

Relicensing Study 3.6.6

**Assessment of Effects of Project
Operation on Recreation and Land Use
Study Report**

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

Prepared for:



Prepared by:



OCTOBER 2016

EXECUTIVE SUMMARY

FirstLight Hydro Generating Company (FirstLight) is the current licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485) and the Turners Falls Hydroelectric Project (FERC No. 1889). FirstLight has initiated the process of relicensing the two projects using the Federal Energy Regulatory Commission's (FERC or Commission) 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.

FirstLight filed a Revised Study Plan (RSP) on August 14, 2013. On September 13, 2013, FERC issued its first Study Plan Determination Letter (SPDL) in which Study No 3.6.6. *Assessment of Project Operation on Recreation Land Use* was accepted. The primary focus of Study No. 3.6.6 is to determine if the operation of the Northfield Mountain Project and the Turners Falls Project, particularly with respect to changes in water levels, has an effect on recreation facilities at either Project.

FirstLight identified 12 recreation sites at which water access or water-based recreation facilities could be potentially affected by Project operation and the resulting changes in water levels and flows where applicable. To assess any potential operational impacts at the sites, FirstLight reviewed information from existing relicensing studies and relied on the HEC-RAS hydraulic model developed as part of Study No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment and below Cabot Station*, to provide water surface elevations and river depths at the water-based recreation sites/facilities within the Projects.

Of the 12 sites evaluated, operation of the Turners Falls and Northfield Mountain Projects were found to have none to minimal impact on seven (7) water based recreation facilities including the Governor Hunt Boat Launch/Picnic Area, Munn's Ferry Boat Camping Recreation Area, the Boat Tour and Riverview Picnic Area, Cabot Camp Access Area, Poplar Street Access, or the Sunderland Bridge Boat Launch during the recreation season (May-October). The Barton Cove Canoe/Kayak Rental Area launch area has two (2) feet of water for launching canoes and kayaks 90% of the time during the recreation season (May-October); the remaining 10% of the time canoeists and kayakers would have to walk a short distance (approximately 15 to 30 feet) further to launch their watercraft.

Minimal impacts to four (4) water-based recreation sites and facilities were found to occur at the Barton Cove Nature Area and Campground, the State Boat Launch, Turners Falls Station No. 1 Fishing Access, and Cabot Woods Fishing Access. Barton Cove is a uniformly shallow cove, much of which is densely filled with aquatic vegetation. Nonetheless water surface elevations are such that the water-based recreation facilities located within the cove remain useable under most impoundment elevations, with the State Boat Launch remaining usable 98% to 99% of the time during the recreation season (May-October), and the boat dock at the Barton Cove Nature Area and Campground also useable 89% to 93% of the time during the months of May through October. The State Boat Launch also has sufficient water depth 100% of the time during the recreation season for use by emergency rescue craft. The Turners Falls Station No. 1 Fishing Access and Cabot Woods Fishing Access are minimally impacted by river flow and water levels. As the flows in the bypass reach increase, the amount of shoreline decreases, however, access remains for bank fishing under a wide range of flows.

One recreation site, the state-owned Pauchaug Boat Launch, was found to be moderately impacted by Project operations. There are occasions (5% to 20% of the time depending on the month) during the recreation season (May-October), when impoundment elevations of less than 181 feet may impact the use of this recreation site by making it more difficult to launch trailerable boats, although canoes and kayaks can still be launched. The launch also has sufficient water depth for use by emergency rescue craft 95% to 100% of the time during the recreation season. Unrelated to Project operation, the boat launch is susceptible to sediment accumulation generally during naturally occurring high spring flows. The sediment does need

Northfield Mountain Pumped Storage Project (No.2485) and Turners Falls Hydroelectric Project (No. 1889)
STUDY 3.6.6 ASSESSMENT OF EFFECTS OF PROJECT OPERATION ON RECREATION AND LAND USE
STUDY REPORT

to be cleared from the ramp and excavated from the base of the ramp by the State periodically to maintain the launch ramp in a useable condition.

TABLE OF CONTENTS

1	INTRODUCTION	1-1
2	STUDY SCOPE	2-1
3	METHODS.....	3-1
3.1	Hydraulic Model Study Reaches.....	3-1
4	RESULTS.....	4-1
4.1	Recreation and Relicensing Study Review	4-1
4.2	Effects of Project Operations on Recreation Sites/Facilities	4-2
4.2.1	Governor Hunt Boat Launch.....	4-2
4.2.2	Pauchaug Boat Launch	4-3
4.2.3	Munn’s Ferry Boat Camping Recreation Area	4-9
4.2.4	Boat Tour and Riverview Picnic Area	4-12
4.2.5	Cabot Camp Access Area	4-17
4.2.6	Barton Cove Canoe and Kayak Rental Area and Barton Cove Nature Area and Campground.....	4-22
4.2.7	State Boat Launch	4-29
4.2.8	Turners Falls Station No. 1 Fishing Access	4-31
4.2.9	Cabot Woods Fishing Access	4-35
4.2.10	Poplar Street Access Site	4-41
4.2.11	Sunderland Bridge Boat Launch.....	4-46
5	DISCUSSION.....	5-1
6	LITERATURE CITED	6-1

LIST OF TABLES

Table 2-1 Recreation Sites Assessed2-1
Table 5-1 Summary of Project Effects on Water Based Recreation Sites and Facilities5-1

LIST OF FIGURES

Figure 2-1 Study Area.....2-2
Figure 4.2.2-1 Pauchaug Boat Launch.....4-6
Figure 4.2.2-2 Pauchaug Boat Launch Bottom Contour Elevation and Median Monthly WSEL4-7
Figure 4.2.2-3 Pauchaug Boat Launch WSEL Duration Curves, Monthly (May-October).....4-8
Figure 4.2.3-1 Munn’s Ferry Boat Camping Recreation Area Floating Boat Dock4-10
Figure 4.2.3-2 Munn’s Ferry Boat Camping Recreation Area Bottom Contour Elevation and Median
Monthly WSEL4-11
Figure 4.2.4-1 Riverview Boat Dock.....4-14
Figure 4.2.4-2 Riverview Bottom Contour Elevation and Median Monthly WSEL4-15
Figure 4.2.4-3 Riverview WSEL Duration Curves, Monthly (May-October)4-16
Figure 4.2.5-1 Cabot Camp Access Area.....4-18
Figure 4.2.5-2 Cabot Camp Access Area.....4-19
Figure 4.2.5-3 Cabot Camp Access Area Bottom Contour Elevation and Median Monthly WSEL4-20
Figure 4.2.5-4 Cabot Camp Access Area WSEL Duration Curves, Monthly (May-October).....4-21
Figure 4.2.6-1 Barton Cove Canoe and Kayak Rental Area as seen from Barton Cove.....4-24
Figure 4.2.6-2 Barton Cove Nature Area and Campground boat dock.....4-25
Figure 4.2.6-3 Barton Cove Bathymetric Contours and Hydraulic Model Transect Locations.....4-26
Figure 4.2.6-4 Barton Cove (Transect 1657) Bottom Contour Elevation and Median Monthly WSEL .4-27
Figure 4.2.6-5 Barton Cove (Transect 1657) WSEL Duration Curves, Monthly (May-October)4-28
Figure 4.2.7-1 State Boat Launch4-30
Figure 4.2.8-1 Recreation Sites Below Turners Fall Dam4-32
Figure 4.2.8-2 Turners Falls Station No. 1 Fishing Access4-33
Figure 4.2.8-3 Transect 10 WSEL with Station No. 1 at 96 cfs4-34
Figure 4.2.9-1 Cabot Woods Fishing Access – Rock Dam Pool4-37
Figure 4.2.9-2 Cabot Woods Fishing Access – Example of Steep Trails to Bypass Shoreline4-38
Figure 4.2.9-3 WSELs in Pool Upstream of Rock Dam Based on Bypass Flows4-39
Figure 4.2.9-4 WSEL in the Pool Downstream of Rock Dam Based on Bypass Flows and Cabot
Generation4-40
Figure 4.2.10-1 Poplar Street Access Site.....4-43
Figure 4.2.10-2 Poplar Street Access Bottom Contour Elevation and Median Monthly WSEL4-44
Figure 4.1.10-3 Poplar Street WSEL Duration Curves, Monthly (May-October)4-45
Figure 4.2.11-1 Sunderland Bridge Boat Launch4-47
Figure 4.2.11-2 Sunderland Bridge Boat Launch Bottom Contour Elevation and Median Monthly
WSEL4-48
Figure 4.2.11-3 Sunderland Bridge Boat Launch WSEL Duration Curves, Monthly (May-October)4-49

LIST OF ABBREVIATIONS

cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
fps	feet per second
FirstLight	FirstLight Hydro Generating Company
HEC-RAS	Hydrologic Engineering Center- River Analysis System
ILP	Integrated Licensing Process
MADFG	Massachusetts Department of Fish and Game
NGVD29	National Geodetic Vertical Datum of 1929
NOI	Notice of Intent
Northfield Mountain Project	Northfield Mountain Pumped Storage Project
NMTTC	Northfield Mountain Tour and Trail Center
PAD	Pre-Application Document
Project	Northfield Mountain Project and Turners Falls Project
PSP	Proposed Study Plan
QII	Quinnetukut II
RSP	Revised Study Plan
SD1	Scoping Document 1
SD2	Scoping Document 2
SPDL	Study Plan Determination Letter
TFI	Turners Falls Impoundment
Turners Falls Project	Turners Falls Hydroelectric Project
WSEL	water surface elevation

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 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 (NOI) with FERC. The PAD included FirstLight's preliminary list of proposed studies. As part of the ILP, FERC conducted public scoping meetings to identify resource issues. 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 Northfield Mountain and Turners Falls Projects. FERC issued Scoping Document 2 (SD2) on April 15, 2013.

FirstLight filed its Proposed Study Plan (PSP) on April 15, 2013 and, per Commission regulations, held a PSP meeting at the Northfield Mountain Visitor Center on May 14, 2013. Thereafter, FirstLight held ten resource-specific study plan meetings to allow for more detailed discussions on each study plan and on studies not being proposed. On June 28, 2013, FirstLight filed with the Commission an Updated PSP to reflect revisions to the PSP based on scoping comments. On or before July 15, 2013, stakeholders filed written comments on the Updated PSP. Subsequently, FirstLight filed a Revised Study Plan (RSP) on August 14, 2013. On September 13, 2013, FERC issued its first Study Plan Determination Letter (SPDL), in which Study 3.6.6 *Assessment of Effects of Project Operation on Recreation and Land Use* was accepted without modification.¹

As stated in the RSP, the single objective of this assessment is to determine if the operation of the Northfield Mountain Project and the Turners Falls Project has an effect on recreation facilities or land use within either Project and down to the Sunderland Bridge. As set forth in the Methodology section of the RSP, the intent of the assessment is to evaluate whether there are access issues resulting from water level fluctuations due to Project operations, including any potential impacts to launching watercraft for emergency rescue operations.

It must be noted that while consideration of Project operational effects on land use was included in the objectives statement of this study plan, this assessment focused on Project operational effects, particularly changes in water levels and flows, where applicable on recreation sites and facilities. The examination of land use and the effects of Project operations (and resulting changes in water levels and velocities) on land use were more specifically evaluated through other relicensing studies, including primarily Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability*, Study No. 3.1.1 *Full River Reconnaissance Study*, and Study No. 3.6.5 *Land Use Inventory*.

¹FERC subsequently issued additional SPDLs with respect to proposed studies. These SPDLs, however, did not affect Study 3.6.6.

2 STUDY SCOPE

The geographic scope of this assessment is the lands and waters within the Project boundary for the Turners Falls and Northfield Mountain Projects, as well as the Connecticut River from Turners Falls Dam downstream to the Sunderland Bridge. The primary focus of the assessment are the recreation sites providing public recreation access to Project waters, as well as recreation sites providing water access to the Connecticut River downstream of the Project to the Sunderland Bridge. The temporal scope of the recreation facility portion of the assessment is the recreation season, May-October, when the water access to recreation sites and facilities are most likely to be utilized for water-based recreation activities.

The recreation sites providing water access to Project waters, or to the Connecticut River downstream of the Turners Falls Project to the Sunderland Bridge, and that are the focus of this assessment, are listed in [Table 2-1](#) and shown in [Figure 2-1](#).

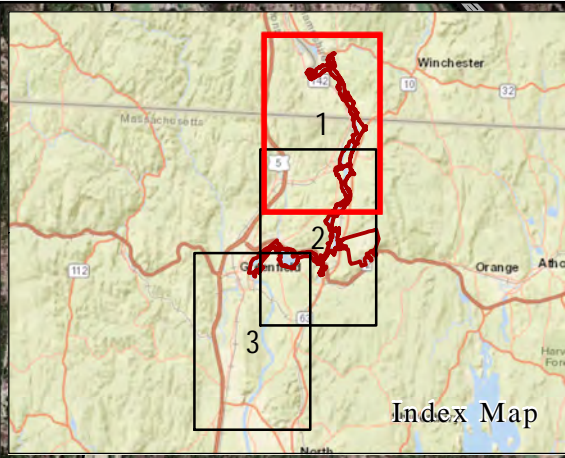
Table 2-1 Recreation Sites Assessed

Recreation Site	Waters Accessed
Governor Hunt Boat Launch/Picnic Area ²	Vernon Project Tailwater/ Turners Falls Impoundment
Pauchaug Boat Launch ³	Turners Falls Impoundment
Munn’s Ferry Boat Camping Recreation Area	Turners Falls Impoundment
Boat Tour and Riverview Picnic Area	Turners Falls Impoundment
Cabot Camp Access Area	Turners Falls Impoundment
Barton Cove Nature Area and Campground	Turners Falls Impoundment
Barton Cove Canoe and Kayak Rental Area	Turners Falls Impoundment
State Boat Launch	Turners Falls Impoundment
Turners Falls Station No. 1 Fishing Access	Turners Falls Bypass
Cabot Woods Fishing Access	Turners Falls Bypass
Poplar Street Access Site	Connecticut River
Sunderland Bridge Boat Launch ⁴	Connecticut River

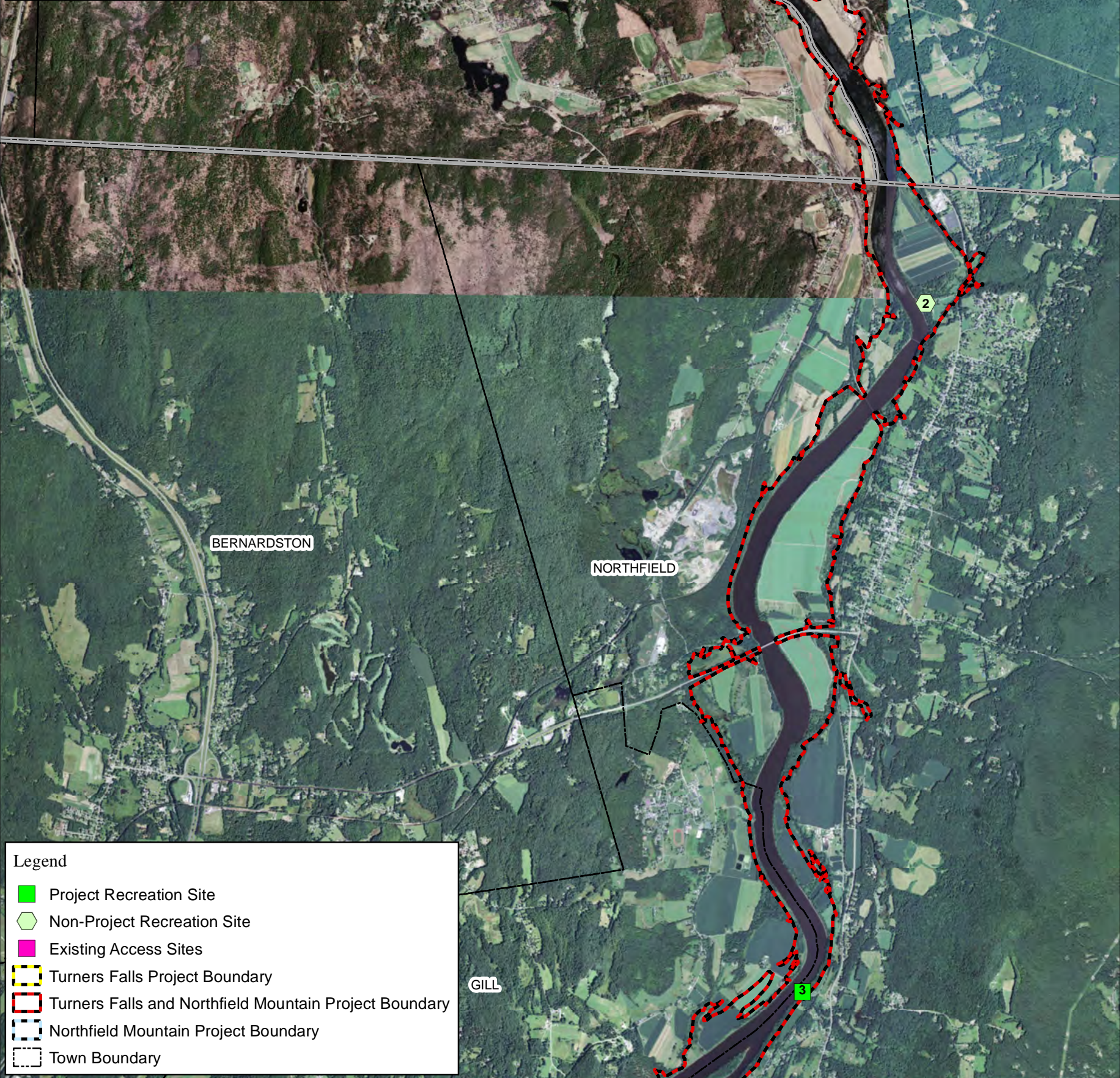
² This recreation site is owned and operated by the Licensee of Vernon Hydroelectric Project (Project No. 1904) and is in the Vernon Project boundary. A portion of the site is also located in the Project boundary for the Northfield Mountain and Turners Falls Projects.

³ The Pauchaug Boat Launch and State Boat Launch are owned and operated by the State of Massachusetts Department of Fish and Game.

⁴ This recreation site is maintained by the Town of Sunderland.



