

**Relicensing Study 3.3.13**

**IMPACTS OF THE TURNERS  
FALLS PROJECT AND  
NORTHFIELD MOUNTAIN  
PROJECT ON LITTORAL ZONE  
FISH HABITAT AND SPAWNING  
HABITAT**

**Updated Study Report Summary**

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

*Prepared for:*



*Prepared by:*



**SEPTEMBER 2015**

## 1.1 Study Summary

Specific objective of this study are to:

- Assess timing and location of fish spawning in the littoral zone.
- Delineate, qualitatively describe (e.g. substrate composition, vegetation type and relative abundance), and map shallow water habitat types subject to inundation and exposure due to project operations.
- Evaluate potential impacts of impoundment fluctuation on nest abandonment, spawning fish displacement and egg dewatering.

This study is informed by information and data obtained through the following studies:

- Study No. 3.3.11 Fish Assemblage Study
- Study No. 3.3.14 Aquatic Habitat Mapping of the Turners Falls Impoundment
- Study No. 3.3.17 Assess the Impact of Project Operations of the Turners Falls Project and Northfield Mountain Project on Tributary and Backwater Area Access and Habitat.

## 1.2 Study Progress Summary

### Task 1: Literature Review

A literature review was performed to determine when resident species known to occur in the Turners Falls Impoundment (TFI) typically spawn. [Table 1](#) and [Figure 1](#) depict the species' spawning strategy, periodicity and preferred temperature range based on the results of the literature review.

A meeting was held on February 4, 2015 to discuss the target species and spawning periodicity for this study. During the meeting, FirstLight presented information on the fishes known to occur in the project area, spawning periods, whether they are nest builders (or not) and their temperature range. There was general agreement on the approach presented in the RSP.

