# Relicensing Study 3.3.11

# FISH ASSEMBLAGE ASSESSMENT

## Updated Study Report Summary

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

*Prepared for:*

**FirstLight**
GDF SUEZ

*Prepared by:*

**Kleinschmidt**

**GOMEZ AND SULLIVAN ENGINEERS**

**SEPTEMBER 2015**

## 1.1 Study Summary

The purpose of this study is to gather baseline information pertaining to the fish assemblage structure within the project area. Specific objectives include:

- Document species occurrence, distribution, and relative abundance of resident and diadromous fish within the project area along spatial and temporal gradients.
- Describe the distribution of resident and diadromous fish species within reaches of the river and in relationship to habitat.
- Compare historical records of fish species occurrence in the project area to results of this study.

## 1.2 Study Progress Summary

Task 1: Sampling Location Selection.

FirstLight emailed the sampling plan (see Appendix A) for stratified sampling of the Turners Falls Impoundment (TFI) on June 5, 2015 to the United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and Massachusetts Division of Fish and Wildlife (MDFW). Comments were received from the MDFW; based on the comments received, no revisions were necessary to the Field Sampling Plan.

Task 2: Fish Capture

A total of 12 electrofishing stations were sampled in the TFI during mid-June through early July, 2015. Four stations were distributed through each of the three TFI strata identified in the sampling plan. The stations sampled were numbered to be consistent with the river mile convention developed in the 2008 survey conducted by Yoder, *et al*. (2009). Within each stratum, two stations were randomly selected from the candidate list developed in the June 5, 2015 memo based on localized microhabitat such as outside bends, and presence of cover, such as woody debris, vegetation, etc. Two additional stations per stratum were identified in the field to provide supplemental sampling data.

TFI sampling was conducted nocturnally to optimize capture efficiency. Gillnets were also deployed in deep holes in each of the three sampling strata concurrent with electrofishing, and beach seining was conducted where feasible in the middle and lower TFI strata. Beach seining was not feasible in the upstream stratum due to the preponderance of snags and the lack of open shoreline suitable for beach seine deployment.

A second sampling series will be performed in late summer (*i.e.* September, 2015) in both the TFI and project bypass reach. Sampling stations in the TFI will be selected by re-randomizing stations within each stratum, and sampling across all mesohabitats in the bypass reach.

A summary of the electrofishing stations sampled in the TFI during June and July 2015 is listed in Table 1.

**Table 1. Summary of electrofishing stations sampled in the Turners Falls Impoundment during June and July, 2015**

| Mesohabitat stratum | Station (rivermile)[1] | Description |
|---|---|---|
| Upper Impoundment | 85.5 | Transition zone, boulder & riprap shoreline |
| Upper Impoundment | 84.3 | Cobble and scattered woody debris |
| Upper Impoundment | 83.8 | Sand/silt/scattered aquatic vegetation |
| Upper Impoundment | 83.0 | Sand/silt/scattered woody debris |
| Middle Impoundment | 80.1 | Cobble and scattered woody debris, submerged aquatic vegetation |
| Middle Impoundment | 78.7 | sand/silt/scattered submerged aquatic vegetation |
| Middle Impoundment | 76.2 | Rip rap on river left bank along Kidd's Island |
| Middle Impoundment | 73.9 | Cobble and boulder, upstream from Northfield Mountain intake |
| Lower Impoundment | 72.9 | Bedrock and boulder in upper French King gorge |
| Lower Impoundment | 71.1 | sand/silt/scattered aquatic vegetation |
| Lower Impoundment | 69.9 | Submergent vegetation bed |
| Lower Impoundment | 69.5 | sand/silt/scattered aquatic vegetation |

A total of 23 species were collected among all stations (Table 2); spottail shiner, white sucker, yellow perch and smallmouth bass were the most numerically abundant species. Species richness ranged from 4 to 11 among electrofishing sites.

**Table 2. Fish species collected in the Turners Falls impoundment during the June and July 2015 fish assemblage survey (*provisional information*). Species listed in declining order of numeric abundance**

| Species |
|---|
| Spottail Shiner |
| White Sucker |
| Yellow Perch |
| Smallmouth Bass |
| Bluegill Sunfish |
| Fallfish |
| Rock Bass |
| Pumpkinseed Sunfish |
| Tessellated Darter |
| Walleye |
| Common Shiner |
| American Eel |
| Largemouth Bass |
| Golden Shiner |
| Black Crappie |
| Channel Catfish |
| Brown Bullhead |
| Common Carp |
| Chain Pickerel |
| Sea Lamprey |
| Mimic Shiner |
| Northern Pike |

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[1] Based on rivermile convention established in the MBI 2008 Connecticut River IBI survey (Yoder, et al., 2009)

| **Species** |
| --- |
| American Shad |

Task 3: Data Analysis and Reporting

Data collection is still underway. Information collected during this study will be compiled and presented in a final report by March 1, 2016.

## 1.3   Variances from Study Plan and Schedule

To date, there are no variances from the study plan or schedule.

## 1.4   Remaining Activities

- A second sampling series is scheduled for late summer *(i.e.* September, 2015) in both the impoundment and project bypass reach.

- Complete Report.

# Appendix A
# Sampling Plan

**TURNERS FALLS IMPOUNDMENT FISH ASSEMBLAGE STUDY SAMPLING PLAN DRAFT**

# 1   INTRODUCTION

The goal of this study is to provide baseline information pertaining to the fish assemblage structure within the study area. The study area includes the Connecticut River from Vernon Dam to the Cabot Tailwater. Sampling methods include boat electrofishing, gill nets, and seine nets. Sampling will be performed during the early summer (June) and again in the fall (September).

Early summer sampling will be restricted to the impoundment to avoid potential impacts to shortnose sturgeon in the remainder of the study area. The purpose of this memo is to document the sampling plan for the Turners Falls impoundment. A separate sampling plan will be developed for the bypass reach.

As dictated by the study plan, a stratified-random sampling design is utilized; sub-strata in the Turners Falls Impoundment were derived from bathymetry data, because the impoundment contains areas with relatively deep water. Data will be collected primarily by boat electrofishing and supplemented by experimental gill net sets in areas too deep for electrofishing (such as deep channels and scour pools), and by beach seine in suitable shoal areas too shallow for boat electrofishing.

# 2   SAMPLING PLAN

Boat Electrofishing

Electrofishing will be conducted in a downstream manner, following standardized methods developed specifically for large river quantitative electrofishing surveys (MBI, 2002, Yoder and Kulik, 2003). The start point, end point, and boat track for each sampling station will be geo-referenced using a handheld GPS instrument. MBI (2002) states that, *"Individual sampling sites are located along the shoreline with the most diverse habitat features in accordance with established methods ... This is generally along the gradual outside bends of large rivers".*

The Turners Falls impoundment geomorphology varies, with a lengthy, shallow, upper portion from the upstream end of the impoundment (approximately 13 miles) to the Northfield Mountain intake that is relatively riverine, with only a few pronounced bends. Much of the shoreline in the upper impoundment reaches is relatively barren of optimal cover and substrates. However there are several river bends with stretches of rich, suitable substrate (*i.e.* gravel/cobble/ boulder), object cover or vegetation for a sufficient linear distance of shoreline that will attract a diverse species assemblage. Downstream from Northfield Mountain, the impoundment enters an approximately 5.4 miles reach of much richer habitat, including bedrock-controlled, diverse shoreline areas with outside bends, weed beds, varied substrates, a deep channel, partially embayed geometry and abundant cover.

