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John S. Howard
Director- FERC Hydro Compliance

October 30, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Re: Northfield Mountain Pumped Storage Project, FERC Project No.2485
Turners Falls Hydroelectric Project, FERC Project No. 1889
Filing of Pre-Application Document

Dear Secretary Bose:

Pursuant to Section 5.6 of the rules and regulations of the Federal Energy Regulatory Commission (Commission or FERC), 18 C.F.R. § 5.6, FirstLight Hydro Generating Company (FirstLight), a subsidiary of IPR-GDF SUEZ North America, Inc., Licensee of the Turners Falls Hydroelectric Project (FERC No. 1889) and the Northfield Mountain Pumped Storage Project (FERC No. 2485), encloses for filing the attached Pre-Application Document (PAD). Although individual licenses are currently held for the Turners Falls Project and Northfield Mountain Project and expire on the same date, FirstLight is filing a single PAD for the Turners Falls Project and Northfield Mountain Project.

The Turners Falls Project consists of: a) two concrete gravity dams separated by an island and appurtenant facilities located on the Connecticut River in the towns of Gill and Montague, MA; b) a gatehouse controlling flow to the main power canal; c) the main power canal and a short branch canal; d) two hydroelectric powerhouses, located on the power canal, known as Station No. 1 and Cabot Station; and e) a reservoir known as the Turners Falls Impoundment.

The Northfield Mountain Project consists of: a) an upper reservoir and dam; b) an underground powerhouse; and c) a tailrace. The Turners Falls Impoundment (Connecticut River) serves as a lower reservoir.

The Turners Falls Project and Northfield Mountain Project are located on the Connecticut River in Franklin County, Massachusetts (MA). The impoundment created by the Turners Falls Dam extends into Windham County, Vermont (VT) and Cheshire County, New Hampshire (NH). The current licenses for the Turners Falls Project and Northfield Mountain Project expire on April 30, 2018.

The PAD describes the existing Turners Falls Project and Northfield Mountain Project facilities and operations and provides information on the existing environment, existing data, and studies relevant to the existing environment, and any known and potential effects of the Turners Falls Project and Northfield Mountain Project on the specified resources, as required by 18 C.F.R. § 5.6.

In accordance with Section 5.6(a)(1) of the Commission's regulations, 18 C.F.R. § 5.6(a)(1), FirstLight is providing a copy of the PAD on compact disc to appropriate federal and state resource agencies, Indian tribes, local governments, and members of the public likely to be interested in the proceeding, as set forth on the attached distribution list. In addition, FirstLight will electronically file the PAD and provide two courtesy paper copies of the same to Commission Staff in the Office of Energy Projects and Office of General Counsel – Energy Projects, as required by the Commission's filing guidelines. Further, as required by 18 C.F.R. § 5.2(a), FirstLight is making available to the public the PAD and all materials referenced therein at the Northfield Mountain Visitor Center at 99 Millers Falls Road, Northfield, MA during regular business hours.

FirstLight looks forward to working with the Commission, agencies, Indian tribes, local governments, and members of the public on the relicensing of the Turners Falls Project and Northfield Mountain Project. If you have any questions regarding the above, please do not hesitate to contact the undersigned. Thank you for your assistance in this matter.

Sincerely,

John S. Howard

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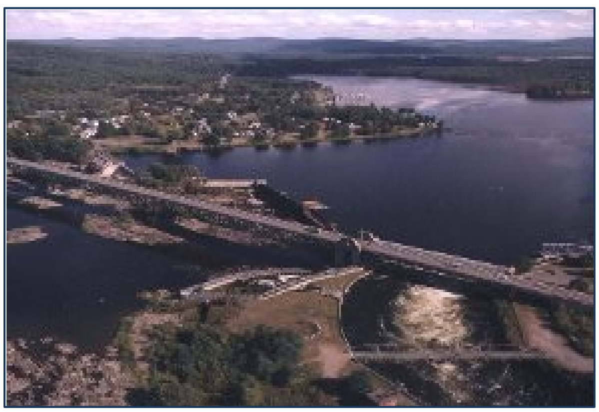
PRE-APPLICATION DOCUMENT

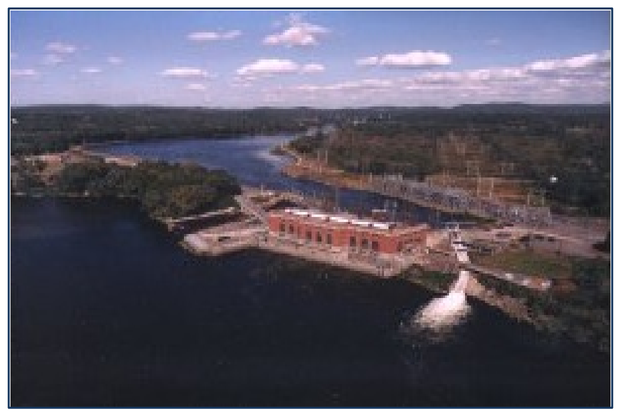
FOR THE

Turners Falls Hydroelectric Project (No. 1889)

and

Northfield Mountain Pumped Storage Project (No. 2485)