**Table 1: Fish Species Spawning Period and Temperature Ranges**

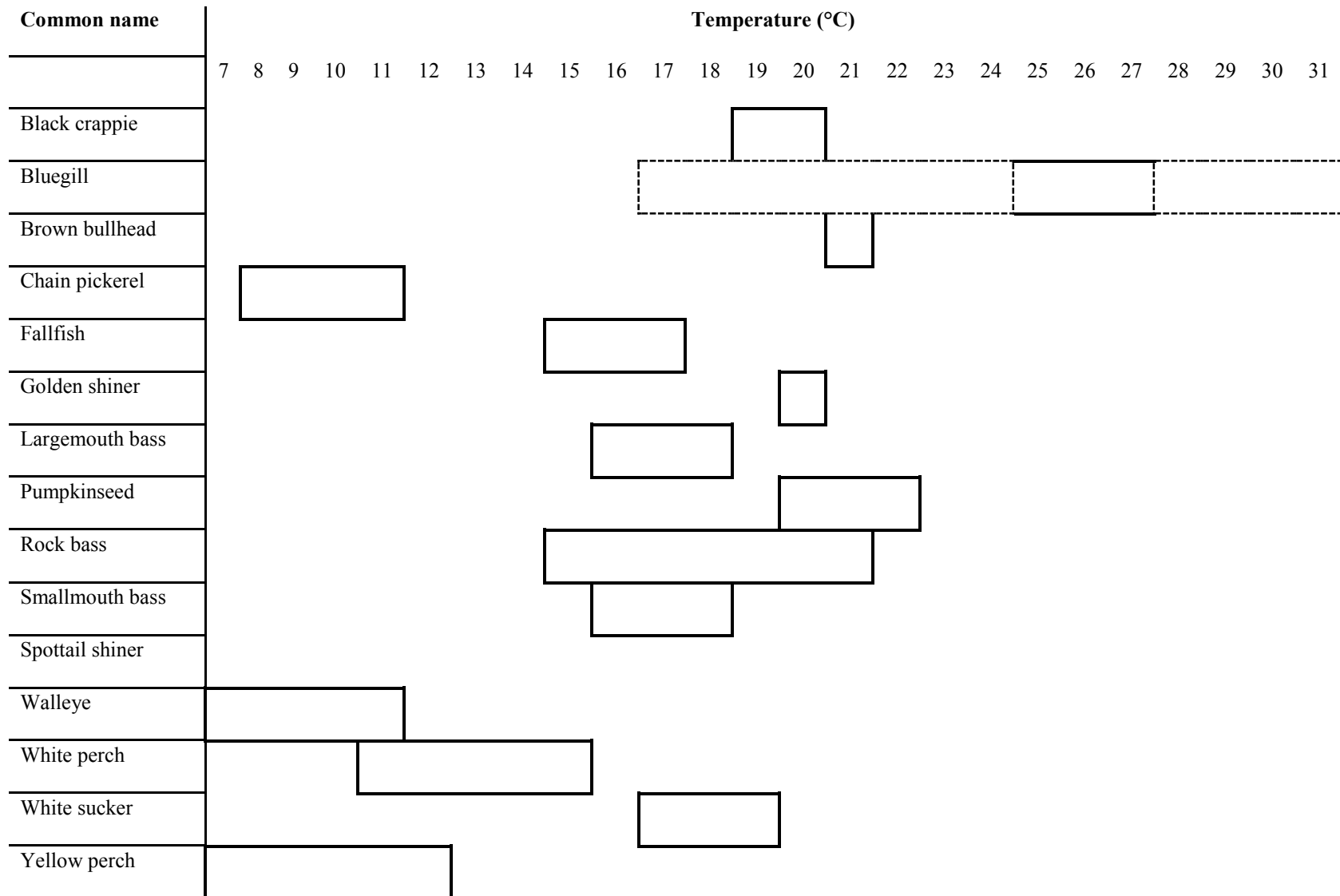
Common Name	Spawning Strategy	Notes**	Spawning Period	Temperature Range**
Yellow perch	Broadcast spawn in shallow weedy areas	Eggs are adhesive, no guardianship	April and May	6.7-12.2 °C
Pumpkinseed	Nest scoured in sand/fines	Male adult guardianship	Late spring to mid summer	20 °C
Smallmouth bass	Sand/gravel nest near object cover	Male adult guardianship	Late spring to early summer	16.1-18.3 °C
Largemouth bass	Sand/fines nest near object cover	Male adult guardianship	Mid spring to early summer	16.7-18.3 °C
Bluegill	Sand/fines nest	Male adult guardianship	Mid May to mid summer	17 -31 °C
Spottail shiner	Broadcast spawn on sand at mouths of streams	No guardianship	May to mid June	
White sucker	Gravel bars in tributary or shoals	No guardianship	Mid April to May	10 °C
Walleye	Cobble riffle or shoals	Broadcast spawn, no guardianship	April	7-11 °C
Golden shiner	Submerged vegetation in shallow water	Broadcast spawn, eggs are adhesive, no guardianship	May to August	20 °C
Black crappie	Nest scoured in sand/fines	Male adult guardianship	Mid spring to early summer	19-20 °C
White perch	Broadcast spawn	Eggs are planktonic	Mid spring	11-15 °C
Rock bass	Sand/gravel nest near object cover	Male adult guardianship	June	15.6-21.1 °C
Brown bullhead	Sand/fines nest	Male adult guardianship	Late May through June	21.1 °C
Chain pickerel	Broadcast spawn glutinous egg strings in marshes	Eggs are adhesive, no guardianship	March to May	8.3-11.1 °C
Fallfish	Gravel in low velocity stream margins	Nest builder, no guardianship	Late April through May	12-16.6 °C

\*\* Sources:

Scott, WB. and E.J. Crossman, 1973. *Freshwater fishes of Canada*. Fish. Res Bd. Canada, Ottawa CA. Bulletin 194. 966 pp;

Hartel, K.E., D.B. Halliwell and A.E. Launer. 2002. *Inland Fishes of Massachusetts*. Massachusetts Audubon Society. 328 pp.

**Figure 1: Fish Species and Temperature Range for Spawning**



## Task 2: Field Survey

### Methods

Two field surveys were scheduled to maximize potential observations of spawning activity, based on thermal ranges reported from the literature. The early spawning survey targeted a period when water temperature ranged from approximately 7 to 14 °C to capture broadcast spawning species such as pike, yellow perch, and walleye. A second survey was scheduled to coincide with water temperatures ranging from approximately 18-22 °C to capture nest-building species. Field work was scheduled to occur during times when river flow was less than 25,000 cfs for safety, and targeted water temperature prevailed.

The study area extended from Vernon Dam downstream to the Turners Falls Dam boat barrier. The entire littoral zone was surveyed. To the extent practical, the surveys sought to document potential spawning habitat across the full range of licensed water surface elevations of 176.0 to 185.0 ft msl. The target survey zone was a general guideline, as the observable characteristics of the littoral zone can vary with water clarity, water level, time of day, and the prevailing weather conditions. The areas typically wetted when the Turners Falls Impoundment (TFI) is at the upper range of its water surface elevation (El. 185.0') were also observed to evaluate potential spawning habitat.

