USFWS Environmental Conservation Online System database (2012);
- Massachusetts Invasive Plant Advisory Group (MIPAG, 2012) data; and
- Northfield Mountain Recreational Trail maps.

Using GIS and other available sources of information, preliminary field maps were produced to assist field surveys. Available habitat data were compared against habitat requirements of regionally known wildlife and plant communities to develop lists of wildlife species most likely to occur within the study area. Prior to field investigations, biologists reviewed the practices and locations of FirstLight Project-related land use management activities (e.g., areas routinely mowed, vegetation management areas, access roads) and recreational uses (e.g., Barton cove, Munn's campsite) along the river. These managed and recreational use areas were a focus of the study.

The NHESP and USFWS were contacted by FirstLight via letter ([Howard, 2011](#)) as part of preparing the PAD, requesting information on the potential presence of RTE species and critical habitats within the study area. NHESP reviewed the study area, and provided a letter stating there are several known or possibly occurring state listed species or federally listed species within in the study area ([French, 2011](#)). Additionally, in a letter dated April 25, 2007 (NHESP Tracking No. 06-19884) from NHESP to Tighe & Bond (on behalf of FirstLight), NHESP reported that there are no state records of areas designated as priority habitats or certified vernal pools were located within the survey area.

### **3.2 Field Reconnaissance**

To document representative botanical and wildlife resources, biologists completed preliminary reconnaissance level field surveys over the course of several weeks from April 2014 to August 2014 and August 2015. To comply with safety issues, high river flows prevented planned surveys on the river until May 27, 2014. More specifically, on-water boat activities are restricted when flow through the TFI exceeds approximately 20,000 cfs. Field surveys of wildlife species were conducted concurrently with other botanical and wetland studies (i.e. Study No. 3.5.1).

### **3.3 Wildlife**

The primary objective of the wildlife surveys was to provide a preliminary census and information on the distribution and abundance of wildlife habitats and land cover. General field observations included unique or unusual habitats and observations of avian, reptilian, amphibian, and mammalian wildlife.

Wildlife surveys were completed using visual and audial encounter surveys along the shoreline of the TFI, the Bypass Reach, and below Cabot Station to the Route 116 Bridge in Sunderland. Biologists boated the shoreline in each location, at a pace of approximately five minutes per 50 meters, for a total search time of up to approximately two hours. All observations were made landward, and biologists surveyed the area for targeted species and indirect signs (i.e., tracks, scat, den areas, nests, etc.). Visual encounter surveys were augmented with incidental observations of wildlife signs while completing preliminary botanical and RTE surveys. More intensive searches were performed where unique habitats or habitats suitable for endangered or resident species were identified (i.e., notable cliffs). The locations of RTE species sightings and observations were documented through the use of a global positioning system (GPS) unit and photographs. GPS field data collected were entered into GIS database. Field data collected were compiled into separate census lists for mammals, reptiles and amphibians, and avian species observed, heard, or likely to occur given available habitat ([Appendices A, B, and C](#), respectively). Supplemental riparian habitat transect surveys were completed in August 2015 to determine species composition, structure, and distribution of vegetative communities and habitat within the study area. RTE species habitats were surveyed in consultation with Jesse Leddick of the NHESP, who assisted with transect placement. Methods, data and reporting for RTE wildlife and plants are detailed in Study No. 3.5.1.

Steve Johnson, PhD, Senior Biologist for New England Environmental, assisted with completing avian surveys on June 2, 3, and 11, 2014. These surveys occurred during spring rare plant species surveys between the Sunderland Bridge and the Vernon Dam and during an avian survey by boat of the TFI between the Turners Falls and Vernon Dams on June 30, 2014. The goal of the avian surveys was to create an inventory of bird species found within the habitats along the Connecticut River. Data were collected continuously as the surveyors moved upstream and downstream.

### **3.4 Vegetation Communities**

Botanical surveys were completed to determine the distribution of vegetation communities within the study area. Data collected included an overall census list of all plant species identified within the study area ([Appendix D](#)). Vegetation communities were identified based on aerial photos or other imagery and classified using the NHESP Classification of the Natural Communities of Massachusetts ([Swain & Kersey](#),

[2011](#)). Vegetation communities were subsequently ground-truthed during the 2015 riparian habitat transect surveys, by visually assessing the dominant plant species and the percent cover for all plant species present.

To refine future vegetation community mapping for the study area, the following tasks were performed:

- Existing GIS vegetation community, land use, and recreational layers from available resources were acquired;
- Visible boundaries in aerial photos or other imagery were used to create polygon boundaries of potential vegetation communities;
- A final vegetation community map displaying vegetation community polygon boundaries, the study area, and specific Project components was developed.

### **3.5 Invasive Plant Survey**

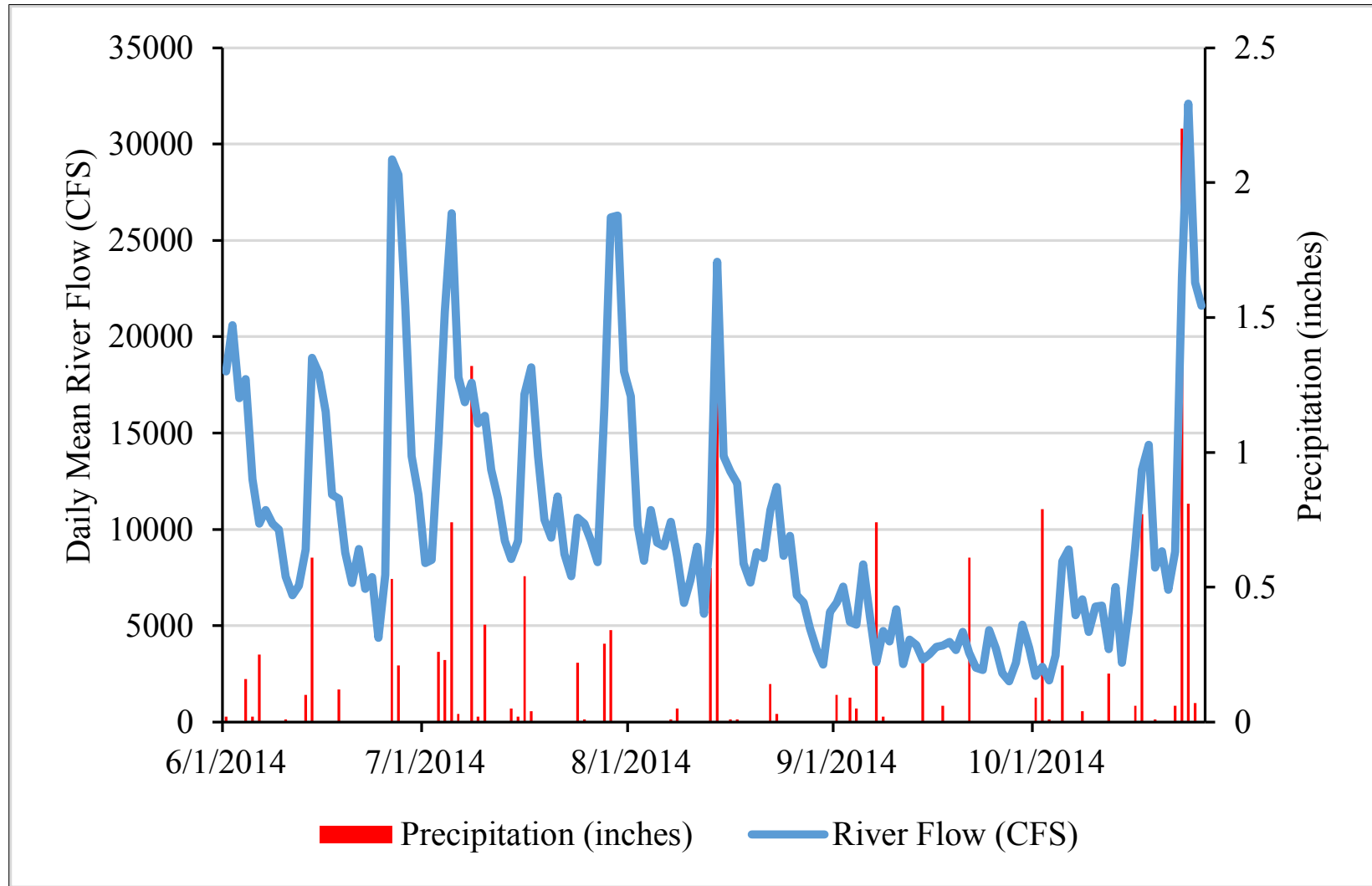
The MIPAG maintains a list of invasive plant species occurring in Massachusetts and provides criteria used in evaluating species. In Massachusetts, the MIPAG lists 35 species as invasive, 29 as likely invasive, and three (3) plant species as potentially invasive. MIPAG defines invasive plants as "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems." Only species on the MIPAG lists were considered invasive for the purpose of this study. Biologists used methods adapted from the United States Forest Service (USFS) Invasive Species Program, *Invasive Species Inventory and Mapping Data Recording Protocols* ([USFS, 2015](#)). These adapted methods focus on presence, location, extent, and abundance to provide site infestation information. As land disturbances due to natural and Project-related fluctuating water levels, recreation, launching of watercraft (i.e., at boat launches), and boating activities can favor establishment of invasive plants over native plant communities, survey efforts for invasive species were focused on areas directly adjacent to the shoreline.

To document an infested area, biologists used a Trimble® GPS survey data collector with sub-foot accuracy to delineate the boundary of the infestation as defined by the dominant cover of the invasive plant. Biologist also used field notes, photographs, and field mark-ups of aerial maps to document observations. Areas containing only occasional invasive species were recorded with a GPS center point and radius necessary to enclose the population. For areas where invasive species were ubiquitous or impractical to map, surveyors characterized invasive species population using estimates of areal coverage and percent cover of species present. Along the shoreline, biologists estimated areal coverage using cover classes of <5%, 6-25%, 26-50%, > 50%.

## **4 RESULTS**

### **4.1 Environmental Conditions**

The daily mean river flow, as measured on the Connecticut River at the United States Geological Survey (USGS) gage at Montague City, ranged from 2,100 cfs on September 27, 2014 to 29,200 cfs on June 26, 2014 throughout the study period (June 11 to October 9, 2014). The daily mean river flow from the start of the study period (June 11 until August 15, 2014) was variable as a result of spring runoff and rain events ([Figure 4.1-1](#)). Daily average discharge was more uniform from September 4 to the end of the study period on October 9 (2,100 cfs to 8,960 cfs). Daily precipitation totals ranged from 0 to 2.2 inches ([Figure 4.1-1](#)). The TFI extends upstream approximately 20 miles to the base of TransCanada's Vernon Dam in Vernon, VT. To provide storage capacity for the Northfield Mountain Pumped Storage Project, the TFI elevation may vary, per the current FERC license, from a minimum elevation of 176.0 feet mean sea level (msl) to a maximum elevation of 185.0 feet msl, a 9 foot fluctuation as measured at the Turners Fall Dam. The TFI is not a level pool; rather, it is sloped between the Vernon Dam and the Turners Falls Dam. The slope of the water surface profile steepens as the magnitude of flow increases.



<sup>a</sup>Data from USGS Station Number 01170500 on the Connecticut River in Montague City, MA.

<sup>b</sup>Data from for <http://www7.ncdc.noaa.gov/CDO/cdosubquervrouter.cmd> for Fitchburg Municipal Airport

**Figure 4.1-1: Daily Mean River Flow<sup>a</sup> (cfs) and Daily Precipitation<sup>b</sup> (inches) from June to October 2014**

## 4.2 Wildlife

The physiographic settings of the study area, with its relatively large tracts of undisturbed terrestrial habitats, provide a wide variety of habitats for terrestrial wildlife. Wildlife associated with habitats within the study area includes a combination of species ranging from those “generalists” species adapted to a broad habitat range to those more specialized species adapted to specific habitats (such as open/edge habitats and woodland vernal pool habitats) (DeGraaf, 2001). For purposes of describing the existing condition of wildlife resources, this discussion has been divided into the following categories: mammals, reptiles and amphibians, and avian species.

### 4.2.1 Mammals

[Appendix A](#) lists 36 mammal species that were directly and indirectly observed in the field, as well as species that are likely to exist in the study area. The list of mammals likely to occur is inferred from available habitat types documented in the study area cross referenced with life histories of mammals that are known to occur within the region as documented in [DeGraaf, \(2001\)](#). The diverse vegetated communities within the study area provide a range of habitats niches for species typical of the highlands of central to western Massachusetts and the Connecticut River valley. The majority of the species are habitat generalists with a known tolerance for habitat modifications and adaptations.

Some of the furbearing animals that are known to inhabit the study area, based on direct observation or presence of preferred habitat, include raccoon (*Procyon lotor*), squirrel (*Sciurus carolinensis*), chipmunk (*Tamias striatus*), beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), muskrat (*Ondatra zibethicus*), Virginia opossum (*Didelphis virginiana*), and striped skunk (*Mephitis mephitis*) (see [Figures 4.2.1-1](#) and [4.2.1-2](#)). These wildlife species reside in many different habitat types such as woodland, wetland, scrub-shrub or early successional, and grassland areas. Use of these areas may shift during different life stages and/or times of year.

White-nose Syndrome (WNS), a fungus that causes harm to bats, has spread rapidly and has caused the catastrophic mortality of bats that hibernate over winter in Massachusetts ([NHESP, 2014](#)). This includes the little brown bat, which used to be the most abundant species of bat in the Commonwealth. Most of the bat colonies are now gone as a result of WNS ([NHESP, 2014](#)). White-nose Syndrome has also devastated the northern long-eared bat (*Myotis septentrionalis*) population. As a result, on April 2, 2015 the USFWS listed the northern long-eared bat as federally threatened, and subsequently published a final rule under section 4(d) of the Environmental Species Act to exempt certain activities from the incidental take prohibitions of the act. The listing and final rule will become effective on February 16, 2016. The northern long-eared bat overwinters in caves or old mines with high humidity and stable temperatures. During the summer the bats will roost in large diameter trees, preferring those with exfoliating bark. Reproduction begins in late summer or fall, with delayed implantation resulting in pupping in the following spring. The study area includes old growth hemlock, shagbark hickory, silver maple, and several other species which are large in diameter and possess bark characteristics which could provide potential summer roosting habitat for the northern long-eared bat. During the 2014 and 2015 field work, this species was not observed in the study area.

There are three species of “tree bats” in Massachusetts that are not exposed to the WNS fungus because they migrate south for the winter. These bats include the red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*). These species typically use riparian habitats for nesting and cover, venturing out into surrounding habitats to forage. No summer colonies of bats were observed in the study area, but there is abundant forested habitat that could support these “tree bats”.





**Figure 4.2.1-1: Fox on West Bank of River Across from First Island in Sunderland**



**Figure 4.2.1-2: Beaver in Bypass Reach**

#### 4.2.2 Reptiles and amphibians

Of the MADFW 45 inland native species of amphibians and reptiles that are known to occur in Massachusetts ([Cardoza & Mirick, 2009](#)), a total of 23 amphibians and reptiles were observed or are likely to occur within the study area (see [Figures 4.2.2-1](#) through [4.2.2-3](#)). Included are nine frogs and toads, four salamanders, three turtles, and seven snakes. These inland native species include terrestrial and semi-aquatic amphibians and reptiles. A list of these reptiles and amphibians is provided in [Appendix B](#).



Figure 4.2.2-1: Eastern Garter Snake in Mountain Alder Shrub at Rock Dam in Bypass



**Figure 4.2.2-2: American Toad Breeding at Rivers Edge in Downstream Stretch at Third Island**



**Figure 4.2.2-3: Pickerel Frog at Edge of Agricultural Field in Turners Falls Impoundment**

#### 4.2.3 Avian Species

The Connecticut River provides important habitat to a wide variety of bird species. During the spring and summer many species (including those observed during this survey) breed and nest along the river. In the spring and fall, the river is a major migratory flyway, and, generally, in the winter it provides habitat for many species of waterfowl that nest further north. Throughout the year, the river is a source of food for foraging birds.