From a strictly bathymetric perspective there are essentially two strata. However due to the relatively long impoundment reach above Northfield Mountain, the upstream reach is further stratified into "*upper*" and "*middle*" sub-strata, to provide better survey resolution and to potentially distinguish "transition zone" habitat/assemblage responses associated with the semi-riverine upstream extremity of the impoundment (Figure A-1).
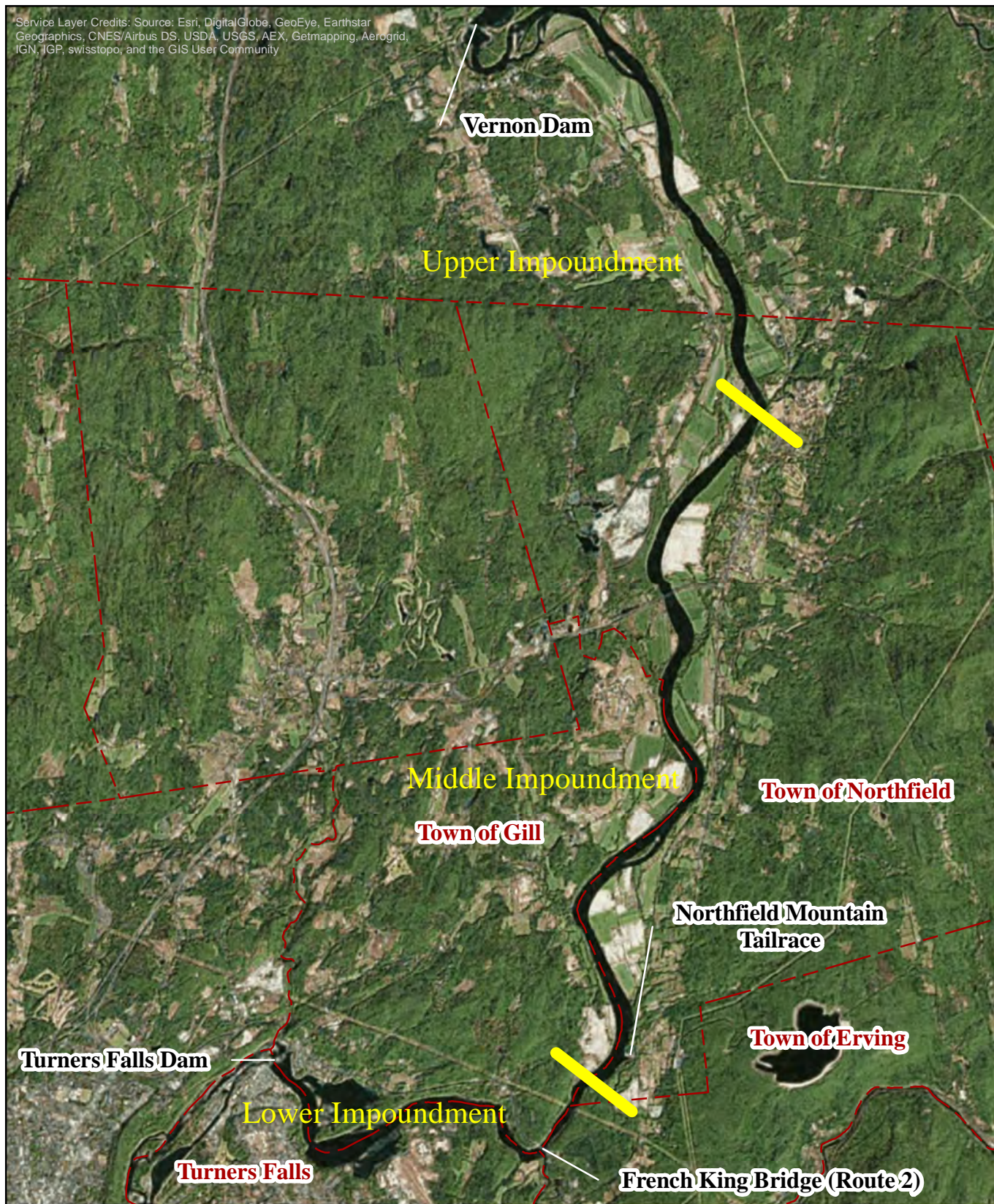
Table 1 and Figure A-2 depict the distribution of qualifying rich-habitat electrofishing stations in each of the three strata. A total of 17 candidate rich-habitat electrofishing stations are available, with four, four, and nine stations in the upper, middle and lower strata, respectively. For each of the two sampling events, two stations will be selected at random from each stratum for electrofishing sampling. Additionally, a minimum of two 0.5 km stations will be selected at random from the remainder of the shorelines within each stratum.

**Table 1. Candidate boat electrofishing stations in the Turners Falls Project Impoundment**

| Mesohabitat stratum | Station *(rivermile)*[2] | Description |
|---|---|---|
| Upper impoundment | 87.0 | Vernon tailwater transition zone |
| Upper impoundment | 85.5 | Transition zone, boulder & riprap shoreline |
| Upper impoundment | 84.3 | Cobble and scattered woody debris |
| Upper impoundment | 82.0 | Cobble and scattered woody debris |
| Middle Impoundment | 80.1 | Cobble and scattered woody debris, submerged aquatic vegetation |
| Middle Impoundment | 77.0 | Cobble and gravel, submerged aquatic vegetation |
| Middle Impoundment | 76.2 | Rip rap on river left bank along Kidd's Island |
| Middle Impoundment | 73.9 | Cobble and boulder, upstream from Northfield Mountain intake |
| Lower Impoundment | 72.9 | Bedrock and boulder in upper French King gorge |
| Lower Impoundment | 71.8 | Bedrock and scattered woody debris |
| Lower Impoundment | 71.2 | Bedrock and scattered woody debris |
| Lower Impoundment | 70.5 | Emergent and submergent vegetation bed |
| Lower Impoundment | 69.9 | submergent vegetation bed |
| Lower Impoundment | 69.0 | Cobble and woody debris |
| Lower Impoundment | 68.8A | Submergent vegetation bed between island and shoreline |
| Lower Impoundment | 68.8B | Riprap and cobble in Barton's Cove |

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[2] Based on rivermile convention established in the MBI 2008 Connecticut River IBI survey (Yoder, *et al.*, 2009)

**Vernon Dam**

Upper Impoundment

Middle Impoundment

**Town of Northfield**

**Town of Gill**

**Northfield Mountain Tailrace**

**Town of Erving**

**Turners Falls Dam**

Lower Impoundment

**Turners Falls**

**French King Bridge (Route 2)**

*Northfield Mountain Pumped Storage Project (No. 2485)*
*and Turners Falls Hydroelectric Project (No. 1889)*
Study No. 3.3.11
Fish Assemblages
Assessment