OCTOBER 30, 2012

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2D	two dimensional
3D	three dimensional
A	ampere
AC	alternating current
CAFRC	Conte Anadromous Fish Research Center
CFR	Code of Federal Regulations
cfs	cubic feet per second
CFU	colony forming units
CL&P	Connecticut Light & Power
cm	centimeter
CRASC	Connecticut River Atlantic Salmon Commission
CRJC	Connecticut River Joint Commissions
CRSEC	Connecticut River Streambank Erosion Committee
CRWC	Connecticut River Watershed Council
CT	Connecticut
CTDEP	Connecticut Department of Environmental Protection
CTDEEP	Connecticut Department of Energy and Environmental Protection
°C	degrees Celsius
°F	degrees Fahrenheit
ft	foot or feet
ft^2	square feet
DO	dissolved oxygen
EA	Environmental Assessment
ECP	Erosion Control Plan
EFH	essential fish habitat
ESA	Endangered Species Act
FERC or Commission	Federal Energy Regulatory Commission
FGS	Field Geology Services
FPA	Federal Power Act
FirstLight	FirstLight Hydro Generating Company
FRCOG	Franklin Regional Council of Governments
FRR	Full River Reconnaissance
GPD	gallons per day
HEC	USACE Hydrologic Engineering Center
hr	hour
ILP	Integrated Licensing Process
ISO-NE	ISO New England

kV	kilovolt
kW	kilowatt
kWH	kilowatt-hour
l	liter
MA	Massachusetts
MAEOEEA	Massachusetts Executive Office of Energy and Environmental Affairs
MACRIS	Massachusetts Cultural Resources Information System
MADFW	Massachusetts Division of Fish and Wildlife
MAWMA	Massachusetts Water Management Act
MBI	Midwest Biodiversity Institute
MDEP	Massachusetts Department of Environmental Protection
m	meter
mi	mile
mg	milligram
MGD	million gallons per day
MHC	Massachusetts Historical Commission
mi^2	square miles
ml	milliliter
MOA	Memorandum of Agreement
msl	mean sea level
MVA	megavolt ampere
MW	megawatt
MWH	megawatt-hour
NEPA	National Environmental Policy Act
NEE	New England Environmental
NH	New Hampshire
NHDES	New Hampshire Department of Environmental Services
NHESP	Natural Heritage and Endangered Species Program
NHFGD	New Hampshire Fish and Game Department
NID	National Inventory of Dams
Northfield Mountain Project	Northfield Mountain Pumped Storage Project
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NOI	Notice of Intent
NTU	Nephelometric Turbidity Unit
NU	Northeast Utilities

NWI	National Wetland Inventory
NY-ISO	New York ISO
O&M	operation and maintenance
PAD	Pre-Application Document
PCBs	polychlorinated biphenyls
PIT	passive integrated transponder
PVPC	Pioneer Valley Planning Commission
QA/QC	quality control/quality assurance
RM	River mile
RTE	Rare, Threatened, and Endangered
S&A	Simons and Associates
SAV	submerged aquatic vegetation
SCORP	State Comprehensive Outdoor Recreation Plan
SD1	Scoping Document 1
SHPO	State Historic Preservation Officer
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TN	total nitrogen
TNC	The Nature Conservancy
TP	total phosphorus
TSS	total suspended solids
Turners Falls Project	Turners Falls Hydroelectric Project
UMass	University of Massachusetts at Amherst
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
µS	microsiemens
VT	Vermont
VTFWD	Vermont Fish and Wildlife Department
WMECO	Western Massachusetts Electric Company
WMA	Wildlife Management Area
YOY	young-of-the-year

1 INTRODUCTION

FirstLight Hydro Generating Company (FirstLight) is licensed by the Federal Energy Regulatory Commission (FERC or the Commission) to operate the 67.709 megawatt (MW) Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889) and the 1,119.2 MW Northfield Mountain Pumped Storage Project (Northfield Mountain Project, FERC No. 2485). The license for the Turners Falls Project was issued on May 5, 1980 and expires on April 30, 2018. The license for the Northfield Mountain Project was issued on May 14, 1968 and also expires on April 30, 2018.

FirstLight is filing with the Commission a notification of intent (NOI) to file new license application(s) for:

- The Turners Falls Project consisting of: a) two concrete gravity dams separated by an island and appurtenant facilities located on the Connecticut River in the towns of Gill and Montague, MA; b) a gatehouse controlling flow to the main power canal; c) the main power canal and a short branch canal; d) two hydroelectric powerhouses, located on the power canal, known as Station No. 1 and Cabot Station; e) a reservoir known as the Turners Falls Impoundment (Connecticut River); and f) one 13.8 kV line to the Montague substation; and

- The Northfield Mountain Project consisting of: a) an upper reservoir and dams and dikes; b) an underground powerhouse; c) a tailrace; and d) two 345 kV lines to the Northfield Switching Station. The Turners Falls Impoundment (Connecticut River) serves as a lower reservoir.

FirstLight will apply for a new license using the Integrated Licensing Process (ILP) as set forth in the Commission's Final Rule and Tribal Policy Statement issued on July 23, 2003 (Final Rule, Order No. 2002). The ILP was developed to integrate the pre-filing consultation with the Commission's scoping pursuant to the National Environment Policy Act (NEPA) (42 USC § 4321, et seq.). As required by the Commission's regulations (18 CFR § 5.6), this Pre-Application Document (PAD) is being filed simultaneously with the NOI and will be distributed to appropriate federal and state resource agencies, local governments, Indian tribes, and members of the public likely to have an interest in the proceeding.

The PAD provides existing engineering, operational, economic, and environmental information pertaining to the Turners Falls Project and Northfield Mountain Project. In the ILP process, the PAD will be incorporated into Exhibit E (the environmental exhibit in the license application); the PAD also serves to help interested parties scope issues and identify study needs for the Commission's NEPA document. This evaluation will be documented in the license application to be prepared by FirstLight and filed with the Commission two years prior to license expiration.