Sixty-four (64) species of birds were observed within the study area ([Appendix C](#)). Most species were found in the surrounding upland floodplain, rather than utilizing aquatic habitat. Species associated with the river included: Double-crested Cormorant (*Phalacrocorax auritus*), Canada Goose (*Branta canadensis*), Common Merganser (*Mergus merganser*), Mallard (*Anas platyrhynchos*), Mute Swan (*Cygnus olor*), Wood Duck (*Aix sponsa*), Bank Swallow (*Riparia riparia*), Northern Rough-winged Swallow (*Stelgidopteryx serripennis*), Spotted Sandpiper (*Actitis macularius*), and Belted Kingfisher (*Megaceryle alcyon*) ([Figures 4.2.3-1](#) and [4.2.3-2](#)). Three occupied Bald Eagle (*Haliaeetus leucocephalus*) nests ([Figures 4.2.3-3](#) to [4.2.3-5](#)) were located within the study area, downstream on Third Island, Barton Island in Barton Cove, and along the east bank of the TFI across from Stebbins Island located just downstream of Vernon Dam.



**Figure 4.2.3-1: Bank Swallow at Nest Opening near Vernon Dam on the Connecticut River**



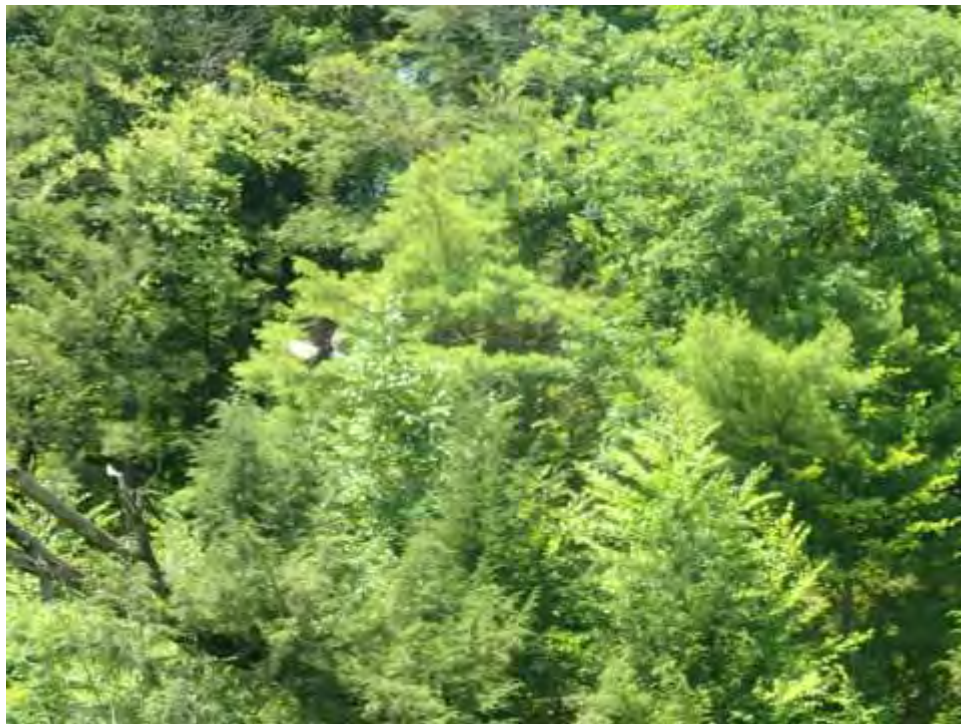
**Figure 4.2.3-2: Northern Rough-winged Swallow**



**Figure 4.2.3-3: Occupied Bald Eagle Nest East Bank of the Turners Falls Impoundment Near Stebbins Island, located just Downstream of Vernon Dam**



**Figure 4.2.3-4: Occupied Bald Eagle Nest on Third Island Sunderland**



**Figure 4.2.3-5: Bald Eagle in Flight at Barton Cove**

### 4.3 Vegetation Communities

The region encompassing the study area is characterized by a diversity of terrestrial botanical resources that are influenced by geological features, soil type, hydrology, climate, and historic and current land use. Located in the Connecticut River valley, with adjacent high elevations of Northfield Mountain, the study area has characteristics of both Northeastern Highlands and Northeastern Coastal Zone ecoregions ([Swain & Kersey, 2011](#)). The Connecticut River, during its course between Vernon Dam and Turners Falls Dam, regains the appearance of a river even though it is impounded. The wide and fertile plains on both sides of the Connecticut River are terminated by terraces rising to forest upland country to the east and west. Examples of geologic and geomorphic features influencing the area's botanical communities include:

- the Connecticut River valley and remnant floodplains;
- the confluence of the Connecticut River and major tributaries (e.g., Millers River); and
- bedrock and alluvial islands within the Connecticut River.

Biologists documented nine (9) primary upland plant communities, totaling over 335 plant species within the study area. One (1) plant community, the calcareous rock cliff community, was identified during survey work, but this habitat was not mapped as the aerial signature and habitat size did not allow for identification using available aerial imagery. Three (3) communities; agricultural, development, and transmission right of way, were mapped, but these are not described by the NHESP. Some community descriptions are based on observations from Study No. 3.4.2 for those communities that were similar in species composition. The primary upland plant communities include:

- Floodplain forests
- Northern hardwoods-hemlock-white pine forest
- Successional northern hardwood
- Calcareous rock cliff community (not mapped)
- Agricultural lands (not described by NHESP)
- High energy riverbanks
- Development (not described by NHESP)
- Right of way (not described by NHESP)

Percent occurrences of each vegetation community are shown on [Table 4.3-1<sup>3</sup>](#), and vegetation community mapping is illustrated in [Figure 4.3-1](#). Downstream of the Cabot tailrace to the Route 116 Bridge in Sunderland, riparian areas were surveyed only up to the top bank. These areas primarily included a thin strip of riparian vegetation or steep banks adjacent to agricultural fields or northern hardwood-hemlock-white pine forest. Below Cabot Station to the Sunderland Bridge there are 29 miles of Northern hardwoods-hemlock-white pine forest along the shoreline.

An overall plant census list of all recorded plant species identified during the 2014 and 2015 field seasons is provided in [Appendix D](#).

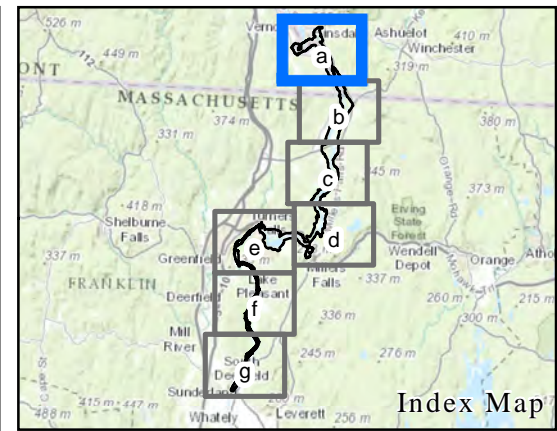
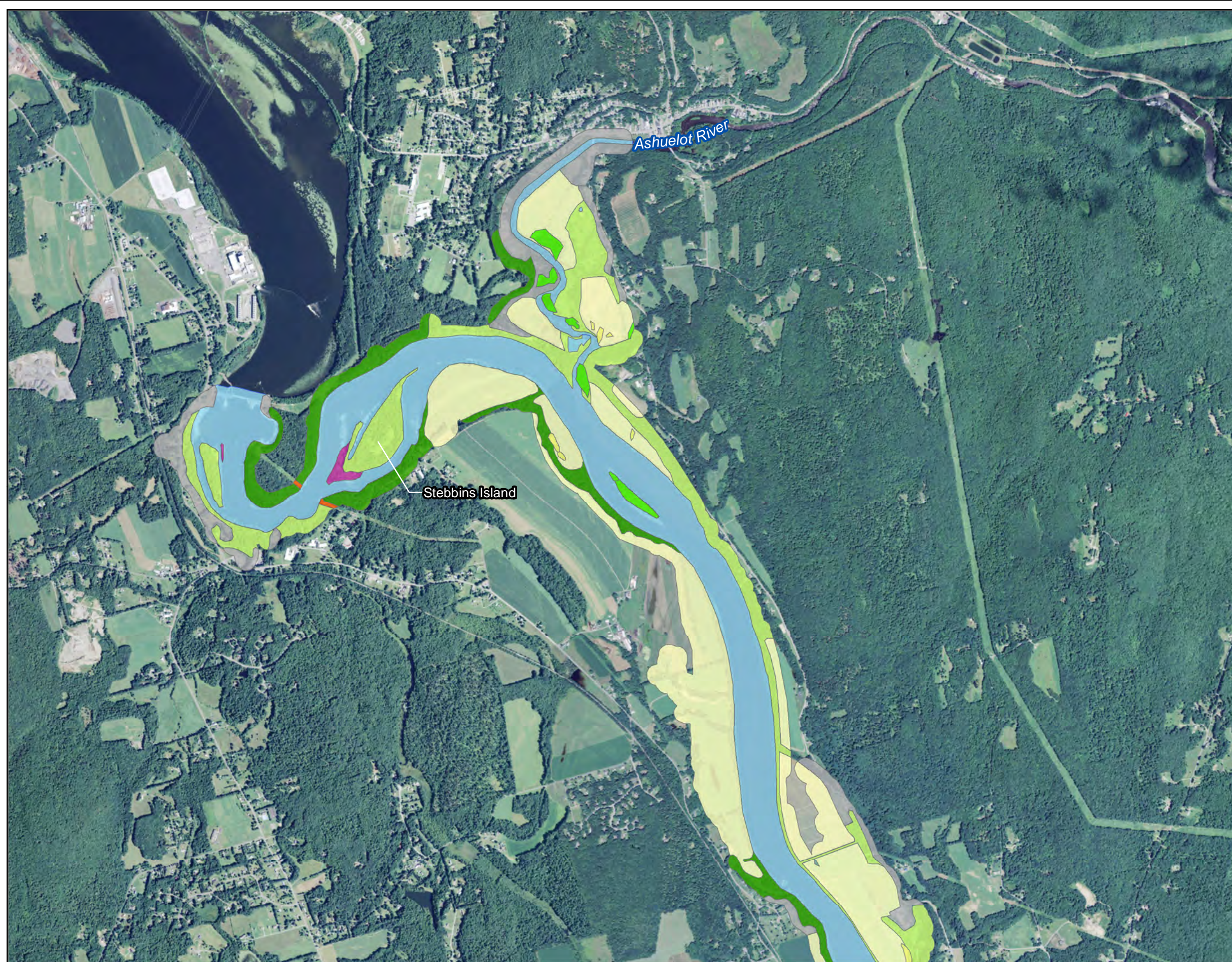
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<sup>3</sup> Total acreage as well as percent vegetation community cover for this study differs from the Draft License Application (DLA). The acreage in the DLA was developed prior to the study area being added to the GIS and includes lands outside of the identified study area for Study 3.4.1. The study area (as described in the study plan) only goes to the top of the bank below Cabot and the lower acreage for this study is the result of correcting the boundary of the study area to match what is described in the study plan. Vegetation community cover was calculated for the DLA exclusively using aerial imagery; subsequent field work resulted in the reclassification of several acres of vegetation for Study 3.4.1.

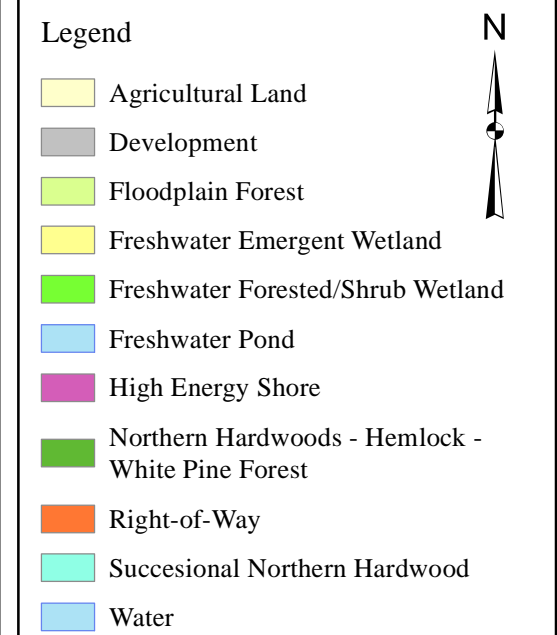
**Table 4.3-1: Vegetation Community, Dominant Vegetation, and Percent Occurrence within the Study Area**

Habitat Type	Dominant Overstory	Dominant Shrub	Dominant Herbaceous	Acres	Percent of Area
Floodplain Forest	silver maple (51-75%), cottonwood (6-25%), red maple (6-25%)	silver maple (trace), cottonwood (trace) red maple (trace)	wood nettle (6-25%), ostrich fern (6-25%), sensitive fern (6-25%)	547.9	7.8
Northern Hardwoods-Hemlock-White Pine	hemlock (75-100%), yellow birch (10-15%), American beech (5-10%)	hemlock (trace), hobblebush (trace), elderberry(trace)	Christmas fern (trace), Canada mayflower (trace), club moss (trace)	1,107.9	15.7
Successional Northern Hardwoods	aspen (26-50%), white birch (6-25%), red maple (6-25%)	arrowwood (5-10%), staghorn sumac (trace), willow (6-25%)	common clotsbur (6-25%), symphyotrichum spp. (trace), carex spp (6-25%)	2.9	.05
Agricultural Lands	N/A	N/A	Agricultural crops (76-100%)	1,624.7	23.0
High Energy Shore	N/A	silky dogwood (trace), sandbar willow (trace), sandbar cherry (trace)	beggartick (6-25%), dogbane (6-25%)	5.17	.07
Development	white pine (trace)	N/A	Kentucky bluegrass (76-100%)	317.3	4.5
Right of Way	N/A	white pine (6-25%), glossy buckthorn (6-25%)	sensitive fern (6-25%), Joe pye weed (6-25%), bracken fern (6-25%), mullein (6-25%)	4.8	.07
Wetlands	See Study 3.5.1	See Study Report No. 3.5.1	See Study Report No. 3.5.1	342.2	4.8
Water	N/A	N/A	N/A	3,112.4	44.1
<b>Total</b>				<b>7,065.2</b>	<b>100.0</b>

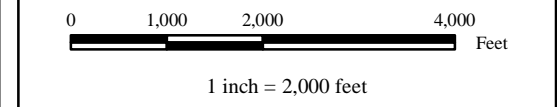




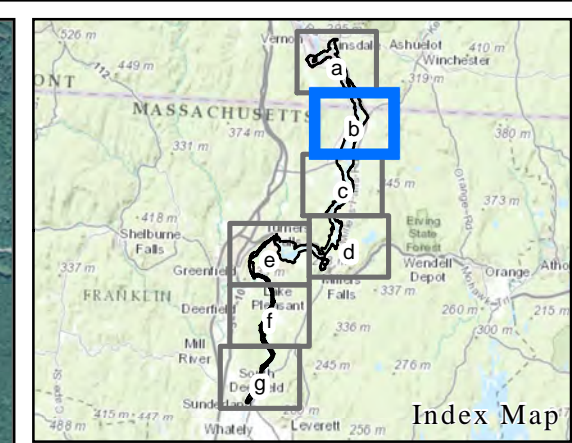
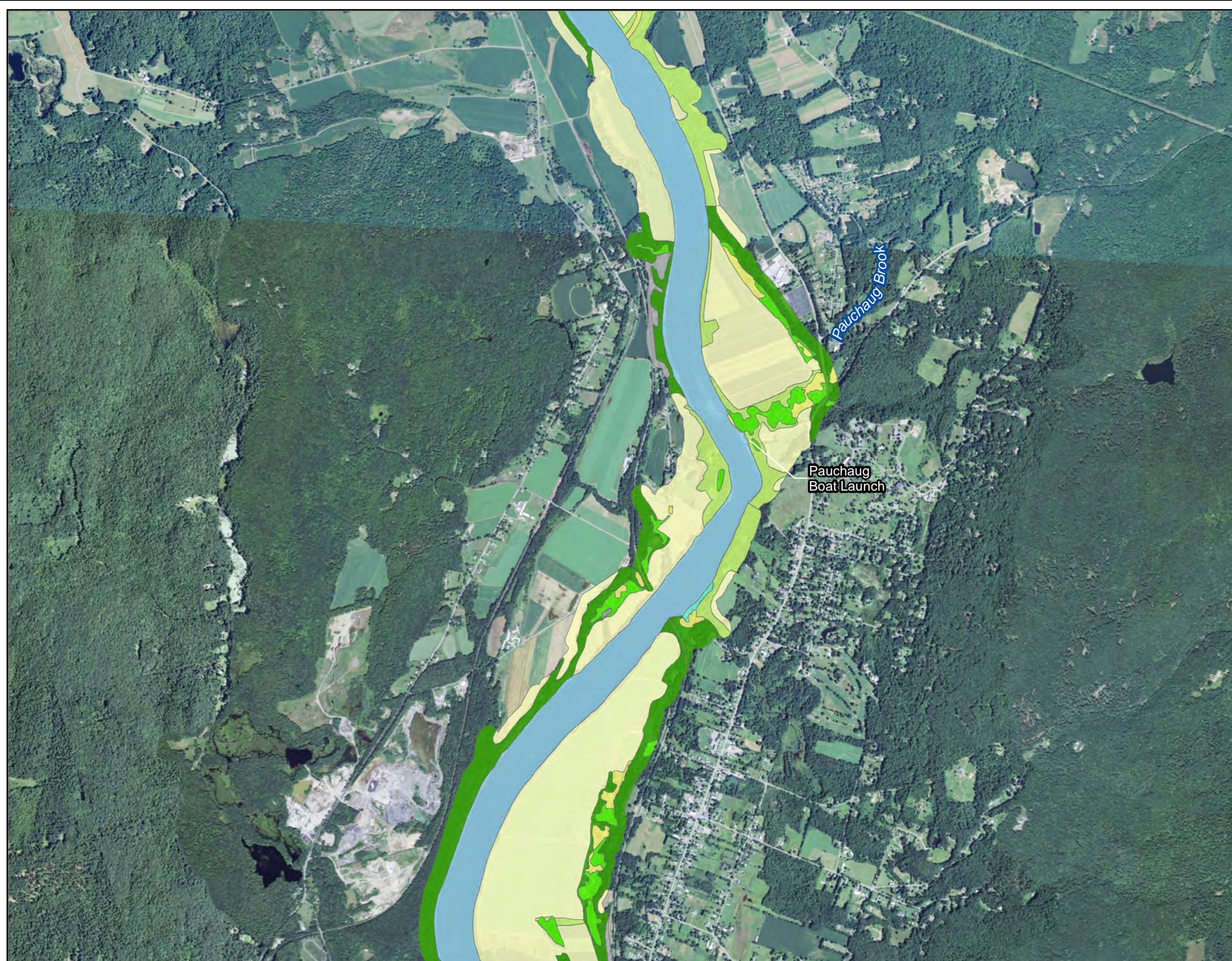
**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.3-1 Map 1  
 Vegetation Communities in the Study Area