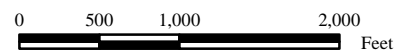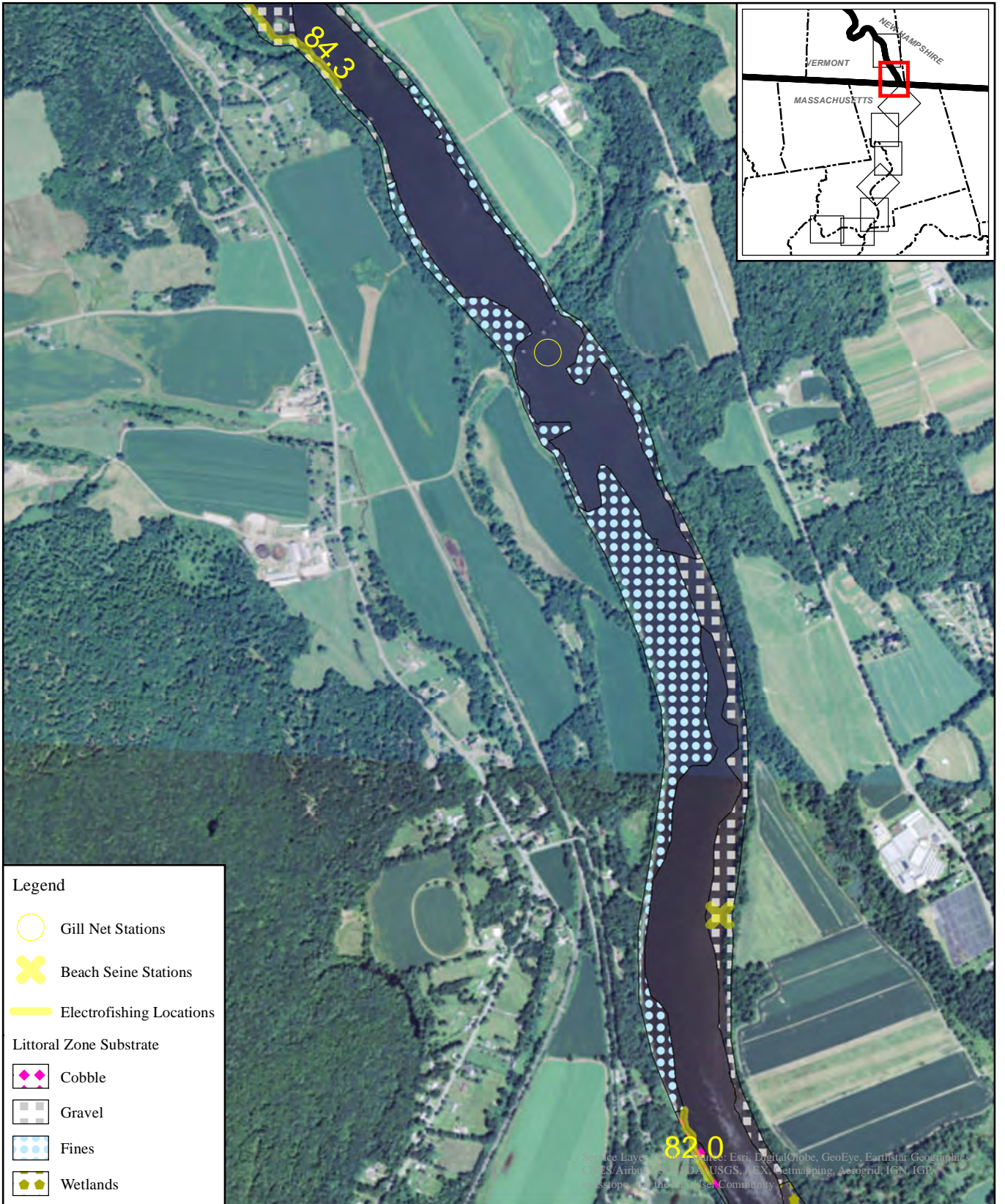Figure A-1. Turners Falls
Impoundment Fish
Assemblage Study Area

FirstLight
GDF SUEZ

N

0    0.75    1.5         3
                                   Miles
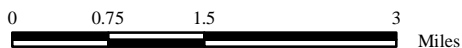
Gill Net Sampling

Gill nets will be deployed to supplement electrofishing data at depths where electrofishing will not be effective. The nets will be deployed to maximize capture area where water depths are greater than net height. Figures 3-1-3 – 3.1.11 illustrate *potential* net set locations where known areas of suitable depth and cover exist. However, the exact locations of each net set will be determined based on field observations, and recorded using a handheld GPS device. In the upper impoundment stratum, there are relatively few deep areas, however there is a known deep scour hole (Figure3-1-2) which will be sampled. Most other suitable deep water gill net sampling areas are likely to occur in the lower impoundment stratum.