- Site**
- 1 Governor Hunt Boat Launch/Picnic Area
 - 2 Pauchaug Boat Launch
 - 3 Munn's Ferry Boat Camping Recreation Area
 - 4 Boat Tour and Riverview Picnic Area
 - 5 Cabot Camp Access Area
 - 6 Barton Cove Campground
 - 7 Barton Cove Nature Area
 - 8 Barton Cove Canoe and Kayak Rental Area
 - 9 State Boat Launch
 - 10 Turners Falls Station No. 1 Fishing Access
 - 11 Cabot Woods Fishing Access
 - 12 Poplar Street Access Site
 - 13 Sunderland Bridge Unimproved Carry-in Access Site
 - 14 Sunderland Bridge Boat Launch



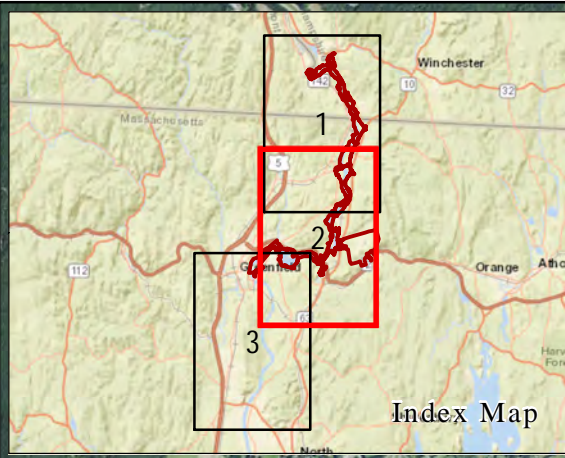
- Legend**
- Project Recreation Site
 - ◊ Non-Project Recreation Site
 - Existing Access Sites
 - Turners Falls Project Boundary
 - Turners Falls and Northfield Mountain Project Boundary
 - Northfield Mountain Project Boundary
 - Town Boundary

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

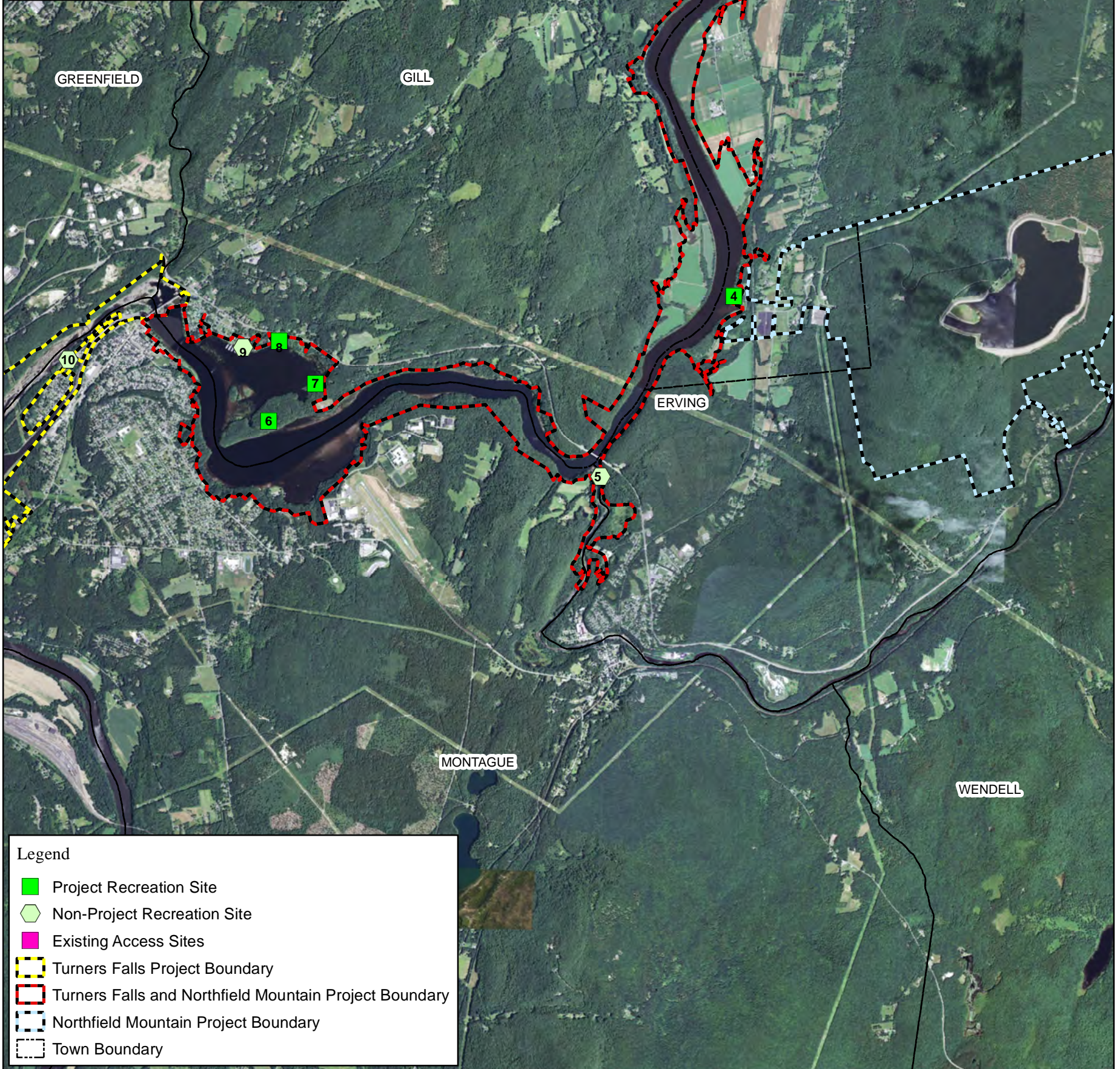
Study 3.6.6 Assessment of Effects of Project Operation on Recreation and Land Use

Figure 2-1: Study Area





- Site**
- 1 Governor Hunt Boat Launch/Picnic Area
 - 2 Pauchaug Boat Launch
 - 3 Munn's Ferry Boat Camping Recreation Area
 - 4 Boat Tour and Riverview Picnic Area
 - 5 Cabot Camp Access Area
 - 6 Barton Cove Campground
 - 7 Barton Cove Nature Area
 - 8 Barton Cove Canoe and Kayak Rental Area
 - 9 State Boat Launch
 - 10 Turners Falls Station No. 1 Fishing Access
 - 11 Cabot Woods Fishing Access
 - 12 Poplar Street Access Site
 - 13 Sunderland Bridge Unimproved Carry-in Access Site
 - 14 Sunderland Bridge Boat Launch



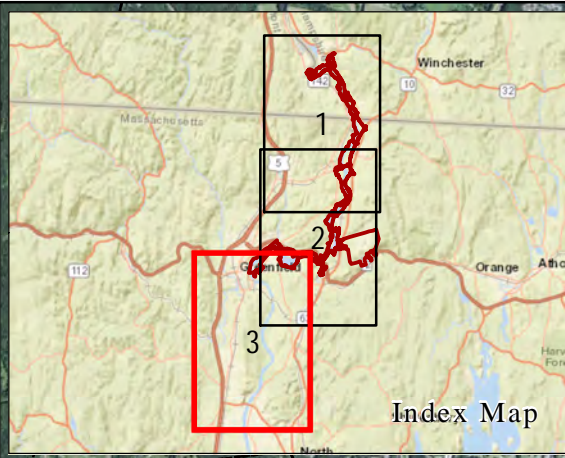
- Legend**
- Project Recreation Site
 - ◊ Non-Project Recreation Site
 - Existing Access Sites
 - Turners Falls Project Boundary
 - Turners Falls and Northfield Mountain Project Boundary
 - Northfield Mountain Project Boundary
 - Town Boundary

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

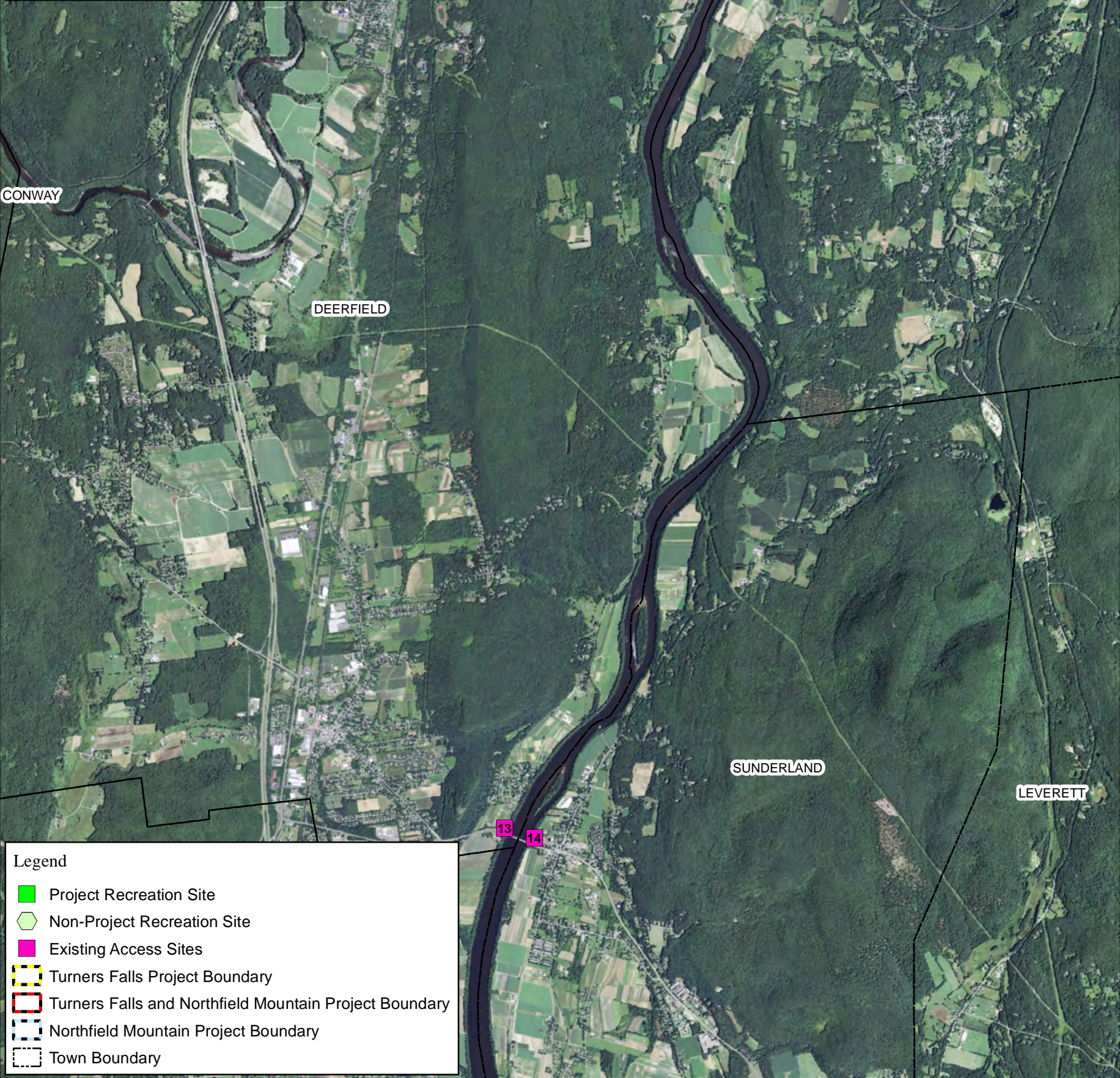
Study 3.6.6 Assessment of Effects of Project Operation on Recreation and Land Use

Figure 2-1: Study Area





- Site**
- 1 Governor Hunt Boat Launch/Picnic Area
 - 2 Pauchaug Boat Launch
 - 3 Munn's Ferry Boat Camping Recreation Area
 - 4 Boat Tour and Riverview Picnic Area
 - 5 Cabot Camp Access Area
 - 6 Barton Cove Campground
 - 7 Barton Cove Nature Area
 - 8 Barton Cove Canoe and Kayak Rental Area
 - 9 State Boat Launch
 - 10 Turners Falls Station No. 1 Fishing Access
 - 11 Cabot Woods Fishing Access
 - 12 Poplar Street Access Site
 - 13 Sunderland Bridge Unimproved Carry-in Access Site
 - 14 Sunderland Bridge Boat Launch

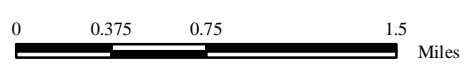


- Legend**
- Project Recreation Site
 - ◊ Non-Project Recreation Site
 - Existing Access Sites
 - Turners Falls Project Boundary
 - Turners Falls and Northfield Mountain Project Boundary
 - Northfield Mountain Project Boundary
 - Town Boundary

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

Study 3.6.6 Assessment of Effects of Project Operation on Recreation and Land Use

Figure 2-1: Study Area



3 METHODS

A variety of information and data sources were used in this assessment to evaluate the effects of Project operations on the existing recreation sites and facilities, and their use. As noted, the primary focus of the assessment was on the effects of Project operations, and the resulting changes in water levels on the use of recreation sites and facilities intended to provide recreational access to Project waters or to the Connecticut River downstream of, but within the potential operational influence of the Turners Falls and Northfield Mountain Projects. Information was drawn primarily from ongoing or recently completed relicensing resource studies, including the following:

- Study No. 3.6.1 *Recreation Use/User Contact Survey* ([FirstLight, 2015a](#)),
- Study No. 3.6.2 *Recreation Facilities Inventory and Assessment* ([FirstLight, 2015b](#)),
- Study No. 3.6.3 *Whitewater Boating Evaluation* ([FirstLight, 2015c](#)),
- Study No. 3.6.4 *Assessment of Day Use and Overnight Facilities Associated with Non-Motorized Boats* ([FirstLight, 2015d](#)), and
- Study No. 3.6.7 *Recreation Study at Northfield Mountain, including Assessment of Sufficiency of Trails for Shared Use* ([FirstLight, 2015e](#)) (Recreation Studies).

The Recreation Studies were used to identify the water access sites and facilities to be evaluated. Results of the *Recreation Use/User Contact Survey* ([FirstLight, 2015a](#)) were also reviewed to glean additional information on user perceptions of potential Project operational effects on water access sites and facilities.

Other studies that were considered as part of this assessment included the following:

- Study No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot Station* ([FirstLight, 2015f](#));
- Study No. 3.3.1 *Instream Flow Studies in Bypass Reach and below Cabot Station* (expected to be filed with FERC on 10/14/2016);
- Study No. 3.3.9 *Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace* ([FirstLight, 2015g](#)); and,
- Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability* ([FirstLight, 2016a](#)).

3.1 Hydraulic Model Study Reaches

Study No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot Station* ([FirstLight, 2015f](#)) included the development of two HEC-RAS⁵ hydraulic models of two reaches of the Connecticut River including:

- the Turners Falls Impoundment (TFI) from the Turners Falls Dam to the Vernon Dam (“TFI hydraulic model”) and,
- the Connecticut River from the United States Geological Survey Gage (USGS, Gage No. 01170500) in Montague to the Holyoke Dam (“Montague hydraulic model”).

⁵ HEC-RAS- Hydrologic Engineering Center- River Analysis System.

The hydraulic models were used to predict water surface elevations (WSEL), mean channel velocities, and depths at various locations (transects) along the study reaches under a range of river flows and Project operating conditions.

Study No. 3.2.2 Hydraulic Model Report was filed with FERC on March 31, 2015. For the TFI hydraulic model, bathymetric data was collected via boat over the entire study reach, thus there is excellent coverage of the entire study reach. Model transects occur approximately every 250 feet from the Turners Falls Dam to Vernon Dam. As part of Study No. 3.2.2 water level loggers were installed at various locations in the TFI that recorded the WSEL⁶ every 15 minutes and for a long duration (see Study 3.2.2 report). As part of the model development and calibration process, the hydraulic model produced WSELs were compared to the observed WSELs obtained with the water level loggers. In summary, there was an excellent match relative to the magnitude and timing of the observed versus modeled WSELs at the water level loggers. Because the hydraulic model is well-calibrated to observed conditions, it was used to predict WSEL's at transects in the TFI by simulating, on an hourly basis, the conditions (Vernon discharges, tributary inflow from the Ashuelot and Millers River, Northfield Mountain Project operations, WSEL at the Turners Falls Dam) that occurred between January 1, 2000 to September 30, 2015. Thus, modeled hourly WSEL data were developed for the 15 year period of record and could be applied to the location of recreation sites and facilities in the study reach.

In addition to the HEC-RAS model developed of the TFI, a 2-dimensional hydraulic model (River2D) was used to evaluate the hydraulics from 5 km downstream to 5 km upstream of the Northfield Mountain Project tailrace/intake. The report for Study No. 3.3.9 *Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace* was filed with FERC on December 1, 2015. The model was primarily developed to determine the impact of the Northfield Mountain Project operations on migratory fish passage. The study determined the WSEL, depth and velocity in the 10 km reach under the following combinations; Northfield Mountain Project pump (2, 4 units) and generation (2, 4 units), starting Turners Falls Dam WSELs (176, 181.3 and 185 feet) and flow through the TFI

Recreation sites/facilities located in the TFI hydraulic model study or the River 2D study reach include:

- Governor Hunt Boat Launch
- Pauchaug Boat Launch
- Munn's Ferry Boat Camping Recreation Area
- Boat Tour and Riverview Picnic Area (River 2D area)
- Cabot Camp Access Area
- Barton Cove Canoe and Kayak Rental Area and Barton Cove Nature Area and Campground
- State Boat Launch

The level of bathymetric data utilized in the Montague hydraulic model is coarser than the TFI hydraulic model, and the transects are spaced further apart. Whereas detailed bathymetry was collected throughout the TFI to "cut" transects, transect data for the Montague hydraulic model includes a combination of:

- transects from Federal Emergency Management Agency (FEMA) flood insurance studies,
- transects of the Connecticut River in the town of Hatfield collected for Study 3.2.2, and

⁶ Note that all elevations in this document are based on the National Geodetic Vertical Datum of 1929 or NGVD29.

- transects developed by the Corps of Engineers of the Northampton area (obtained for a separate hydraulic model developed by the Corps).

As part of Study No. 3.2.2 water level loggers were installed at locations in the Montague study reach that recorded the WSEL every 15 minutes. The hydraulic model produced WSELs were compared to the observed WSELs obtained with the water level loggers. In summary, there was a good match relative to the magnitude and timing of the observed versus modeled WSELs at the water level loggers. The hydraulic model was then used to predict WSELs at the transects by simulating, on an hourly basis, the conditions (Turners Falls Project discharges, Deerfield River flow and smaller tributary flow) that occurred between January 1, 2008 to September 30, 2015. Thus, modeled hourly WSEL data were developed for the eight (8) year period of record and could be applied to location of recreation facilities located in the study reach.

Recreation sites/facilities located in the Montague hydraulic model study reach include:

- Poplar Street Access Site
- Sunderland Bridge Boat Launch

In addition to the above two study reaches, hydraulic models were also developed for the Turners Falls bypass reach between the Turners Falls Dam and the Montague USGS gage. As part of Study No. 3.3.1 *Instream Flow Studies in Bypass Channel and below Cabot Station*, instream flow studies were conducted for purposes of developing relationships between flow and fish habitat. For modeling purposes, the bypass reach was divided into Reach 1, 2, and 3. Reach 1 extends from the Turners Falls Dam to just upstream of Station No. 1, Reach 2 extends for just upstream of Station No. 1 to approximately Rock Dam, and Reach 3 extends from Rock Dam to the Montague USGS. Calibrated hydraulic models were developed for Reach 2 and 3.

Recreation sites/facilities located in the bypass reach hydraulic models include:

- Turners Falls Station No. 1 Fish Access
- Cabot Wood Fishing Access

The above hydraulic models were used to simulate WSEL, water depth, and mean channel velocity conditions at transects located in close proximity to recreation access sites and facilities, as a means of examining potential impacts from Project operations on the recreation sites and site use. Water level effects on recreation facilities were evaluated using modeled hourly WSELs for the respective period of records to create monthly and seasonal (May-October) WSEL duration plots for the transects located closest to the recreation sites/facilities, and comparing the elevation duration plots to the minimum elevation required for that site/facility to remain operational. However, unlike the TFI and Montague hydraulic models, the modeling in the bypass reach used steady-state conditions for a wide range of flow and tailwater conditions, so hourly, daily and monthly information is not available.

For purposes of this analysis, a minimum of three (3) feet of water depth at the end of a boat ramp was assumed as the threshold for determining the usability of a boat launch by a typical recreational powerboat ([SOBA, 2006](#)). A depth of two (2) feet of water within 20 feet of the shoreline was used as the threshold for launching and paddling canoes and kayaks. In both cases, less depth may be suitable for some boats. Site specific information is discussed in Section 4.

The TFI hydraulic model—a one-dimensional model- produces flow velocity for transects located in close proximity to the water access recreation sites and facilities. The River2D hydraulic model – a two-dimensional model- of the 10 km reach around the Northfield Mountain project intake/tailrace produces the magnitude and direction of velocity. For this evaluation it was determined that only one of the water-based recreation sites/facilities, the Riverview boat dock, might be susceptible to changes in flow direction and flow velocities as a direct result of Northfield Mountain Project operations. In addition, the FirstLight

Northfield Mountain Pumped Storage Project (No.2485) and Turners Falls Hydroelectric Project (No. 1889)
STUDY 3.6.6 ASSESSMENT OF EFFECTS OF PROJECT OPERATION ON RECREATION AND LAND USE
STUDY REPORT

recreation manager was interviewed to gain information on whether flow velocities and directional changes affect use of the Riverview boat dock.

4 RESULTS

4.1 Recreation and Relicensing Study Review

The objectives of Study No. 3.6.1 *Recreation Use/User Contact Survey* ([FirstLight, 2015a](#)) were to quantify recreation use and describe recreational demand at the Projects, and to determine user satisfaction with regard to the availability, adequacy, and condition of recreation facilities. Of particular relevance to this assessment, the User Contact Surveys asked specifically about water levels and water level fluctuations as they related to user satisfaction, and more generally, open-ended questions such as what did you like most/least about your recreational experience and what enhanced/detracted from your recreational experience. These questions and responses are contained in Tables 4.2-6, 4.2-8, 4.2-10, 4.2-12, 4.2-13, 4.3-3, 4.3-5, 4.3-7, and 4.3-8 of the Study No. 3.6.1 *Recreation Use/User Contact Survey* report.

Results of the user survey suggest that overall, recreational use of the Project recreation sites and facilities is generally unaffected by current Project operations and the resulting changes in water levels. As summarized in Table 4.2-6 of the Study No. 3.6.1 *Recreation Use/User Contact Survey* report, of the 427 responses to the question regarding satisfaction with water levels at the Project, 93% of the respondents indicated that they are satisfied with Project water levels; 37% of the responding recreationists were Satisfied, 43% Moderately Satisfied, and 13% Extremely Satisfied with water levels. The remaining 7% of the responding recreationists were either slightly satisfied (5%) or not satisfied at all (2%). In response to the open-ended question “overall, how satisfied were you the river water level during your trip?” 14 of 19 responding recreationists reported that water levels were either too low (12) or too high (2). The remaining five respondents responded that the water level is inconsistent (2), that there was mud (1), that the water level negatively impacted swan nests (1), or that the boat ramp was flooded (this survey was taken at the Pauchaug boat ramp during spring) (1). Other open-ended questions regarding user satisfaction produced a small number of responses related to water levels, which to the extent possible, were attributed to a specific site. The sites to which these responses pertain are discussed in more detail in Section 4.2.

Study No. 3.6.2 *Recreation Facilities Inventory and Assessment* ([FirstLight, 2014](#)), and *Recreation Facilities and Assessment Addendum* ([FirstLight, 2015b](#)) identified recreation sites at the Projects and inventoried the type and condition of the facilities available at each site. This information was used to determine which sites and facilities specifically provide access to Project waters and have the potential to be affected by Project operations (i.e., river flows, water levels, and water level fluctuations). Study results allowed FirstLight to carefully consider which recreation sites provide recreational access to Project waters, and which sites include water access facilities/amenities that have the potential to be impacted by Project operations and the resulting water levels and flows. Of the 28 sites evaluated in the Recreation Use Inventory and Addendum, 11 provide recreational access to Project waters. [Table 2.1](#) identifies these sites: 1) Governor Hunt Boat Launch/ Picnic Area, 2) Pauchaug Boat Launch, 3) Munn’s Ferry Boat Camping Recreation Area, 4) Boat Tour and Riverview Picnic Area, 5) Cabot Camp Access Area, 6) Barton Cove Nature Area and Campground, 7) Barton Cove Canoe and Kayak Rental Area , 8) State Boat Launch, 9) Turners Falls Station No. 1 Fishing Access, 10) Cabot Woods Fishing Access, and 11) Poplar Street Access. The remaining recreation sites inventoried as part of Study No. 3.6.2 support only land-based recreational uses, such as hunting, camping, hiking, and picnicking and consequently they were eliminated from further analysis because they are not impacted by Project operation.