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**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.3-1 Map 2  
 Vegetation Communities in the Study Area

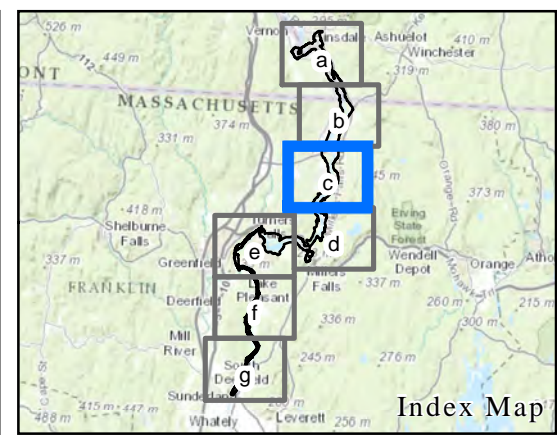
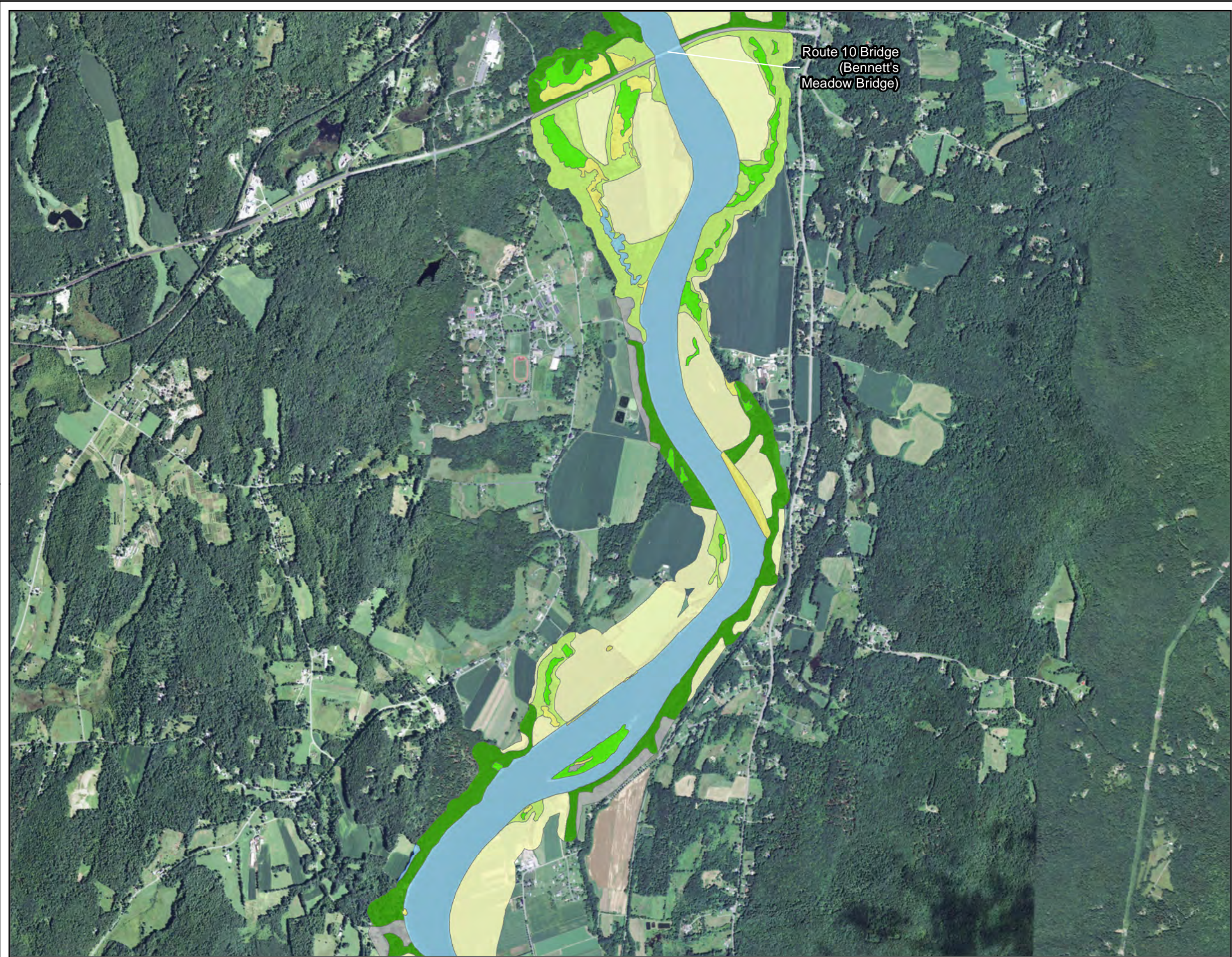
**Legend**

- Agricultural Land
- Development
- Floodplain Forest
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- High Energy Shore
- Northern Hardwoods - Hemlock - White Pine Forest
- Right-of-Way
- Successional Northern Hardwood
- Water

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**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.3-1 Map 3  
 Vegetation Communities in the Study Area

**Legend**

- Agricultural Land
- Development
- Floodplain Forest
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- High Energy Shore
- Northern Hardwoods - Hemlock - White Pine Forest
- Right-of-Way
- Successional Northern Hardwood
- Water

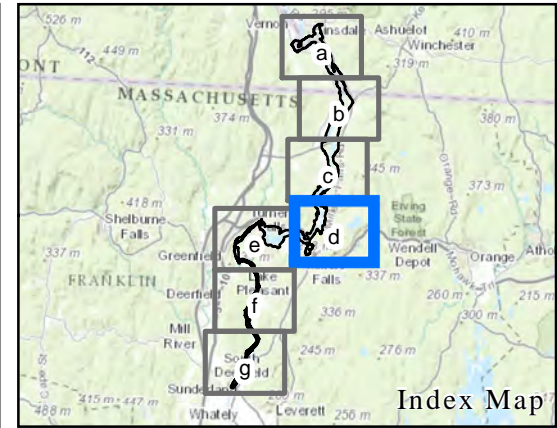
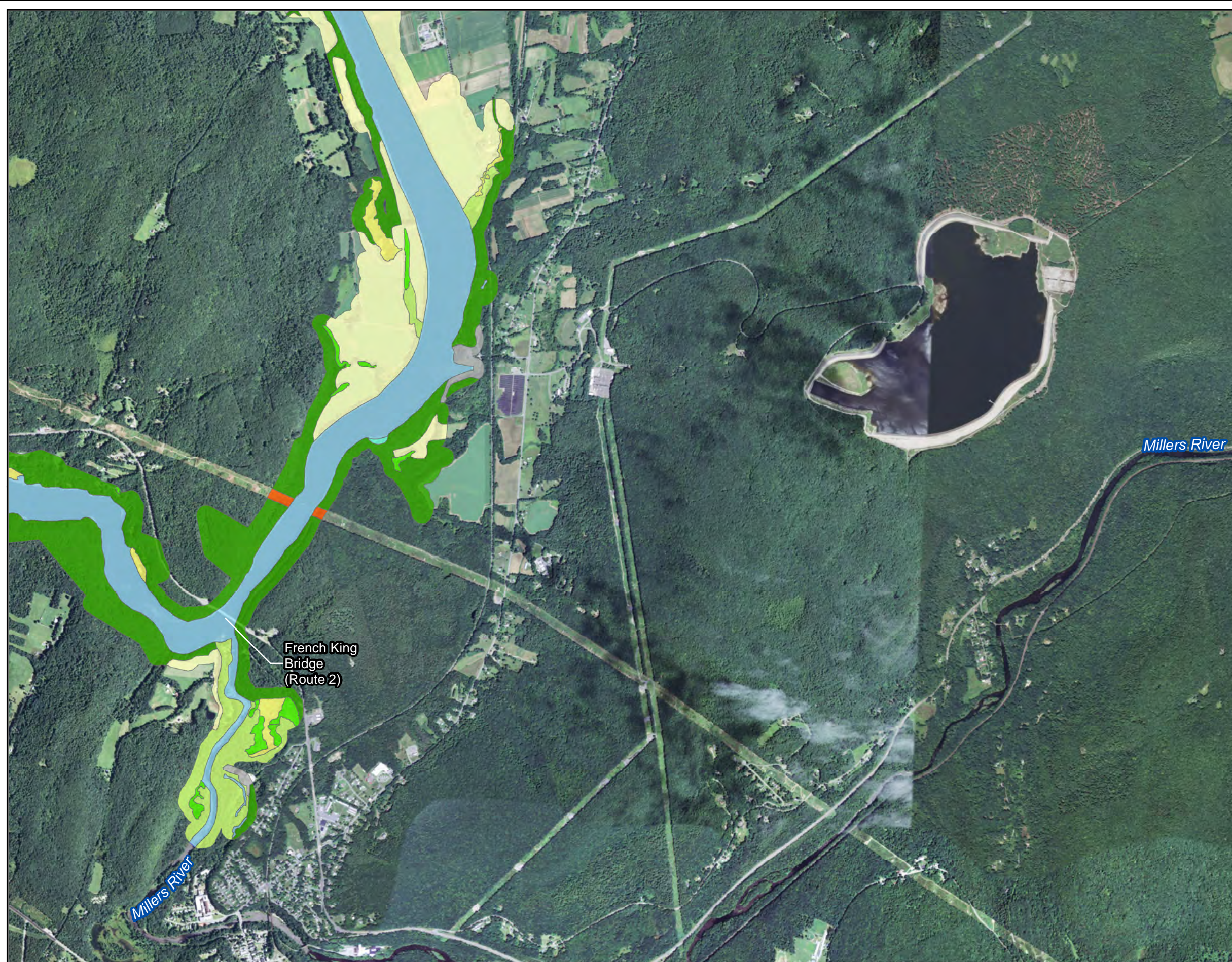
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**Northfield Mountain Pumped Storage Project (No. 2485) and  
Turners Falls Hydroelectric Project (No. 1889)**  
3.4.1 Baseline Study of Terrestrial  
and Botanical Resources  
Figure 4.3-1 Map 4  
Vegetation Communities in the Study Area

**Legend**

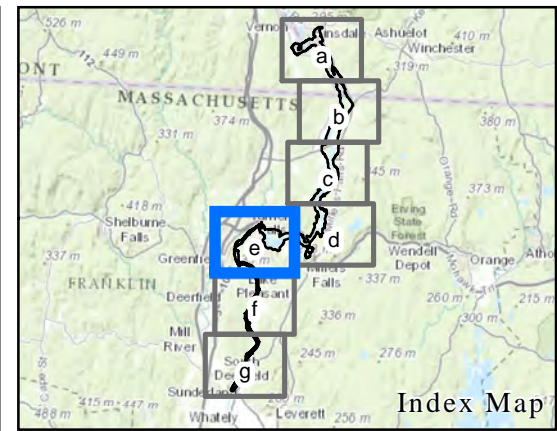
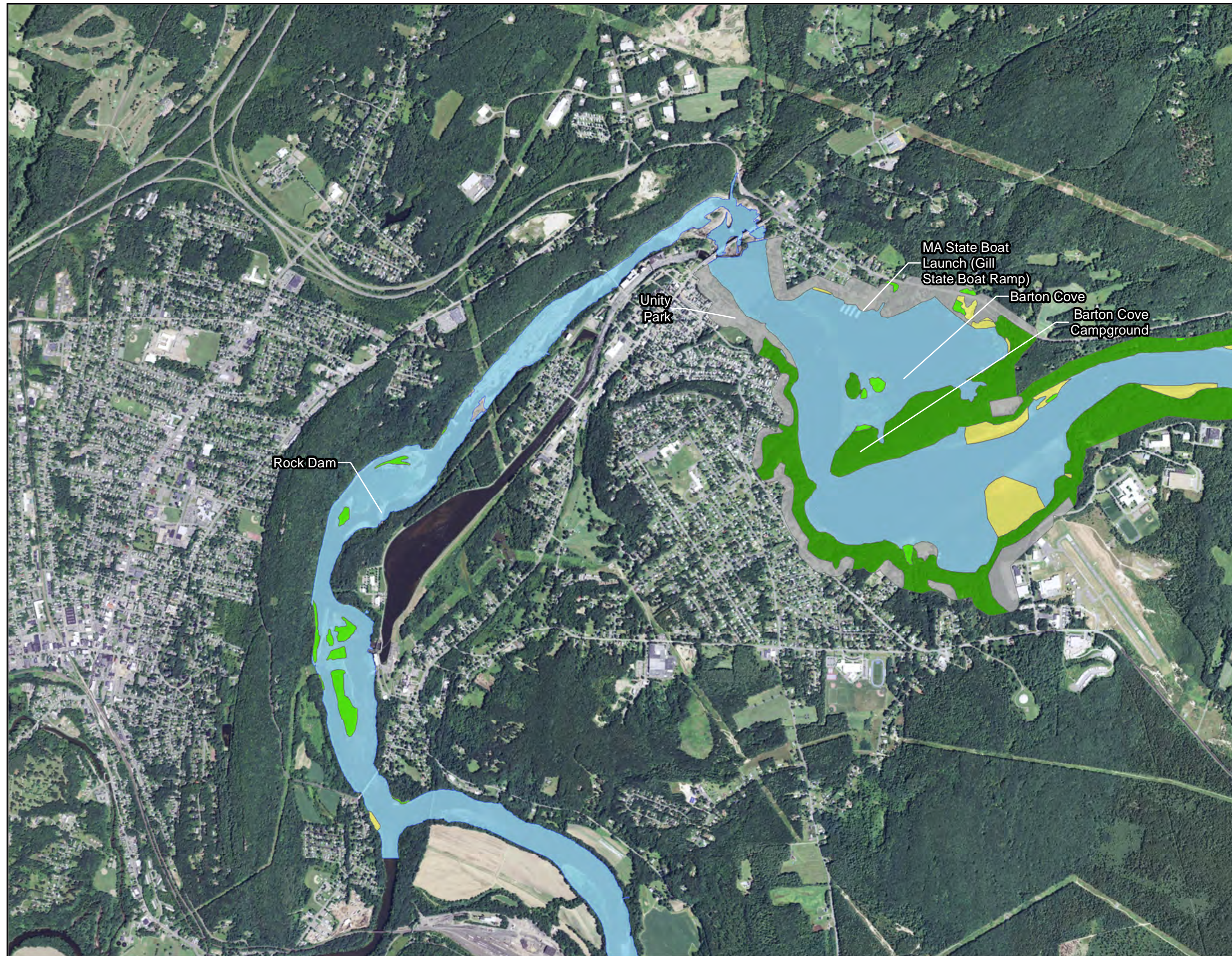
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- Floodplain Forest
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- High Energy Shore
- Northern Hardwoods - Hemlock - White Pine Forest
- Right-of-Way
- Successional Northern Hardwood
- Water