Beach Seine Sampling

Sampling will be performed in shallow shoreline locations where boat access is not be feasible and where safe wading is possible. Seining stations must also be free of debris and snags. Figures 3-1-3 – 3.1.11 indicate *potential* seining stations, however these may vary depending on field conditions. This will be determined based on field observations, and the exact locations of each seine haul recorded using a handheld GPS device.
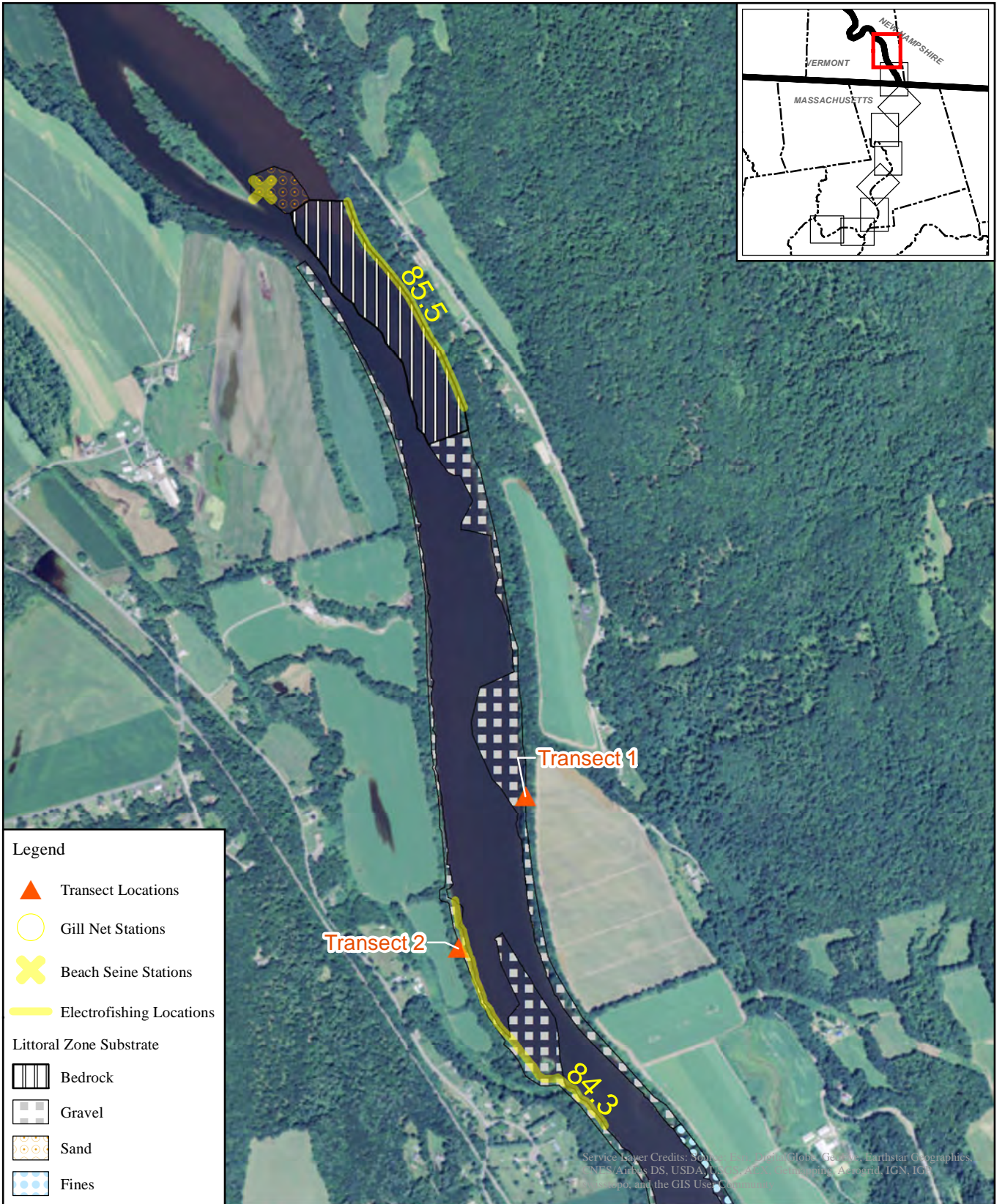
Legend

▲ Transect Locations

◯ Gill Net Stations

✕ Beach Seine Stations

▬ Electrofishing Locations

Littoral Zone Substrate

▦ Bedrock

▦ Gravel

⦿ Sand

⦿ Fines

85.5

Transect 1

Transect 2

84.3

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

*Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)*
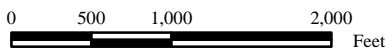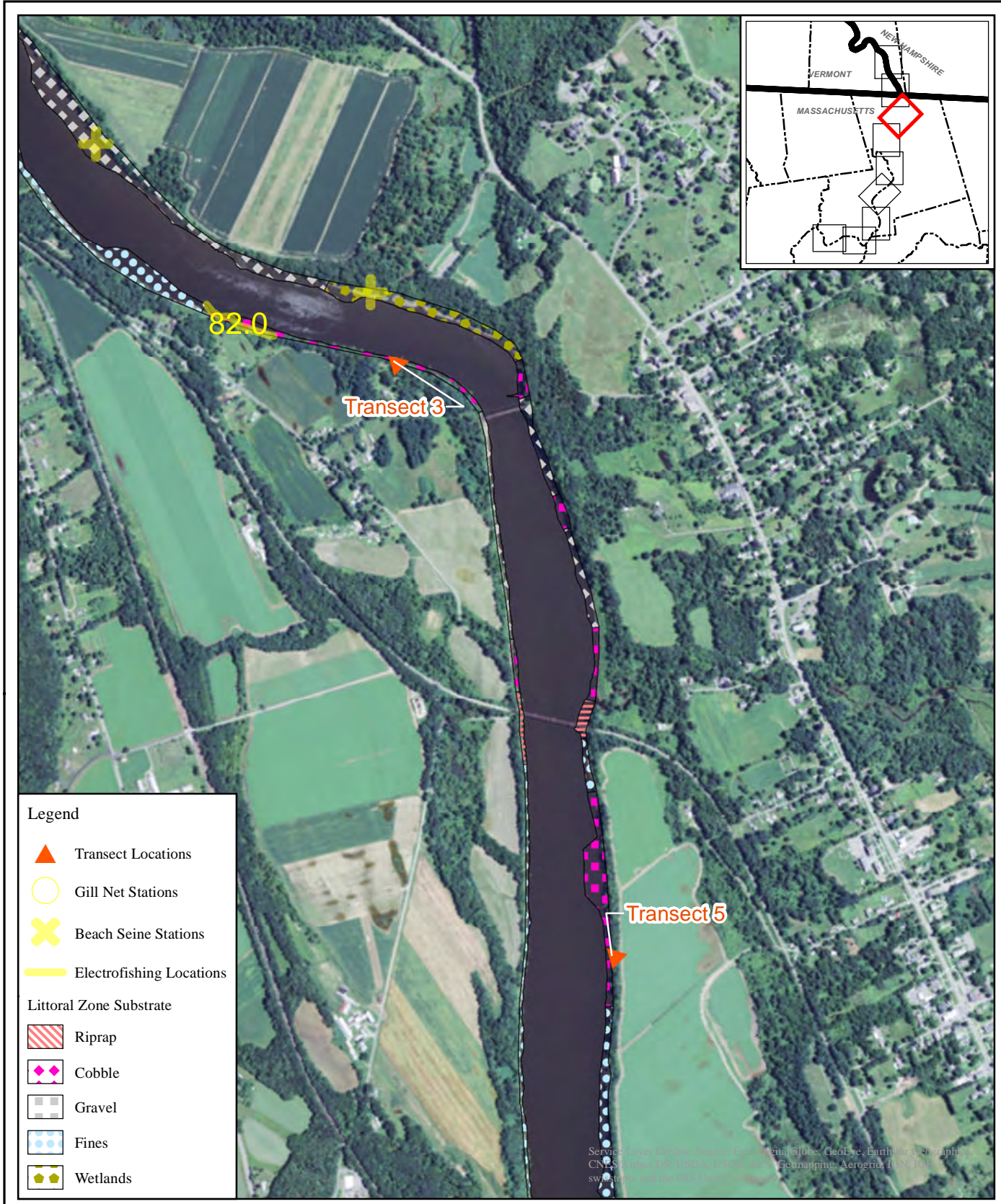
Study No. 3.3.11
Fish Assemblages
Assessment

N

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Feet

FirstLight
GDF SUEZ

Figure A-2, Page 1
Distribution of qualifying
rich-habitat electrofishing
stations

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Legend

◯ Gill Net Stations

✕ Beach Seine Stations

▬ Electrofishing Locations

Littoral Zone Substrate

◆◆ Cobble

▦ Gravel

⬤⬤ Fines

⬠⬠ Wetlands

84.3

82.0

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Study No. 3.3.11
Fish Assemblages
Assessment