In compliance with the Commission's regulations governing the content of the PAD, FirstLight contacted state and federal resource agencies and interested public parties that may be interested in the relicensing of the Turners Falls Project and Northfield Mountain Project. FirstLight requested that all parties provide any relevant studies, data, and information on topics such as water quality, fisheries, recreation, wildlife, wetlands, aesthetics, and cultural resources. Appendix A contains a letter sent to potentially interested stakeholders requesting that information on the Turners Falls Project and Northfield Mountain Project be provided for inclusion in the PAD. Appendix A also contains a list of contacts made by FirstLight in connection with preparing this PAD. In addition to soliciting background information for the PAD, FirstLight met with certain stakeholders (see Appendix A for list) in advance of the official FERC process. The purpose of these meetings was to summarize the layout and operation of the Turners Falls Project and Northfield Mountain Project, to educate stakeholders on the ILP and schedule, and to solicit issues and concerns.

As set forth in 18 CFR § 5.8, the Commission will issue Scoping Document 1 (SD1) within 60 days of the filing of this PAD and hold a public scoping meeting and site visit within 30 days of issuing SD1. However, in this case, because the site visit would fall in the winter 2013, FERC opted to hold the site visit on October 4 and 5, 2012[1]. The site visit allowed stakeholders an opportunity to observe the Turners Falls Project and Northfield Mountain Project layout, understand operations, and participate in a question and answer session.

The information contained in this document was assembled based on the requirements set forth in 18 CFR § 5.6 (c) and (d) and is organized as follows:

Section 2 – Process plan and schedule for all pre-application activities, 18 CFR § 5.6(d)(1).

Section 3 – General description of the Turners Falls Project and Northfield Mountain Project location, facilities, and operations, 18 CFR § 5.6(d)(2).

Section 4 – Description of the existing environment and resource impacts, 18 CFR § 5.6(d)(3).

Section 5 – Preliminary resource issues and potential studies or information gathering needs associated with the issues, 18 CFR § 5.6(d)(4).

Section 6 – Literature and information sources cited in the descriptions and summaries of existing resource data, 18 CFR § 5.6(c)(2).

Appendix A – Summary of contacts and correspondence letter made in preparing the PAD, 18 CFR § 5.6(d)(5). In addition a table of pre-FERC process stakeholder outreach meetings is provided. Correspondence with the Massachusetts Executive Office of Energy and Environmental Affairs (MAEOEEA) is also provided.

Appendix B – Pre-Application Document Content Cross Reference Table.

Appendix C – Agent for the Applicant, 18 CFR § 5.6(d)(2)(i).

Appendix D – Current Licenses and Amendments, 18 CFR § 5.6(d)(2)(v)(A).

Appendix E – 2012 Water Elevation Plots.

Appendix F – List of Mammals and Bird Species Likely to Occur in the Turners Falls Project and Northfield Mountain Project Area.

Appendix G – List of Reports of Studies Conducted at the Turners Falls Fishway Complex to Investigate Upstream Passage of Adult American Shad and Downstream Passage of Atlantic Salmon Smolts and Juvenile Clupeids, and at the Northfield Mountain Project to Investigate Upstream Passage of Adult American Shad and Emigrating Atlantic Salmon Smolts.

[1] FERC issued public notice entitled "Notice of Environmental Site Review" of the October 4-5, 2012 site visits on August 3, 2012.

2 PROCESS PLAN AND SCHEDULE

Pursuant to 18 CFR Part 5, the filing of the NOI commences the relicensing process and sets the schedule for further licensing activities. FERC may hold an initial tribal consultation meeting within thirty days following the filing of the NOI and PAD with Indian tribes potentially affected by the Turners Falls Project and Northfield Mountain Project.

FERC will issue a notice of commencement of the proceeding and scoping document within 60 days of receipt of FirstLight's NOI and PAD. Typically, FERC will hold a public scoping meeting and site visit within 30 days of issuing the notice of commencement. But as noted above, the site visit occurred on October 4 and 5, 2012.

A detailed Process Plan and Schedule with a timetable for the balance of the licensing process is shown in Table 2.0-1. The process plan may reflect deadlines that fall on weekend days (Saturday or Sunday) or holidays. Deadlines falling on a weekend, holiday, or day when the Commission is closed due to adverse conditions are deemed to fall on the close of business of the next Commission business day in accordance with FERC regulations[2]. The Process Plan and Schedule was developed in accordance with, and incorporates, the time frames set forth in 18 CFR Part 5.

To assist in disseminating information throughout the relicensing process, FirstLight has developed a website site (http://www.northfieldrelicensing.com). The website will be used to post schedules, agendas, meeting minutes, reports, and other documents created during the relicensing process.

In accordance with 18 CFR § 5.6(c)(2), FirstLight will make available to the public the sources referenced in the PAD. FirstLight will provide requested information within 20 days of a request for information. In responding to a request, FirstLight will provide any requested reference electronically, if possible. If a PAD recipient requests references, please send an email to firstlight@gomezandsullivan.com.

[2] Filing of the Final License Application on or before April 30, 2016 is a firm deadline.