Additionally, tributaries identified in Study 3.3.17 as accessible during spawning seasons were observed during the field surveys. Field sampling was conducted by systematically traversing the littoral zone of the Turners Falls Impoundment via boat and/or foot (wading) to visually identify any fish nests, egg masses/deposits, and/or spawning habitat. The Northfield control room was contacted at the beginning and end of the survey each day and periodically during the course of the survey to obtain current information on river flow and recorded impoundment elevation.

To optimize visual detection of spawning, surveys were limited to periods of good ambient light (*i.e.*, no earlier than 1 hour after sunrise to no later than 1 hour prior to sunset); heavily overcast, stormy periods or periods of heavy precipitation were avoided. The survey crew traversed the littoral zone in a vessel at a slow rate of speed parallel to the shoreline as close to shore as possible. The entire shoreline of the TFI was cruised during each survey, from the boat barrier line upstream of the Turners Falls Dam to just downstream of Vernon Dam.

During the early spring, where the search was focused on areas where broadcasted adhesive eggs could occur, locations such as gravel shoals, point bars etc. were scrutinized by boat and also wading where safe and practical. At locations where eggs could be embedded in gravel interstices, substrates were inspected using underwater surveillance such as an Aquascope viewing tube. Aquatic and riparian vegetation was also examined for evidence of extruded egg masses.

During the late spring when the search was focused on areas where nest construction could occur, the crew sought evidence of either nest construction, redd formation or spawning aggregations of adult fish. In most cases the species of fish was visually determined, but in some cases (centrarchids) where the spawning adults could not be identified precisely to species, an attempt was made to collect the guardian male through angling. If that was not possible, the fish were identified to the genus level based on body form or listed as “unknown.”

At each spawning location an RTK-GPS unit was used to geo-reference the location and elevation of identified habitats, egg deposits, and nests; corresponding data describing the prevailing water depth, nest diameter (where applicable), substrate, vegetation and water velocity were recorded. The presence or absence of adult fish was also recorded. Also recorded was an opinion as to whether the nest was active or

abandoned. The field sheet was used to record any additional qualitative observations to assist with data interpretation such as general observations, weather conditions, and other relevant descriptive information.

Water temperature was recorded *in situ* using a handheld meter with a tethered probe; water clarity was measured using a secchi disc. Substrate was classified using a standard Wentworth scale. A stadia rod was used to record depth of identified spawning habitats, egg deposits, and nests.

Six temporary water level loggers were installed in the TFI to record water surface elevation and temperature on a 15-minute time step.

## Results

The early spring survey commenced May 4, 2015, once water levels were safe, and extended to May 6. Water temperature during this period ranged from 10.1 to 11.7 °C, except in the lower reaches of tributaries such as Pauchaug Brook and Millers River which were warmer (16-16.7 °C). Prevailing inflow to the impoundment during this period ranged from approximately 12,000 to 15,000 cfs, and water clarity was generally good (6-7.5 ft visibility), allowing clear view of the littoral zone bottom.

The late spring survey was initiated on June 1, 2015 but aborted due to rising river flow. The survey resumed June 11 and extended to June 13. Due to extensive precipitation in early June, relatively high river flow persisted and visibility was somewhat reduced to 4-6 ft. During the June 11 to 13 survey period, water temperature ranged from 18 to 21.5 °C, with the exception of one site at Stebbins Island, above the elevation of the impoundment at the time, where the water temperature was 17 °C.

A total of 18 spawning locations were surveyed during the early spawning season, and 16 locations were surveyed during the late spring season. A number of spawning locations, particularly in the late spring featured multiple nests clustered in close proximity to each other.

[Figure 2](#) illustrates the location and distribution of spawning sites that were detected during the survey. [Figure 3](#) shows the same data focused on the lower sections of the TFI where a majority of the spawning was observed during the second survey.

Presently the data are undergoing QA/QC review. Subsequent to the review, the data will be analyzed in association with Study 3.3.14 (Aquatic Habitat Mapping of Turners Falls Impoundment). A report will be prepared on the impacts of water level fluctuations in the TFI on resident species' spawning and spawning habitat, including potential nest abandonment, spawning fish displacement and egg dewatering.