Study No. 3.6.3 *Whitewater Boating Evaluation* considered the boatability and whitewater boating experience provided in the Turners Falls bypass reach under a range of flow conditions. The study provided some insight into how two recreation sites providing access to the Turners Falls bypass (the Turners Falls Station No. 1 Fishing Access and the Poplar Street Access) might serve as put-in and/or take-out locations for the whitewater boating run. To the extent that the study examined flow and/or water level effects on these sites for boating access, such effects are considered in the site-specific discussions later in this report.

Study No. 3.6.4 *Assessment of Day Use and Overnight Facilities Associated with Non-Motorized Boats* was designed, in part, to determine the location of existing overnight and access facilities that support self-powered boating trips within the Project boundary and was extended an additional nine and one-half miles downstream to the Sunderland Bridge. The results of this study identified three access sites and no campsites within the 9.5 mile study reach downstream of the Project to the Sunderland Bridge. These sites were the Poplar Street Access Site, Sunderland Bridge unimproved boat launch, and the unimproved carry-in access area on the opposite side of the river from the unimproved boat launch.

Study No. 3.6.7 examined recreational use of the Northfield Mountain Tour and Trail Center (NMTTC). Because there is no water-based recreational access provided at the NMTTC, and because there is no recreational use of the Northfield Mountain Reservoir, use of the NMTTC and its facilities were considered no further as part of this study.

Study No. 3.3.1 *Instream Flow Studies in Bypass Reach and below Cabot Station* (which will be filed with FERC on October 14, 2016) was used to examine the effects of flows for access from the two (2) recreation sites located in the bypass reach.

Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability* was designed to evaluate and identify the causes or erosion in the TFI and to determine to what extent they are related to Project operations. A review of the study was completed for the eight (8) recreation sites that are located on the TFI. There was no erosion reported at these eight (8) recreation sites. The report for Study No. 3.1.2 will be filed with FERC on October 14, 2016.

4.2 Effects of Project Operations on Recreation Sites/Facilities

This section includes the site specific evaluation of the 12 recreation sites that provide recreational access to the water and/or that have water-based recreation facilities, such as a boat ramp and/or dock.

4.2.1 Governor Hunt Boat Launch

The Governor Hunt Boat Launch is located immediately below TransCanada's Vernon Dam. While the site is located within the Vernon Hydroelectric Project boundary, a portion of the site is also located within the Turners Falls and Northfield Mountain Project boundaries. This recreation site is owned and managed by TransCanada. The portion of the site that is located within both the Turners Falls and Northfield Mountain Project boundaries includes a single-lane, hard surface (concrete planks) boat ramp. Additional shoreline for launching small watercraft via hand carry or trailer is also available along the sandy shoreline. Recreational uses taking place in the portion of the site located within the Turners Falls and Northfield Mountain Project boundaries include fishing and boating.

Although the Turners Falls and Northfield Mountain Projects have some effect on water levels at the site, the operation of the Vernon Project has a greater influence. The TFI hydraulic model showed that with a) a current FERC-required minimum flow of 1,250 cfs being discharged from Vernon, b) Northfield Mountain Project idle and c) a WSEL at the Turners Falls Dam of 176.0 feet⁷, the modeled WSEL in the Vernon Dam tailrace is 181.16 feet. These results demonstrate that there is a hydraulic control located just downstream of Vernon Dam, which limits the WSEL upstream of this control from falling below 181.0 feet.

More specifically, based on Study No. 3.2.2 findings, the hydraulic control is located just above Stebbins Island. The Governor Hunt boat launch is located upstream of the hydraulic control, and therefore is unaffected by changes in TFI levels when Vernon releases are very low and the water level at the Turners

⁷ The FERC license for the Turners Falls Project and Northfield Mountain Project permits the water level, as measured at the Turners Falls Dam, to operate between 176 and 185 feet. For reference the median water level at the Turners Falls Dam based on hourly data from 2000 to 2009 is 181.3 feet.

Falls Dam is below approximately 181.0 feet. At very low Vernon discharges, Northfield Mountain Project idle, and a WSEL at the Turners Falls Dam above 181 feet, the TFI WSEL is nearly flat with a WSEL only slightly higher at the Vernon Dam tailrace than at the Turners Falls Dam. Under high Vernon discharges, while the WSEL at Turners Falls Dam does affect the WSEL at the Vernon Dam tailrace, the releases from Vernon Dam become the primary influence controlling the WSEL at this boat launch.

Operation of the Northfield Mountain Project also has the ability to affect the WSEL at this location. However, the extent of the effects from the Northfield Mountain Project are a function of the magnitude and duration of the pumping or generation as well as the WSEL at the Turners Falls Dam and the magnitude of Vernon discharges. Under typical operational conditions when the WSEL at the Turners Falls Dam is generally between about 179 and 183 feet and Northfield Mountain Project is not operating with all of its units, Vernon discharges are generally a larger influence on WSELs at this site than Northfield Mountain Project operations as summarized in the bullets below ([FirstLight, 2015f](#)):

- With a downstream Turners Falls Dam WSEL at 181.3 feet and Northfield Mountain idle (0 cfs), and Vernon at its maximum discharge (17,130 cfs) versus Vernon at its minimum flow (1,250 cfs), the WSEL difference is 6.28 ft;
- With a downstream Turners Falls Dam WSEL at 181.3 feet and Vernon at its maximum discharge (17,130 cfs), when Northfield Mountain is at maximum generation (20,000 cfs- Scenario 2) versus maximum pumping (15,200 cfs), the WSEL difference is 0.89 ft;
- With a downstream Turners Falls Dam WSEL at 181.3 feet and Vernon at its maximum discharge (17,130 cfs) and Northfield Mountain idle (0 cfs), the difference in the WSEL, with Northfield Mountain pumping (15,200 cfs) is -0.12 feet, and with Northfield generation (20,000 cfs, is 0.77 feet. and
- With Vernon at its maximum discharge (17,130 cfs) and Northfield Mountain idle (0 cfs), the difference caused by a Turners Falls Dam WSEL of 185 ft to 176 ft is 1.07 feet.

Overall, the model results demonstrate that water levels in the vicinity of the Governor Hunt boat launch do not fall below a water level of 181 feet, due to the existing hydraulic control. Observation of the boat launch site at the 181 foot level found that a water depth of three (3) feet occurs within 30 feet of the shoreline. Observation also found that the other portions of the shoreline, which are known to be used for launching boats, remain useable at the 181 foot water level.

This result is consistent with the findings of the recreation user survey. A review of the responses to recreation surveys conducted as part of Study No. 3.6.1 identified no issues related to water levels or river flows at this site. More specifically, there were no comments from recreational users surveyed at the site suggesting that either water levels or flows have any adverse impact on boat launching or other water-based activities at this site. This is also consistent with TransCanada Hydro Northeast Inc's ILP Study 30 Recreation Facility Inventory, Use and Needs Assessment Study Report. The inventory report for the Governor Hunt Recreation Area and Boat Launch included in Appendix A of the report state that users can launch at all water levels ([TransCanada, 2016](#)).

4.2.2 *Pauchaug Boat Launch*

The Pauchaug Boat Launch ([Figure 4.2.2-1](#)) is located on the south side of Pauchaug Brook within the Turners Falls and Northfield Mountain Project boundaries, on the TFI. The launch ramp provides boat access to the TFI and itself is positioned within a narrow cut along a relatively flat, low-lying portion of the river bank. This recreation site is owned, operated, and maintained by the Massachusetts Department of Fish and Game (MADFG).

The Pauchaug Boat Launch is suitable for launching canoes and kayaks, as well as small to moderate size power boats on trailers. Water depths at the end of the launch ramp are relatively shallow, but generally, the contour of the river bottom in this area is suitable for launching boats, and the launch remains useable under much of the allowable operating range of TFI (between 176.0 feet msl and 185.0 feet msl, as measured at Turners Falls Dam).

The Northfield Fire Department utilizes this boat launch for rescue operations on the Connecticut River. According to the Northfield Fire Department webpage, the Fire Department utilizes a RescueONE® Connector Boat ([Northfield Fire Department, 2016](#)). This type of boat requires a minimum of 18-24 inches of water for launching. When called for a rescue on the TFI, the Northfield Fire Department will call the Northfield Control Room for information regarding TFI elevation and river flows. The Fire Department uses this information to determine how rescue operations will proceed.

[Figure 4.2.2-2](#) shows the river bed elevation at the Pauchaug Boat Launch at specified distances from the shoreline. Also shown is the 50% (or median) exceedance WSEL based on the period January 1, 2000 to September 30, 2015 for the recreation months, May through October⁸. The estimated end of the boat ramp is at approximate elevation 178 feet. Assuming a minimum of three (3) feet of water depth is necessary for the launching and/or retrieving of boats on trailers, a WSEL of 181 feet or greater would be necessary for the boat ramp to be usable for small to moderate size power boats.

Using the model produced hourly WSELs at the Pauchaug boat launch, monthly WSEL duration curves were developed as shown in [Figure 4.2.2-3](#). As shown, water depths at the end of the Pauchaug Boat Launch are three (3) feet or greater (elevation 181 feet) 95% of the time in May, 90% of the time in June, 82% of the time in July, 80% of the time in August, 81% of the time in September, and 88% of the time in October. Thus, under existing Project operations, resulting TFI elevations of less than 181 feet may have the potential to impact the use of this recreation site by making it more difficult to launch trailerable boats, although canoes and kayaks can still be launched.

With respect to the Northfield Fire Department's boat for rescue operations, the WSEL duration curves show that water depths at the end of the Pauchaug Boat Launch are two (2) feet or greater (elevation 180 feet) 100% of the time in May, 98% of the time in June, 95% of the time in July through September, and 97% of the time in October. Water depths at the end of the boat launch are greater than 1.5 feet (elevation 179.5 feet) 100% of the time in May, 100% of the time in June, 98% of the time in July, 98% of the time in August, 98% of the time in September, and 100% of the time in October. Thus, under existing Project operation, water depths are sufficient for launching an emergency rescue boat that has a draw of 18-24 inches anywhere from 95% (assuming a 2 foot draw) of the time (month of July) to 100% of the time.

Sedimentation may also periodically interfere with the usability of the Pauchaug Boat Launch. A review of 63 recreation surveys collected from this site found that 11 respondents mentioned sediment or "mud" as potentially affecting the quality of the boat launch. Both FirstLight and MADFG have indicated that sediment accumulation can be a problem at the Pauchaug Boat Launch. According to MADFG, sediment accumulation occurs during periods of high river flows and spring flooding, which is when the suspended sediment load in the river is the greatest⁹. In addition, the location of the boat launch and its orientation to the prevailing river currents seem to make the site particularly susceptible to sediment deposition. The boat launch site is located within a relatively narrow cut in the river bank, just downstream from the Pauchaug Brook confluence, and is a natural deposition area for sediment delivered from Pauchaug Brook. That

⁸ Note that for this recreation site and other recreation sites within the TFI, two figures are provided. The WSEL data shown on these figures are based on modeled hourly WSELs at each recreation site for the period January 1, 2000 to September 30, 2015.

⁹ Note that information on suspended sediment load is described in Study No. 3.1.3 *Sediment Management Plan and Monitoring*, which is slated to be filed with FERC on October 14, 2016.

combined with the narrow opening to the boat launch apparently makes this site particular susceptible to sedimentation ([Figure 4.2.2-1](#)).

Accumulation of sediment on the ramp can cause the ramp to be slippery and difficult to traverse in vehicle or on foot. Several recreation user survey respondents indicated that the launch ramp was “muddy” due to sediment. Accumulated sediment at the base of the launch ramp can also cause problems for boat launching by creating a sediment bar off the end of the ramp that fills the launch channel and makes launching difficult, regardless of TFI water levels. One user survey respondent specifically commented “dredge boat ramp.”

On an as-needed basis, MADFG clears/plows the launch ramp of sediment that accumulates following seasonal high flows, and excavates accumulated sediment at the end of the boat ramp to keep the launch channel open. Ramp clearing is typically accomplished by plowing the sediment (similar to snow-plowing), while an excavator is used to remove sediment from the end of the boat launch and keep the channel open. FirstLight works cooperatively with the state on its excavation efforts, by attempting to hold the TFI level at or close to the lowest allowable level (176 ft) during the excavation period, to facilitate the excavation activity.

Figure 4.2.2-1 Pauchaug Boat Launch



Pauchaug Boat Launch – showing narrow channel cut and accumulated sediment on both sides of boat launch. Turners Falls Impoundment elevation at the time of this picture was 180.3 ft.

Figure 4.2.2-2 Pauchaug Boat Launch Bottom Contour Elevation and Median Monthly WSEL
(based on hourly model WSEL at the Pauchaug Boat Launch for the period January 1, 2000 to September 30, 2015)

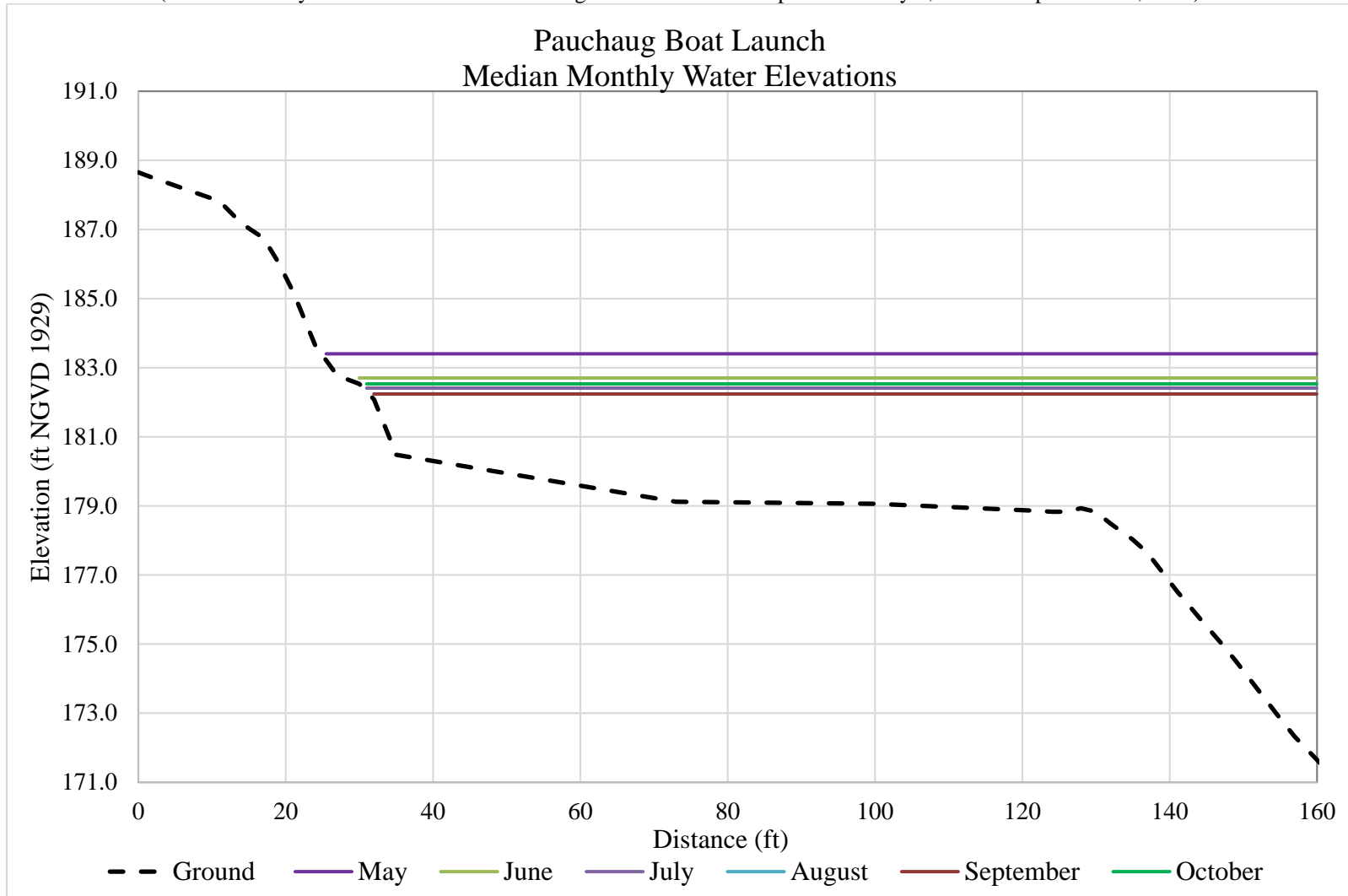
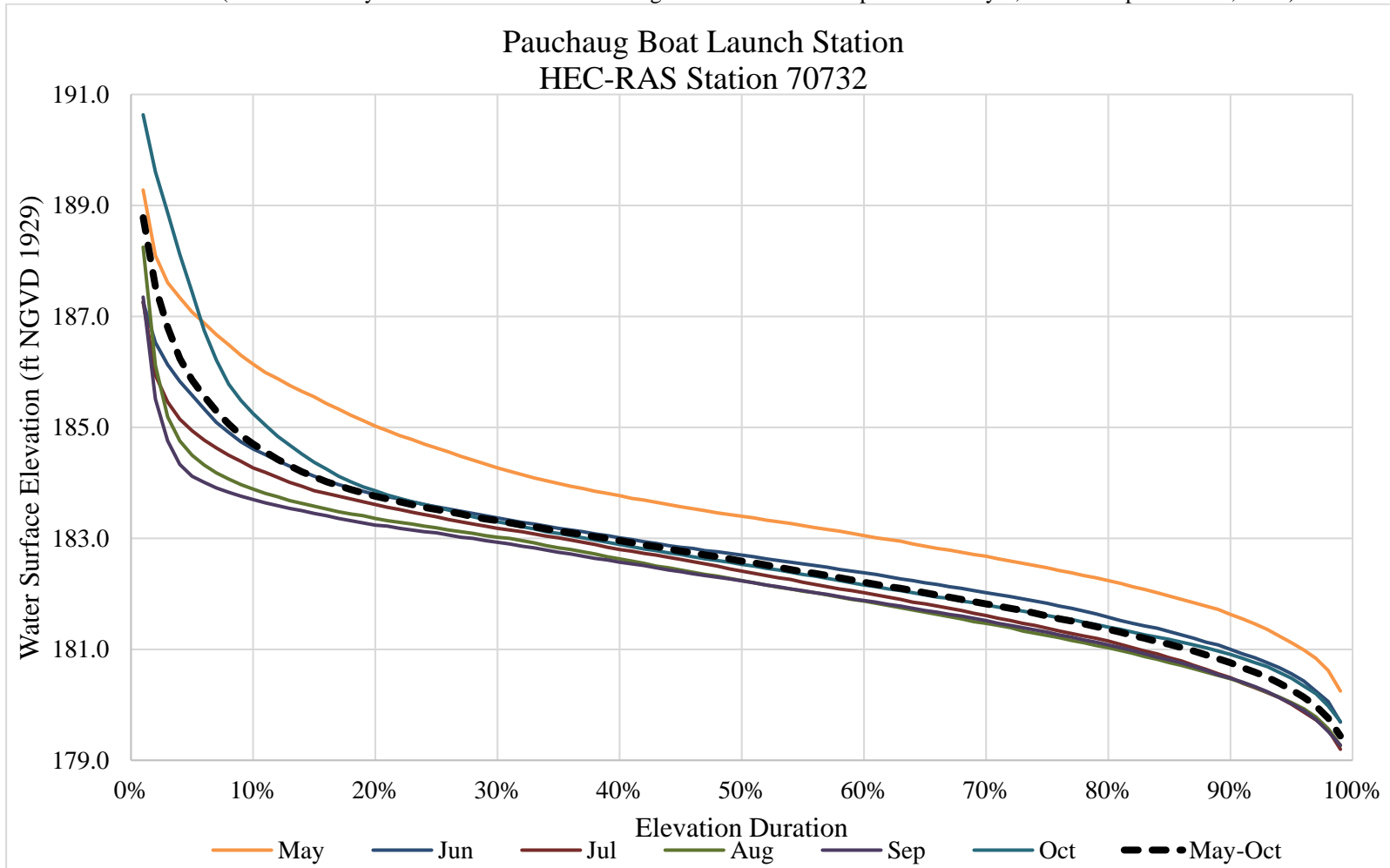


Figure 4.2.2-3 Pauchaug Boat Launch WSEL Duration Curves, Monthly (May-October)
(based on hourly model WSEL at the Pauchaug Boat Launch for the period January 1, 2000 to September 30, 2015)



4.2.3 Munn's Ferry Boat Camping Recreation Area

The Munn's Ferry Boat Camping Recreation Area is located on the east side of the TFI in Northfield, MA. The site is owned and managed by FirstLight as a water access-only campground. There is one water access facility at the site, a floating boat dock and associated ramp that is installed seasonally for campers' use ([Figure 4.2.3-1](#)). The ramp is approximately 25 feet long, and the floating dock is approximately 20 ft by 8 ft, in size.