Table 2.0-1: Process Plan and Schedule

Activity	Responsibility	Required Time Frame	Citation	Deadline[3]
Site Visit[4]	FERC	Typically, within 30 days of issuance of SD1, modified by FERC	18 CFR § 5.8(d)	Oct 4-5, 2012
File Notice of Intent (NOI) and Pre-Application Document (PAD)	Applicant	At least 5 (but no more than 5 1/2) years before existing license expires	18 CFR § 5.5(d)	Oct 30, 2012
Hold Initial Tribal Consultation Meeting	FERC	Within 30 days of filing of NOI & PAD	18 CFR § 5.7	Nov 30, 2012
Notice NOI/PAD and Issue Scoping Document 1 (SD1)	FERC	Within 60 days of filing of NOI & PAD	18 CFR § 5.89(a)	Dec 30, 2012
Hold Scoping Meeting	FERC	Within 30 days of issuance of SD1	18 CFR § 5.8(d)	Jan 29, 2013
Comment on PAD and SD1; Submit Study Requests	Stakeholders	Within 60 days of issuance of SD1	18 CFR § 5.9(a)	Feb 28, 2013
File Proposed Study Plan (PSP)	Applicant	Within 45 days of deadline for filing comments on PAD and SD1	18 CFR § 5.9	Apr 14, 2013
Hold Study Plan Meeting	Applicant	Within 30 days of deadline for filing PSP	18 CFR § 5.11(e)	May 14, 2013
Comment on Proposed Study Plan	Stakeholders	Within 90 days of filing PSP	18 CFR § 5.12	Jul 13, 2013
File Revised Study Plan (RSP)	Applicant	Within 30 days of deadline for filing comments on PSP	18 CFR § 5.13(a)	Aug 12, 2013
Comment on Revised Study Plan	Stakeholders	Within 15 days of filing of RSP	18 CFR § 5.13(b)	Aug 27, 2013
FERC Issues Study Plan Determination	FERC	Within 30 days of filing of RSP	18 CFR § 5.13(c)	Sep 13, 2013
Initiate Formal Study Dispute Resolution Process (if necessary)	Agencies with conditioning authority	Within 20 days of issuance of Study Plan Determination	18 CFR § 5.14(a)	Oct 4, 2013
File Response to Study Dispute(s) (if necessary)	FirstLight	Within 25 days of Notice of Study Dispute	18 CFR § 5.14(i)	Oct 29, 2013
FERC Dispute Panel Issues Finding	Dispute Panel	Within 50 days of Notice of Study Dispute	18 CFR § 5.14(k)	Nov 23, 2013
FERC Issues Determination on Study Dispute (if necessary)	FERC	Within 70 days of Notice of Study Dispute	18 CFR § 5.14(l)	Dec 13, 2013
Conduct Field Studies	Applicant	Pursuant to approved SP	18 CFR § 5.15	2014 & 2015
File Study Progress Report(s)	Applicant	Six months after studies begin	18 CFR § 5.15(b)	Dec 2014
File Initial Study Report	Applicant	Pursuant to approved SP or no later than 1 year after approval of SP	18 CFR § 5.15(c)(1)	Sep 13, 2014
Hold Study Results Meeting	Applicant	Within 15 days of filing of initial study report	18 CFR § 5.15(c)(2)	Sep 28, 2014
File Study Results Meeting Summary	Applicant	Within 15 days of study results meeting	18 CFR § 5.15(c)(3)	Oct 13, 2014
File Meeting Summary Disagreements	Stakeholders	Within 30 days of filing of study results meeting summary	10 CFR § 5.15(c)(4)	Nov 14, 2014
File Responses to Disagreements	Applicant	Within 30 days of filing of meeting summary disagreements	18 CFR § 5.15(c)(5)	Dec 14, 2014
Resolve Disagreements	FERC	Within 30 days of filing of responses to disagreements	18 CFR § 5.15(c)(6)	Jan 13, 2015

[3] Note that although the "Time Frames" are dictated by 18 CFR Part 5, the specific dates or deadlines are dependent on the timing of prior events and thus may differ from the dates presented in this Table. For updated dates see http://www.northfieldrelicensing.com.
[4] The timing of the site visit was modified by FERC in their August 3, 2012 public notice entitled "Notice of Environmental Site Review".

Activity	Responsibility	Required Time Frame	Citation	Deadline[3]
File Updated Study Report (if applicable)	Applicant	Pursuant to approved SP or no later than 2 years after approval of SP	18 CFR § 5.15(f)	Sept 13, 2015
File Preliminary Licensing Proposal (PLP) or Draft License Application	Applicant	No later than 150 days before final application is filed	18 CFR § 5.16(a)	Dec 1, 2015
Comment on PLP, Additional Information Requests (if necessary)	Stakeholders	Within 90 days of filing of PLP or draft license application	18 CFR § 5.16(e)	Feb 29, 2016
File License Application	Applicant	No later than 24 months before existing license expires	18 CFR § 5.17(a)	Apr 29, 2016

3 PROJECT LOCATION, FACILITIES, AND OPERATION (18 C.F.R. § 5.6 (d)(2))

3.1 Project Location (18 C.F.R. § 5.6 (d)(2)(ii))

The Turners Falls Project and Northfield Mountain Project are located on the Connecticut River in the states of Massachusetts (MA), New Hampshire (NH) and Vermont (VT). The greater portion of the Turners Falls Project and Northfield Mountain Project, including developed facilities and most of the lands within the Project boundary, are located in Franklin County, MA; specifically, in the towns of Erving, Gill, Greenfield, Montague, and Northfield. The northern reaches of the Turners Falls Project and Northfield Mountain Project boundary extend into the town of Hinsdale, in Cheshire County, NH, and the town of Vernon, in Windham County, VT.

The Turners Falls Dam is located at approximately river mile 122 (above Long Island Sound) on the Connecticut River, at coordinates 42°36'38.77" north and 72°33'05.76" west, in the towns of Gill and Montague, MA. The tailrace of the Northfield Mountain Project is located approximately 5.2 miles upstream of Turners Falls Dam, in the town of Northfield, MA. The upper reservoir of the Northfield Mountain Project is located atop Northfield Mountain in Erving, MA.