N

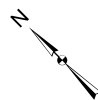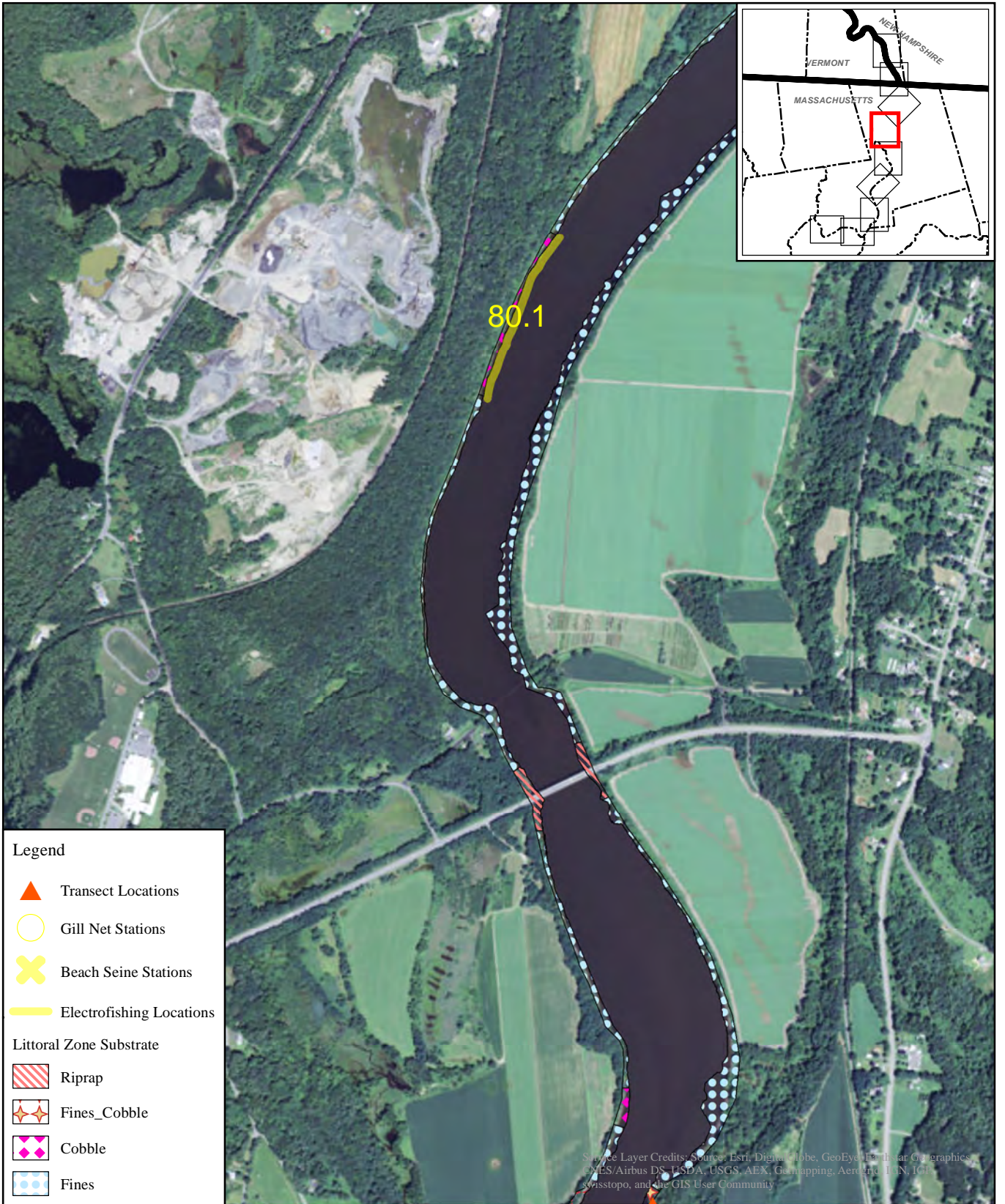0   500   1,000        2,000
Feet

Figure A-2, Page 2
Distribution of qualifying
rich-habitat electrofishing
stations

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Legend

- ▲ Transect Locations
- ◯ Gill Net Stations
- ✕ Beach Seine Stations
- ▬ Electrofishing Locations

Littoral Zone Substrate
- Riprap
- Cobble
- Gravel
- Fines
- Wetlands

82.0

Transect 3

Transect 5

*Northfield Mountain Pumped Storage Project (No. 2485)*
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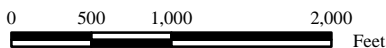Study No. 3.3.11
Fish Assemblages
Assessment

Figure A-2, Page 3
Distribution of qualifying
rich-habitat electrofishing
stations

FirstLight
GDF SUEZ

N

0    500    1,000        2,000
Feet

80.1

Legend

▲ Transect Locations

◯ Gill Net Stations

✕ Beach Seine Stations

▬ Electrofishing Locations

Littoral Zone Substrate

▨ Riprap

✦ Fines_Cobble

◈ Cobble

⬡ Fines

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earth Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

***Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)***
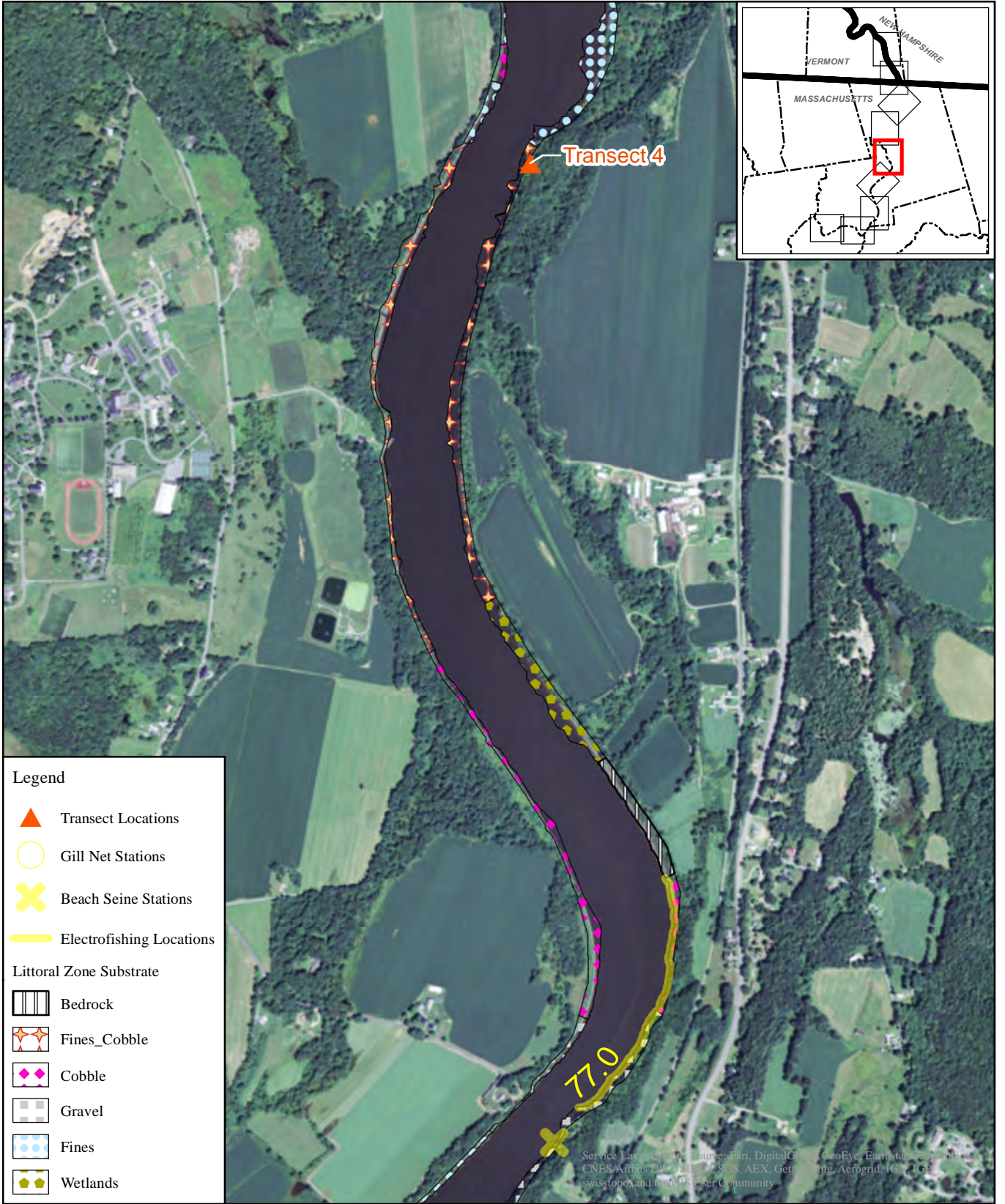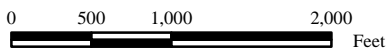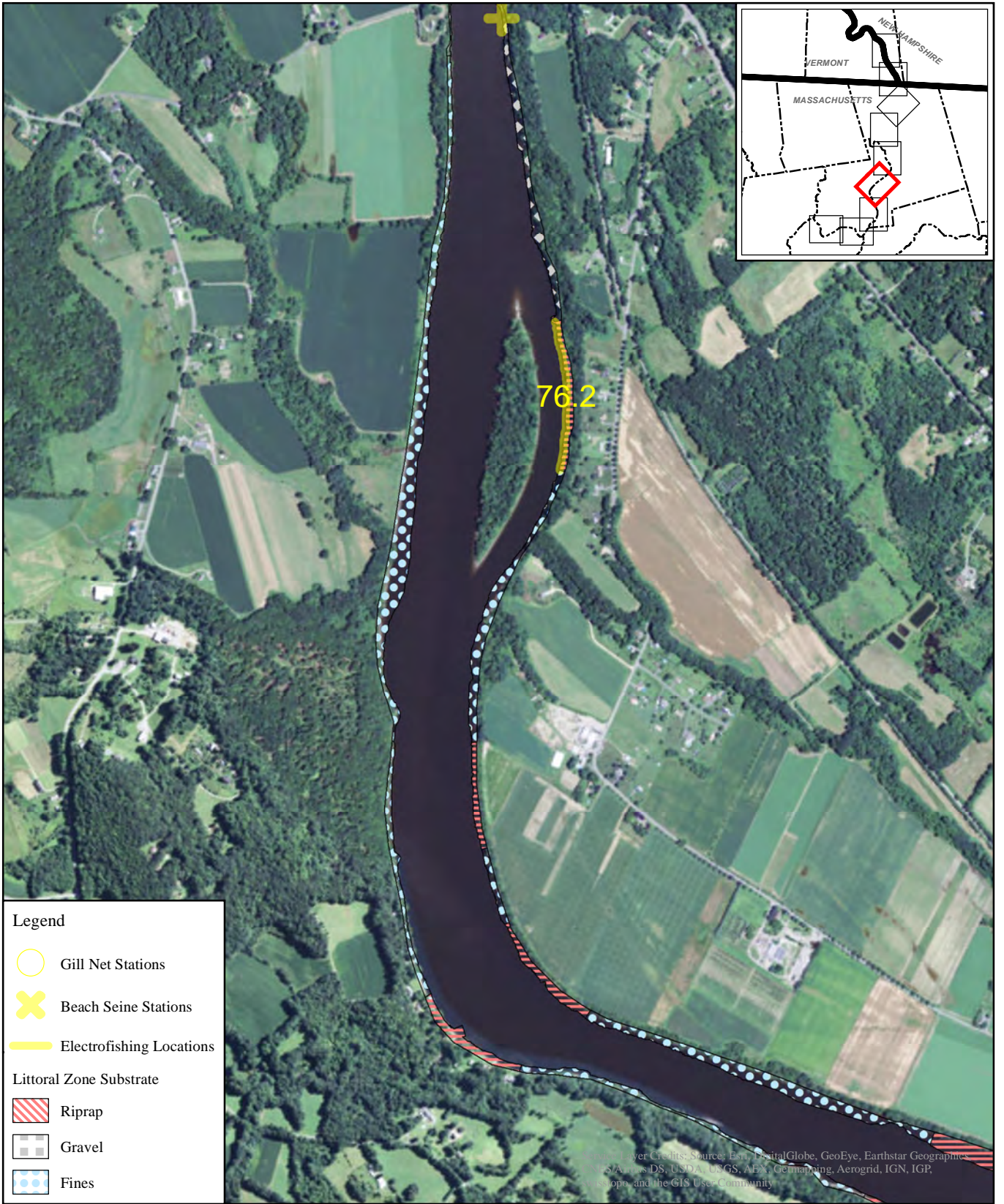
Study No. 3.3.11
Fish Assemblages
Assessment

Figure A-2, Page 4
Distribution of qualifying
rich-habitat electrofishing
stations

FirstLight
GDF SUEZ

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Feet

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Legend

▲ Transect Locations

◯ Gill Net Stations

✕ Beach Seine Stations

— Electrofishing Locations

Littoral Zone Substrate

▦ Bedrock

✧ Fines_Cobble

◆ Cobble

▦ Gravel

▦ Fines

⬠ Wetlands

Transect 4

77.0

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Study No. 3.3.11
Fish Assemblages
Assessment

N

0    500    1,000    2,000
Feet

Figure A-2, Page 5
Distribution of qualifying
rich-habitat electrofishing
stations