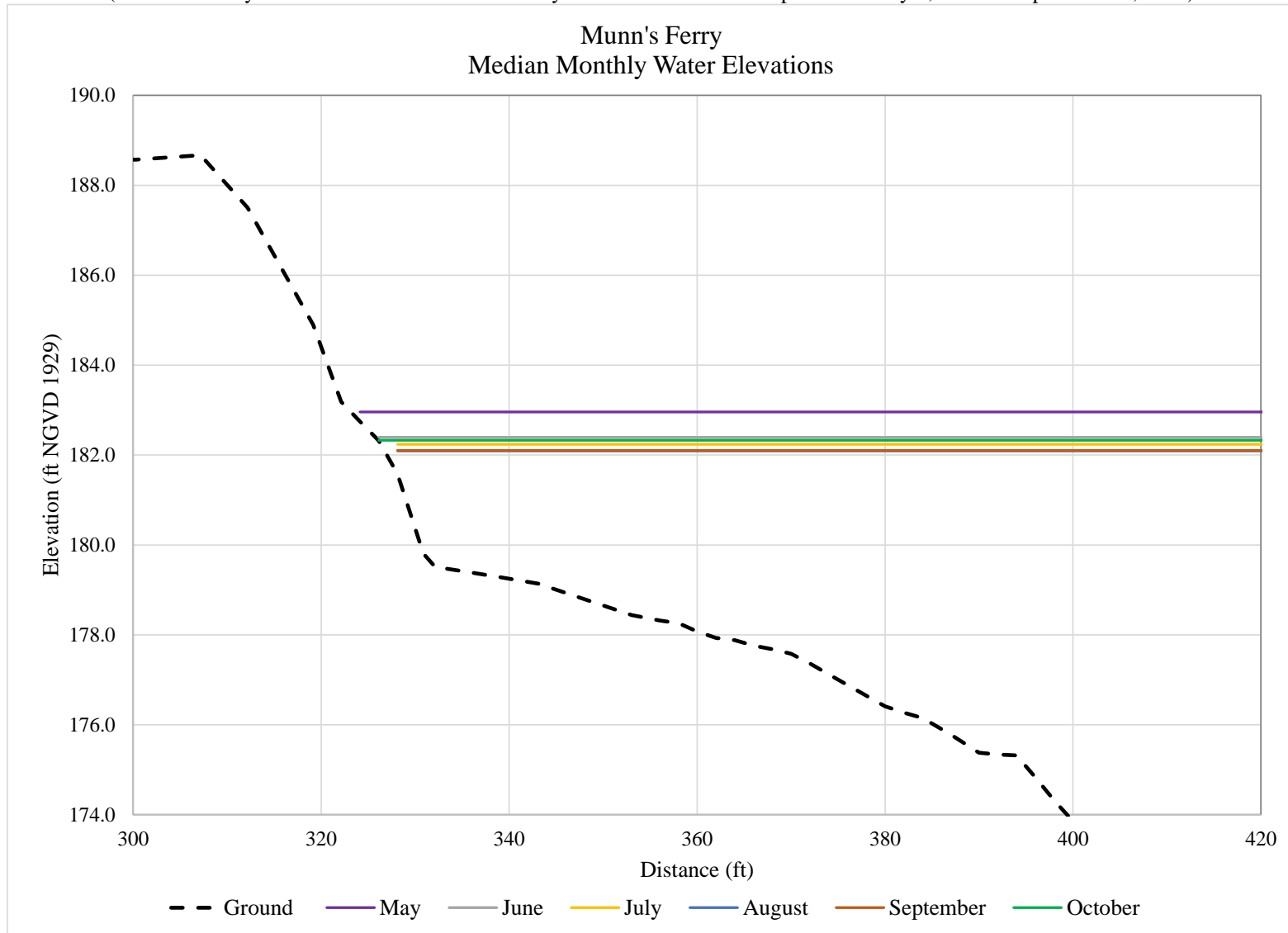
The boat dock at Munn's Ferry Boat Camping Recreation Area is designed to accommodate small to moderate sized watercraft, as well as canoes and kayaks. [Figure 4.2.3-2](#) shows the river bed elevation at the transect nearest the Munn's Ferry Boat Camping Recreation Area boat dock at specified distances from the shoreline. Bathymetry data show that the elevation of the river bottom in the area of the boat dock is approximately 164 feet. To allow for a minimum of three (3) feet of water depth for docking power boats, the WSEL would need to be at least 167 feet. The lowest allowable operating range for the TFI is elevation 176 feet. Thus, the WSELs at the boat dock are above 167 feet 100% of the time, including during the recreation season (May through October), and the Munn's Ferry Boat Camping Recreation Area boat dock remains useable all of the time during the recreation season. Results of the Recreation User Survey confirm this result. Of the six (6) surveys collected from recreation users at the Munn's Ferry Boat Camping Recreation Area, none mentioned water levels as a concern with respect the usability of the boat dock.

Figure 4.2.3-1 Munn’s Ferry Boat Camping Recreation Area Floating Boat Dock



Munn’s Ferry Boat Camping Recreation Area Floating Boat Dock – Turners Falls Impoundment elevation at the time of this picture was 180.3 ft.

Figure 4.2.3-2 Munn's Ferry Boat Camping Recreation Area Bottom Contour Elevation and Median Monthly WSEL
(based on hourly model WSEL at the Munn's Ferry Recreation Area for the period January 1, 2000 to September 30, 2015)



4.2.4 Boat Tour and Riverview Picnic Area

The Boat Tour and Riverview Picnic Area site is located off Pine Meadow Road immediately upstream of the Northfield Mountain Pumped Storage Project tailrace. A boat ramp and floating dock provide access to Project waters ([Figure 4.2.4-1](#)). The Quinnetukut II (QII) leaves from this recreation site, which is managed by FirstLight. The riverboat makes a 12-mile round trip through French King Gorge and Barton Cove. Other boaters may use the boat dock when the QII is not there. Other recreational uses at the site include fishing and picnicking.

[Figure 4.2.4-2](#) shows the river bed elevation at the transect nearest the Boat Tour and Riverview Picnic Area boat dock at specified distances from the shoreline, in relation to the median monthly WSELs under existing Project operations, for the period May through October. Bathymetry data show that the elevation of the river bottom in the area of the boat dock is approximately 172 feet. To allow for a minimum of three (3) feet of water depth for docking (the estimated draw of the QII), the WSEL would need to be at least 175 feet.

WSEL duration curves for the Riverview boat dock area are shown in [Figure 4.2.4-3](#). As shown, the WSELs at the boat dock are at or above 175 feet 100% of the time during each of the months in the recreation season (May-October). In fact, WSELs at the boat dock location did not fall below approximately 179 feet during the recreation season, indicating that there is typically about seven (7) feet of water depth at the Riverview boat dock. The floating boat dock moves up and down with the WSEL and remains usable throughout the recreation season (May-October). Consequently, the WSEL changes due to Project operations in the vicinity of the Boat Tour and Riverview Picnic Area do not affect recreational access to Project waters at this site.

Of the 53 surveys collected at this site, two responses to the recreation user contact survey identified low water level as an issue at this recreation site. One of the two commentors was boating and indicated that “water can be shallow at times,” and that it can be “hard to get boats to water.” The other recreationist who commented about low water levels was walking and indicated simply “shallow water.” Neither commentor specifically indicated a problem with water levels on the use of the Riverview boat dock, or other specific recreation activity at this site. It should be noted that the TFI WSEL at Riverview during the administration of the user surveys ranged from approximately 180 feet to over 185 feet. WSELs of 180 feet provide approximately 8 feet of water depth at the end of the dock, which provides enough water depth for the QII riverboat and other watercraft.

The Riverview site is located just upstream of the Northfield Mountain Project tailwater area. Because of its proximity to the Northfield Mountain Project, river flows at the site also have the potential to be affected by the operation of the Northfield Mountain Project, as well as Vernon Hydroelectric Project discharges. Flow velocities and flow direction at the Riverview boat dock were evaluated with the River 2D hydraulic model developed for Study No. 3.3.9. As part of Study No. 3.3.9 the magnitude and direction of velocity was evaluated in the reach 5 km upstream and 5 km downstream of the Northfield Mountain Project tailrace under a range of operating conditions. Over 60 combinations of operating conditions were assessed via the model. The following variables were assessed: Northfield Mountain generation flow (2 units, 4 units), Northfield Mountain pumping flow (2 units, 4 units), WSEL at Turners Falls Dam (176, 181.3, 185 ft), and various inflows from Vernon (1,760, 4,900, 8,440, 15,700, 40,100 cfs representing the 95, 75, 50, 25, 10% exceedance flows).

Modeling results show that under the majority of operating conditions, the river flow moves in a downstream direction at the Boat Tour and Riverview Picnic Area. Because recreation typically occurs during daylight hours, the Northfield Mountain Project would either be idle or in a generating mode. During the May through October period, between the hours of 7 am and 7 pm when the daily average Vernon discharge is 18,000 cfs or less, the typical average channel velocity is between 0 fps and 2 fps with a median

average channel velocity of 0.5 fps. This range of velocities is generally suitable for boating, and is well within the QII's safe operating range and these velocities are lower than common velocities in the French King Gorge area. When river flow is low and Northfield Mountain is generating, the Boat Tour and Riverview Picnic Area is subject to flow reversals as water moves upstream. However the upstream velocities are low, typically ranging between 0 fps and -1 fps, and therefore do not interfere with the usability of the Riverview boat dock for the QII or other power boats.

Flow velocities at this location can also be affected by pumping operations at Northfield Mountain. However, because pumping operations at Northfield Mountain typically occur only at night, operation of the QII and use of the Riverview boat dock are not affected by such pumping operations.

Figure 4.2.4-1 Riverview Boat Dock



Riverview Floating Boat Dock – Quinnetukut II Riverboat sails from this boat dock, and it is available for other boats to use when the QII is not there. Turners Falls Impoundment elevation at the time of this picture was 184 ft.

Figure 4.2.4-2 Riverview Bottom Contour Elevation and Median Monthly WSEL
(based on hourly model WSEL at the Riverview for the period January 1, 2000 to September 30, 2015)

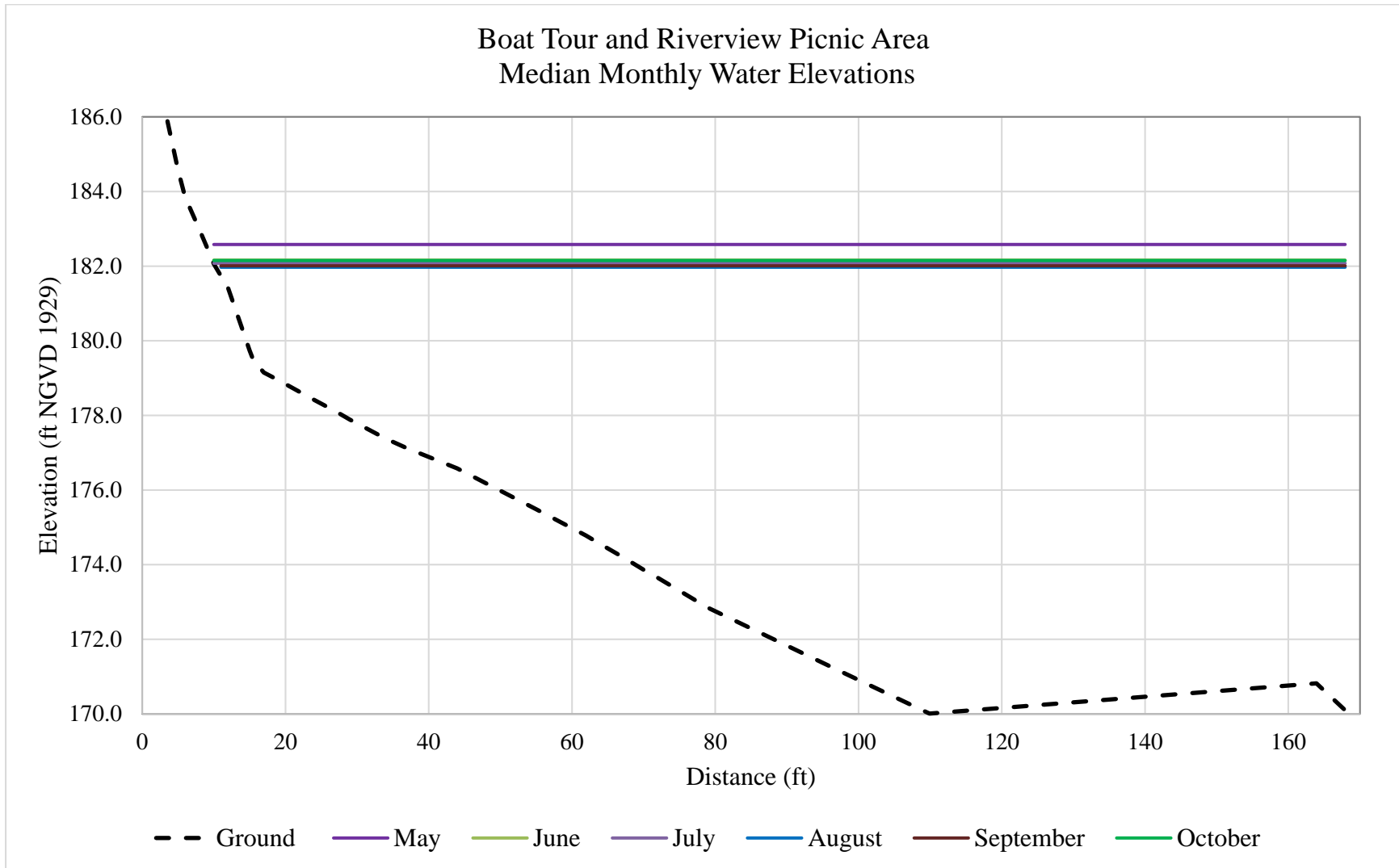
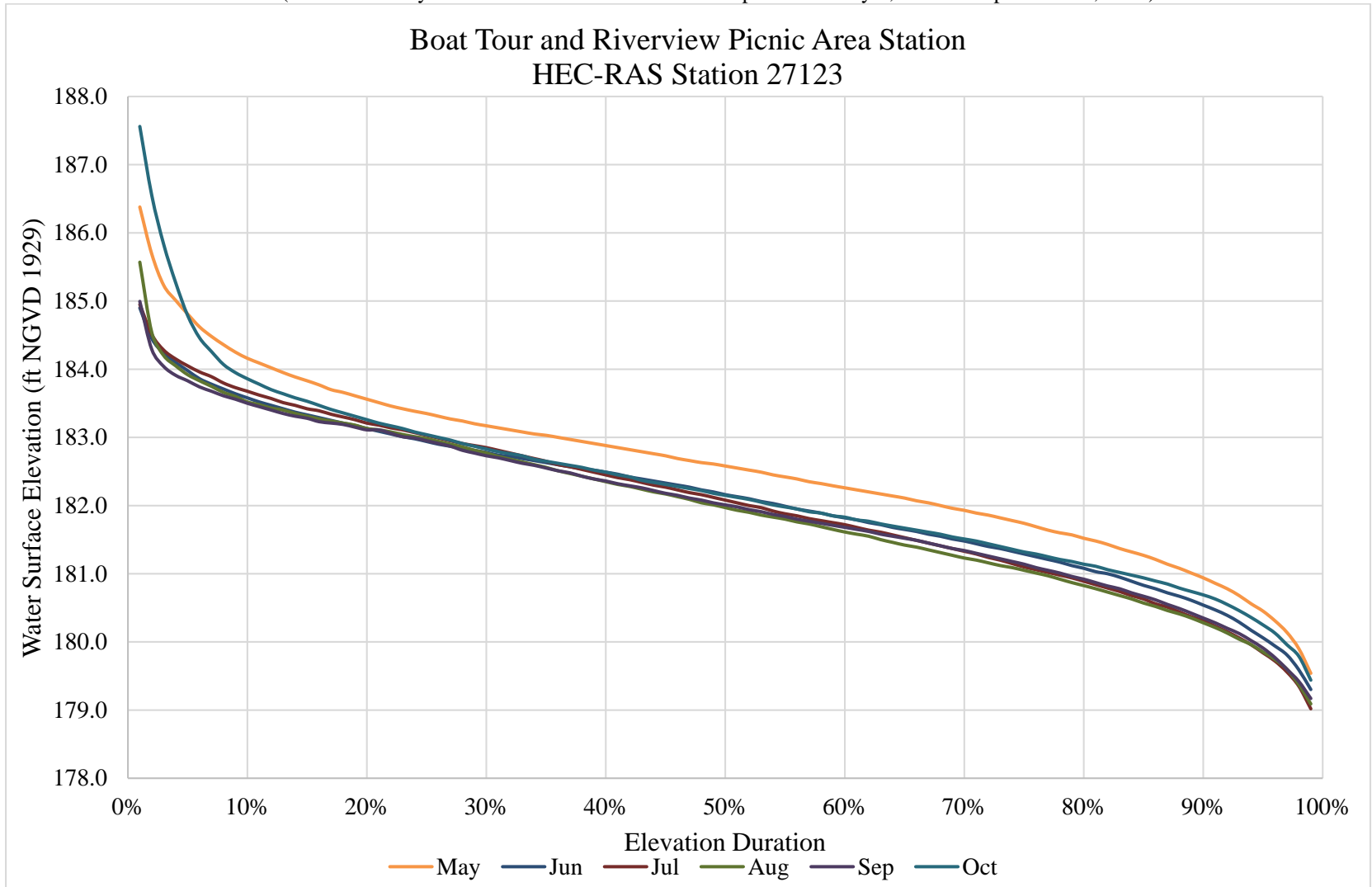


Figure 4.2.4-3 Riverview WSEL Duration Curves, Monthly (May-October)
(based on hourly model WSEL at Riverview for the period January 1, 2000 to September 30, 2015)



4.2.5 Cabot Camp Access Area

The Cabot Camp Access Area ([Figure 4.2.5-1](#), [Figure 4.2.5-2](#)) is located on the TFI at the confluence with the Millers River. The site is owned and managed by FirstLight and is open to the public for shoreline access and bank fishing. Although there are no formal water access facilities at the site, the site provides ample access to the TFI shoreline for anglers and those launching or retrieving canoes/kayaks.

The Cabot Camp Access Area is situated at the confluence of the Millers River and the Connecticut River and provides water access to both rivers. An informal network of trails connects the river access areas to the parking area. In total there is an estimated 225 feet of shoreline (along both rivers) that is accessible to recreationists. In some place the shoreline is relatively steep, and in other places the shoreline is more moderate in slope. [Figure 4.2.5-3](#) shows the bathymetry at the transect nearest the Cabot Camp Access along with the median monthly WSELs. [Figure 4.2.5-4](#) shows the WSEL duration curves for that transect. Much of the shoreline remains fully accessible to anglers, boaters and other recreationists under the full range of allowable TFI elevations (176.0 feet msl to 185.0 feet msl, as measured at Turners Falls Dam), under normal Project operations.

Of the 65 recreation user surveys collected at the Cabot Camp Access Area, only one specifically commented on water levels, noting that water levels could be “a little higher” and that what they liked least at this site was “water level.” This same respondent noted that they were concerned about “water level fluctuations and the damage it does to spawning fish.” This respondent did not indicate whether water levels adversely affected recreation access at this site.

Figure 4.2.5-1 Cabot Camp Access Area



Cabot Camp Access Area –Primary water access site along the Connecticut River. Impoundment elevation at the time of this picture was 179.67 ft.

Figure 4.2.5-2 Cabot Camp Access Area



Cabot Camp Access Area – Trails and water access area at the confluence of the Connecticut River and Millers River. Impoundment elevation at the time of this picture was 179.67 ft.

