

# Relicensing Study 3.2.1

## **WATER QUALITY MONITORING STUDY**

### **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

The purpose of this study is to characterize baseline water quality [water temperature, dissolved oxygen (DO)] conditions in the Turners Falls Impoundment (TFI), bypass reach, power canal and in the Connecticut River below Cabot Station.

## 1.2 Study Progress Summary

### Task 1: Develop Sampling Plan

The Federal Energy Regulatory Commission's (FERC) February 21, 2014 Study Plan Determination Letter (SPDL), stated "*We recommend FirstLight develop a temperature monitoring study plan for the reach between Cabot Station and the Holyoke dam to describe temperature and temperature rate of change associated with peaking operations. The plan should be developed in consultation with interested stakeholders and file for Commission approval with the Initial Study Report in September 2014.*"

FirstLight emailed the Water Quality Monitoring Study Field Sampling Plan on June 30, 2014 to the United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Massachusetts Department of Environmental Protection (MADEP), New Hampshire Department of Environmental Services (NHDES), Vermont Agency of Natural Resources (VANR), Massachusetts Division of Fish and Wildlife (MDFW), Connecticut River Watershed Council (CRWC), Trout Unlimited (TU), The Nature Conservancy (TNC), Landowners and Concerned Citizens for License Compliance (LCCLC), Franklin Regional Council of Governments (FRCOG) and Karl Meyer and requested written comments be provided by July 28, 2014. Comments were received from the following:

- MADEP Division of Watershed Management
- CRWC
- MDFW (Natural Heritage and Endangered Species Program, NHESP)

Based on the comments received, the Field Sampling Plan was revised and filed as Appendix A to the ISR filing. The Field Sampling Plan was approved without modification in FERC's January 22, 2015 Determination on Requests for Study Modifications and New Studies.

### Tasks 2 - 3: Continuous Dissolved Oxygen and Temperature Monitoring and Vertical Profiles

There are a total of 18 water quality sampling locations as summarized in [Table 1](#). [Table 1](#) includes a summary of when the continuous water quality equipment was installed and when DO/temperature profiles began in the TFI.

Continuous temperature loggers were installed in the TFI on April 3, 2015, in the bypass reach and power canal on March 31, 2015, and in the Connecticut River below Cabot Station on April 10, 2015 (or April 30, 2015 for Station 12).

The continuous temperature monitoring equipment in the TFI, power canal, bypass reach, and at Station 11, below Cabot Station, was replaced with continuous DO and temperature loggers on May 13 or 14, 2015. The water quality monitoring equipment is serviced approximately every two weeks to collect independent spot measurements, download and review the continuous data, and clean and calibrate the meters, as necessary.

The continuous water quality monitoring equipment was installed during a period of higher flows. For the temperature monitoring Stations 13 and 14 (located below Cabot), there was a period when water levels

dropped to a point that the equipment was exposed. The monitoring equipment for these two stations was repositioned in a deeper location during the bi-weekly servicing.

The DO/temperature profiles in the TFI (Stations 2, 6, 7) started on April 3, 2015 at Stations 2 and 6. Profiles at Station 7 (boat barrier line) could not be conducted because this location was still ice-covered in early April. Additionally, during subsequent sampling events, flows were in excess of 20,000 cfs and the boat barrier line had not been installed. Per FirstLight's safety protocol, study boats are not permitted below the Northfield Mountain tailrace when flows exceed approximately 20,000 cfs, or until the boat barrier is installed. The boat barrier was installed on May 13, 2015. The first vertical profile at Station 7 was collected on May 14, 2015.

The vertical profiles are being collected in the early morning, between 6-9 am. As requested by MADEP, data through June 30 were provided to MADEP along with the corresponding vertical profile data. FirstLight consulted with MADEP to determine if early morning vertical profile collection is justified. MADEP indicated that the proposed schedule of starting at 6:30 - 7:00 and finishing around 9:00 for biweekly profiles is approved (email from R. Kubit, July 20, 2015).

The general findings to date include:

Flow and weather conditions in the study area during the monitoring period are compared to long-term averages. Summer conditions in July and August have been fairly typical. April and May were drier than normal and June was wetter. May was very dry and warm and there were only 0.62 inches of rain recorded that month at Sunderland, MA which is -3.62 inches less than normal. Conversely, June was wetter than normal, having 7.37 inches of rain at Sunderland (+3.00 inches above normal). July precipitation was slightly higher than normal (+1.31 inches). [Table 2](#) summarizes the monthly precipitation and average air temperatures in the vicinity of the Project.

Average daily flow data from the USGS Montague City, MA gage were obtained for the monitoring period and compared to long-term median daily value in [Figure 1](#). Flows were generally higher than the long-term average in mid-April and for most of June, and below average in May. Thus far in July and August, flows have been low, and typically close to the long-term average.

#### DO/Temperature Vertical Profiles

- Through August 18, 2015, the river was well-mixed at each of the three profiles stations; the DO and temperature did not vary considerably between the water surface and deepest point of the profile. On August 18, the water temperature at Station 2 (the most upstream profile) ranged from 24.8-24.9 °C and DO was above 7.3 mg/L at all depths. The profiles collected at Station 6-7 were slightly warmer (25.3-25.8 °C) and DO was above 7.5 mg/L at all depths.
- None of the biweekly profiles have revealed any evidence of vertical stratification up to this point in the sampling program.