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Legend

○ Gill Net Stations

✕ Beach Seine Stations

▬ Electrofishing Locations

Littoral Zone Substrate

Riprap

Gravel

Fines

76.2

*Northfield Mountain Pumped Storage Project (No. 2485)*
*and Turners Falls Hydroelectric Project (No. 1889)*
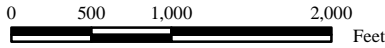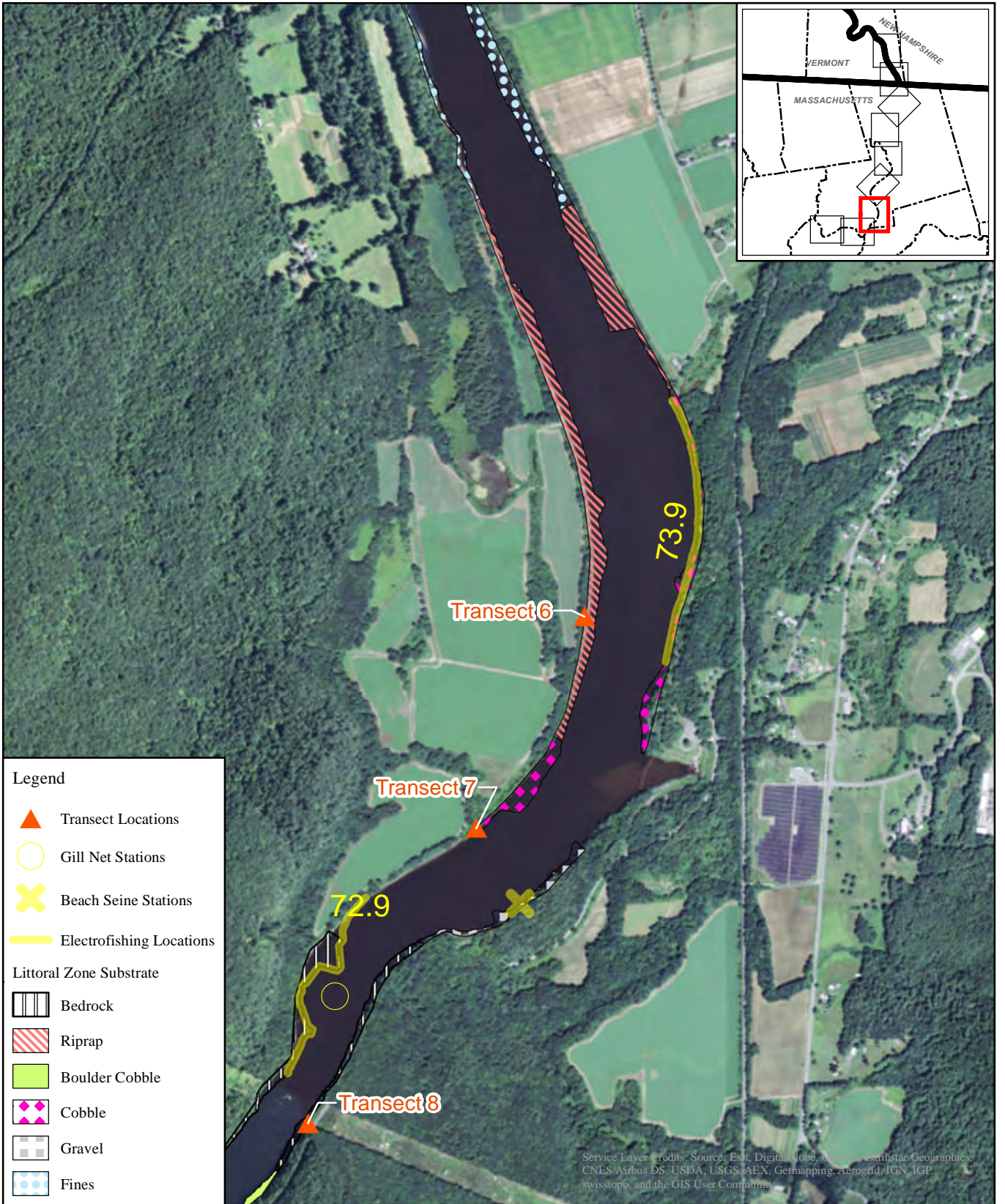
Study No. 3.3.11
Fish Assemblages
Assessment

Figure A-2, Page 6
Distribution of qualifying
rich-habitat electrofishing
stations

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Feet

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Legend

▲ Transect Locations

◯ Gill Net Stations

✕ Beach Seine Stations

━ Electrofishing Locations

Littoral Zone Substrate

▥ Bedrock

▨ Riprap

▩ Boulder Cobble

◆ Cobble

▦ Gravel

⦿ Fines

Transect 6

Transect 7

Transect 8

73.9

72.9

*Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)*
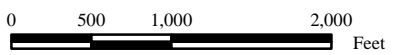
Study No. 3.3.11
Fish Assemblages
Assessment

Figure A-2, Page 7
Distribution of qualifying
rich-habitat electrofishing
stations