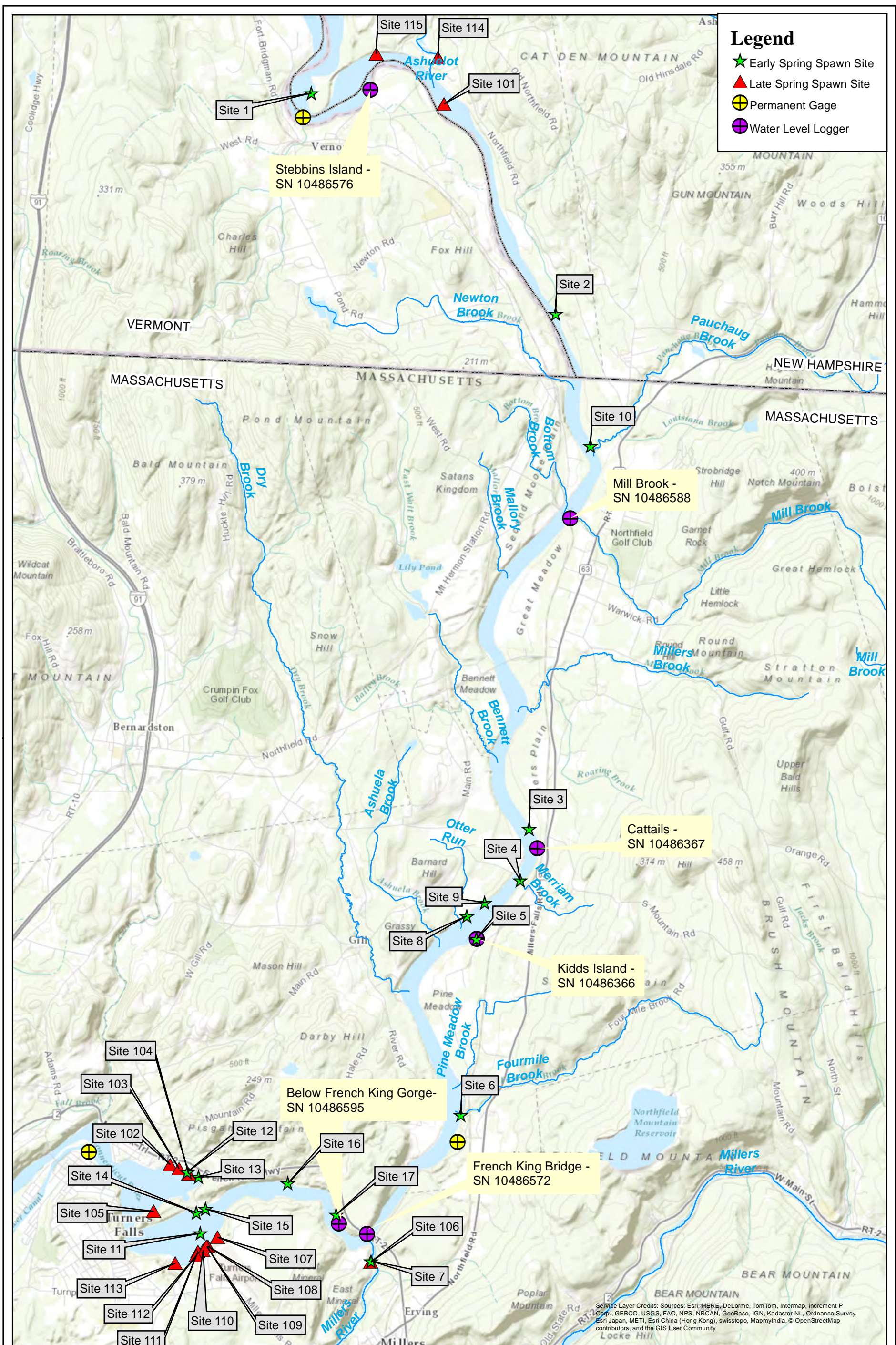
### **1.3 Variances from Study Plan and Schedule**

To date, there are no variances from the study plan. A final report will be completed by June 1, 2016.

### **1.4 Remaining Activities**

- Compile and review the collected field data
- Conduct analysis of these data in conjunction with Study No. 3.3.14, and Study No. 3.3.17.