#### Continuous DO/Temperature

- As of August 18, 2015, the continuous monitoring data are undergoing review for quality assurance. Preliminary results reveal that DO measurements in the TFI are above the MA water quality standard of 5.0 mg/L. The maximum instantaneous water temperature observed thus far in the TFI has been 26.7 °C. Data from monitoring stations in the bypass reach, canal and below Cabot Station are still in review.
- Water temperature data at the stations below Cabot Station are being reviewed for quality assurance. Preliminary results reveal that water temperatures are very similar from station to station.

- Flow and operations data are being compiled in an ongoing basis for use in the analysis of the water quality data.

#### Task 4: Data Analysis and Report

Data analysis is ongoing. Per the study plan, continuous DO data are to be collected through September 30, 2015, and continuous temperature and vertical profile data are to be collected through November 15, 2015. The report is not complete.

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

The Study Plan called for commencement of continuous water temperature sampling and collection of vertical profiles beginning on April 1, 2015. The study area was initially visited on March 31, 2015 at which time the monitoring equipment was installed in the bypass reach and canal (Stations 8-10). Some of the continuous loggers were not in place by April 1 due to ice cover on the Connecticut River making some of the locations inaccessible for installation. See [Photo 1](#) of the Pauchaug boat launch taken on March 31, 2015.

With the exception of Station 7 at the boat barrier line, the continuous temperature loggers in the TFI were installed on April 3, 2015. There was ice cover on Barton Cove into April and because the boat barrier was not installed until May 13, 2015, safety concerns prevented installation of a temperature logger at Station 7 until May 14, 2015.

The continuous temperature loggers below Cabot Station were installed on April 10, 2015, once the boat launch was open water and clear of ice. The exception was at Station 12, the temperature logger was initially installed too far upstream and repositioned to the intended station on April 30, 2015.

Similar to the continuous monitoring effort, the vertical profiles began on April 3, 2015, except at Station 7. Because the boat barrier was not installed until May 13, 2015, safety concerns prevented profile collection until May 14, 2015. No profiles were collected at Stations 6 and 7 on June 25, 2015 due to high flows causing a safety concern.

Also note that at Station 10 in the canal, the study plan specified the monitoring location should be at the 11<sup>th</sup> Street Bridge. The actual location for Station 10 is about 950 feet upstream from this locations at the old railroad bridge across the canal. This station was chosen because it is more secure than the public bridge.

### **1.4 Remaining Activities**

- Analysis of the data.
- Completion of the report.

**Table 1: Water Quality Sampling Locations**

Station No.	Type	Location	Date Installed
Connecticut River- Turners Falls Impoundment (Temperature and DO)			
1	Continuous	Below the Vernon Dam and Ashuelot River Confluence	Temperature: 4/3/2015 DO: 5/14/15
2	Profile	Deep area upstream of Northfield Mountain	Profiles collected biweekly starting on 4/3/2015
3	Continuous	Above the Northfield Mountain Tailrace; Downstream of Kidds Island	Temperature: 4/3/2015 DO: 5/14/15
4	Continuous	Northfield Mountain Tailrace	Temperature: 4/3/2015 DO: 5/14/15
5	Continuous	Below the Northfield Mountain Tailrace; Upstream of Millers River Confluence	Temperature: 4/3/2015 DO: 5/14/15
6	Profile	Deepest area of Turners Falls Impoundment	Profiles collected biweekly starting on 4/3/2015
7	Profile and Continuous	Upstream of the Turners Falls Dam at Boat Barrier	Temperature and DO: 5/14/15. Profiles collected biweekly starting on 5/14/2015
Connecticut River- Bypass Reach (Temperature and DO)			
8	Continuous	Upstream of Station No. 1	Temperature: 3/31/2015 DO: 5/14/15
9	Continuous	Upstream of Rock Dam; west channel at Rawson Island.	Temperature: 3/31/2015 DO: 5/13/15
Turners Falls Power Canal (Temperature and DO)			
10	Continuous	At the Railroad Bridge	Temperature: 3/31/2015 DO: 5/13/15
Connecticut River- Below Cabot Station (Temperature and DO)			
11	Continuous	Below the Cabot Station tailrace, upstream of Deerfield River confluence	Temperature: 4/10/2015 DO: 5/13/15
Connecticut River- Cabot Station to Holyoke Dam (Temperature)			
12	Continuous	Downstream of the Deerfield River confluence at railroad bridge	4/30/15
13	Continuous	Third Island	4/10/15
14	Continuous	Second Island, near shore of island.	4/10/15
15	Continuous	Submerged shallow bar	4/10/15
16	Continuous	Submerged shallow bar	4/10/15
17	Continuous	River right channel at Elwell Island	4/10/15
18	Continuous	Mitch's Island	4/10/15

**Table 2: 2015 Monthly Average Air Temperatures and Total Precipitation at Sunderland and Greenfield, MA Compared with Long-Term Average**

Month	Air Temperature (°F), Greenfield, MA			Precipitation (inches), Sunderland, MA		
	Mean (2015)	Normal (2000-2014)	Departure	Total (2015)	Normal (1979-2014)	Departure
April	44.3	47.3	-3.0	2.09	4.03	-1.94
May	62.0	57.4	+4.6	0.61	4.23	-3.62
June	63.3	65.8	-2.4	7.37	4.37	+3.00
July	69.5	71.0	-1.5	5.70	4.39	+1.31
August	incomplete	69.1	incomplete	incomplete	4.31	incomplete

Source: NOAA Online Weather Data. Monthly Total Precipitation for Sunderland, MA. Monthly Mean of Average Daily Temperature for Greenfield No. 3, MA.



**Photo 1: Pauchaug boat launch on March 31, 2015.**



Figure 1: 2015 Connecticut River Discharge at Montague City, MA (USGS Gage No. 01170500) compared to long-term median (through August 18).