Figure 4.2.5-3 Cabot Camp Access Area Bottom Contour Elevation and Median Monthly WSEL
(based on hourly model WSEL at Cabot Camp for the period January 1, 2000 to September 30, 2015)

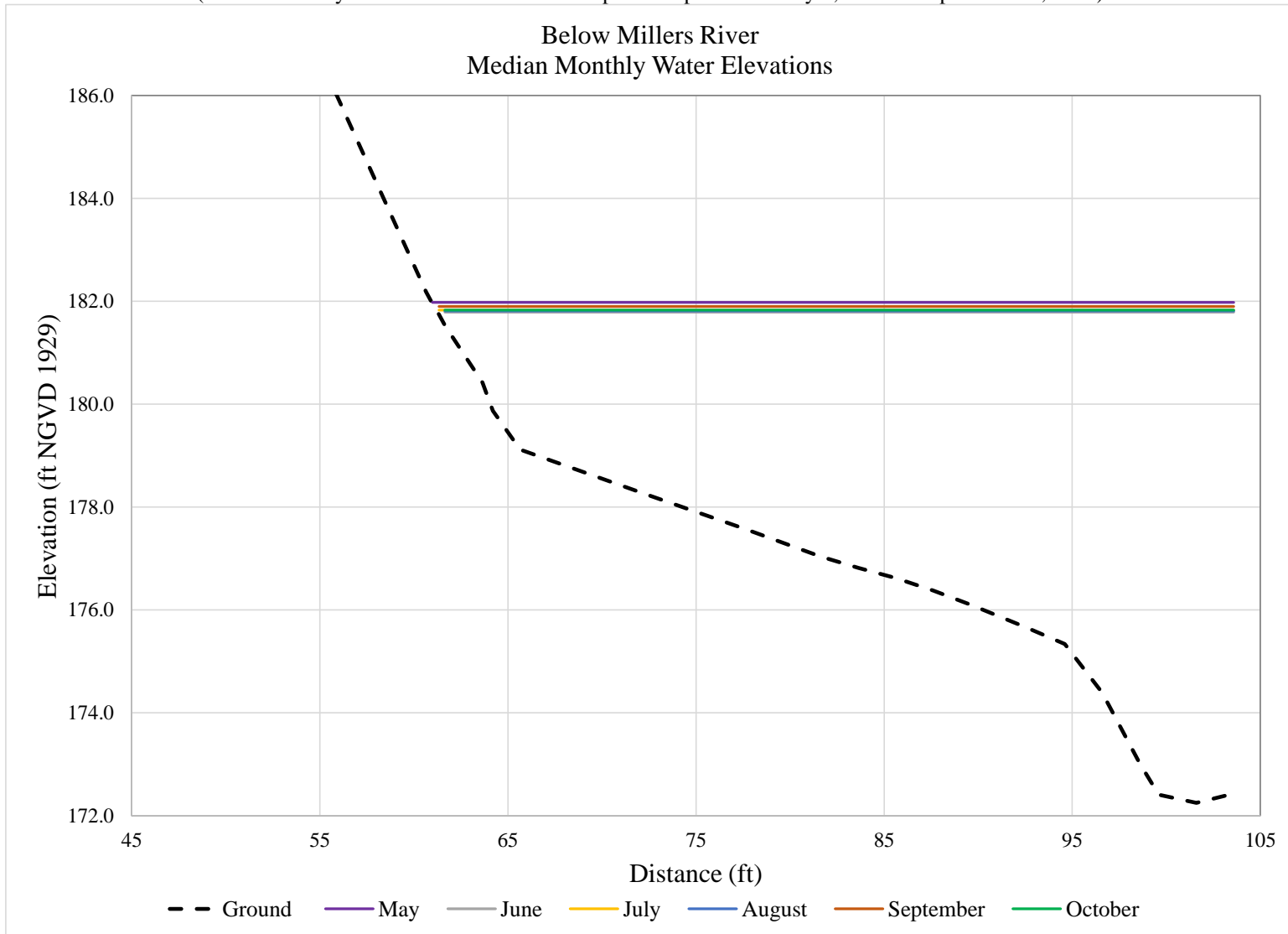
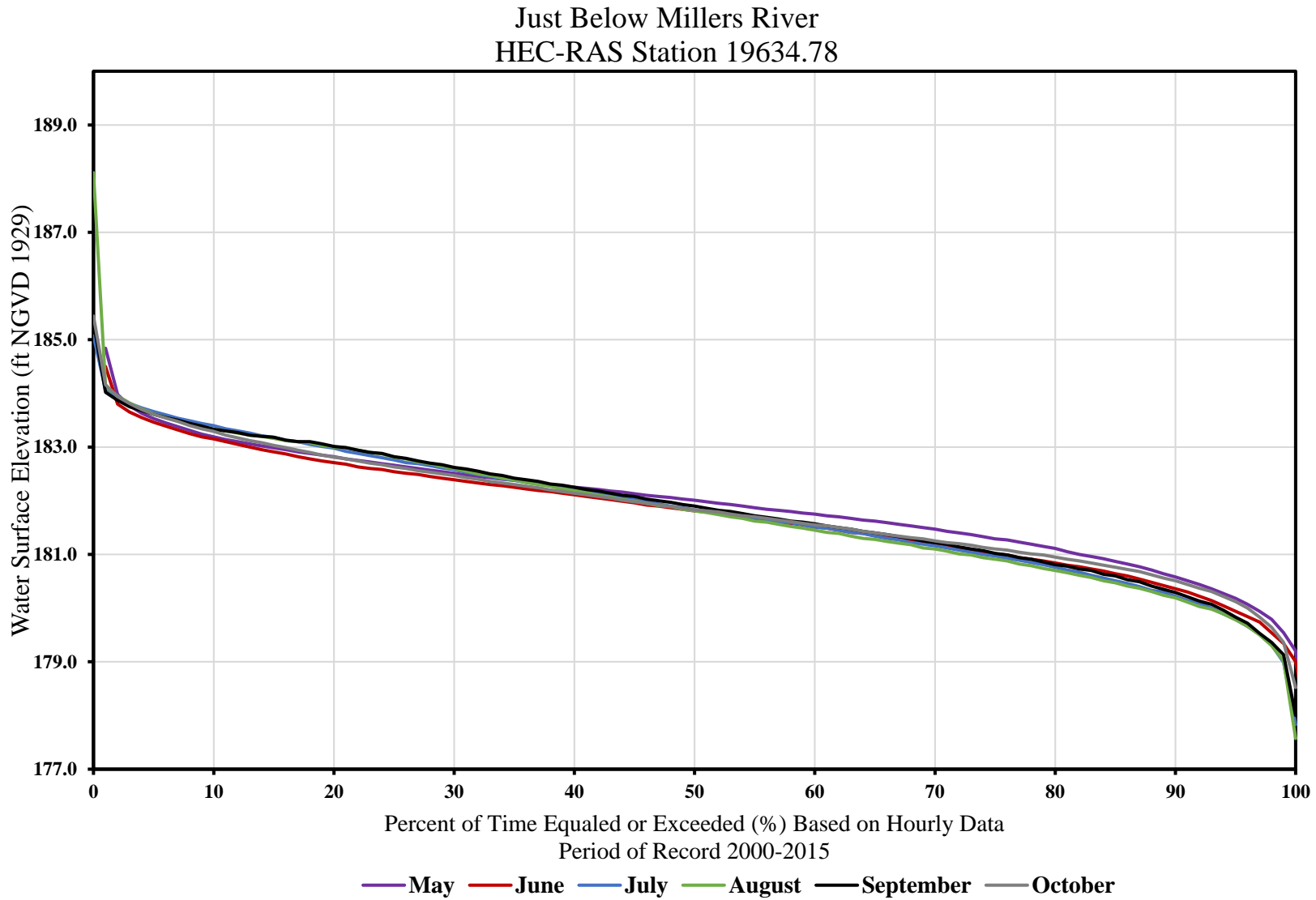


Figure 4.2.5-4 Cabot Camp Access Area WSEL Duration Curves, Monthly (May-October)
(based on hourly model WSEL at Cabot Camp for the period January 1, 2000 to September 30, 2015)



4.2.6 Barton Cove Canoe and Kayak Rental Area and Barton Cove Nature Area and Campground

The Barton Cove Canoe and Kayak Rental Area ([Figure 4.2.6-1](#)) and Barton Cove Nature Area and Campground ([Figure 4.2.6-2](#)) are both located along Barton Cove in Gill, Massachusetts, within the Turners Falls and Northfield Mountain Project boundaries. Two specific areas/facilities located at these sites provide water access and have the potential to be affected by Project operations. The canoe and kayak rental site has a shallow bank with a sandy/gravel slope to the water for about 300 feet that is used for launching carry-in watercraft, such as canoes and kayaks. The Barton Cove Nature Area and Campground site has a floating boat dock with slips for approximately 10 boats, which are reserved for campground users, and/or utilized by FirstLight for maintenance boats and for overnight docking of the QII. Both recreation sites and associated facilities are owned and managed by FirstLight.

Barton Cove is a large cove located on a bend in the Connecticut River, just upstream from Turners Falls Dam. It is protected from the main river channel by several islands. As shown in [Figure 4.2.6-3](#), the cove is generally quite shallow. [Figure 4.2.6-3](#) also shows location of the hydraulic model transects located within Barton Cove. Transect 1657, which is closest to the canoe and kayak rental area as well as the State Boat Launch was used for this analysis, as it was deemed most representative of the water depth conditions likely to be encountered by boaters in Barton Cove.

[Figure 4.2.6-4](#) shows the river bed elevation in the vicinity of the Barton Cove Canoe and Kayak Rental at specified distances from the shoreline, in relation to the median monthly WSELs under existing Project operations, for the period May through October (the recreation season). Bathymetry data show that the bottom of Barton Cove at the canoe/kayak launch area is between 178 feet and 179.5 feet in elevation. National Park Service design guidance for canoe and kayak launches recommends a minimum of two (2) feet of water depth for paddling ([NPS, 2004](#)). Elevations at the launch between 180 feet and 181.5 would provide two (2) feet of water depth within 20 feet of the shoreline.

The TFI WSEL duration curves for the Barton Cove Canoe and Kayak Rental are shown in [Figure 4.2.6-5](#). As shown, the WSELs at this recreation site are at or above 180 feet 89% of the time in May, 90% of the time in June, 91% of the time in July, 91% of the time in August, 93% of the time in September, and 89% of the time in October. These results indicate that water depths in the area of the canoe and kayak launch are sufficient for launching canoes and kayaks. There may be infrequent occasions when a canoeist or kayaker would have to walk a short distance further (approximately 15 to 30 feet) to launch his/her craft at this site.

The boat dock at the Nature Area also generally remains useable under normal Project operations. While there is no bathymetric data for the boat dock area or model transect that runs close to the dock, bathymetric contours for Barton Cove ([Figure 4.2.6-3](#)) suggest that the elevation of the cove bottom in the immediate vicinity of the boat dock is similar to the elevations seen around the canoe kayak area. In addition, FirstLight personnel very familiar with this boat dock report that the dock remains useable nearly all the time, so long as the TFI WSEL at the dam is at or close to 180 feet. As shown in [Figure 4.2.6-5](#), the TFI WSEL of Barton Cove remains at or above 180 feet over 89% of the time in May, 90% of the time in June, 91% of the time in July, 91% of the time in August, 93% of the time in September, and 89% of the time in October.

The shallow nature of Barton Cove and the fact that much of the cove is densely filled with submerged aquatic vegetation during much of the boating season can impact navigation through the Cove ([FirstLight, 2016c](#)). However, boaters who frequent the cove utilize a couple of channels to move in and out of the cove. The primary channel is a well-marked (with buoys) channel leading from the main river channel into Barton Cove in the vicinity of the State Boat Launch. This channel is clearly visible in [Figure 4.2.6-3](#), and provides boaters utilizing the Barton Cove boat dock, canoe and kayak launch area, and the State Boat Launch with the ability to navigate to the main river channel. While there is no hydraulic model transect that bisects this channel, those familiar with the channel report that the channel remains useable by nearly all watercraft,

including the QII at all TFI elevations greater than 179 feet. As shown in [Figure 4.2.6-5](#), the TFI WSEL in the primary channel remains at or above 179 feet 98% of the time in May, 98% of the time in June, 98% of the time in July, 98% of the time in August, 99% of the time in September, and 98% of the time in October. Thus, while boating use in the Cove may be impacted by the nature of the Cove, WSELs during normal Project operation have a minimal impact on boating use.

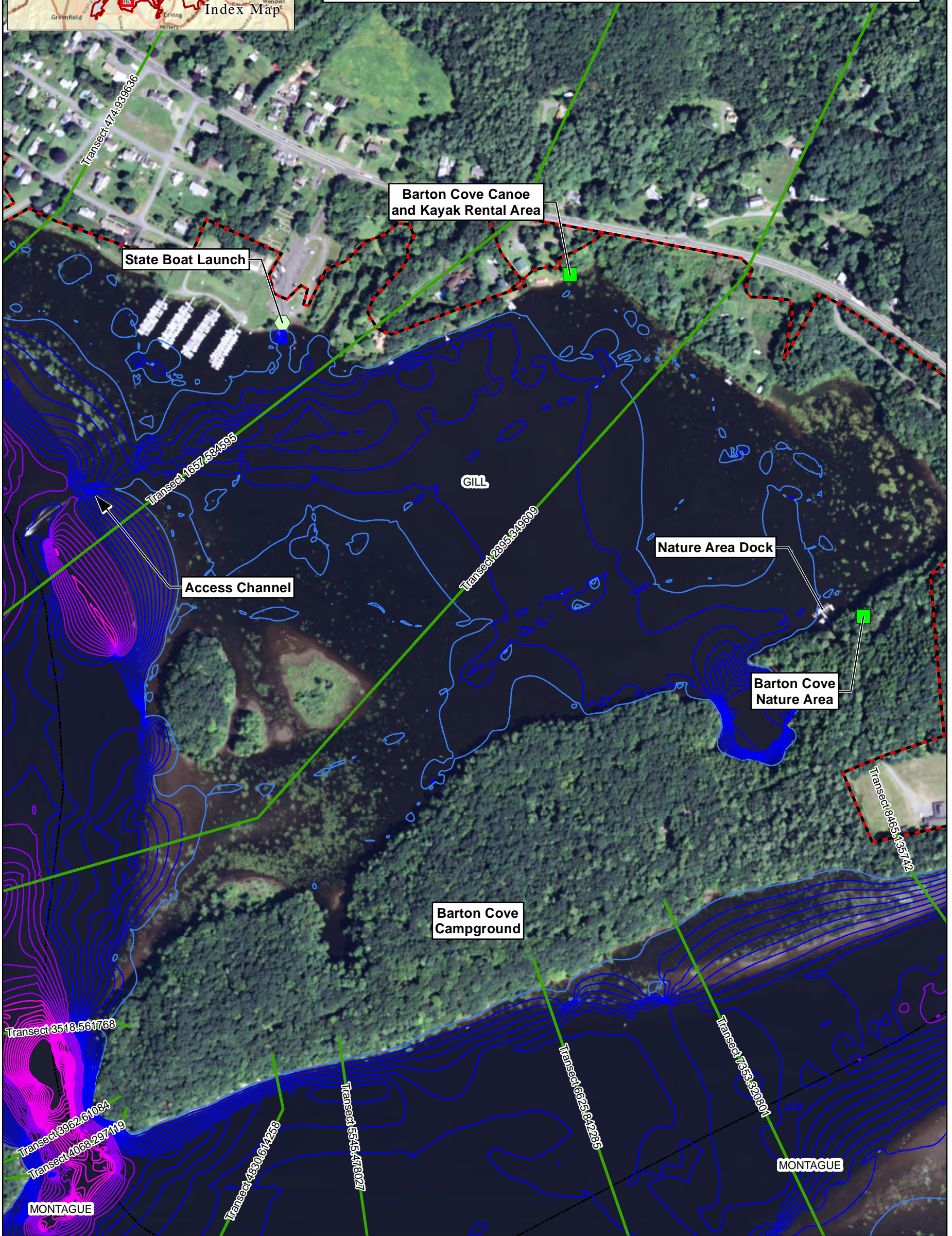
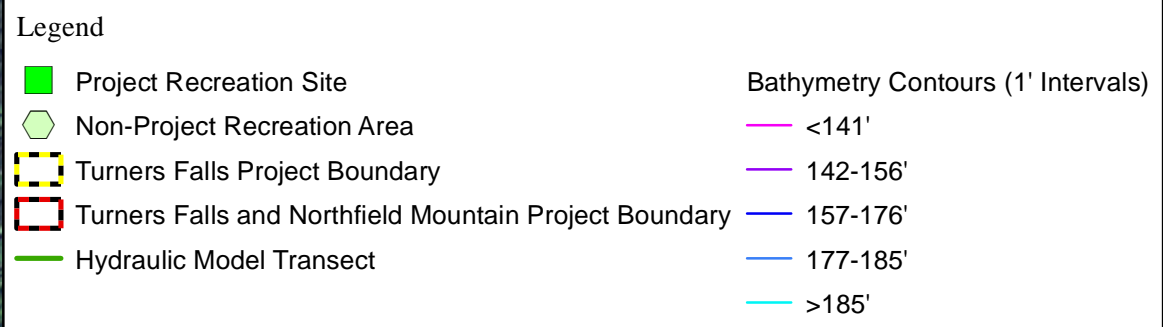
These findings appear to be consistent with the results of the user surveys. Of the 144 user surveys collected at Barton Cove, four (4) survey respondents utilizing the nature area and campground indicated “low water” as an issue, with one also specifying concern with water level effects on nesting swans. However, none of these respondents specifically mentioned difficulty using any of the site facilities, or the boat docks during low water conditions.

Figure 4.2.6-1 Barton Cove Canoe and Kayak Rental Area as seen from Barton Cove



Figure 4.2.6-2 Barton Cove Nature Area and Campground boat dock





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

Study 3.6.6 Assessment of Effects of Project Operation on Recreation and Land Use

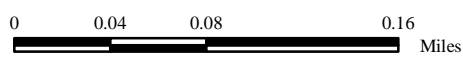


Figure 4.2.6-3:
Barton Cove Bathymetric Contours and Hydraulic Model Transect Locations

Figure 4.2.6-4 Barton Cove (Transect 1657) Bottom Contour Elevation and Median Monthly WSEL
(based on hourly model WSEL at Barton Cove for the period January 1, 2000 to September 30, 2015)

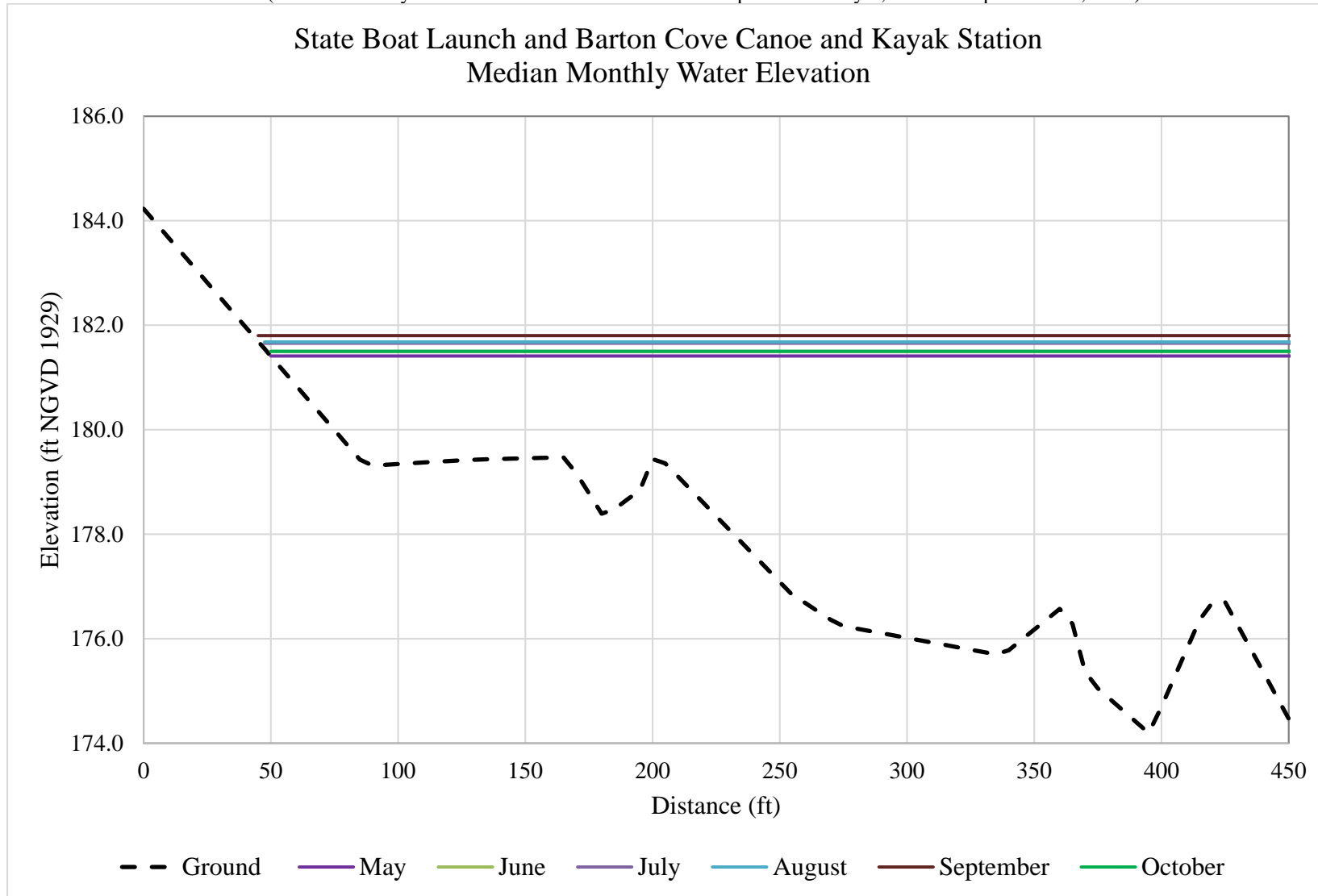
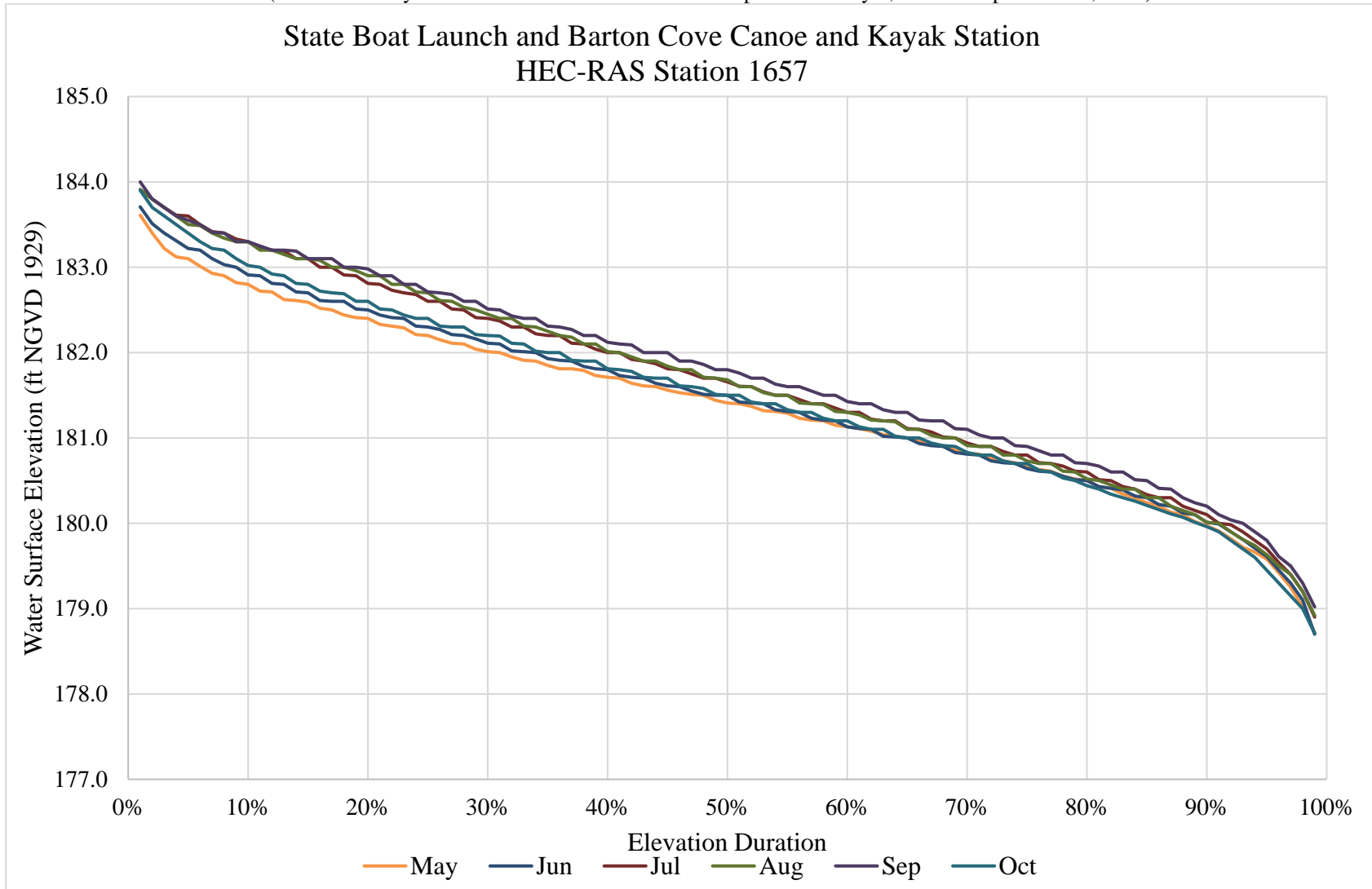