The Turners Falls Impoundment, created by the Turners Falls Dam (which also serves as the lower reservoir for the Northfield Mountain Project), is approximately 20 miles long, extending upstream through the Connecticut River valley to the base of Vernon Dam, located in Vernon, VT. Most of the Turners Falls Impoundment lies in MA; however, approximately 5.7 miles of the northern portion of the impoundment are located in NH and VT.

The Turners Falls Project and Northfield Mountain Project location relative to state boundaries and nearby cities is as follows: the New York border is about 60 miles to the west of the Turners Falls Project and Northfield Mountain Project, by road; the CT-MA border is about 40 miles to the south of the Turners Falls Project and Northfield Mountain Project; and the Turners Falls Project and Northfield Mountain Project are about 35 miles north of Springfield, MA, 60 miles north of Hartford, CT, and 92 miles west of Boston, MA. Although the Turners Falls Project and Northfield Mountain Project boundaries span three states, they discharge only in Massachusetts.

At Turners Falls Dam, the total drainage area is approximately 7,163 square miles (mi^2), or about 64% of the Connecticut River Basin drainage area (11,250 mi^2). The Connecticut River is the largest and longest river in New England, and is tidal up to Windsor Locks, CT, which is located approximately 60 miles from Long Island Sound.

In a downstream-to-upstream direction, the first three dams on the Connecticut River (and their approximate distances from Long Island Sound) are as follows: Holyoke Dam (87 miles), Turners Falls Dam (122 miles) and Vernon Dam (142 miles). Hydroelectric projects on the Connecticut River starting at Holyoke Dam are shown in Table 3.1-1. The Vernon, Bellows Falls, and Wilder Hydropower Projects, owned and operated by TransCanada, have the same license expiration date (04/30/2018) as the Turners Falls Project and Northfield Mountain Project.

The general Turners Falls Project and Northfield Mountain Project area relative to the surrounding states is shown in Figure 3.1-1. The dams upstream (Vernon) and downstream (Holyoke) of the Turners Falls Dam are shown in Figure 3.1-2.

Turners Falls Project Layout

The Turners Falls Dam creates the Turners Falls Impoundment, which is approximately 20 miles long, and extends upstream to the base of Vernon Dam (see Figure 3.1-2). The Turners Falls Dam is located on a "Z turn" in the river, and is oriented on a northeast-southwest axis, with the impounded area on the east side of the dam, and extending north. At the southwest end of the Turners Falls Dam is the gatehouse. Below the dam, originating at the gatehouse, is the Turners Falls power canal. Paralleling this power canal is a bypassed section of the Connecticut River. Associated with this power canal are the two hydroelectric generating facilities: Station No. 1 and Cabot Station. Station No. 1 is located approximately one-third of the way down the power canal. Water is conveyed from the power canal, to a small branch canal that feeds the Station No. 1 turbines, before discharging into the bypassed reach of the Connecticut River. Cabot Station is located at the downstream terminus of the power canal, where it rejoins the main stem of the Connecticut River. Station No. 1 and Cabot Station discharge into the Connecticut River approximately 0.9 miles and 2.7 miles downstream of the Turners Falls Dam, respectively.

Northfield Mountain Project Layout

The Northfield Mountain Project is a pumped-storage facility that uses the Turners Falls Impoundment as its lower reservoir. The tailrace of the Northfield Mountain Project is located approximately 5.2 miles upstream of Turners Falls Dam, on the east side of the Turners Falls Impoundment. This Project's upper reservoir is a man-made structure situated atop Northfield Mountain, to the east of the tailrace. During pumping operations, water is pumped from the Turners Falls Impoundment to the upper reservoir. When generating, water is passed from the upper reservoir intake via an underground pressure shaft to an underground powerhouse. An underground tailrace tunnel then delivers water back to the Turners Falls Impoundment.