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1 inch = 2,000 feet



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**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.3-1 Map 5  
 Vegetation Communities in the Study Area

**Legend**

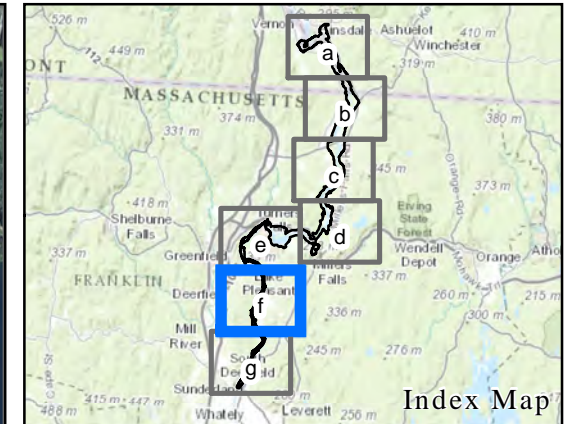
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- Development
- Floodplain Forest
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- High Energy Shore
- Northern Hardwoods - Hemlock - White Pine Forest
- Right-of-Way
- Successional Northern Hardwood
- Water

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap

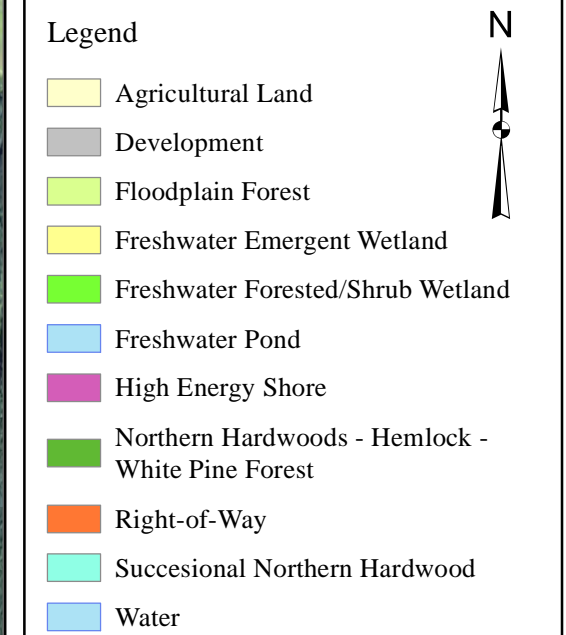
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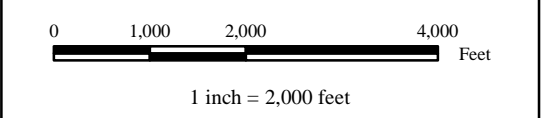
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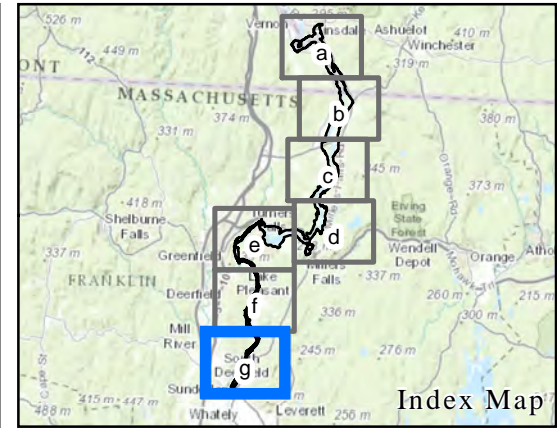
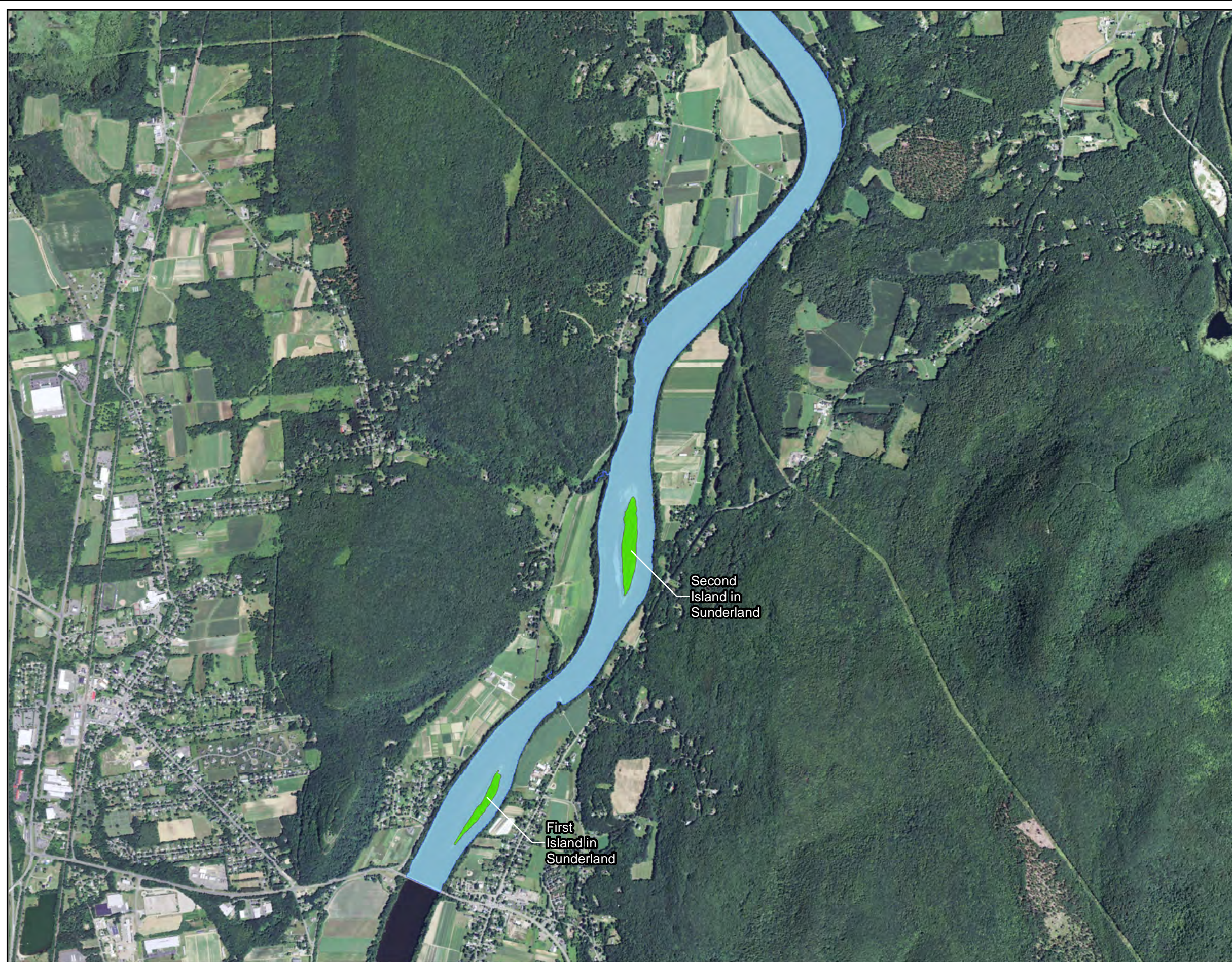
**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.3-1 Map 6  
 Vegetation Communities in the Study Area



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**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.3-1 Map 7  
 Vegetation Communities in the Study Area

**Legend**

- Agricultural Land
- Development
- Floodplain Forest
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- High Energy Shore
- Northern Hardwoods - Hemlock - White Pine Forest
- Right-of-Way
- Successional Northern Hardwood
- Water

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#### 4.3.1 Floodplain Forests

Floodplain forests are characterized by annual flood events that provide alluvial deposition and minimize the development of an organic surficial soil layer (A-horizon). Silver maple (*Acer saccharinum*) dominates these assemblages and is accompanied by sycamore (*Plantanus occidentalis*), cottonwood (*Populus deltoides*), red maple (*Acer rubrum*), ash (*Fraxinus spp.*), American elm (*Ulmus americana*), and willow (*Salix spp.*). A shrub layer is generally lacking; however, saplings of overstory trees are common. The herbaceous layer is typically an even mixture of wood-nettle (*Laportea canadensis*), ostrich fern (*Metteuccia struthiopteris*), sensitive fern (*Onoclea sensibilis*) and false nettle (*Boehmeria cylindrical*). Within the study area, these limited floodplain forests are the dominant forest type present along the main stem of the Connecticut River, islands, and its major tributaries. The photograph below provides a depiction of this typical community in which silver maple was observed with a dense understory of wood-nettle.



**Figure 4.3.1-2: Example of Floodplain Forest Adjacent to Boat Launch Located Approximately 0.75 Miles Upstream of Northfield Road Bridge (Downstream Left)**

#### 4.3.2 Northern Hardwoods-Hemlock-White Pine Forest

Northern hardwoods - hemlock - white pine forest is the dominant vegetated community along the shoreline from Barton Cove upstream to the French King Bridge. This forest type is associated with a closed canopy forest of a mixture of deciduous and evergreen trees, with sparse shrub and herbaceous layers. This is the predominant hardwood forest community type throughout much of northern New England, and the cooler parts of Massachusetts (Swain & Kersey, 2011). The forest is dominated by a mix of sugar maple (*Acer saccharum*), American beech (*Fragus grandifolia*), yellow birch (*Betula alleghaniensis*) and red oak (*Quercus rubra*) in variable proportions, with eastern hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) intermingled throughout. American beech tend to dominate on drier locations. Occurrences with large portions of white pine are usually recovering from a past disturbance where the land was open. Hemlock is typically dominate in ravines or cool edges of wetlands. Black cherry (*Prunus serotina*), white birch (*Betula papyrifera*), red maple, and other early successional tree species are often scattered, with occurrences in the subcanopy with striped maple (*Acer pensylvanicum*), and sometimes ironwood (*Carpinus caroliniana*). The shrub layer is usually open, but may have clumps of hobblebush (*Viburnum alinifolium*) and elderberry (*Sambucus canadensis*). Individuals of honeysuckle (*Lonicera sp.*) and currant (*Ribes sp.*) are characteristically present. The diverse but sparse herb layer includes Christmas fern (*Polystichum acrostichoides*), Canada mayflower (*Maianthemum canadensis*), club mosses (*Lycopodium*), asters (*Aster sp.*), trillium (*Trillium sp.*), violet (*Viola sp.*), and bluebead lily (*Clintonia borealis*), which appear in the spring.





**Figure 4.3.2-1: Typical Rocky Shoreline Habitat and Northern Hardwoods - Hemlock -White Pine Forest along Turners Falls Impoundment Shoreline between Barton Cove and French King Bridge**

#### 4.3.3 Successional Northern Hardwoods

Successional northern hardwoods are a broadly defined time sequence of forest communities, from thick young sprouts with little diversity to mature, diversifying forests with undergrowth of more shade tolerant trees. The canopy is seldom completely closed and undergrowth may be dense or open. Areas may be associated with past disturbance such as cutting, blow-down / storm damage, or fire. Aspen (*Populus tremuloides*), white birch, red maple, and /or black cherry tend to be common throughout the community. Gray birch (*Betula populifolia*) tends to be more common on very well drained soils. Pin cherry (*Prunus pensylvanica*) is a common associate. As the forest matures, the understory is comprised of young trees (typically less than 10" at diameter at breast height) of more shade tolerant species. Shrubs and herbaceous species are variable, and depend on surrounding seed sources and the type of disturbance that established the early successional community. Successional northern hardwood forests are found intermingled throughout the study area and are typical of transition areas and edge habitat around developed areas and agricultural lands. Arrowwood (*Viburnum dentatum*) and staghorn sumac (*Rhus hirta*) were also observed in some areas considered to be part of this forest community.



**Figure 4.3.3-1: Example of Successional Hardwoods**

#### *4.3.4 Calcareous Rock Cliff Community*

Rock Cliff Communities all occur on a more or less vertical bedrock cliff faces. They have extremely sparse scattered vascular plants on ledges and in crevices. Calcareous rock cliffs have vegetation that is more distinct and specific to the habitat. Purple cliff brake (*Pellaea atropurpurea*), maidenhair spleenwort (*Asplenium trichomanes*), blunt-lobed cliff-fern (*Woodsia obtusa*), and columbine (*Aquilegia canadensis*) are characteristic of calcareous cliffs. Surrounding vegetation tends to be northern hardwood forest. This is a more uncommon community found throughout Massachusetts and is host to several unusual plants. A Calcareous Rock Cliff community exists on the western bank of the TFI extending upstream and downstream of the French King Bridge.



**Figure 4.3.4-1: Calcareous Cliff Habitat**

(Host site of purple cliff brake - Sensitive plant watch list species) West Bank Upstream of French King Bridge

#### 4.3.5 *Agricultural Lands*

Land use along the corridor of the Connecticut River is primarily rural and agricultural. In the study area, approximately 23% of the land use is classified as agricultural/open field habitat. These lands are managed and go through several vegetative changes within a growing season. The edge habitat of agricultural lands can be vulnerable to the introduction of invasive species. Invasive species also favor these edges as a result of abundant sunlight which promotes favorable growing conditions. Most agricultural land within the study area is a mosaic of various croplands, with few lands used for active livestock pasture. There were relatively few instances where agricultural fields were cleared to the river's edge. Typically, there exists a narrow buffer of forested land which offers erosion protection along the shoreline.



**Figure 4.3.5-1: Example of Agricultural Land in the Study Area**



**Figure 4.3.6-2: Agricultural Land at Pauchaug Boat Launch**  
This hayfield is mowed 2-3 times a year.

#### 4.3.6 High Energy Riverbanks

High-energy riverbank communities are associated with steep gradient, fast-moving water, alluvial deposition and scour. These environments have limited plant growth and cover and were observed in the bypass reach and on the upstream ends of riverine islands – specifically, Sunderland Islands in Deerfield, MA. The upper reaches of some island communities transitioned into a band of invasive shrubs and vines, then transitioned further upland into floodplain and hardwood communities, previously described.

The bypass reach is approximately 2.7 miles long. Fall River, located near the head of the bypass channel, discharges into the bypass reach. Station No. 1 discharges into the bypass reach approximately 0.9 miles downstream of the Turners Falls Dam. The bypass is a unique habitat comprised of a mosaic of high energy shoreline and exposed bedrock. This habitat has sparse areas of vegetation including silky dogwood (*Cornus amomum*), sandbar willow (*Salix exigua*), sandbar cherry (*Prunus pumila*), dogbane (*Apocynum spp.*) and beggartick (*Bidens frondosa*). The eastern side of the bypass is occupied by historic industrial developments with numerous discharge locations that supported the historic industries that were built on the canal. The western side of the bypass is steeply sloping woodlands of Rocky Mountain Park. Rocky Mountain Park is part of the Pocumtuck Ridge, and is the northernmost subrange of the Metacomet Ridge mountain range of southern New England known for its continuous high cliffs, scenic vistas, and microclimate ecosystems containing species common to the northern hardwoods ecosystem types. Eastern hemlocks crowd narrow ravines, blocking sunlight and creating damp, cool growing conditions with associated cool climate plant species. Talus slopes are especially rich in nutrients and support several calcium-loving plants uncommon in the region. The Massachusetts Audubon Society considers the Rocky Mountain section of Pocumtuck Ridge exceptionally rich in its diversity of bird species, and an especially important area for migratory, breeding, and wintering birds.



**Figure 4.3.7-1: Typical Habitat of Bypass During Low-Flow in Late Summer**



**Figure 4.3.7-2: Typical Bypass Habitat**

Note Historic Developments on Eastern Shoreline and Rocky Mountain Park on Western Shoreline



**Figure 4.3.7-3: Rock Outcrop Habitat Downstream of Turners Falls Dam**



**Figure 4.3.7-4: Bypass Habitat Downstream of Turners Falls Dam**



**Figure 4.3.7-5: Bypass Habitat from Turners Falls Road Bridge (View Upstream)**



**Figure 4.3.7-6: Bypass Habitat taken from Turners Falls Road Bridge (View Downstream)**

#### 4.3.7 Development

Portions of the upland habitat within the study area are dominated by maintained spaces (i.e., residential, commercial, or transportation corridors) and sporadic shrub or overstory vegetation, such as solitary white pines or other species. The primary vegetation in these areas is comprised of shrub and herbaceous layer vegetation. Herbaceous vegetation is dominated by mowed areas of Kentucky bluegrass (*Poa pratensis*) and the shrub layer vegetation includes glossy buckthorn (*Frangula alnus*), Russian olive (*Elaeagnus angustifolia*), and several species of northern hardwood saplings.