Figure 4.2.6-5 Barton Cove (Transect 1657) WSEL Duration Curves, Monthly (May-October)
(based on hourly model WSEL at Barton Cove for the period January 1, 2000 to September 30, 2015)



4.2.7 State Boat Launch

The State Boat Launch ([Figure 4.2.7-1](#)) is also located on Barton Cove, upstream of the Turners Falls Dam and within the Turners Falls and Northfield Mountain Project boundaries. The site has a hard surface boat launch and boat dock. Boating and shoreline fishing are recreational uses at the site. FirstLight shares ownership of the site with the Commonwealth of Massachusetts, and the Commonwealth manages the site.

[Figure 4.2.6-4](#) shows the river bed elevation near the State Boat Launch at specified distances from the shoreline, in relation to the median monthly WSELs under existing Project operations, for the period May through October. Bathymetric data indicate that the elevation of the river bed at the end of the boat ramp is 176 feet. A WSEL of 179 feet would provide three (3) feet of water depth for the launching and retrieval of boats. The elevation duration curves for the State Boat Launch are shown in [Figure 4.2.6-5](#). As shown, water depths at the end of the State Boat Launch are three (3) feet or greater (elevation 179 feet) 98% of the time in May through August; 99% of the time in September, and 98% of the time in October. There is only a minimal operational impact at the State Boat Launch in that it may be more difficult to launch trailerable boats when the TFI WSELs are below 179 feet, although canoes and kayaks can still be launched.

Similar to the Pauchaug Boat Launch, the State Boat Launch may be utilized by rescue crews to launch water craft. The RescueONE® Connector Boat, which is the emergency watercraft used by the towns of Northfield, Gill, and Turners Falls requires a minimum of 18-24 inches of water for launching. Model-predicted hourly WSEL duration curves show that required water depths associated with a WSEL of greater than 178 feet (i.e., two feet of water depth) occur 100% of the time in May through October. Thus, under existing Project operation, water depths are sufficient for launching an emergency rescue boat that has a draw of 18-24 inches during the entire recreation season (May-October).

Of the 86 surveys collected at the State Boat Launch, four respondents commented on WSELs at the State Boat Launch. Three (3) of the four (4) responses commented that water levels were too low, and the fourth indicated that they “wish it was higher.” The lowest WSEL recorded at Turners Falls Dam during the administration of the surveys was 179 feet. While these responses suggest some dissatisfaction with TFI WSELs, none of these survey responses specifically indicated difficulty with launching their boats, except one respondent noted the “pothole near ramp is terrible.” Thus, it may be that the concern about water level is a broader dissatisfaction with the overall shallowness of Barton Cove, the presence of aquatic vegetation, and the need to navigate carefully through the channel areas in order to reach the main river channel.

Figure 4.2.7-1 State Boat Launch



4.2.8 Turners Falls Station No. 1 Fishing Access

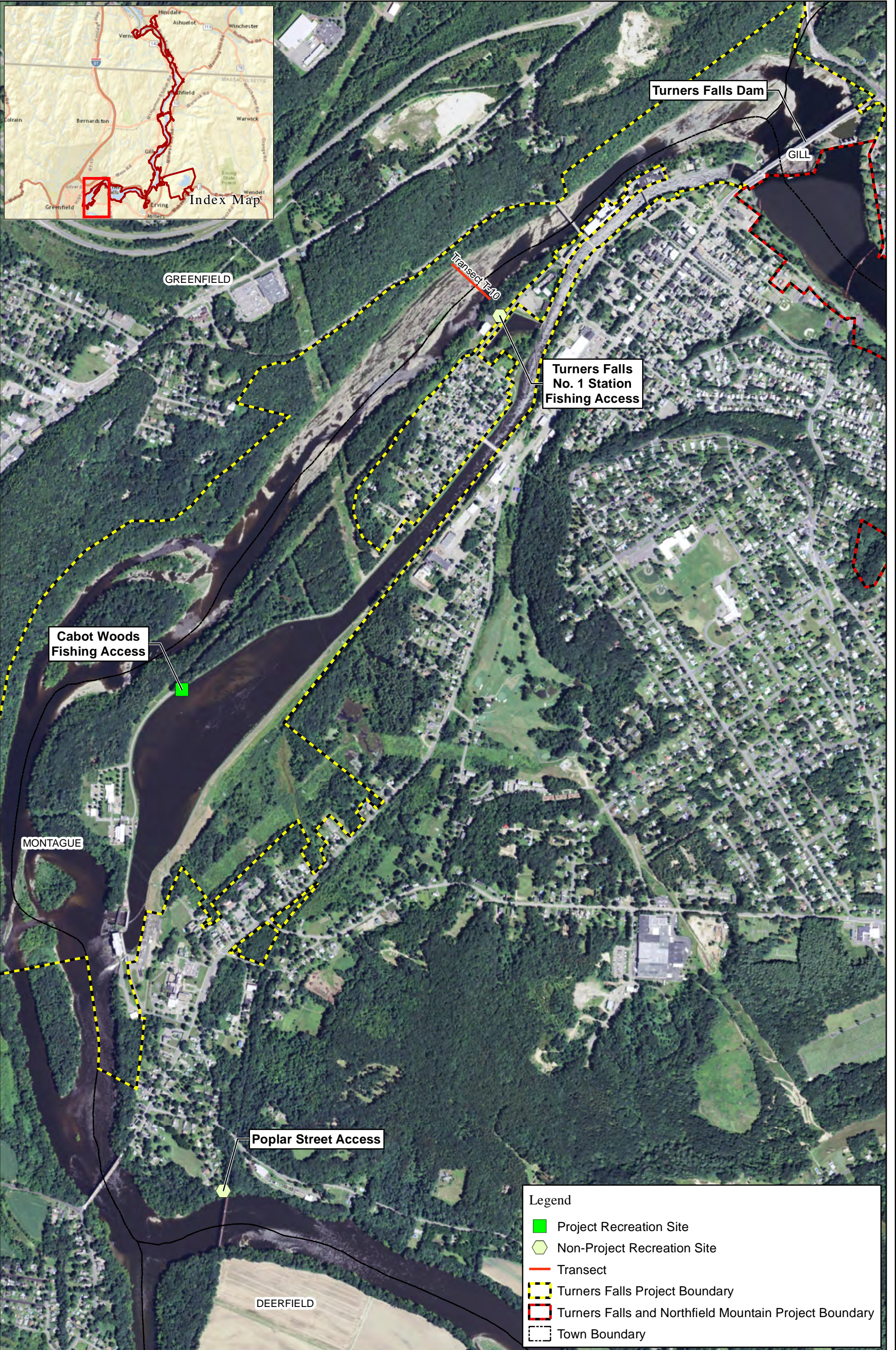
The Turners Falls Station No. 1 Fishing Access is an informal site located along the Turners Falls bypass reach adjacent to the Station No. 1 powerhouse, which is primarily used for shoreline fishing ([Figure 4.2.8-1](#)). An informal trail connects the bypass reach access areas to the parking area provided at the powerhouse ([Figure 4.2.8-2](#)). There is an estimated 500 feet of shoreline along the bypass reach upstream of the powerhouse that appears to be used by recreationists. In some places the shoreline is relatively steep, and in other places the shoreline has a more moderate slope.

Currently, the minimum flow in the bypass reach released at Turners Falls Dam ranges between 120 cfs and 400 cfs between May and October. However, much higher flows occur in the bypass reach whenever river flows exceed the hydraulic capacity of the power canal (about 18,000 cfs), and excess water is spilled at the Turners Falls Dam into the bypass reach. Such events are most common during the early spring and late winter, but bypass spill events can occur in any month as a result of high river flow conditions. The WSELs at this recreation site are affected by discharges at Station No. 1, which has a maximum generation capacity of 2,210 cfs and leakage from Station No. 1 during non-generation periods, which has been estimated at 98 cfs ([FirstLight, 2016b](#)).

Flows in the bypass reach are the subject of several relicensing studies, including recreation Study No. 3.6.3 *Whitewater Boating Evaluation* ([FirstLight, 2015c](#)) and Study No. 3.3.1 *Instream Flow Habitat Assessments in the Bypass Reach and Below Cabot Station* ([FirstLight, 2016b](#)). The whitewater boating study examined the boatability of the bypass reach under a range of flow conditions from 2,500 cfs to 13,000 cfs, but there was no component of this study that considered how high bypass reach flows might affect recreational access to, and shoreline use of, the bypass reach by anglers or other recreationists. The instream flow study (Study 3.3.1), however, does provide an opportunity to examine the effect of a range of different bypass reach flows on wetted area and velocity, two factors which could affect recreational access to the river at the Turners Falls Station No. 1 Fishing Access site.

[Figure 4.2.8-3](#) shows the cross section at the instream flow study Transect 10, which is located on the bypass reach immediately upstream of Station No. 1, in the immediate vicinity of the angler access area. As shown, the WSEL at this transect changes appreciably as bypass flows are increased from 200 cfs up to 2,000 cfs. As flows increase above about 2,000 cfs, due to the geometry of the transect, the changes in the WSEL do not increase as rapidly. For example, between a flow of 200 cfs and 2,000 cfs, the WSEL increases by about 2.5 feet, but between 2,000 and 7,500 cfs, the WSEL increases by only another 2.5 feet. Due to this flow vs stage relationship and the steep banks, the river remains accessible at Station No. 1 under a wide range of flows. As flows increase, the amount of shoreline available for river access diminishes. But, flows above about 400 cfs are not typical of normal project operations, and currently occur only during periods of high river flows that exceed the hydraulic capacity of the canal (18,000 cfs) and are spilled into the bypass reach.

Overall, access to the river at Station No. 1 for angling appears to be maintained across a wide range of bypass flow conditions. This is consistent with the findings of the recreation user survey. None of the recreation user surveys collected at the Station No. 1 access site specifically commented on water levels or flows as an issue at this site.



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

Study 3.6.6 Assessment of Effects of Project
Operation on Recreation and Land Use

Figure 4.2.8-1:
Recreation Sites Below Turners Falls Dam

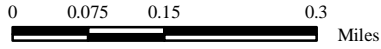
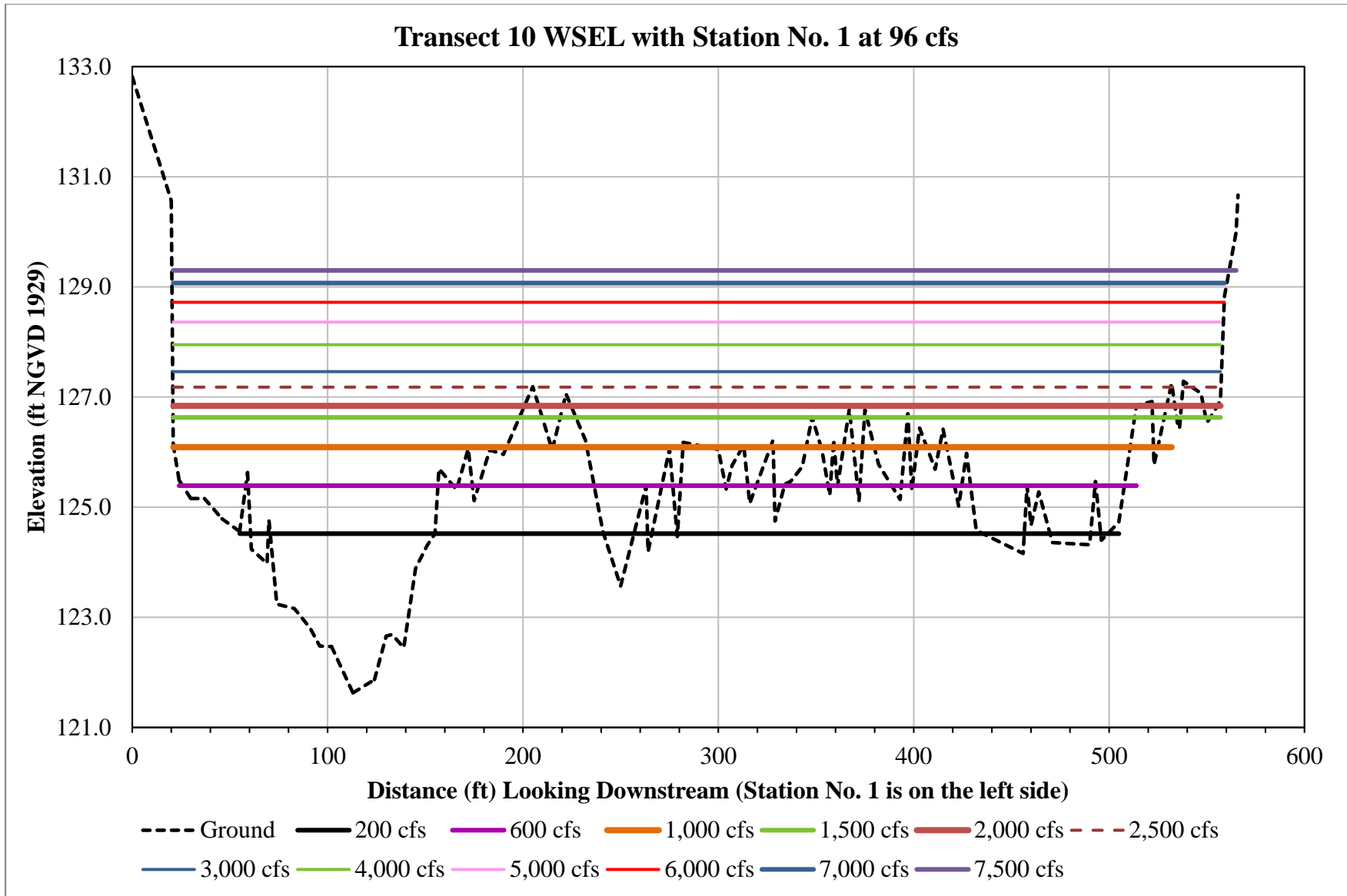


Figure 4.2.8-2 Turners Falls Station No. 1 Fishing Access



Figure 4.2.8-3 Transect 10 WSEL with Station No. 1 at 96 cfs



4.2.9 Cabot Woods Fishing Access

The Cabot Woods Fishing Access is located along Migratory Way between the Turners Falls Project power canal and the bypass reach. The site is owned by FirstLight and is open to the public for day use activities. Facilities at this site include parking lots and picnic tables. There are no formal water access facilities at the site, but numerous informal angler trails provide access to the bypass reach. In total there is an estimated 800 feet of shoreline along the bypass reach that is accessible to anglers at this site. The shoreline area extends upstream and downstream of Rock Dam, a natural ledge that creates a backwater above the ledge, a vertical falls, and then a pool just below the falls.

The shoreline along most of the Cabot Woods Fishing Access area is steep ([Figure 4.2.9-1](#)), and many of the access trails are also steep, making access challenging at this site ([Figure 4.2.9-2](#)). As part of Study 3.6.3, *Whitewater Boating Evaluation*, this site was evaluated as a possible put-in or take-out area to the bypass reach for whitewater boating, but due to the steep terrain was found to be unsuitable for whitewater boating access to the bypass reach ([FirstLight, 2015c](#)).

As at the Turners Falls Station No. 1 Fishing Access, water access for recreation at Cabot Woods Fishing Access can be affected by flows in the bypass reach (above Rock Dam) and Cabot Station operations (below Rock Dam). More specifically, conditions above and below Rock Dam are influenced by both hydrology (inflow) and hydraulics. The hydrology and hydraulics above Rock Dam are a function of the following variables:

- Relative to hydrology, inflow to Rock Dam is controlled by spill and required releases from the Turners Falls Dam, flows needed for fish passage at the Spillway ladder, Fall River tributary flow, and Station No. 1, which discharges a maximum of 2,210 cfs and leakage during non-generation periods of about 98 cfs) ([FirstLight, 2016b](#)).
- Relative to hydraulics, as [Figure 4.2.8-1](#) shows, upstream of Rock Dam, the bypass reach splits such that some portion of the inflow flows on the other side of the island and another portion flows toward Rock Dam.

The hydrology and hydraulics in the pool just below Rock Dam is a function of the following variables:

- Relative to hydrology, a portion of the bypass flow is conveyed over Rock Dam.
- Relative to hydraulics, there is a natural constriction below Rock Falls that creates a plunge pool below Rock Dam. In addition, depending on the magnitude of the discharge versus the amount of bypass flow, Cabot Station discharges can impact the hydraulics in the plunge pool.

Currently, the minimum flow in the bypass reach released at Turners Falls Dam ranges between 120 cfs and 400 cfs between May and October. However, much higher flows occur in the bypass reach whenever river flows exceed the hydraulic capacity of the power canal (about 18,000 cfs), and excess water is spilled at the Turners Falls Dam into the bypass reach. Such events are most common during the early spring and late winter, but large bypass flow events can occur in any month as a result of high river flow conditions.

Flows in the bypass reach are the subject of several relicensing studies, including recreation study 3.6.3 *Whitewater Boating Evaluation* and the *Instream Flow Habitat Assessments in the Bypass Reach and Below Cabot Station* (Study 3.3.1). The whitewater boating study examined the boatability of the bypass reach under a range of flow conditions from 2,500 cfs to 13,000 cfs, but did not consider how the high bypass reach flows evaluated might affect recreational access to, and shoreline use of, the bypass reach by anglers or other recreationists. The instream flow study (Study 3.3.1), however, does provide an opportunity to examine the effect of a range of different bypass reach flows on wetted area and velocity, two factors which could affect recreational access to the river at the Cabot Woods Fishing Access site.

[Figure 4.2.9-3](#) shows a left bank (looking downstream) transect in the pool immediately upstream of Rock Dam, an area of the bypass which is directly accessible from the Cabot Woods Fishing Access site. As shown, because this is a large pool formed by Rock Dam, the shoreline in this area of the bypass reach in this area does not change dramatically at bypass flows of 120, 300, 500, 1,000, 2,000, and 5,000 cfs. Therefore the pool remains accessible to anglers accessing the shoreline from the Cabot Woods Fishing Access area, under a wide range of flows.

[Figure 4.2.9-4](#) shows a left bank transect in the pool immediately downstream of Rock Dam, another area that is directly accessible from the Cabot Woods Fishing Access site. This figure shows the water level associated with Cabot¹⁰ generation flows of 2,500, 5,000, 9,000, and 13,728 cfs and bypass flows of 120, 1,000, and 5,000 cfs. This figure shows that backwatering of this location does occur from Cabot generation especially at the higher values, but changes in the bypass flows are the larger influence. Similar to the pool upstream of Rock Dam, the pool remains accessible to anglers from the shoreline under a wide range of flows.