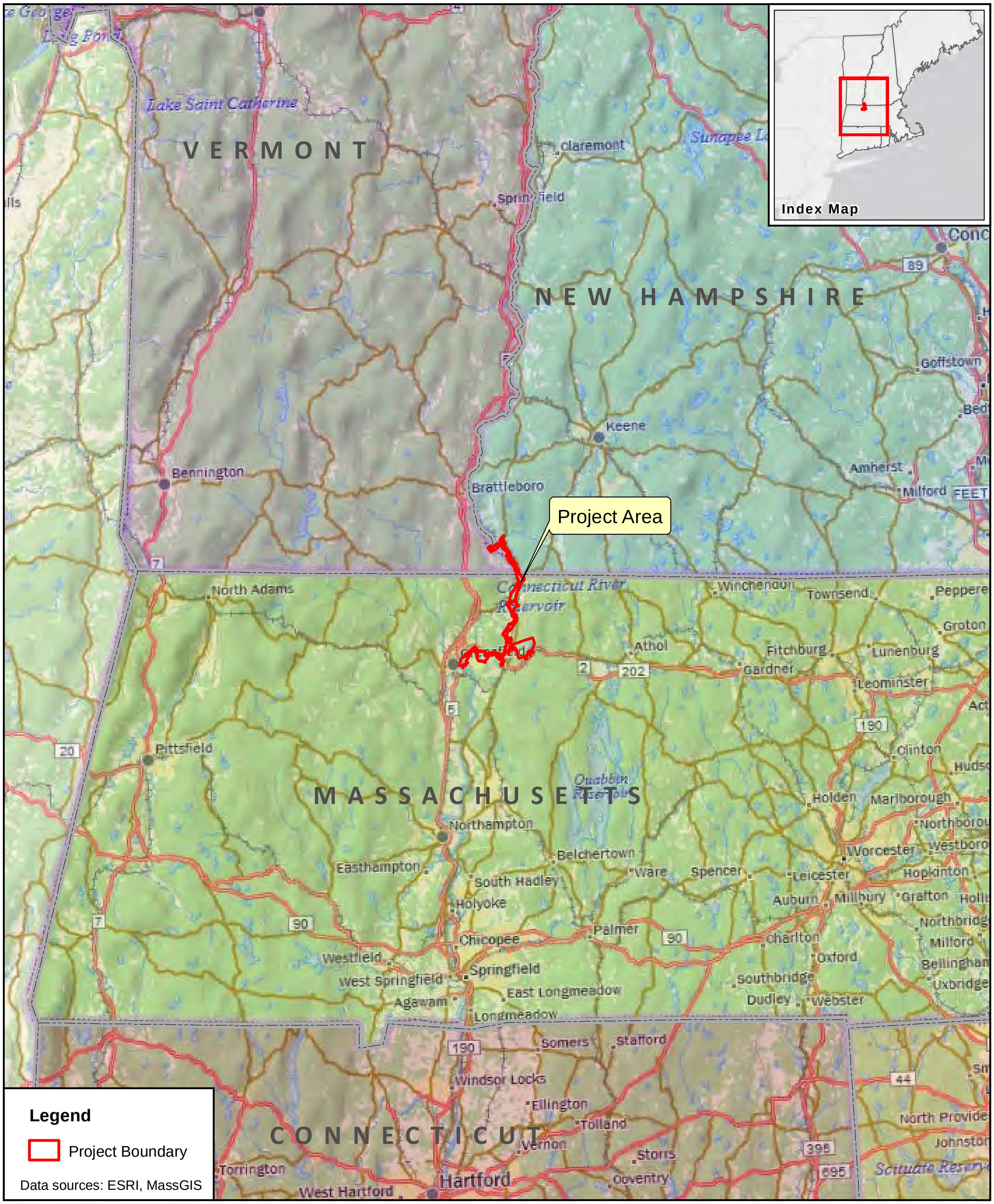
Project Location and Lands

Figure 3.1-3 depicts the current Project boundary for the Turners Falls Project and Northfield Mountain Project. Note that although there are two individual licenses for the Turners Falls Project and Northfield Mountain Project; the boundaries for both facilities overlap in almost all locations.

Table 3.1-1: Hydropower Projects on the Connecticut River

FERC Project No.	Project Name	River Mile *(above Long Island Sound)*	Licensee	License Expiration
2004	Holyoke	87	City of Holyoke Gas & Electric Co.	08/31/2039
1889	Turners Falls	122	FirstLight Hydro Generating Co.	04/30/2018
2485[1]	Northfield Mountain Pumped Storage	127	FirstLight Hydro Generating Co.	04/30/2018
1904	Vernon	142	TransCanada Hydro Northeast, Inc.	04/30/2018
1855	Bellows Falls	174	TransCanada Hydro Northeast, Inc.	04/30/2018
1892	Wilder	217	TransCanada Hydro Northeast, Inc.	04/30/2018
8011	Dodge Falls	270	Dodge Falls Hydro Co.	Exempt
2077	Fifteen Mile Falls (McIndoes, Comerford, and Moore Dams)	274 281 288	TransCanada Hydro Northeast, Inc.	03/31/2042
2392	Gilman	302	Ampersand Gilman Hydro, L.P.	03/31/2024
7528	Canaan	373	Public Service Co. of NH	07/31/2039

[1]*The Northfield Mountain Pumped Storage Project does not "dam" the Connecticut River; rather it pumps from, and discharges to, the Connecticut River.*



FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

FirstLight Power Resources GDF SUEZ

N

0 7.5 15 30 Miles

Figure 3.1-1
Turners Falls Project and Northfield Mountain Project Location Overview