**Legend**

- ★ Early Spring Spawn Site
- ▲ Late Spring Spawn Site
- ⊕ Permanent Gage
- ⊕ Water Level Logger



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UPDATED STUDY REPORT SUMMARY  
RELICENSING STUDY 3.3.13

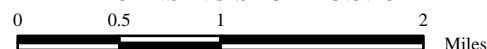
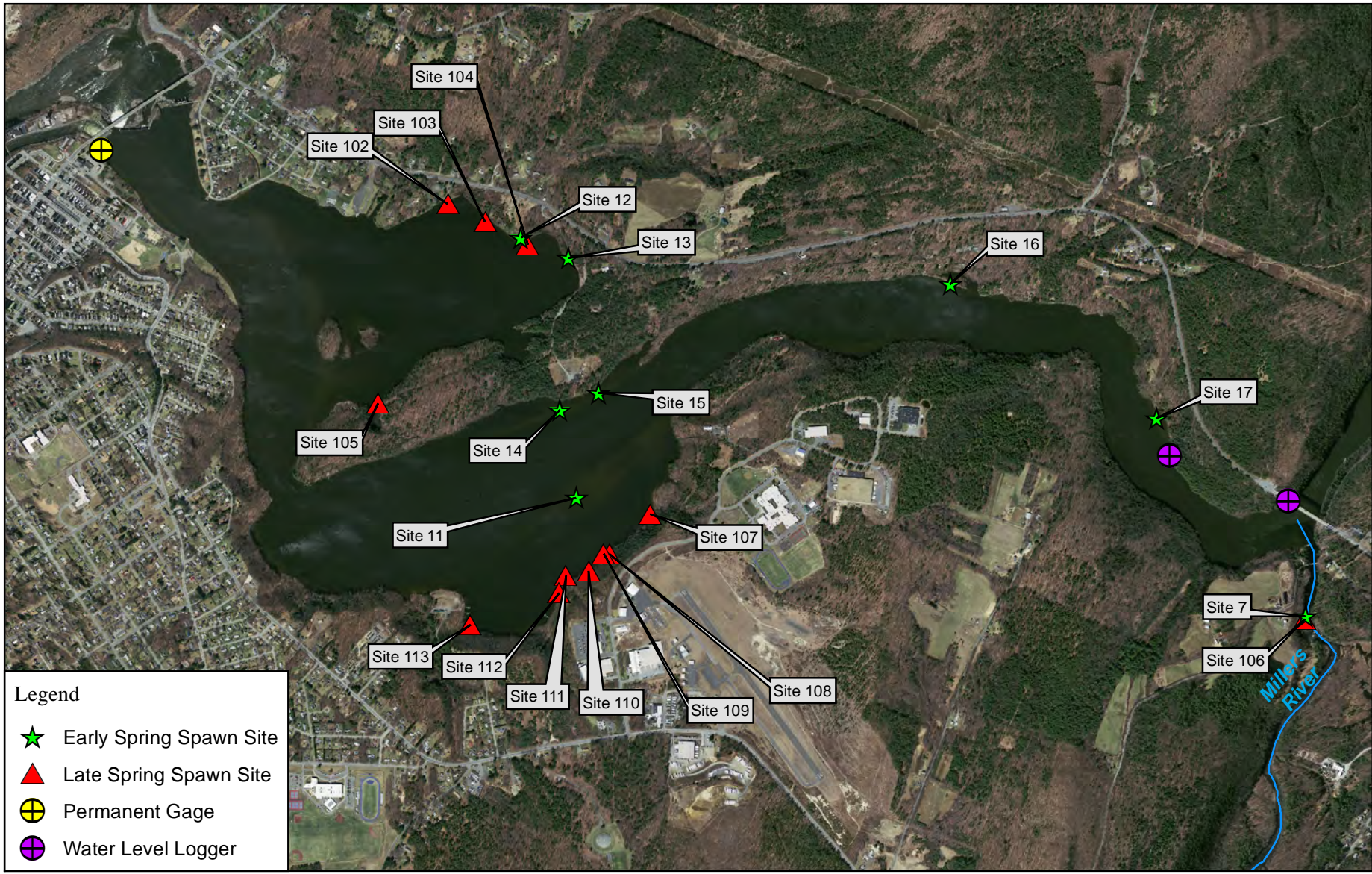


Figure 2: Overview of Littoral Zone Fish Spawning Survey Locations





**Legend**

- ★ Early Spring Spawn Site
- ▲ Late Spring Spawn Site
- ⊕ Permanent Gage
- ⊕ Water Level Logger

FirstLight  
GDF SVEZ



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UPDATED STUDY REPORT SUMMARY  
RELICENSING STUDY 3.3.13

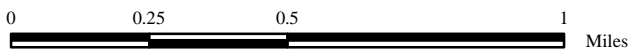


Figure 3: Littoral Zone Fish Spawning Survey Locations in the Lower Section of the Turners Falls Impoundment

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