#### 4.3.8 Right-of-Way

This community, which is not identified by the NHESP, was identified within portions of the study area crossed by electric transmission right-of-ways. These areas are maintained by periodic vegetation management (cutting) which limits the growth of large woody vegetation. The dominant communities are shrub and herbaceous communities. Shrub layer vegetation is dominated by white pine saplings, glossy buckthorn, red cedar (*Juniperus virginiana*), and meadowsweet (*Spiraea alba* var. *latifolia*). The herbaceous community is extensive and includes several weedy species such as chicory (*Cichorium intybus*), mullein (*Verbascum thapsus*), and pearly everlasting (*Anaphalis margaritacea*). Additional herbaceous vegetation includes bracken fern (*Pteridium aquilinum*), sensitive fern (*Onoclea sensibilis*), Joe pye weed (*Eutrochium maculatum*), and milkweed (*Asclepias* sp.). Portions of these areas include gravel access roads.





**Figure 4.3.9-1: Typical Right-of-way Spanning the Connecticut River within the Study Area**

#### **4.4 Invasive Plants**

Biologists identified 21 upland invasive plants in the study area, which include MIPAG listed non-native invasive plants and one U. S. Department of Agriculture (USDA) Forestry Service early detection species (spotted knapweed; see [Table 4.4-1](#)). Because invasive species were somewhat ubiquitous along the shoreline, the relative abundance and distribution of invasive plants in the study area were mapped using estimated cover classes of <5%, 6-25%, 26-50%, > 50%. Patches of invasive species were also mapped when encountered in the field by biologists completing other studies ([Figure 4.4-1](#)). The following five (5) exotic and invasive plant species were found to be common within the study area during the 2014 and 2015 field reconnaissance surveys:

- Oriental Bittersweet (*Celastrus orbiculatus*) - found throughout the study area, particularly ubiquitous along the edge of the river where there is abundant sunlight. Highest concentrations were noted in the TFI north of Pauchaug Brook where it transitions to a more dynamic riverine environment. In the upper reaches of the TFI, Oriental bittersweet can be found covering at least 50% of the trees and shrubs along the shoreline.
- Japanese Knotweed (*Fallopia japonica*) - typically confined to discrete patches along the immediate shoreline and, in some instances, in small stands along the edge habitat of previously disturbed areas.
- Multiflora Rose (*Rosa multiflora*) - scattered throughout the study area, particularly along edges of field habitat and along shoreline/transition areas that abut agricultural lands.
- Japanese Barberry (*Berberis thunbergii*) - throughout the study area, a common forest understory shrub that forms monoculture thickets. Particularly found in low lying lands and on upland islands within the river.
- Black Swallowwort (*Cynanchum louiseae*) – found throughout study area, particularly on the banks of the river and the TFI.

Invasive species occurring within the study area are present in areas that have been cleared in the past and are subsequently labeled as disturbed habitat. The forested habitat in the study area along the river has varying amounts of invasive species abundance and distribution. Invasive species cover is between 26-50% of the vegetative cover along the shoreline in the TFI from the Route 10 Bridge upstream to Stebbins Island (just below Vernon Dam) ([Figures 4.4-2 to 4.4-4](#)).

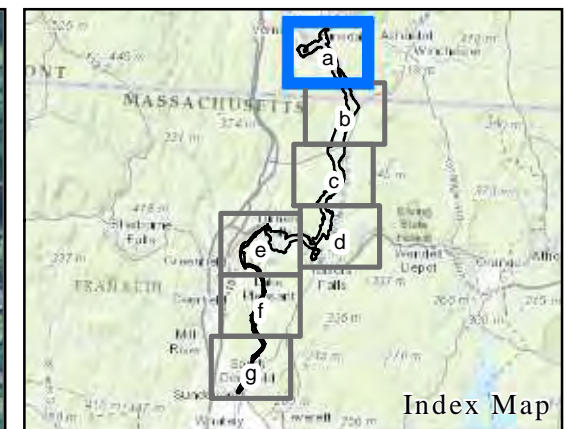
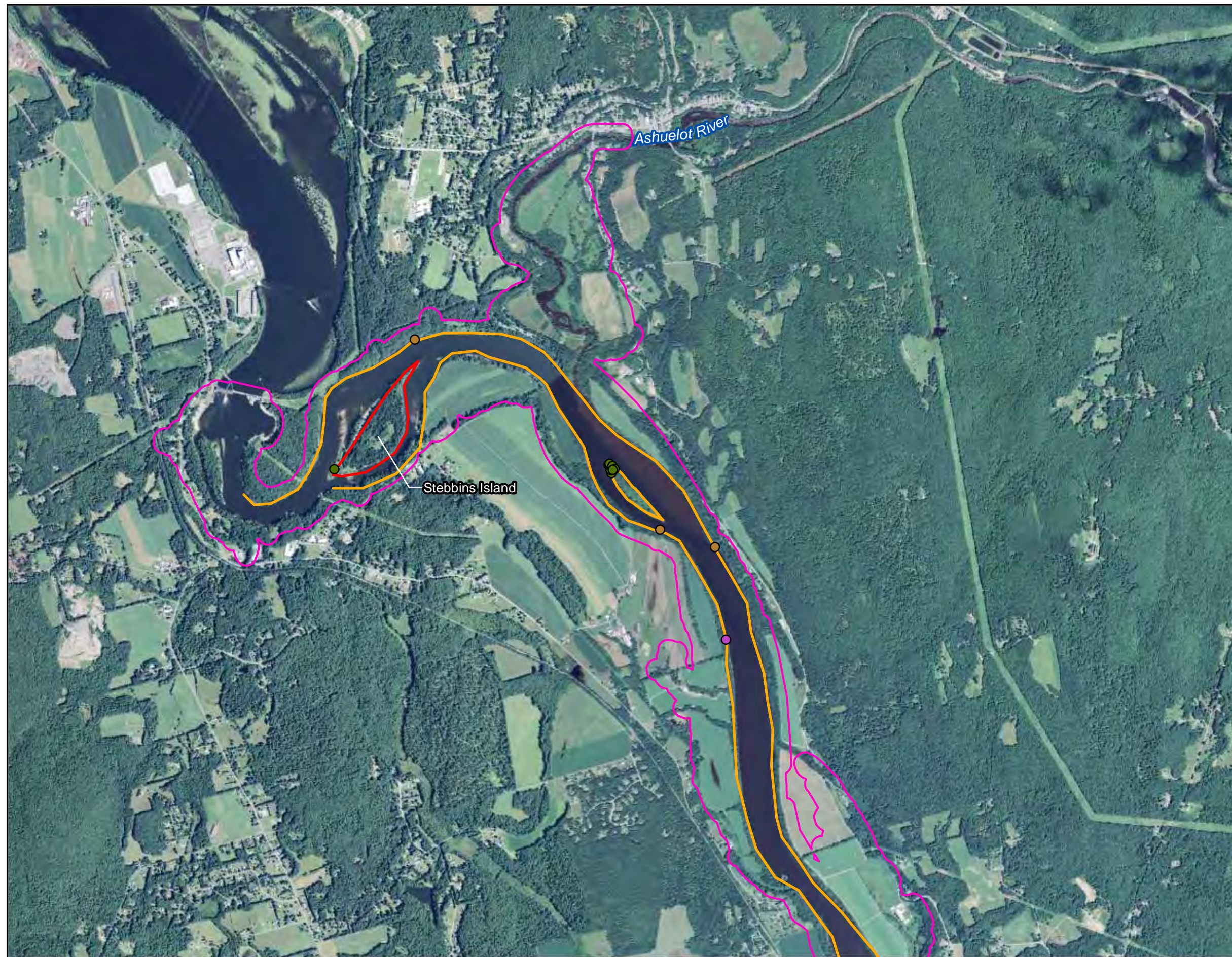
Invasive species concentrations decrease downstream of the Route 10 Bridge. Barton Cove hosts a high concentration of invasive plants particularly around the shoreline of Unity Park and around the MA state boat launch. Invasive species around the Barton Cove area are routinely mechanically cut through roadside mowing practices ([Figure 4.4-5](#)). The eastern side of the bypass, which has historically gone through many land alterations, maintains an invasive cover of 26-50% along the shoreline. This is in contrast to the undisturbed banks along the western shore of the bypass, which only contains trace amounts of invasive plants (less than 5%). Downstream of Cabot station, invasive plant species are largely limited to discrete patches and the upstream high-energy habitats of river islands where purple loosestrife and Japanese knotweed are found ([Figures 4.4.6 to 4.4.8](#)). Invasive shrubs, particularly Japanese barberry and multiflora rose, exist among the periphery of many of the recreation sites at the Project. Seed and vegetative reproduction sources for invasive species recorded at the site are prevalent in the surrounding landscape.

**Table 4.4-1: Upland Invasive Plant List in Study Area**

Scientific Name	Common Name	Lifeform Type	Notes	MIPAG Status
<i>Acer platanoides</i>	Norway maple	Tree	Common in woodlands with colluvial soils, grows full sun to full shade dispersed by water, wind and vehicles	MIPAG listed non-native invasive
<i>Alliaria petiolata</i>	Garlic mustard	Biennial Herb	Widespread, grows full sun to full shade, spreads by seed, especially in wooded areas	MIPAG listed non-native invasive
<i>Berberis thunbergii</i>	Japanese barberry	Shrub	Wooded uplands and wetlands, grows in full sun to full shade, spread by birds, forms dense stands	MIPAG listed non-native invasive
<i>Celastrus orbiculatus</i>	Oriental bittersweet	Perennial vine	Grows in full sun to partial shade, berries spread by birds and humans	MIPAG listed non-native invasive
<i>Centaurea maculosa</i>	Spotted knapweed	Perennial herb	Occurs in full sun, spreads rapidly in artificial corridors, agricultural fields, and margins.	Early Detection Species - recorded as potentially invasive in MA by USDA Forest Service
<i>Cynanchum louiseae</i>	Black swallow-wort	Perennial vine	Grows in full sun to partial shade, forms dense stands, deadly to Monarch butterfly larvae	MIPAG listed non-native invasive
<i>Elaeagnus umbellata</i>	Autumn olive	Shrub	Grows in full sun, berries spread by birds, aggressive in open areas	MIPAG listed non-native invasive
<i>Euonymus alatus</i>	Burning bush	Shrub	Capable of germinating in full sun to full shade. Escapes from cultivation and can form dense thickets and dominate the understory	MIPAG listed non-native invasive
<i>Euphorbia esula</i>	Leafy spurge	Perennial herb	Occurs in grasslands	MIPAG listed non-native invasive
<i>Fallopia japonica</i>	Japanese knotweed	Perennial Herb-subshrub	Widespread, grows in full sun to full shade, spreads vegetatively and by seed, forms dense thickets	MIPAG listed non-native invasive
<i>Lonicera japonica</i>	Japanese honeysuckle	Perennial vine	Widespread, grows full sun to full shade, climbs vegetation, seeds dispersed by birds	MIPAG listed non-native invasive
<i>Lonicera morrowii</i>	Morrow's honeysuckle	Shrub	Widespread, grows full sun to full shade, dispersed by birds, can hybridize with other honeysuckle species	MIPAG listed non-native invasive
<i>Lysimachia nummularia</i>	Creeping jenny	Perennial herb	Occurs in uplands and wetlands, grows in full sun to full shade, forms dense mats	MIPAG listed non-native invasive

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Scientific Name	Common Name	Lifeform Type	Notes	MIPAG Status
<i>Lythrum salicaria</i>	Purple loosestrife	Perennial herb	Occurs in uplands and wetlands, grows in full sun to partial shade, high seed production, overtakes wetlands	MIPAG listed non-native invasive
<i>Phalaris arundinacea</i>	Reed canary grass	Perennial grass	Occurs in uplands and wetlands, grows full sun to partial shade, can form large colonies, common in agricultural settings	MIPAG listed non-native invasive
<i>Phragmites australis</i>	Common reed	Perennial grass	Grows in uplands and wetlands, full sun to full shade, forms dense stands, flourishes in disturbed areas	MIPAG listed non-native invasive
<i>Polygonum perfoliatum</i>	Mile-a-minute	Perennial vine	Occurs in streamside, fields, and road edges in full sun to partial shade; highly aggressive.	MIPAG listed non-native invasive
<i>Ranunculus ficaria</i>	Lesser celandine	Perennial herb	Occurs in lowland and upland woods, grows in full sun to full shade, spreads vegetatively and by seed, forms dense stands	MIPAG listed non-native invasive
<i>Rhamnus cathartica</i>	Common buckthorn	Shrub-tree	Occurs in uplands and wetlands, grows in full sun to full shade.	MIPAG listed non-native invasive
<i>Robinia pseudoacacia</i>	Black locust	Tree	Occurs in uplands, grows full sun to full shade, aggressive in areas with sandy soils	MIPAG listed non-native invasive
<i>Rosa multiflora</i>	Multiflora rose	Shrub	Widespread, grows in full sun to full shade, forms thorny thickets, dispersed by birds.	MIPAG listed non-native invasive



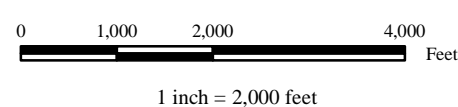
**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
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 Relative Abundance and Distribution of Invasive Plants in the Study Area

**Legend**

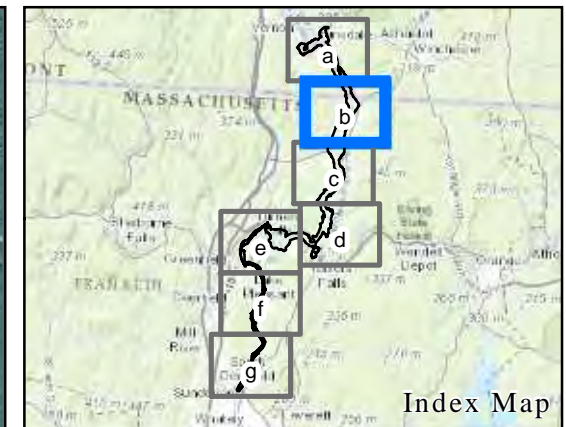
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<span style="color: green;">—</span> <5%	<span style="color: orange;">●</span> C. orbiculatus
<span style="color: yellow;">—</span> 5-25%	<span style="color: purple;">●</span> F. japonica
<span style="color: orange;">—</span> 25-50%	<span style="color: green;">●</span> L. salicaria
<span style="color: red;">—</span> >50%	



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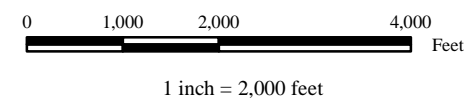
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 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.4-1 Map 2  
 Relative Abundance and Distribution of Invasive Plants in the Study Area