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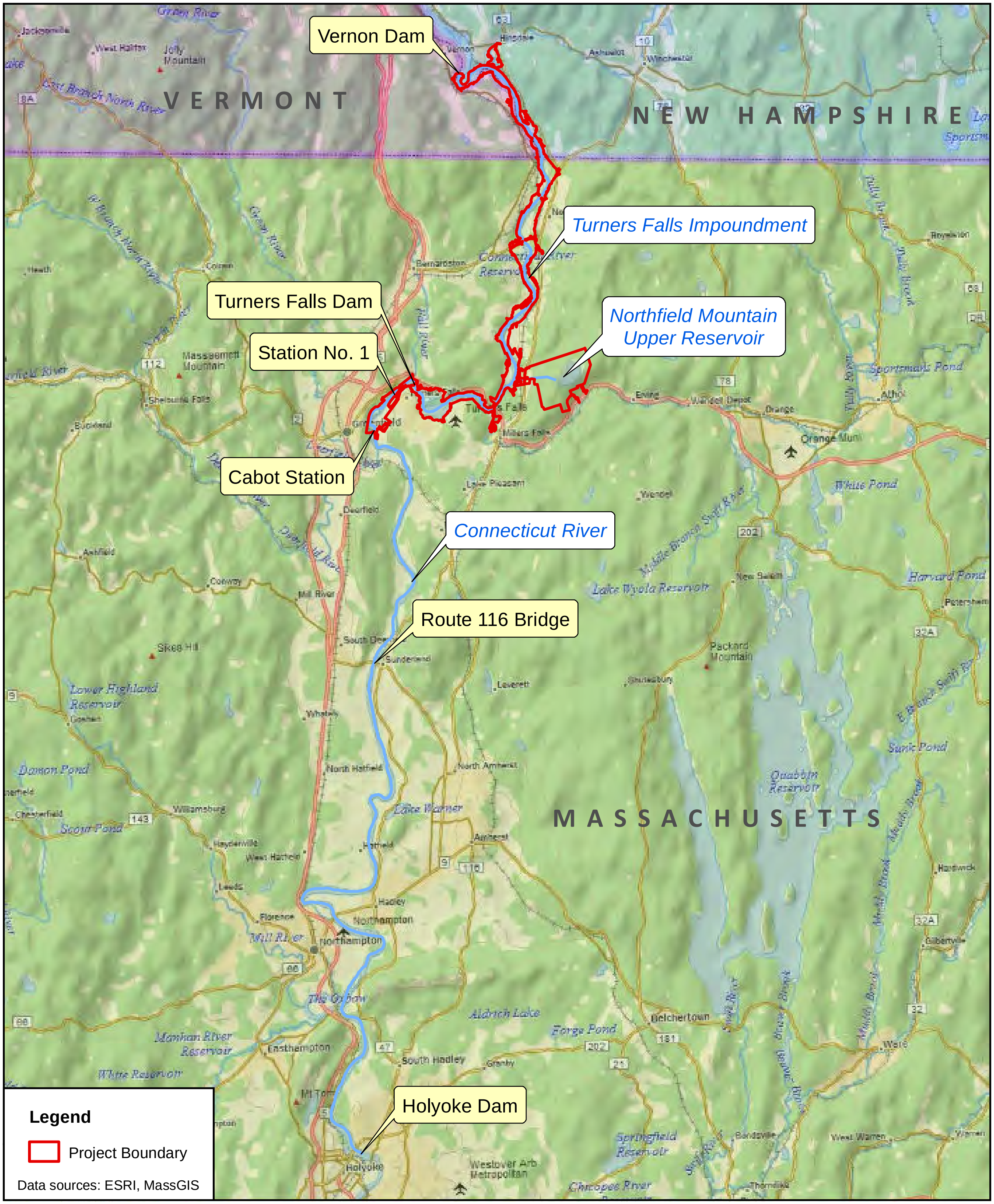

FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

Figure 3.1-2
Turners Falls Project and Northfield Mountain Project Vicinity Map

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FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

FirstLight Power Resources
GDF SUEZ

N

0 0.5 1 2 Miles

Figure 3.1-3
Turners Falls Project and Northfield Mountain Project Boundary Map

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3.2 Project Facilities (18 C.F.R. § 5.6 (d)(3)(iii))

3.2.1 Turners Falls Hydroelectric Project

Key features of the Turners Falls Project are shown in Figure 3.2.1-1 and consist of: a) two individual concrete gravity dams separated by an island; b) a gatehouse controlling flow to the power canal; c) the power canal and a short branch canal; d) two hydroelectric powerhouses, located on the power canal, known as Station No. 1 and Cabot Station; e) a bypassed section of the Connecticut River; f) a reservoir known as the Turners Falls Impoundment, and g) one 13.8 kV line to the Montague substation. Each of these is described in detail, below. The fish passage facilities at the Turners Falls Project are described in Section 3.2.3.

Turners Falls Dam

The Turners Falls Dam consists of two individual concrete gravity dams, referred to as the Gill Dam and Montague Dam, which are connected by a natural rock island known as Great Island. The 630-foot-long Montague Dam is founded on bedrock and connects Great Island to the west bank of the Connecticut River. It includes four bascule type gates, each 120 feet wide by 13.25 feet high and a fixed crest section which is normally not overflowed. All four bascule[5] gates are operated by hydraulic cylinders. The bascule gate closest to the gatehouse is typically used to provide required flow releases to the bypass reach. The average height above bedrock is 35 feet and the dam crest elevation is 172.26 feet msl. When fully upright, the top of the bascule gates are at elevation 185.5 feet msl.

The Gill Dam is approximately 55-feet-high and 493-feet-long extending from the Gill shoreline (east bank) to Great Island. It includes three 40-foot-wide by 39-foot-high tainter spillway gates. Each tainter[6] gate is operated by two electric motor driven hoists installed on a hoist support structure. When closed, the elevation atop the tainter gate is at elevation 185.5 feet msl.

Gatehouse

The power canal gatehouse is located on the Montague side of the Connecticut River. It forms the abutment for connecting the Montague Dam spillway with the shoreline and is equipped with headgates controlling flow from the Turners Falls Impoundment to the power canal. The structure is of masonry and reinforced concrete foundations with a brick walled superstructure. The gatehouse is approximately 214-feet-long and houses 14 operable gates controlling flow to the power canal. Six of the gates are 10’-8” high by 8’-9” wide wooden gates and eight of the gates are 12’-6” high by 9’-6” wide wooden gates. There is one, now inoperable gate, that is 19’0” high by 8’-8” wide. The gatehouse fishway passes through the gatehouse at the east bank.

The local controls and operating equipment for the dam’s bascule gates are in the gatehouse. They can also be operated remotely from the control room located at Northfield Mountain. The tainter gates are operated locally at the Gill Dam. The magnitude of flow passing through the gatehouse is a function of the gate(s) opening and the hydraulic head or the differential in the Turners Falls Impoundment elevation and the power canal elevation.

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[5] A bascule gate is a hinged crest gate. Each bascule gate is controlled by a pair of hydraulic cylinders, mounted in the concrete gravity dam.

[6] A tainter gate is a spillway gate whose face is a section of a cylinder; it rotates about a horizontal axis on the downstream end of the gate and can be closed under its own weight.

Power Canal

The power canal is approximately 2.1 miles long and ranges in width from approximately 920 feet in the Cabot forebay (downstream terminus of canal) to 120 feet in the canal proper. The canal has a design capacity of approximately 18,000 cubic feet per second (cfs). There are several entities that can withdraw water from the canal; Table 3.2.1-1 lists the water users, approximate hydraulic capacity, and FERC project number (where applicable).