At higher flows, however, Rock Dam itself becomes a potential hazard to both anglers and other recreationists. As part of Study 3.6.3, *Whitewater Boating Evaluation*, whitewater boaters were asked to rate the rapids within the bypass reach over the range of flows evaluated (2,500 – 13,000 cfs). Whitewater ratings for Rock Dam ranged from Class II to Class IV, depending on river flows and watercraft type, indicating that this feature creates serious hydraulic conditions when flows increase above 2,500 cfs ([FirstLight, 2015c](#)). In recognition of the potential safety hazard posed by Rock Dam, FirstLight prohibits swimming at the Cabot Woods Fishing Access, and there are numerous signs posted indicating such.

Overall, access to the river at Cabot Woods Fishing Access for angling appears to be maintained across a wide range of bypass flow conditions. This is consistent with the findings of the recreation user survey. Of the 201 recreation user surveys collected at the Cabot Woods Fishing Access site, none specifically commented on water levels or flows as an issue at this site.

¹⁰ Cabot has six equally sized generators with a total hydraulic capacity of 13,728 cfs.

Figure 4.2.9-1 Cabot Woods Fishing Access – Rock Dam Pool



Figure 4.2.9-2 Cabot Woods Fishing Access – Example of Steep Trails to Bypass Shoreline



Figure 4.2.9-3 WSELs in Pool Upstream of Rock Dam Based on Bypass Flows

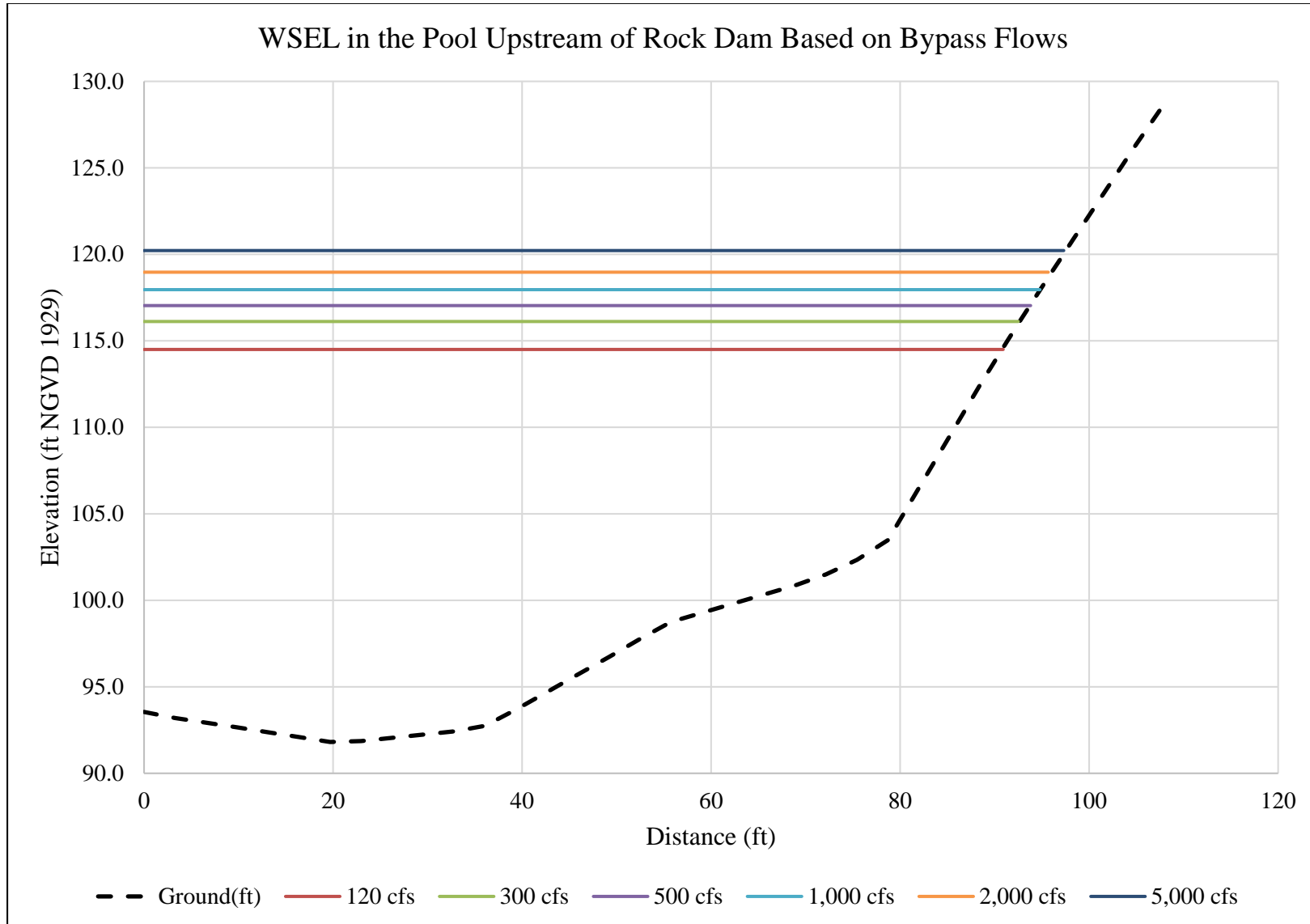
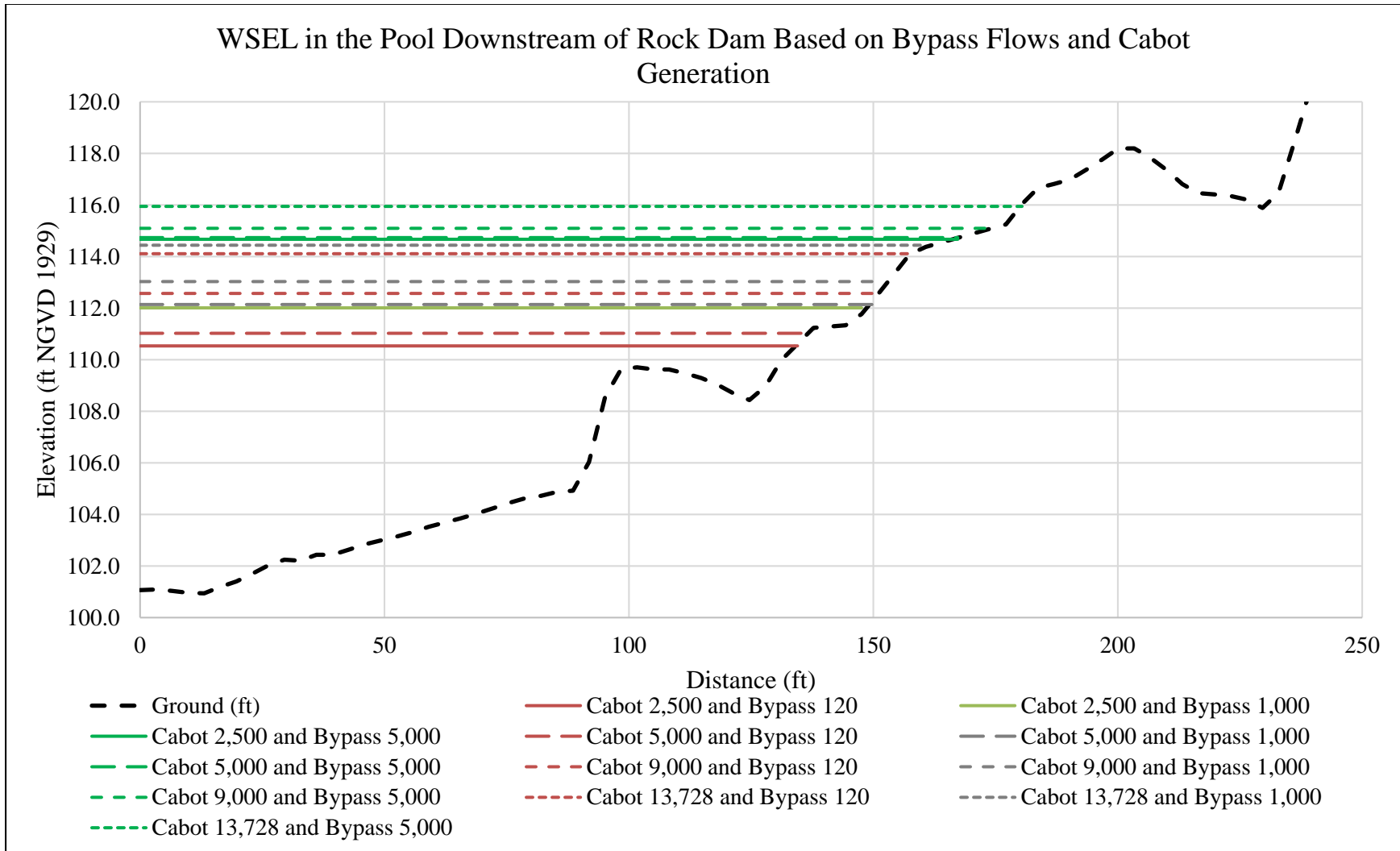


Figure 4.2.9-4 WSEL in the Pool Downstream of Rock Dam Based on Bypass Flows and Cabot Generation



4.2.10 Poplar Street Access Site

The Poplar Street Access Site ([Figure 4.2.8-1](#)) is an unimproved site located outside the Turners Falls Project boundary, downstream of Cabot Station, on Poplar Street in Montague, Massachusetts. This site is owned by FirstLight and is utilized for carry-in boat access, fishing, and as the downstream put-in location for the canoe portage. The shoreline is accessible via a steep, unimproved, trail. This site was assessed as a potential take-out point for recreational boaters as part of Study No. 3.6.4 *Assessment of Day Use and Overnight Facilities Associated with Non-Motorized Boating* and was utilized as the downstream take-out location for Study 3.6.3 *Whitewater Boating Evaluation* ([FirstLight, 2015c](#)). While the primary use of the Poplar Street Access is as a canoe/kayak put-in, the site also provides some shoreline access for anglers. Approximately 50 feet of river shoreline can be accessed from this site. [Figure 4.2.10-1](#) is a photographic view of the water access provided at the Poplar Street Access site.

The Poplar Street Access Site is located approximately one mile downstream of Cabot Station and approximately 0.2 miles downstream of the Deerfield River confluence. Because of its location, the site is influenced by the combined flows being discharged from Cabot Station, through the bypass reach (includes Station No.1 that has a maximum generation capacity of 2,210 cfs), and from the Deerfield River. Cabot Station has a maximum generation capacity of 13,728 cfs, and Deerfield River Project Station No. 2, the lowermost project on the Deerfield River, has a maximum generation capacity of 1,450 cfs. Thus, when river flows are controllable by hydropower generation, the WSEL and flow velocities at this site are more influenced by the operation of the Turners Falls Project than by the Deerfield River Project ([FirstLight, 2015f](#)).

Hydraulic modeling of the river reach downstream of Cabot Station has been done as part of Study 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and Below Cabot*, and the resulting HEC-RAS hydraulic model was used to examine typical water level conditions in the vicinity of the Poplar Street Access ([FirstLight, 2015f](#)). [Figure 4.2.10-2](#)¹¹ shows the cross-sectional river bed elevation in close vicinity to the Poplar Street Access at specified distances from the shoreline, in relation to the median monthly WSELs under existing Project operations, for the period May through October (the recreation season). [Figure 4.2.10-3](#) provides the WSEL duration curves for this same location, based on hourly hydraulic model data. As can be seen from the cross-sectional profile, the river bank in this area is quite steep, and changes in median monthly flows do not result in much change in the wetted perimeter of this cross section, nor in the accessibility to the water from the shoreline. Because there are no formal water access facilities at this site, there is no specific elevation associated with the site's use as a put-in or take-out location for canoes and kayaks.¹² Moreover, the overall steepness of the shoreline river bed along the Poplar Street Access shoreline insures that regardless of the river water level, there is water sufficiently deep for canoe/kayak put-in and take-out. From the cross-sectional profile it appears that there is adequate depth for launching a canoe or kayak over the full range of WSEL's typically observed at this location, under normal Project operations, between May and October.

Of the 26 surveys collected at this site, two respondents, both of whom were fishing at the time of the survey, indicated a concern with water levels. One respondent noted that water levels are "not consistent" and "too low," while the other respondent noted water levels were "pretty low." The respondents did not

¹¹ Note that the Montague hydraulic model includes the Poplar Street Access Area Site. The Montague hydraulic model was developed on an hourly basis for the period January 1, 2008 to September 30, 2015 (a different period than the TFI hydraulic model).

¹² In its Draft License Application filed with FERC on April 29, 2016, FirstLight proposed improvements to the Poplar Street Access Site. WSELs, shoreline topography, and the like will be taken into consideration when developing final designs for improvements to the site.

Northfield Mountain Pumped Storage Project (No.2485) and Turners Falls Hydroelectric Project (No. 1889)
STUDY 3.6.6 ASSESSMENT OF EFFECTS OF PROJECT OPERATION ON RECREATION AND LAND USE
STUDY REPORT

indicate whether the concern related to whether water levels had an impact on the ability to access the water from the site, or whether the concern was a more general comment regarding flows in the bypass reach.

Figure 4.2.10-1 Poplar Street Access Site



Figure 4.2.10-2 Poplar Street Access Bottom Contour Elevation and Median Monthly WSEL
(based on hourly model WSEL at Poplar Street Access for the period January 1, 2008 to September 30, 2015)

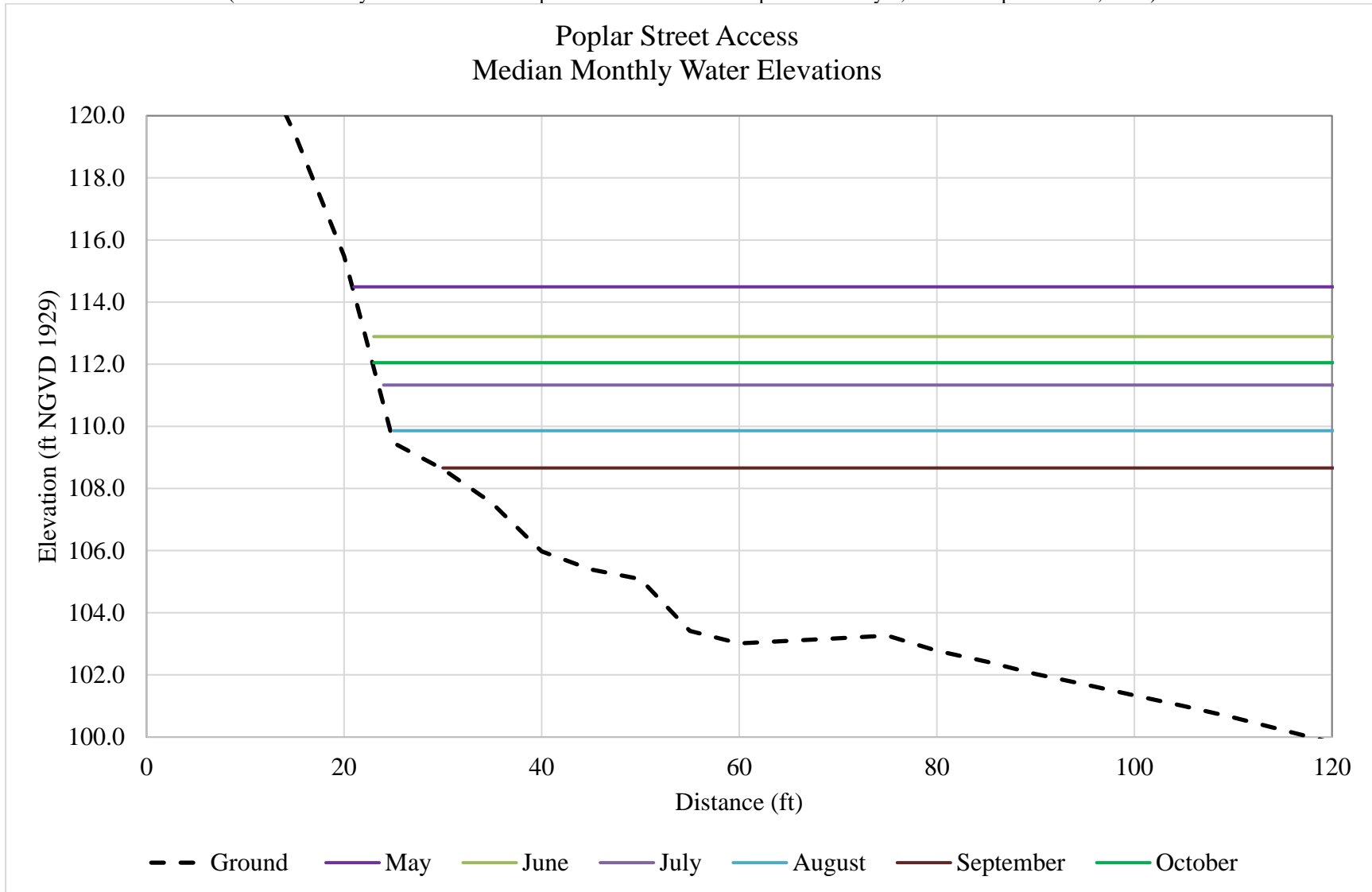
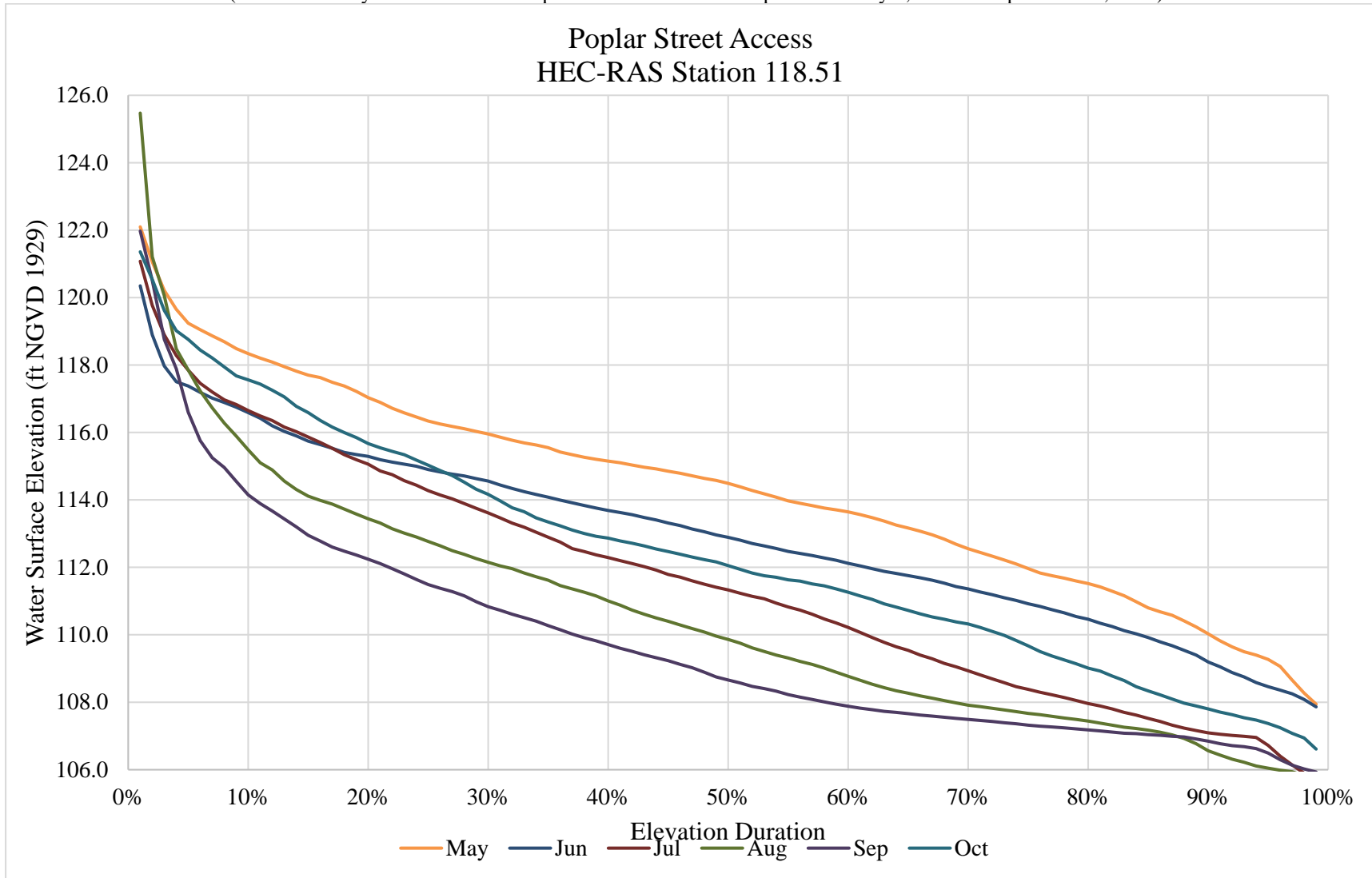


Figure 4.1.10-3 Poplar Street WSEL Duration Curves, Monthly (May-October)
(based on hourly model WSEL at Poplar Street Access for the period January 1, 2008 to September 30, 2015)



4.2.11 *Sunderland Bridge Boat Launch*

There are two separate water access recreation sites located at Sunderland Bridge, approximately 10 miles downstream of Cabot Station and 9 miles downstream of the Deerfield River confluence. On river right¹³ (western shore) there is an unimproved site with parking that provides informal carry-in access to the river. On river left (eastern shore) there is an access area off of School Street that includes an unimproved boat launch maintained by the Town of Sunderland. The boat launch area is suitable for smaller trailered craft, as well as canoes and kayaks. [Figure 4.2.11-1](#) shows the Sunderland Bridge boat launch site.