**Legend**

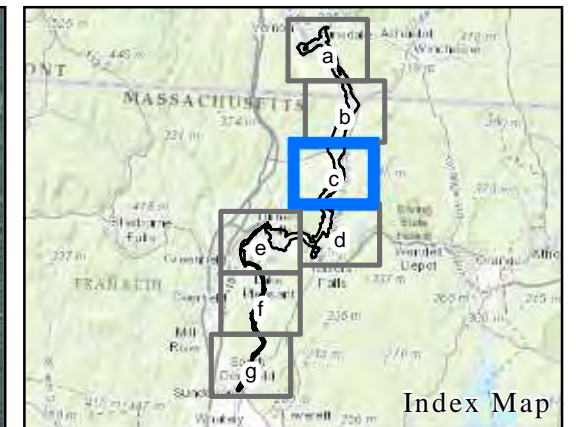
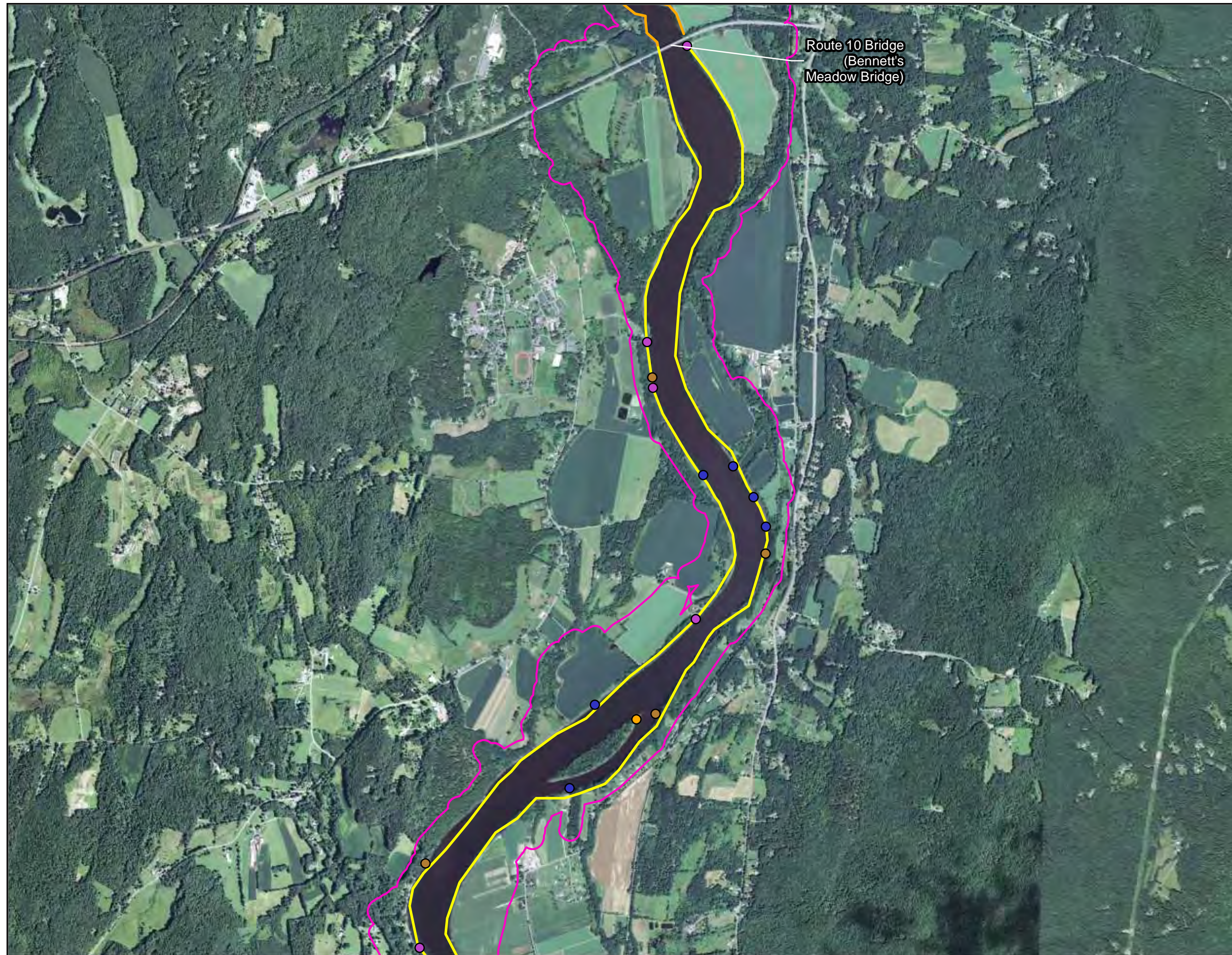
<b>Shoreline Invasive Species Coverage</b>	<b>Invasive Species</b>
<5%	C. orbiculatus
5-25%	F. japonica
25-50%	P. australis
>50%	



Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap



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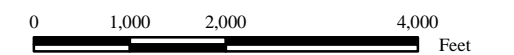
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 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.4-1 Map 3  
 Relative Abundance and Distribution of Invasive Plants in the Study Area

**Legend**

Shoreline Invasive Species Coverage	Invasive Species
<span style="color: green;">—</span> <5%	<span style="color: brown;">●</span> C. orbiculatus
<span style="color: yellow;">—</span> 5-25%	<span style="color: purple;">●</span> F. japonica
<span style="color: orange;">—</span> 25-50%	<span style="color: blue;">●</span> P. australis
<span style="color: red;">—</span> >50%	<span style="color: orange;">●</span> C. louisae



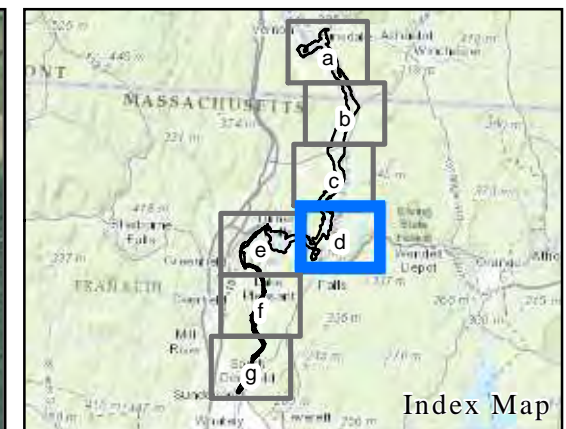
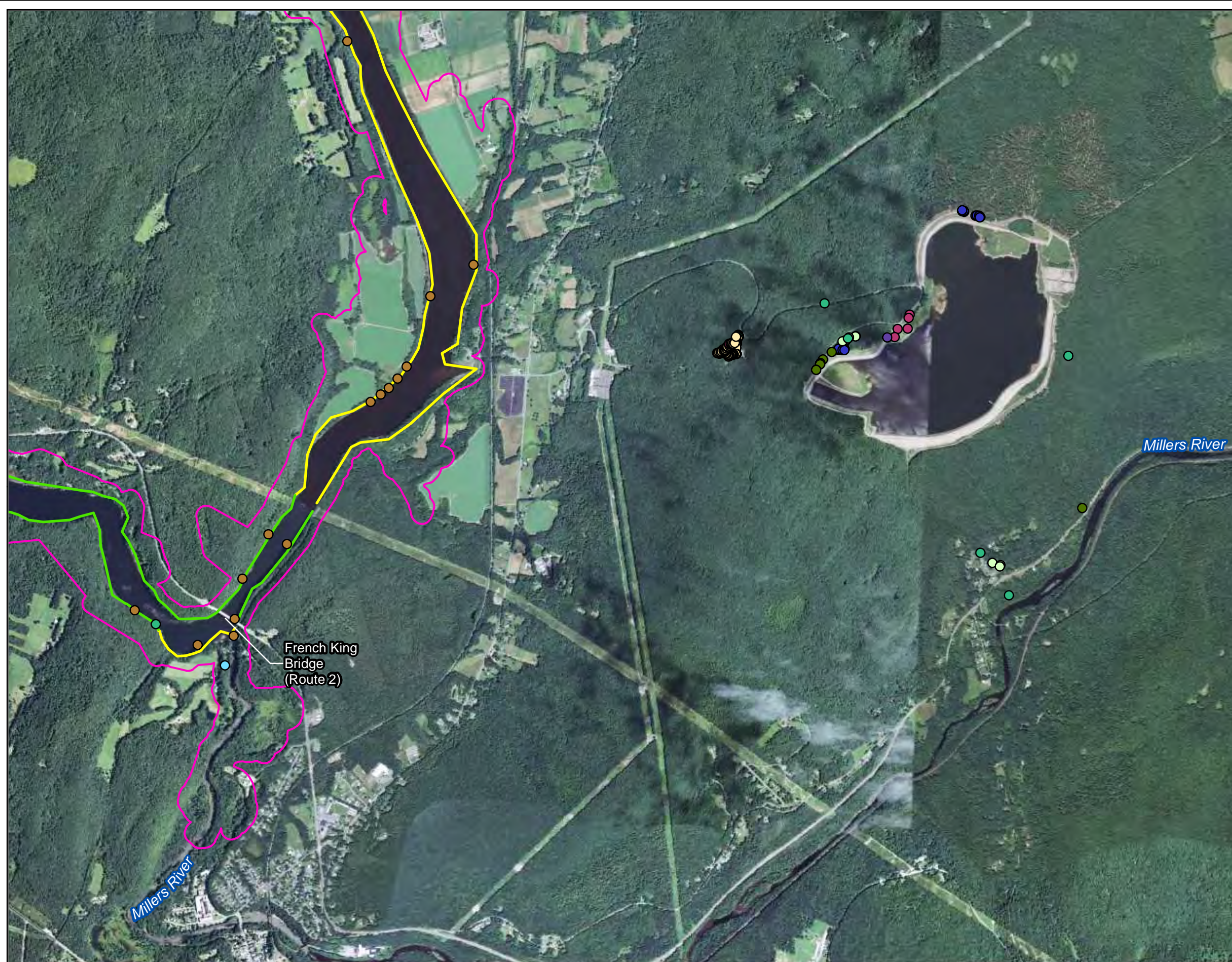
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**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.4-1 Map 4  
 Relative Abundance and Distribution of Invasive Plants in the Study Area

**Legend**

<b>Shoreline Invasive Species Coverage</b>	<b>Invasive Species</b>
<span style="color: green;">—</span> <5%	<span style="color: green;">●</span> B. thunbergii
<span style="color: yellow;">—</span> 5-25%	<span style="color: red;">●</span> C. maculosa
<span style="color: orange;">—</span> 25-50%	<span style="color: brown;">●</span> C. orbiculatus
<span style="color: red;">—</span> >50%	<span style="color: yellow;">●</span> E. umbellata
	<span style="color: purple;">●</span> L. japonica
	<span style="color: green;">●</span> L. salicaria
	<span style="color: blue;">●</span> P. australis
	<span style="color: lightgreen;">●</span> R. multiflora
	<span style="color: cyan;">●</span> E. alatus

N

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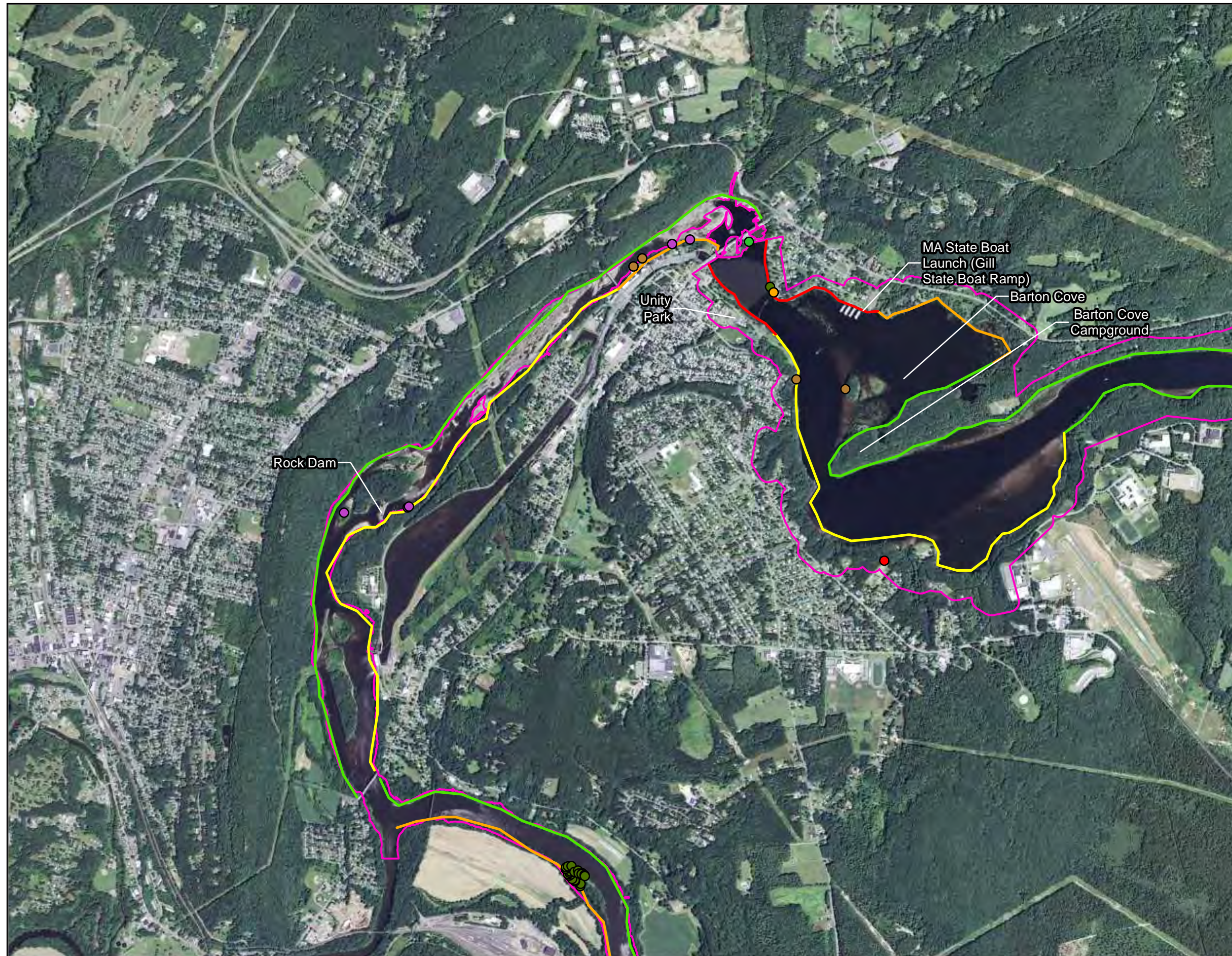
0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet



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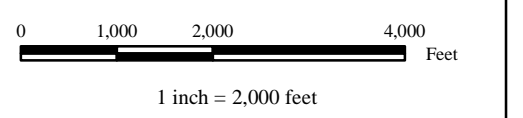
**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.4-1 Map 5  
 Relative Abundance and Distribution of Invasive Plants in the Study Area

**Legend**

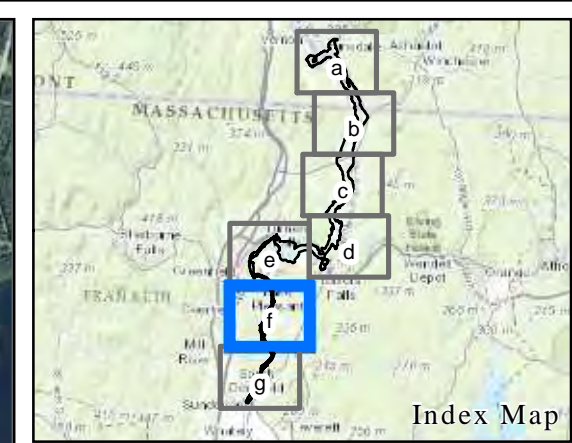
<b>Shoreline Invasive Species Coverage</b>	<b>Invasive Species</b>
<5%	C. orbiculatus
5-25%	F. japonica
25-50%	L. salicaria
>50%	T. natans
	C. louiseae
	P. perfoliata



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**Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)**  
 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.4-1 Map 6  
 Relative Abundance and Distribution of Invasive Plants in the Study Area