FirstLight
GDF SUEZ

N

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Feet

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

▲ Transect Locations

○ Gill Net Stations

✕ Beach Seine Stations

▬ Electrofishing Locations

Littoral Zone Substrate

Bedrock

Boulder Cobble

◆◆ Cobble

Gravel

Fines

Wetlands

***Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)***
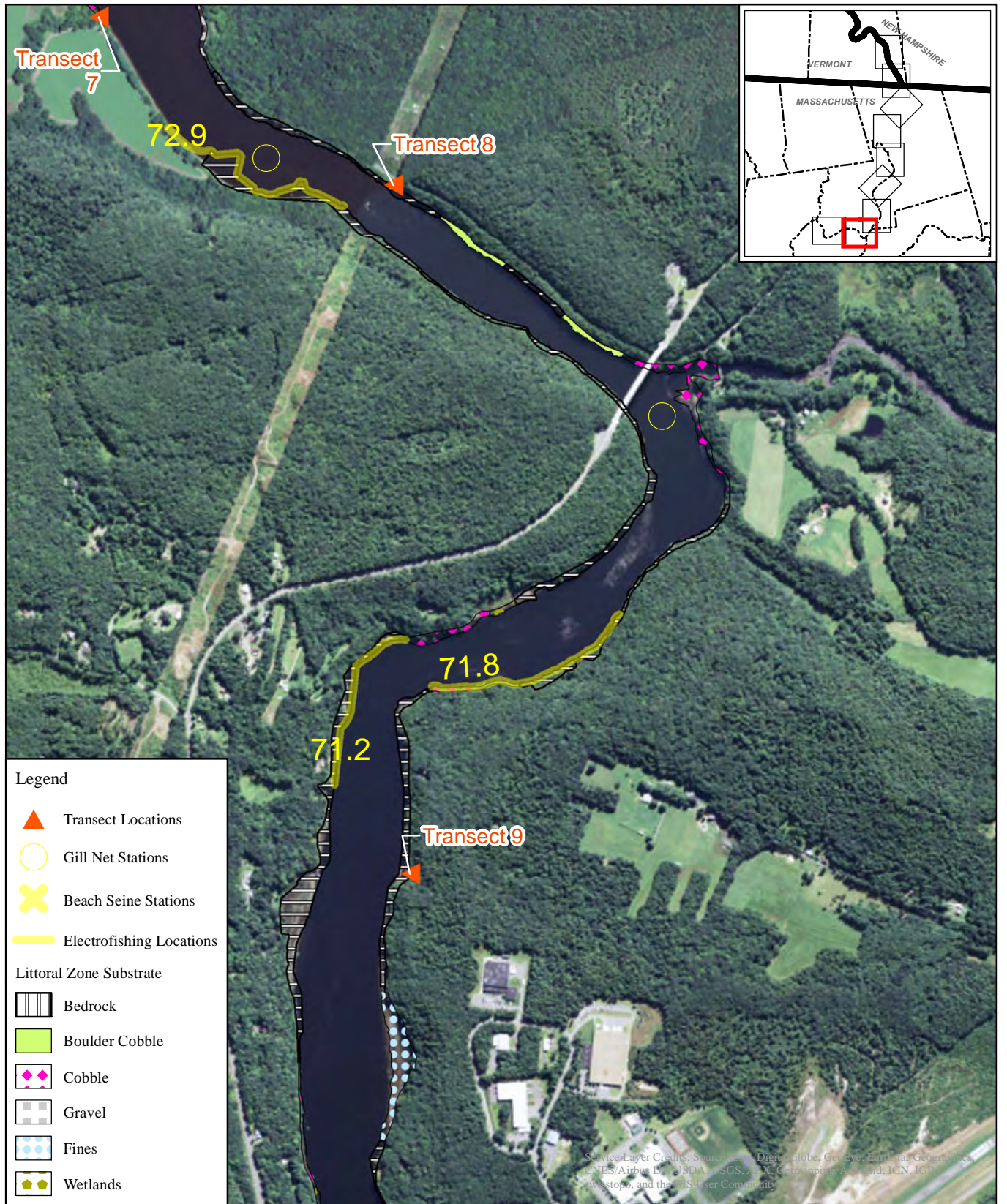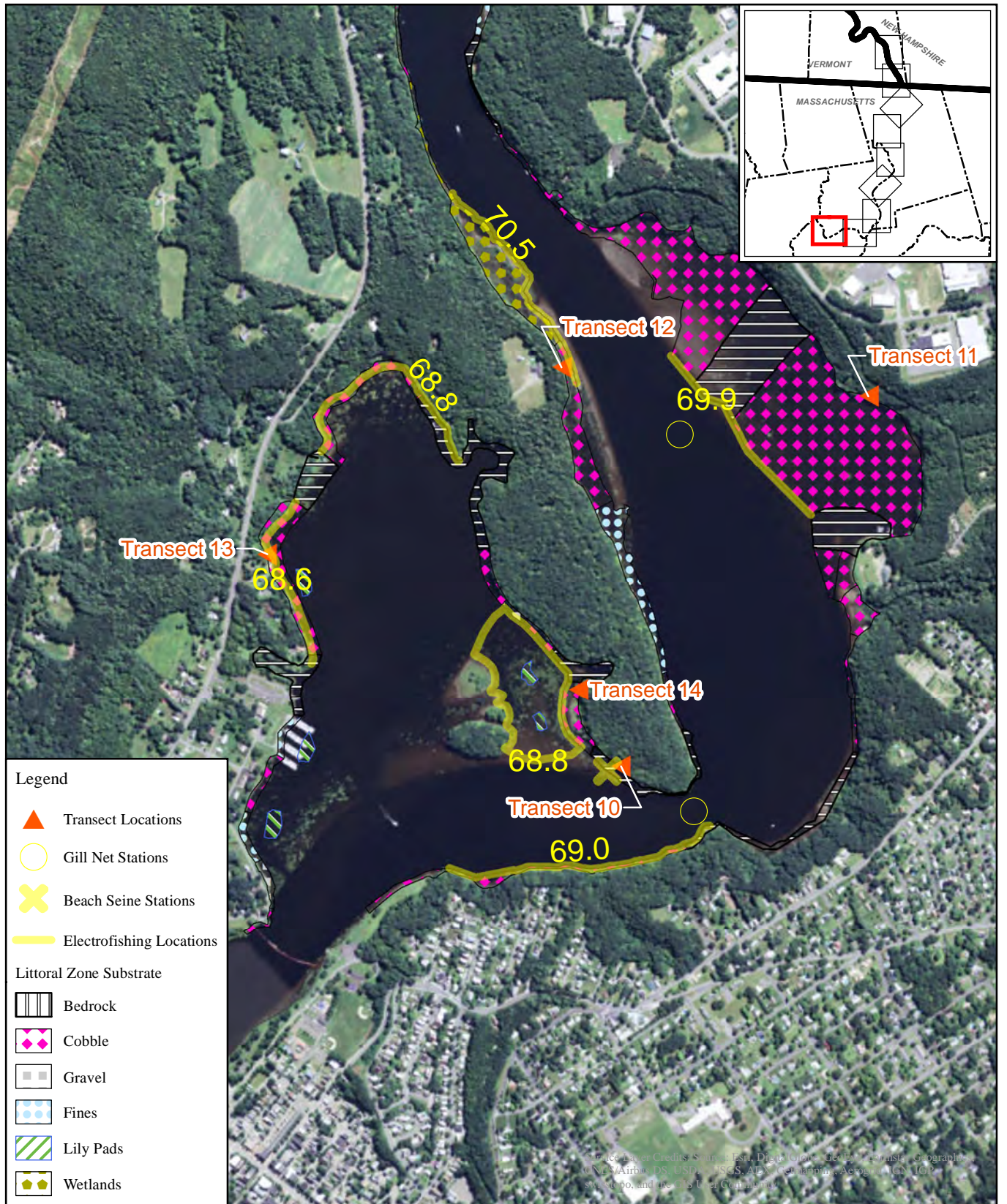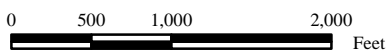
Study No. 3.3.11
Fish Assemblages
Assessment

Figure A-2, Page 8
Distribution of qualifying
rich-habitat electrofishing
stations

FirstLight™

GDF SUEZ

0   500   1,000   2,000
Feet

Legend

▲ Transect Locations

◯ Gill Net Stations

✕ Beach Seine Stations

━ Electrofishing Locations

Littoral Zone Substrate

▦ Bedrock

◈ Cobble

▦ Gravel

▦ Fines

▨ Lily Pads

⬠ Wetlands

Transect 12
Transect 11
Transect 13
Transect 14
Transect 10

70.5
68.8
69.9
68.6
68.8
69.0

Figure A-2, Page 9
Distribution of qualifying
rich-habitat electrofishing
stations

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0    500    1,000    2,000 Feet

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# 3  LITERATURE CITED

Midwest Biodiversity Institute. (2002). Quality assurance project plan: fish assemblage assessment of Maine and New England large rivers. Columbus, Ohio: MBI. 38 pp. plus appendices.

Yoder, C.O. & Kulik, B.H.. (2003). The development and application of multimetric indices for the assessment of impacts to fish assemblages in large rivers: a review of current science and applications. Canadian Water Res. Journal. 28(2):302-328.

Yoder, C.O., Hersha, L.E., & Apell, B. (2009). Fish assemblage and habitat assessment of the Upper Connecticut River: preliminary results and data presentation. Final Project Report to: U.S. EPA, Region 1, Boston, MA. Center for Applied Bioassessment & Biocriteria. Columbus, OH: Midwest Biodiversity Institute