Similar to the Poplar Street Access Site, at the Sunderland Bridge Boat Launch, the WSELs and flow velocities are influenced primarily by the operation of the Turners Falls Project. In addition, this location is generally only very slightly affected by the 1.2 foot variation at the WSEL at the Holyoke Dam, located about 25 miles downstream ([FirstLight, 2015f](#)). The Montague hydraulic model was used to examine typical water level conditions in the vicinity of the Sunderland Bridge Boat Launch ([FirstLight, 2015f](#)). [Figure 4.2.11-2](#) shows the cross-sectional river bed elevation in close vicinity to the Sunderland Bridge Boat Launch at specified distances from the shoreline, in relation to the median monthly WSELs under existing Project operations, for the period May through October. [Figure 4.2.11-3](#) provides the WSEL duration curves for this same location, based on hourly hydraulic model data. As can be seen from the cross-sectional profile, the river bank in this area is moderately steep, with a nearly consistent slope. As a result, changes in median monthly flows do not result in dramatic changes in the wetted perimeter of this cross section, nor in the accessibility to the water from the shoreline.

Because there is no improved boat launch at the Sunderland Bridge site, there is no specific elevation associated with the site's use for launching small trailered boats, canoes or kayaks. Moreover, the moderate steepness of the shoreline river bed along the eastern shoreline at Sunderland Bridge means that during normal Project operation, water depths are sufficient for small boat launching and canoe/kayak put-in and take-out. Similarly, because the informal carry-in site on river right has no improvements, there is no specific elevation associated with the site's use as an informal carry-in. Nonetheless, as with the unimproved boat launch, the steep sandy slope to the shoreline means that during that the access remains useable under normal Project operation.

¹³ River right refers to the right side of the river when looking in a downstream direction.

Figure 4.2.11-1 Sunderland Bridge Boat Launch



Figure 4.2.11-2 Sunderland Bridge Boat Launch Bottom Contour Elevation and Median Monthly WSEL
(based on hourly model WSEL Sunderland Bridge Boat Launch for the period January 1, 2008 to September 30, 2015)

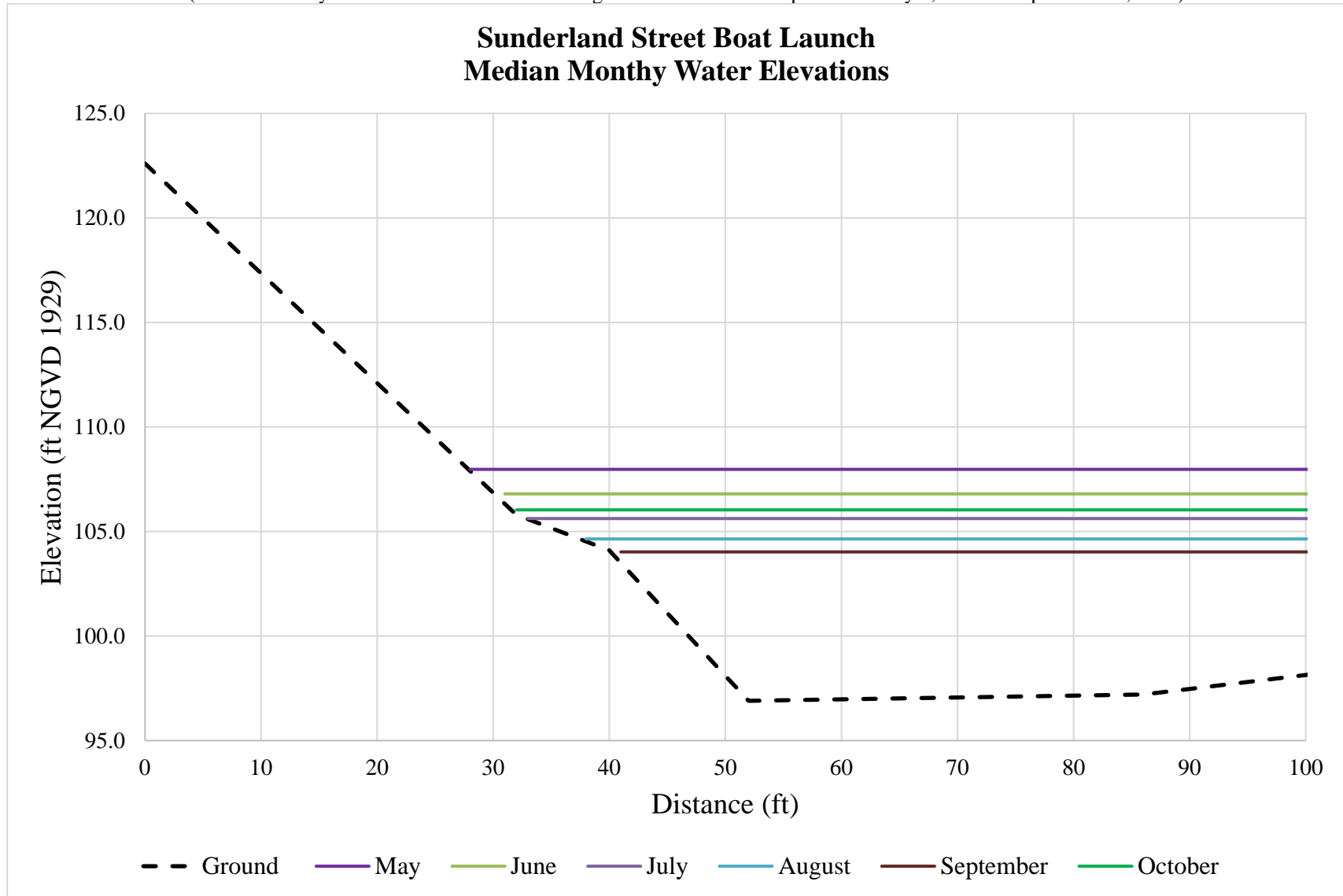
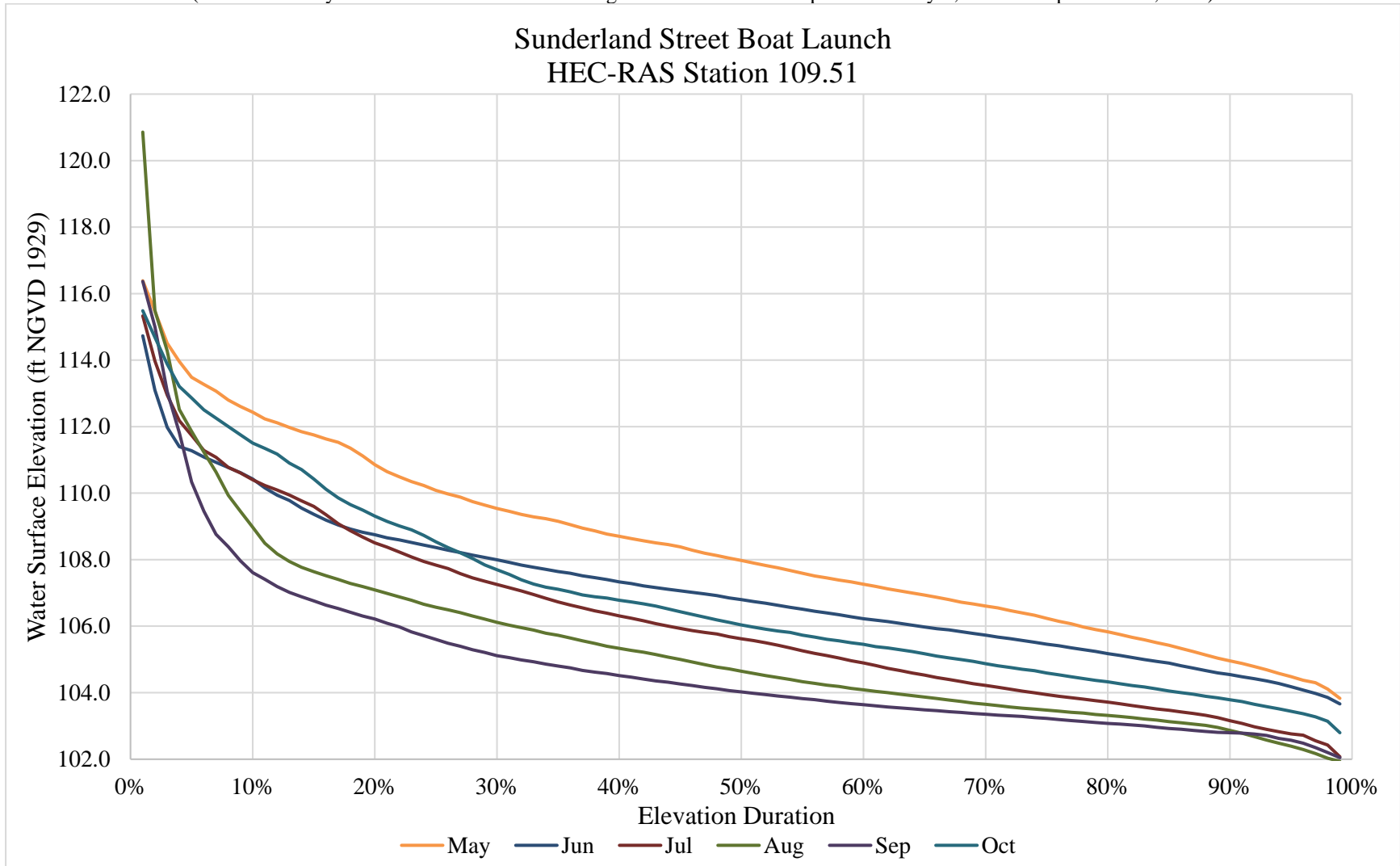


Figure 4.2.11-3 Sunderland Bridge Boat Launch WSEL Duration Curves, Monthly (May-October)
(based on hourly model WSEL Sunderland Bridge Boat Launch for the period January 1, 2008 to September 30, 2015)



5 DISCUSSION

This study focused on 12 recreation sites that provide water-based access to Project waters or the Connecticut River downstream of the Project to the Sunderland Bridge, and that have the potential to be affected by the operation of the Northfield Mountain and Turners Falls Projects. Each site was discussed in detail above, and the operational impacts identified for each are summarized below in [Table 5-1](#).

Table 5-1 Summary of Project Effects on Water Based Recreation Sites and Facilities

Recreation Site	Water Access Recreation Facilities/ Amenities	Water-based Recreation Uses	Project Operational Impacts
Governor Hunt Boat Launch/Picnic Area	Boat launch	Boating Fishing	None; the boat launch is located upstream of a hydraulic control, which limits the water surface elevation from falling below 181-ft
Pauchaug Boat Launch	Boat launch	Boating	Moderate water level impacts; launch ramp use is affected at WSELs of < 181 feet, which may occur anywhere from 80% (August) of the time to 95 % (May) of the time during the recreation season (May-October). Launch also has sufficient water depth for emergency rescue craft 95% to 100% of the time (May-October).
Munn’s Ferry Boat Camping Recreation Area	Boat dock (floating)	Boating Fishing	None; WSEL of 167 feet is needed for docking power boats. The lowest allowable operating range for the TFI is elevation 176 feet. Thus, the WSEL at the boat dock is above 167 feet 100% of the time.
Boat Tour and Riverview Picnic Area	Boat dock (floating)	Riverboat cruise Boating Fishing	None to minimal; WSEL of 175 feet is needed for docking the QII; WSELs >175 feet 100% of the time during the recreation season (May-October); when river flow is low and Northfield Mountain is generating, the Boat Tour and Riverview Picnic Area is subject to flow reversals as water moves upstream. However the upstream velocities are low and do not interfere with the usability of the Riverview boat dock for the QII or other power boats
Cabot Camp Access Area	None	Fishing	None; TFI shoreline remains fully accessible for bank fishing and those launching or retrieving canoes/kayaks under full range of allowable TFI elevations.
Barton Cove Nature Area and Campground	Boat dock (floating)	Fishing	Minimal water level impacts; floating boat dock adjusts with WSEL and remains useable at water levels of > 180 feet, which occur 89% to 93% of the time during the months of May through October.

Northfield Mountain Pumped Storage Project (No.2485) and Turners Falls Hydroelectric Project (No. 1889)
STUDY 3.6.6 ASSESSMENT OF EFFECTS OF PROJECT OPERATION ON RECREATION AND LAND USE
STUDY REPORT

Recreation Site	Water Access Recreation Facilities/ Amenities	Water-based Recreation Uses	Project Operational Impacts
Barton Cove Canoe and Kayak Rental Area	Canoe/Kayak launch	Canoeing/ Kayaking	None; the WSELs > 180 feet (2 foot depth) 90 % of the time during the recreation season (May-October); there may be infrequent occasions when a canoeist or kayaker would have to walk a short distance (approximately 15 to 30 feet) further to launch his/her craft at this site.
State Boat Launch	Boat launch	Boating Fishing	Minimal water level impacts; boat launch remains useable (3 foot depth at end of launch) at water surface elevations of > 179 feet, which occur 98 % to 99% of the time during the months of May through October. The launch has sufficient depth for emergency water craft 100% of the time between May and October.
Turners Falls Station No. 1 Fishing Access	None	Fishing	Minimal flow and water level impacts; Bypass reach shoreline remains accessible for bank fishing under a wide range of bypass flows; amount of available shoreline may diminish when flows exceed hydraulic capacity of the power canal.
Cabot Woods Fishing Access	None	Fishing	Minimal flow and water level impacts; Bypass reach shoreline remains accessible for bank fishing under a wide range of bypass flows. But recreation user safety may be impacted at higher bypass flows, particularly in the vicinity of Rock Dam.
Poplar Street Access Area	Canoe portage put-in	Canoeing/ Kayaking Fishing	None; River shoreline remains fully accessible for canoe/kayak put-in and take-out under the range of water surface elevations typically produced by normal Project operations.
Sunderland Bridge Boat Launch	Boat launch	Boating Fishing	None; Unimproved boat launch remains fully useable for small boat and canoe/kayak launching under the range of water surface elevations typically produced by normal Project operations.

In summary, Turners Falls and Northfield Mountain Project operations have little to no impact on water based recreation facilities at the Governor Hunt Boat Launch/Picnic Area, Munn’s Ferry Boat Camping Recreation Area, the Boat Tour and Riverview Picnic Area, Cabot Camp Access Area, the Barton Cove Canoe and Kayak Rental Area, Poplar Street Access, or the Sunderland Bridge Boat Launch. As discussed in Section 4, a hydraulic control exists just downstream of Vernon Dam, which limits the WSEL at the Governor Hunt Boat Launch/Picnic Area from falling below 181 feet. The boat dock at the Northfield Mountain Boat Tour and Riverview Picnic Area has 7 feet of water depth 100% of the time, which is sufficient for docking. Munn’s Ferry Boat Camping Recreation Area has greater than three feet of water depth 100% of the time, which is sufficient for docking. Cabot Camp Access Area provides water access and bank fishing opportunities for recreationists, and access to the water and river shoreline are available under the allowable range of Turners Falls Impoundment water surface elevations. The canoe/kayak launch

area at the Barton Cove Canoe and Kayak Rental Area has a minimum of 2 feet of water depth 90% of the time for the launching and retrieving of hand carry watercraft, thus requiring canoeists and kayakers to walk a short distance further on infrequent occasions.

Downstream of Cabot Station and the Project boundary, recreation use of Poplar Street Access and the boat launch at Sunderland Bridge, is generally not impacted by Project operations. The river bank in the area of Sunderland Bridge is moderately steep, with a nearly consistent slope. As a result, changes in median monthly flows do not result in dramatic changes in the wetted perimeter of this cross section, nor in the accessibility to the water from the shoreline.

Minimal Project operational impacts to water-based recreation sites and facilities were found to occur at the Barton Cove Nature Area and Campground the State Boat Launch, Turners Falls Station No. 1 Fishing Access, and Cabot Woods Fishing Access. Barton Cove is a uniformly shallow cove, much of which is densely filled with aquatic vegetation. Despite the shallowness of the cove, the water-based recreation facilities located within the cove remain useable under most TFI elevations. The WSEL duration plots show that the State Boat Launch is usable 98% to 99% of the time during the recreation season (May-October), under existing Project operations and 100% of the time during the recreation season (May-October) for rescue operations.¹⁴ The Barton Cove boat dock at the nature area is also useable 89% to 93% of the time during the recreation season (May-October).

Along the bypass reach, the Turners Falls Station No. 1 Fishing Access and Cabot Woods Fishing Access both provide access to the Turners Falls bypass reach for anglers. The shoreline in both areas is accessed via informal trails, and there are no improvements or water-based recreation facilities at either site. As the flows in the bypass increase, the amount of shoreline decreases, however, both sites remain useable by anglers under a wide range of bypass flow conditions. Hydraulic conditions in the vicinity of Rock Dam may pose a safety hazard at higher flows.

Only one recreation site, Pauchaug Boat Launch, was found to be moderately impacted by Project operations. This site is usable a majority of the time between May and October (86%), but it may experience insufficient water depths for launching trailered boats at times during the drier, summer months of July, August, and September under existing operations. It also is useable by the Northfield Fire Department emergency rescue boat nearly 100% of the time during the recreation season. The Northfield Fire Department generally contacts FirstLight Northfield Control Room when it needs to use the boat launch for emergency rescue operations. The location of the boat launch makes it particularly susceptible to sediment accumulation during naturally occurring high flows. The sediment is periodically cleared from the ramp and excavated from the base of the ramp by MADFG in order to keep the launch ramp in a useable condition.

¹⁴ This is based on the use of a boat requiring 18-24 inches of water to successfully launch.

6 LITERATURE CITED

- Boyd, T., McPherson, J., Murphey, J., Bazley, T., Edwards, B., Hough, M., Skaar, K. (2006). Design Handbook for Recreational Boating and Fishing Facilities, Second Edition. Warren, RI: States Organization for Boating Access (SOBA).
- Cameron, Douglas. (2016). Massachusetts Department of Fish and Game. Personal communication via phone. June, 2016.
- FirstLight. (2012). Pre-Application Document (PAD) for FERC Project Nos. 2485 and 1889. Northfield, MA: Author.
- FirstLight. (2014). Initial Study Report Summary Relicensing Study 3.6.2 Recreation Facilities Inventory and Assessment. Prepared by Gomez and Sullivan Engineers and TRC Solutions. Northfield, MA: Author.
- FirstLight. (2015a). Relicensing Study 3.6.1 Recreation Use/User Contact Survey. Prepared by Gomez and Sullivan Engineers and TRC Solutions. Northfield, MA: Author.
- FirstLight. (2015b). Relicensing Study 3.6.2 Recreation Facilities Inventory and Assessment Addendum. Prepared by Gomez and Sullivan Engineers and TRC Solutions. Northfield, MA: Author.
- FirstLight. (2015c). Relicensing Study 3.6.3 Whitewater Boating Evaluation. Prepared by Gomez and Sullivan Engineers and TRC Solutions. Northfield, MA: Author.
- FirstLight. (2015d). Relicensing Study 3.6.4 Assessment of Day Use and Overnight Facilities Associated with Non-Motorized Boats. Prepared by Gomez and Sullivan Engineers and TRC Solutions. Northfield, MA: Author.
- FirstLight. (2015e). Relicensing Study 3.6.7 Recreation Study at Northfield Mountain, including Assessment of Sufficiency of Trails for Shared Use. Prepared by Gomez and Sullivan Engineers and TRC Solutions. Northfield, MA: Author.
- FirstLight. (2015f). Relicensing Study 3.2.2 Hydraulic Study of Turners Falls Impoundment, Bypass Reach and Below Cabot. Prepared by Gomez and Sullivan Engineers. Northfield, MA: Author.
- FirstLight. (2015g). Relicensing Study 3.3.9 Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace. Prepared by Gomez and Sullivan Engineers. Northfield, MA: Author.
- FirstLight. (2016a). Relicensing Study 3.1.2 Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability. Prepared by Simons & Associates, Cardno Entrix, & Gomez and Sullivan Engineers. Northfield, MA: Author.
- FirstLight. (2016b). Relicensing Study 3.3.1 Instream Flow Habitat Assessments in the Bypass Reach and below Cabot Station. Prepared by Gomez and Sullivan Engineers and Kleinschmidt Associates. Northfield, MA: Author.

Northfield Mountain Pumped Storage Project (No.2485) and Turners Falls Hydroelectric Project (No. 1889)
STUDY 3.6.6 ASSESSMENT OF EFFECTS OF PROJECT OPERATION ON RECREATION AND LAND USE
STUDY REPORT

FirstLight. (2016c). Relicensing Study 3.5.1 Baseline Inventory of Wetland, Riparian, and Littoral Habitat in the Turners Falls Impoundment, and Assessment of Operational Impacts on Special Status Species. Prepared by Gomez and Sullivan Engineers. Northfield, MA: Author.

Northfield Fire Department. (2016). Retrieved from: <http://www.northfieldmafire.com/>. Last accessed August 17, 2016.

National Park Service (NPS) Rivers, Trails & Conservation Assistance Program. (2004). Logical Lasting Launches Design Guidance for Canoe and Kayak Launches. Retrieved from: <https://www.nps.gov/ncrc/programs/rtca/helpfultools/launchguide.pdf>.

TransCanada. (2016). ILP Study 30 Recreation Facility Inventory, Use and Needs Assessment Study Report. Prepared by Louis Berger and Normandeau Associates.