**Legend**

**Shoreline Invasive Species Coverage**

- <5%
- 5-25%
- 25-50%
- >50%

N

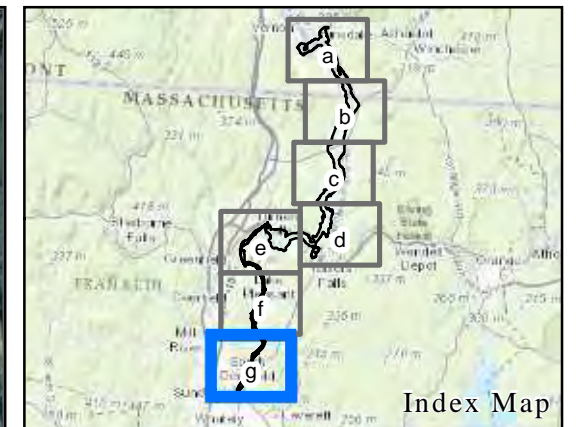
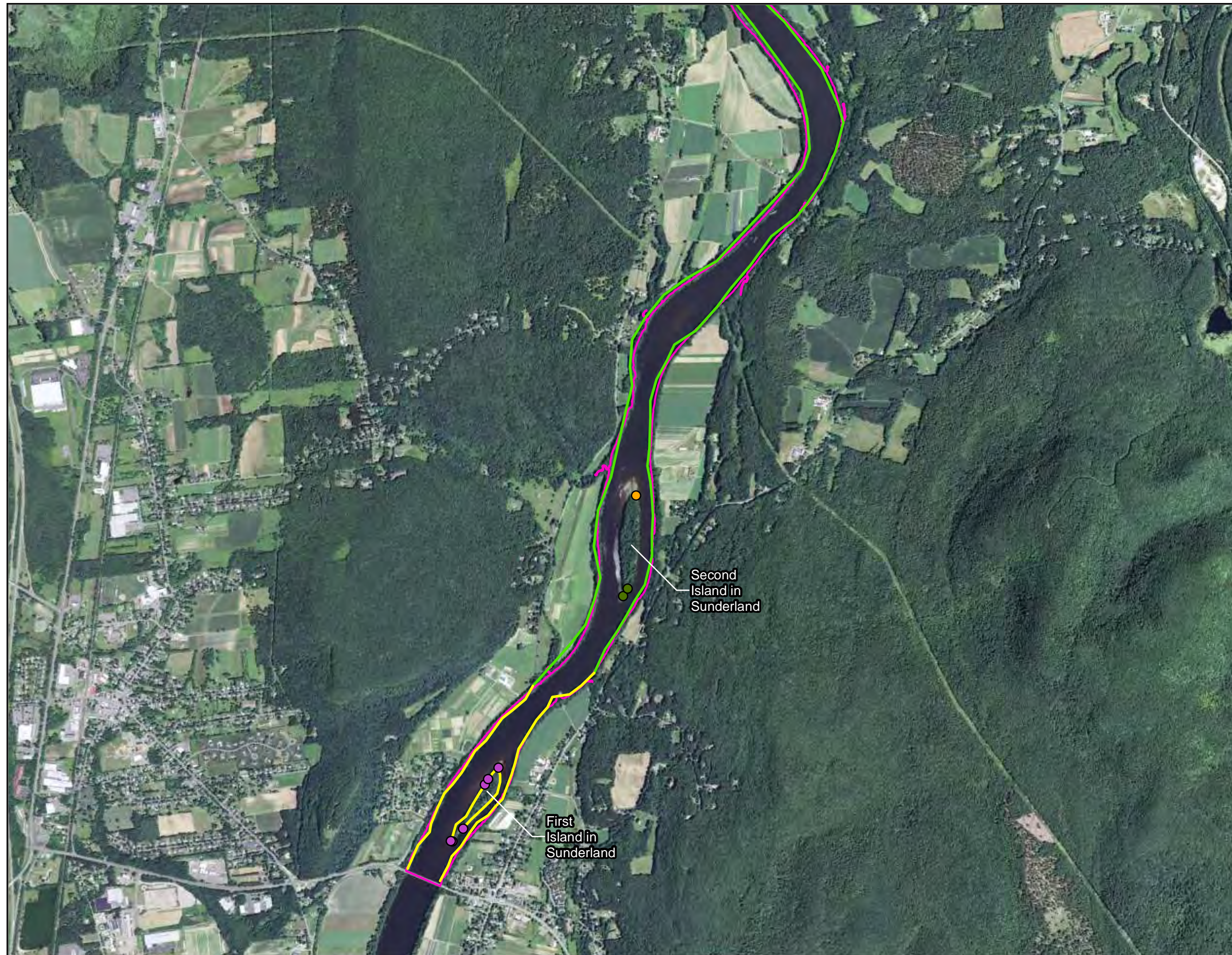
Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap

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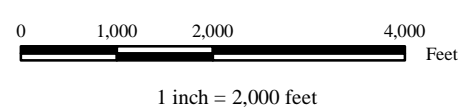
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 3.4.1 Baseline Study of Terrestrial and Botanical Resources  
 Figure 4.4-1 Map 7  
 Relative Abundance and Distribution of Invasive Plants in the Study Area

**Legend**

<b>Shoreline Invasive Species Coverage</b>	<b>Invasive Species</b>
<span style="color: green;">—</span> <5%	<span style="color: purple;">●</span> F. japonica
<span style="color: yellow;">—</span> 5-25%	<span style="color: green;">●</span> L. salicaria
<span style="color: orange;">—</span> 25-50%	<span style="color: orange;">●</span> C. louiseae
<span style="color: red;">—</span> >50%	



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**Figure 4.4-2: Typical Japanese Barberry Dominated Understory in Upper Reaches of Turners Falls Impoundment (Stebbins Island)**



**Figure 4.4-3: Example of Japanese Knotweed Stand in Turners Falls Impoundment Along Armored Shoreline**



**Figure 4.4-4: Example of Common Invasive Species along Shoreline (Japanese Knotweed, Multiflora Rose, and Oriental Bittersweet) in Upper Stretch of the Turners Falls Impoundment (North of Route 10 Bridge)**



**Figure 4.4-5: Example of Vegetation Management at Unity Park Upstream of Turners Falls Dam**



**Figure 4.4-6: Japanese Knotweed Patch on Second Island in Sunderland**



**Figure 4.4-7: Example of invasive Oriental Bittersweet Covering Trees**



**Figure 4.4-8: Example of Purple Loosestrife on Upstream Face of River Islands (Photo at Sunderland Second Island)**

## **5 DISCUSSION**

The Turners Falls and Northfield Mountain Projects have little effect on botanical and wildlife resources within the study area and bordering lands. The occurrence and distribution of wildlife and botanical resources in the study area are generally unrelated to the Turners Falls and Northfield Mountain Projects and/or Project operations. The majority of invasive species found in the study area are upland species, above the water level. Recreational activities in the study area do not appear to cause extensive harm on wildlife. Wildlife as well as botanical resources within the study area may be negatively affected by vegetation management and maintenance of development lands around the TFI and the maintenance of development-related access ways. As such, there is some potential for ground disturbing activities (i.e., land clearing construction activities), which may result in the spread or propagation of invasive species. In addition recreational facilities (i.e., boat launches) may allow for the movement or introduction of invasive vegetation (both terrestrial and aquatic). However, such effects would be minimized through construction related vegetation management planning.



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# **APPENDIX A – LIST OF MAMMALS**

**Table A.1 List of Mammals Observed or Likely to Occur in Study Area**

<b>Common Name</b>	<b>Scientific name</b>
Beaver*	<i>Castor canadensis</i>
Black bear*	<i>Ursus americanus</i>
Bobcat	<i>Felix rufus</i>
Coyote*	<i>Canis latrans</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Eastern chipmunk*	<i>Tamias striatus</i>
Eastern mole	<i>Scalopus aquaticus</i>
Fisher	<i>Martes pennanti</i>
Gray fox*	<i>Urocyon cinereoargenteus</i>
Gray squirrel*	<i>Sciurus carolinensis</i>
Hairy-tailed mole	<i>Parascalops breweri</i>
Hoary bat	<i>Lasiurus cinereus</i>
House mouse	<i>Mus musculus</i>
Long-tailed shrew	<i>Sorex dispar</i>
Masked shrew	<i>Sorex cinereus</i>
Meadow jumping mouse	<i>Zapus hudsonius</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Muskrat*	<i>Ondatra zibethicus</i>
New England cottontail*	<i>Sylvilagus transitionalis</i>
Northern short-tailed shrew	<i>Blarina brevicauda</i>
Norway rat	<i>Rattus norvegicus</i>
Porcupine *	<i>Erethizon dorsatum</i>
Raccoon*	<i>Procyon lotor</i>
Red bat	<i>Lasiurus borealis</i>
Red fox*	<i>Vulpes vulpes</i>
Red squirrel*	<i>Tamiasciurus hudsonicus</i>
River otter	<i>Lontra canadensis</i>
Silver-haired bat	<i>Lasionycteris noctivagans</i>
Star-nosed mole	<i>Condylura cristata</i>
Striped skunk*	<i>Mephitis mephitis</i>
Virginia opossum *	<i>Didelphis virginiana</i>
White-footed mouse	<i>Peromyscus leucopus</i>
White-tailed deer*	<i>Odocoileus virginianus</i>
Woodchuck	<i>Marmota monax</i>
Woodland jumping mouse	<i>Napaeozapus insignis</i>
Woodland vole	<i>Microtus pinetorum</i>

\* Denotes Direct Observation

\*\* Denotes Indirect Observation

# **APPENDIX B – LIST OF REPTILES AND AMPHIBIANS**

**Table B.1 List of Reptiles and Amphibians Observed or Likely to Occur in the Study Area**

<b>Common Name</b>	<b>Scientific name</b>
<b>Frogs &amp; Toads</b>	
American bullfrog*	<i>Lithobates catesbeiana</i>
American toad*	<i>Anaxyrus americanus</i>
Fowler's toad	<i>Bufo fowleri</i>
Gray treefrog*	<i>Hyla versicolor</i>
Green frog*	<i>Lithobates clamitans</i>
Northern leopard frog	<i>Lithobates pipiens</i>
Pickerel frog*	<i>Lithobates palustris</i>
Spring peeper*	<i>Pseudacris crucifer</i>
Wood frog*	<i>Lithobates sylvatica</i>
<b>Salamanders</b>	
Eastern red-backed salamander*	<i>Plethodon cinereus</i>
Northern dusky Salamander*	<i>Desmognathus fuscus</i>
Red -spotted newt*	<i>Notophthalmus viridescens</i>
Spotted salamander *	<i>Ambystoma maculatum</i>
<b>Snakes</b>	
Common ribbon snake	<i>Thamnophis sauritus</i>
Eastern garter snake*	<i>Thamnophis sirtalis</i>
Eastern ratsnake	<i>Pantherophis alleghaniensis</i>
Northern black racer*	<i>Coluber constrictor</i>
Northern red-bellied snake	<i>Storeria occipitomaculata</i>
Northern ring-necked snake	<i>Diadophis punctatus edwardsii</i>
Northern watersnake*	<i>Nerodia sipedon</i>
<b>Turtles</b>	
Wood turtle	<i>Glyptemys insculpta</i>
Snapping turtle*	<i>Chelydra serpentina</i>
Eastern box turtle	<i>Terrapene carolina carolina</i>

## **APPENDIX C – LIST OF AVIAN SPECIES**

**2014 List of Documented Birds within Study Area**  
**Bold X Indicates Commonly Observed Species**

Species	CT River	Northfield Mountain					
		Total area	NW Slope	NE Slope	SE Slope	SW Slope	Reservoir
Baltimore Oriole	X						
Brown-headed Cowbird	X						
Common Grackle	X						
Orchard Oriole	X						
Red-winged Blackbird	X						
Double-crested Cormorant	X						
American Crow	X	X	X		X		X
Blue Jay	X	<b>X</b>	X	X	X	X	
Common Raven	X	X			X		
Black-billed Cuckoo	X	X	X				
Yellow-billed Cuckoo	X						
Canada Goose	X						
Common Merganser	X						
Mallard	X						
Mute Swan	X						
Wood Duck	X						
American Goldfinch	X	X	X		X		
Chipping Sparrow		X	X		X	X	<b>X</b>
Eastern Towhee		X	X				
Field Sparrow		X					X
Indigo Bunting	X	X	X	X	X		<b>X</b>
Rose-breasted Grosbeak		X	X		X		
Song Sparrow	<b>X</b>	X	X				X
Eastern Kingbird	X						
Eastern Phoebe	X	X	X	X	X	X	
Eastern Wood-Pewee		X	<b>X</b>	X	X	<b>X</b>	
Great Crested Flycatcher	X	X	X		X	X	
Least Flycatcher	X						
Wild Turkey		X	X		X	X	X
Ruby-throated Hummingbird		X	X			X	
Belted Kingfisher	X						
Black-capped Chickadee	X	X	X		X	X	
Brown Creeper		X	X		X		
Cedar Waxwing	X	X	X	X		X	X
Eastern Bluebird		X					X
European Starling		X	X				
Gray Catbird	<b>X</b>	X	X				
Northern Cardinal	X	X	X				
Northern Mockingbird		X	X				
Red-breasted Nuthatch		X	X		X		
Scarlet Tanager	X	X	X	X	X	X	
Tufted Titmouse	X	X	X		X	X	
White-breasted Nuthatch	X	X	X	X	X	X	
Winter Wren		X	X		X		



Species (continued)	CT River	Northfield Mountain					
		Total area	NW Slope	NE Slope	SE Slope	SW Slope	Reservoir
Rock Pigeon	X						
Bald Eagle	X	X					X
Coopers Hawk	X						
Broad-winged Hawk	X						
Osprey	X						
Peregrine Falcon		X			X		
Red-tailed hawk	X	X		X	X		
Turkey Vulture	X	X	X				X
Killdeer	X	X					X
Spotted Sandpiper	X	X					X
Greater Yellowlegs	X						
Bank Swallow	X	X					X
Barn Swallow	X						
Northern Rough-winged Swallow	X						
Tree Swallow	X	X					X
Chimney Swift	X						
American Robin	X	X	X		X		X
Hermit Thrush		X	X		X	X	
Veery	X	X	X	X	X	X	
Wood Thrush	X	X	X	X	X	X	
Blue-headed Vireo		X	X		X	X	
Red-eyed Vireo	X	X	X	X	X	X	X
Warbling Vireo	X						
Yellow-throated Vireo		X	X				
Great Blue Heron	X						
Green Heron	X						
American Redstart	X	X	X		X		
Black and White Warbler	X	X	X	X	X	X	
Blackburnian Warbler		X	X	X	X		
Black-throated Blue Warbler		X	X	X	X	X	
Black-throated Green Warbler	X	X	X	X	X	X	
Blue-winged Warbler	X						
Chestnut-sided Warbler	X	X	X				
Common Yellowthroat	X	X	X				X
Louisiana Waterthrush	X						
Oven Bird		X	X	X	X	X	
Pine Warbler		X	X		X	X	
Prairie Warbler		X	X				
Yellow Warbler	X						
Downy Woodpecker	X	X	X				
Hairy Woodpecker		X	X		X	X	
Northern Flicker		X				X	X
Pileated Woodpecker	X	X	X	X	X	X	
Yellow-bellied Sapsucker	X	X			X	X	
<b>Total Number Observed</b>	<b>64</b>	<b>59</b>	<b>47</b>	<b>17</b>	<b>36</b>	<b>26</b>	<b>18</b>

## **APPENDIX D – LIST OF PLANTS**

**Table D.1: Botanical Species Found in the Study Area**

Scientific Name	Common Name
<i>Acalypha rhomboidea</i>	three seed mercury
<i>Acer pensylvanicum</i>	striped maple
<i>Acer platanoides</i> **	Norway maple
<i>Acer negundo</i>	box elder
<i>Acer rubrum</i>	red maple
<i>Acer saccharinum</i>	silver maple
<i>Acer saccharum</i>	sugar maple
<i>Acer trilobum</i>	maple-leaved viburnum
<i>Achillea millefolium</i>	yarrow
<i>Acorus americanus</i>	sweetflag
<i>Adiantum pedatum</i>	maiden-hair fern
<i>Agalinis tenuifolia</i>	slender gerardia
<i>Ageratina altissima</i>	white snakeroot
<i>Alisma subcordatum</i>	common water plantain
<i>Alliaria petiolate</i> **	garlic mustard
<i>Alnus rugosa</i>	speckled alder
<i>Alnus serrulata</i>	smooth alder
<i>Alnus viridis ssp. crispa</i> *	mountain alder
<i>Ambrosia artemisiifolia</i>	common ragweed
<i>Amelanchier arborea</i>	common shadbush
<i>Amelanchier canadensis</i>	serviceberry
<i>Amorpha fruticosa</i>	false indigo
<i>Amphicarpaea bracteata</i>	hog peanut
<i>Anaphalis margaritacea</i>	pearly everlasting
<i>Andropogon gerardii</i>	big bluestem
<i>Apios americana</i>	groundnut
<i>Apocynum adrosaemifolium</i>	spreading dogbane
<i>Apocynum cannabinum</i>	clasping dogbane
<i>Aquilegia canadensis</i>	wild columbine
<i>Aralia nudicaulis</i>	sarsaparilla
<i>Arctium minus</i>	common burdock
<i>Arisaema triphyllum</i>	Jack in the pulpit
<i>Aronia melanocarpa</i>	black chokeberry
<i>Artemisia vulgaris</i>	common mugwort
<i>Asclepias syriaca</i>	common milkweed
<i>Asclepias viridiflora</i>	green milkweed
<i>Asparagus officinalis</i>	asparagus
<i>Asplenium platyneuron</i>	ebony spleenwort
<i>Asplenium trichomanes</i>	maidenhair spleenwort

Scientific Name	Common Name
<i>Aster cordifolius</i>	heart-leaved aster
<i>Aster divaricatus</i>	white wood aster
<i>Avena fatua</i>	wild oats
<i>Berberis thunbergii</i> **	Japanese barberry
<i>Betula alleghaniensis</i>	yellow birch
<i>Betula lenta</i>	black birch
<i>Betula lenta</i>	sweet birch
<i>Betula nigra</i>	river birch
<i>Betula papyrifera</i>	paper birch
<i>Bidens frondosa</i>	beggar's tick
<i>Bidens laevis</i>	larger bur marigold
<i>Boehmeria cylindrical</i>	false nettle
<i>Cladium sp.</i>	twig rush
<i>Calamagrostis canadensis</i>	bluejoint grass
<i>Caltha palustris</i>	marsh marigold
<i>Campanula rotundifolia</i>	harebell
<i>Carex deweyana</i>	Dewey's sedge
<i>Carex lurida</i>	shallow sedge
<i>Carex novae-angliae</i>	New England sedge
<i>Carex plantaginea</i>	plantain-leaved sedge
<i>Carex rosea</i>	big-star sedge
<i>Carex stricta</i>	tussock sedge
<i>Carex tonsa</i>	shaved sedge
<i>Carpinus caroliniana</i>	musclewood
<i>Catalpa speciosa</i>	northern catalpa
<i>Celastru orbiculatus</i> **	oriental bittersweet
<i>Celastrus scandens</i>	climbing bittersweet
<i>Cephalanthus occidentalis</i>	buttonbush
<i>Cerastium vulgatum</i>	mouse-ear-chickweed
<i>Chelone glabra</i>	turtle head
<i>Chimaphila maculata</i>	spotted wintergreen
<i>Chimaphila umbellata</i>	pippsissewa
<i>Cichorium intybus</i>	chickory
<i>Cicuta maculata</i>	water hemlock
<i>Circaea quadrisulcata</i>	enchanter's nightshade
<i>Cirsium arvense</i>	Canada thistle
<i>Clematis verticillaris</i>	purple virgins bower
<i>Clematis virginiana</i>	virgin's bower
<i>Commelina communis</i>	Asiatic dayflower
<i>Comptonia peregrina</i>	sweet fern

Scientific Name	Common Name
<i>Convallaria majalis</i>	lily-of-the-valley
<i>Coptis groenlandica</i>	goldthread
<i>Cornus alternifolia</i>	alternate-leaved dogwood
<i>Cornus amomum</i>	silky dogwood
<i>Cornus florida</i>	flowering dogwood
<i>Cornus obliqua</i>	pale dogwood
<i>Cornus rugosa</i>	round-leaved dogwood
<i>Cornus sericea</i>	red-oiser dogwood
<i>Crataegus sp.</i>	hawthorn
<i>Cynanchum louiseae</i> **	black swallow-wort
<i>Cyperus esculentus</i>	yellow nutsedge
<i>Danthonia compressa</i>	flattened oatgrass
<i>Daucus carota</i>	Queen Anne's lace
<i>Desmodium nudiflorum</i>	naked-flowered tick trefoil
<i>Dichanthelium clandestinum</i>	deer tongue
<i>Diervilla lonicera</i>	bush honeysuckle
<i>Doellingeria umbellata</i>	flat-top white aster
<i>Dryopteris sp.</i>	wood fern
<i>Dulichium arundinaceum</i>	three-way sedge
<i>Elaeagnus umbellata</i> **	autumn olive
<i>Elaeagnus angustifolia</i>	Russian olive
<i>Eleocharis intermedia</i> *	intermediate spike-sedge
<i>Eleocharis obtusa</i>	blunt spikerush
<i>Eleocharis palustris</i>	common spikerush
<i>Epilobium ciliatum</i>	purple leaved willow herb
<i>Equisetum fluviatile</i>	water horsetail
<i>Erigeron spp.</i>	fleabane
<i>Euonymus alatus</i> **	burning bush
<i>Eupatorium rugosum</i>	white snakeroot
<i>Eupatorium maculatum</i>	spotted joe-pyeweed
<i>Eupatorium perfoliatum</i>	boneset
<i>Eupatorium purpureum</i>	Joe-pye-weed
<i>Euphorbia esula</i> **	leafy spurge
<i>Fagus grandifolia</i>	American beech
<i>Fallopia japonica</i> **	Japanese knotweed
<i>Festuca rubra</i>	red fescue
<i>Fragaria virginiana</i>	wild strawberry
<i>Frangula alnus</i>	glossy buckthorn
<i>Fraxinus americana</i>	white ash
<i>Fraxinus pennsylvanica</i>	green ash

Scientific Name	Common Name
<i>Galium mollugo</i>	wild madder
<i>Galium spp.</i>	bedstraw
<i>Gaultheria procumbens</i>	wintergreen
<i>Geum canadense</i>	white avens
<i>Glechoma hederacea</i>	ground ivy
<i>Gnaphalium macounii</i>	clammy everlasting
<i>Goodyera pubescens</i>	downy rattlesnake plantain
<i>Habenaria viridis</i>	long-bracted orchis
<i>Hamamelis virginia</i>	witch hazel
<i>Helianthus tuberosus</i>	Jerusalum artichoke
<i>Hepatica americana</i>	round-lobed hepatica
<i>Houstonia sp.</i>	bluets
<i>Hypericum perforatum</i>	st. johnswort
<i>Ilex verticillata</i>	common winterberry
<i>Impatiens capensis</i>	spotted jewelweed
<i>Ipomoea purpurea</i>	morning glory
<i>Iris pseudacorus**</i>	yellow iris
<i>Iris versicolor</i>	blue flag iris
<i>Isotes spp.</i>	quillwort
<i>Juncus canadensis</i>	Canada rush
<i>Juncus effusus</i>	soft rush
<i>Juncus tenuis</i>	path rush
<i>Kalmia latifolia</i>	mountain laurel
<i>Lactuca biennis</i>	tall blue lettuce
<i>Lactuca virosa</i>	wild lettuce
<i>Laportea canadensis</i>	wood nettle
<i>Leersia oryzoides</i>	rice cutgrass
<i>Leersia virginica</i>	white ricegrass
<i>Leucobryum albidum</i>	pin cushion moss
<i>Ligustrum obtusifolium</i>	Japanese privet
<i>Lilium tigrinum</i>	tiger lily
<i>Linaria vulgaris</i>	butter-and-eggs
<i>Lobeila siphilitca *</i>	great blue lobelia
<i>Lobelia cardinalis</i>	cardinal flower
<i>Lobelia inflata</i>	Indian tobacco
<i>Lobelia kalmii</i>	Kalm's lobelia
<i>Lonactis linariifolius</i>	stiff aster
<i>Lonicera japonica**</i>	Japanese honeysuckle
<i>Lonicera tatarica ***</i>	Tartarian honeysuckle
<i>Ludwigia alterniflora</i>	seed box

Scientific Name	Common Name
<i>Lycopodium obscurum</i>	princess pine
<i>Lycopus americanus</i>	horehound
<i>Lycopus uniflorus</i>	northern bugleweed
<i>Lysimachia ciliata</i>	fringed loosestrife
<i>Lysimachia nummularia</i> **	creeping jenny
<i>Lysimachia quadrifolia</i>	whorled loosestrife
<i>Lysimachia terrestris</i>	swamp candles
<i>Lythrum salicaria</i> **	purple loosertrife
<i>Maianthemum canadense</i>	Canada mayflower
<i>Maianthemum racemosum</i>	False Solomon's seal
<i>Matteuccia struthiopteris</i>	ostrich fern
<i>Medeola virginiana</i>	Indian cucumber
<i>Melilotus alba</i>	white sweet clover
<i>Mentha arvensis</i>	mint
<i>Microstegium vimineum</i> ***	Japanse stiltgrass
<i>Mimulus guttatus</i>	monkey flower
<i>Mitchella repens</i>	partridge berry
<i>Monarda didyma</i>	bee balm
<i>Monotropa uniflora</i>	Indian pipe
<i>Morus rubra</i>	red mulberry
<i>Myostis scorpiodes</i>	forget-me-not
<i>Myrica gale</i>	sweetgale
<i>Myrica pensylvanica</i>	northern bayberry
<i>Nasturtium officinale</i>	watercress
<i>Nyssa sylvatica</i>	black gum
<i>Oclemena acuminata</i>	whorled wood aster
<i>Oenothera biennis</i>	common evening primrose
<i>Oligoneuron album</i> *	upland white aster
<i>Onoclea sensibilis</i>	sensitive fern
<i>Orontium aquaticum</i>	golden club
<i>Osmunda cinnamomea</i>	cinnamon fern
<i>Osmunda claytoniana</i>	interrupted fern
<i>Osmunda ragalis</i>	royal fern
<i>Ostrya virginiana</i>	hop hornbeam
<i>Oxalis montana</i>	common wood sorrel
<i>Panicum clandestinum</i>	deer tongue
<i>Panicum vigatum</i>	switchgrass
<i>Parnassia palustris</i>	marsh grass of Parnassus
<i>Parthenocissus henryana</i>	sliver vein
<i>Parthenocissus quinquefolia</i>	Virginia creeper

Scientific Name	Common Name
<i>Pellaea atropurpurea</i>	purple cliff brake
<i>Peltandra virginica</i>	arrow arum
<i>Phalaris arundinacea</i> **	reed canary grass
<i>Phragmites australis</i> **	giant reed
<i>Physostegia virginiana</i>	false dragonhead
<i>Pilea pumila</i>	clearweed
<i>Pinus resinosa</i>	red pine
<i>Pinus strobus</i>	eastern white pine
<i>Platanus occidentalis</i>	sycamore
<i>Podophyllum peltatum</i>	mayapple
<i>Polygala paucifolia</i>	gaywings
<i>Polygonatum canaliculatum</i>	great Solomon's seal
<i>Polygonatum pubescens</i>	hairy Solomon's seal
<i>Polygonium hydropiper</i>	marshpepper knotweed
<i>Polygonium lapathifolium</i>	nodding smartweed
<i>Polygonium pensylvanicum</i>	pinkweed
<i>Polygonum sagittatum</i>	arrow-leaved tearthumb
<i>Polygonum sp.</i>	smartweed
<i>Polypodium virginianum</i>	common polypody
<i>Polystichum acrostichoides</i>	Christmas fern
<i>Polytrichum juniperinum</i>	hair-cap moss
<i>Pontederia cordata</i>	pickerelweed
<i>Populus deltoides</i>	eastern cottonwood
<i>Potentilla norvgica</i>	rough cinquefoil
<i>Potentilla simplex</i>	common cinquefoil
<i>Prenanthes altissima</i>	tall rattlesnake root
<i>Prunella vulgaris</i>	self-heal
<i>Prunus pumila var. depressa</i> *	sandbar cherry
<i>Prunus serotina</i>	black cherry
<i>Pteridium aquilinum</i>	bracken fern
<i>Pyrus arbutifolia</i>	red chokeberry
<i>Pyrus floribunda</i>	purple chokeberry
<i>Pyrus melanocarpa</i>	black chokeberry
<i>Quercus ilicifolia</i>	scrub oak
<i>Quercus prinus</i>	chestnut oak
<i>Quercus rubra</i>	northern red oak
<i>Quercus velutina</i>	black oak
<i>Ranunculus ficaria</i> **	lesser celandine
<i>Ranunculus hispidus</i>	hispid buttercup
<i>Ranunculus reptans</i>	creeping spearwort



Scientific Name	Common Name
<i>Rhamnus cathartica</i> **	common buckthorn
<i>Rhamnus frangula</i>	glossy buckthorn
<i>Rhododendron viscosum</i>	swamp azalea
<i>Rhus typhina</i>	staghorn sumac
<i>Robinia pseudoacacia</i> **	black locust
<i>Rosa multiflora</i> **	multiflora rose
<i>Rubus allegheniensis</i>	common blackberry
<i>Rubus flagellaris</i>	dewberry
<i>Rubus hispidus</i>	swamp dewberry
<i>Rubus odoratus</i>	purple-flowering raspberry
<i>Rubus parviflorus</i>	thimbleberry
<i>Rudbeckia serotina</i>	black-eyed Susan
<i>Rumex dotusifolius</i>	bitter dock
<i>Rumex obtusifolius</i>	broad-leaved dock
<i>Salix exigua</i> *	sandbar willow
<i>Salix nigra</i>	black willow
<i>Salix pupurea</i>	purple osier willow
<i>Sambucus canadensis</i>	elderberry
<i>Sanguinaria canadensis</i>	bloodroot
<i>Sassafras albidum</i>	sassafras
<i>Saxifraga spp.</i>	saxifrage
<i>Schoenoplectus tabernaemontani</i>	soft-stem bulrush
<i>Schoenoplectus smithii</i>	Smith's club sedge
<i>Scirpus cyperinus</i>	woolgrass
<i>Scirpus pungens</i>	American bulrush
<i>Scutellaria lateriflora</i>	mad dog skullcap
<i>Sedum ternatum</i>	wild stonecrop
<i>Senecio aureus</i>	golden ragwort
<i>Sium suave</i>	water parsnip
<i>Smilacina racemosa</i>	false Solomon's seal
<i>Smilax herbacea</i>	carrion flower
<i>Smilax rotundifolia</i>	common greenbrier
<i>Solanum dulcamara</i>	bittersweet nightshade
<i>Solidago bicolor</i>	silver rod
<i>Solidago caesia</i>	blue-stemmed goldenrod
<i>Solidago gigantea</i>	giant goldenrod
<i>Solidago nemoralis</i>	gray goldenrod
<i>Solidago odora</i>	anise-scented goldenrod
<i>Solidago patula</i>	rough-leaved goldenrod
<i>Solidago rugosa</i>	rough-stemmed goldenrod

Scientific Name	Common Name
<i>Solidago spp</i>	goldenrod
<i>Solidago tenuifolia</i>	slender-leaved goldenrod
<i>Sorghastrum nutans</i>	Indian grass
<i>Sparganium americanum</i>	burreed
<i>Spiraea alba</i> var. <i>latifolia</i>	meadowsweet
<i>Spirea tomentosa</i>	steeplebush
<i>Stellaria media</i>	chickweed
<i>Symphlyotrichum lateriflorum</i>	calico aster
<i>Symphlyotrichum simplex</i>	panicled aster
<i>Symphlyotrichum novae-angliae</i>	New England aster
<i>Symphlyotrichum novi-belgii</i>	New York aster
<i>Symphlyotrichum tradescantii</i> *	Tradescant's aster
<i>Symplocarpus foetidus</i>	skunk cabbage
<i>Taraxacum officinale</i>	dandelion
<i>Taxus canadensis</i>	Canada yew
<i>Thalictrum pubescens</i>	tall meadow rue
<i>Thelypteris noveboracensis</i>	New York fern
<i>Thelypteris palustris</i>	marsh fern
<i>Tiarella cordifolia</i>	foam flower
<i>Tilia americana</i>	American basswood
<i>Tovara virginiana</i>	jump seed
<i>Toxicodendron radicans</i>	poison ivy
<i>Trapa natans</i>	water-chestnut
<i>Trientalis borealis</i>	starflower
<i>Trifolium arvense</i>	rabbit-foot clover
<i>Trifolium pratense</i>	red clover
<i>Tsuga canadensis</i>	eastern hemlock
<i>Tussilago farfara</i> ***	coltsfoot
<i>Typha latifolia</i>	broad-leaved cattail
<i>Ulmus americana</i>	American elm
<i>Urtica dioica</i>	stinging nettle
<i>Uvularia sessilifolia</i>	wild oats
<i>Vaccinium staminium</i>	deer berry
<i>Vaccinium angustifolium</i>	low bush blueberry
<i>Vaccinium corymbosum</i>	high bush blueberry
<i>Veratrum viride</i>	false hellebore
<i>Verbascum thapsus</i>	common mullein
<i>Verbena hastata</i>	blue vervain
<i>Verbena stricta</i>	hoary vervain
<i>Veronica americana</i>	American speedwell

<b>Scientific Name</b>	<b>Common Name</b>
<i>Veronica scutellata</i>	marsh speedwell
<i>Veronia serpyllifolia</i>	thyme-leaved speedwell
<i>Viburnum acerifolium</i>	maple leaf viburnum
<i>Viburnum cassinoides</i>	wild raisin
<i>Viburnum dentatum</i>	arrowwood
<i>Viburnum lantanoides</i>	hobblebush
<i>Viburnum lentago</i>	nannyberry
<i>Vicia cracca</i> **	cow vetch
<i>Viola adunca</i>	sand violet
<i>Viola sp.</i>	violet
<i>Vitis labrusca</i>	fox grape
<i>Vitis riparia</i>	riverbank grape
<i>Woodsia obtusa</i>	blunt-lobed cliff-fern
<i>Xanthium chinense</i>	common cocklebur
<i>Xanthium strumarium</i>	large cocklebur
<i>Zizia aurea</i>	golden Alexander's

\* Denotes RTE

\*\* Denotes Invasive according to MIPAG

\*\*\* Denotes Likely Invasive according to MIPAG