Southworth Paper[7] and Turners Falls Hydro, LLC[8] have indentured water rights. FirstLight has an agreement with each of these entities which provides that the entity will not generate power, thus providing FirstLight with additional flow for generation at its facilities. However, the agreements allow these two hydropower facilities to generate power when the hydraulic capacity of the Station No. 1 and Cabot stations is exceeded. The United States Geological Survey (USGS), which withdraws water for the Conte Anadromous Fish Laboratory, also has a water use agreement with FirstLight; however, its water use is minimal.

Station No. 1

From the power canal there is an approximate 700-foot-long by 100-foot-wide branch canal. At the end of the branch canal is the entrance to Station No. 1, consisting of eight bays, each 15 feet wide for a total intake width of 120 feet. Trashracks are angled across the entire entrance, totaling 114 feet wide by 20.5 feet high. With a normal canal elevation of approximately 173.5 feet, the effective trashrack opening is approximately 114 feet wide by 15.9 feet high, resulting in a gross area of 1,813 square feet (ft^2). The bar rack thickness is 0.375 inches and the bars are 3 inches on center, thus the clear spacing between bars is 2.625 inches. At full hydraulic capacity (2,210 cfs), the velocity in front of the racks is approximately 1.2 feet/second.

After passing the trashrack, the intakes narrow down to four individual 13'-1.5" diameter penstocks feeding the original seven horizontal Francis turbines housed in the powerhouse. Only five of the turbines are operational. The powerhouse consists of brick masonry on concrete foundations. The powerhouse has five generators, all alternating current (AC) horizontal type, 60 cycle, and 2300 volt.

Penstock 1 feeds Unit 1, penstock 2 feeds Units 2 and 3, penstock 3 feeds Units 4 and 5, and penstock 4 feeds Units 6 and 7. Note that penstock 4 bifurcates into pipes leading to Units 6 and 7; Units 4 and 6 are no longer in service. Station No. 1 operates under a gross head of 43.7 feet, and has an approximate total electrical nameplate capacity and hydraulic capacity of 5,693 kilowatts (kW) and 2,210 cfs, respectively.

Table 3.2.1-2 includes information on Station No. 1's generators and turbines. During the relicensing process, FirstLight will evaluate the feasibility of either: (1) rehabilitating/upgrading Station No. 1; or (2) potentially closing Station No. 1, while adding another unit at Cabot Station to utilize Station No. 1's hydraulic capacity.

Transmission facilities at Station No. 1 include generator leads and the 2.3 kV bus. Station No. 1 has one bank consisting of a single, three phase, 4800/6000 Ka, 2300-13800 volts, oil immersed, self cooled

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[7] A water use agreement between then Esleeck Manufacturing Company (a predecessor to Southworth Paper) and then Turners Falls Power and Electric Company (a predecessor to FirstLight) was signed in August 1928.
[8] A water exchange agreement between then Keith Paper Company (a predecessor to Turners Falls Hydro, LLC) and then Western Massachusetts Electric Company (a predecessor to FirstLight) was signed in September 1951.

transformer. The three stations service transformers are 7.5 kW, 1100/2200-110/220 transformers. Figure 3.2.1-2 shows Station No. 1's single line electrical diagram.

Cabot Station

Cabot Station is located at the downstream terminus of the power canal. The trashrack opening is 217 feet wide by 31 feet high, resulting in a gross area of 6,727 ft^2. At maximum hydraulic capacity of 13,728 cfs, the intake velocity immediately in front of the racks is approximately 2.0 feet/sec. The trashracks are angled, and include upper and lower racks. The top 11 feet of the upper racks have clear bar spacing of 0.94 inches (15/16-inch, and the bottom 7 feet of the upper racks have clear bar spacing of 5 inches. The entire 13 feet of the lower racks have clear bar spacing of 5 inches. After passing through the trashracks, flow is conveyed through one of six penstocks to turbines housed in the powerhouse. The powerhouse is a brick and steel structure set on a concrete substructure on a rock foundation. It houses six vertical, Francis type, single runner turbines. At a 60-foot head, each unit is rated at 13,867 horsepower. The wicket gates for each unit are operated by two servomotors.

Transmission facilities at Cabot Station consist of (i) generator leads and two 13.8 kV buses for three units each for a total of six units, (ii) one 13.8 kV transmission line, about 200 feet long and extending across the power canal to the Montague substation, and (iii) one 13.6/115 kV oil immersed air cooled transformer and appurtenant facilities. The six generators are vertical shaft 13.8 kV, 97.3 rpm with Kingsbury thrust bearings. Each unit has its own static excitation system rated at 160 volts DC, 781 amps. Figure 3.2.1-3 is Cabot's single line electrical diagram.

Cabot Station has a total station nameplate capacity of 62.016 megawatts (MW) or approximately 10.336 MW/unit. The station has a total hydraulic capacity of approximately 13,728 cfs or 2,288 cfs/unit.

At the downstream terminus of the power canal and adjacent to the Cabot Powerhouse are eight wooden 16'-8" high by 13'-7" wide spillway gates, which permit the discharge of approximately 12,000 cfs. These gates are used to rapidly draw down the power canal in the event of a Cabot Station load rejection or canal dike breach or to sluice ice and debris. In addition, there is a 16'-2" wide by 13'-1" high log sluice located near the bottom of the forebay that can be used for dewatering the power canal.

Bypass Reach

The 2.1 mile long power canal bypasses approximately 2.7 miles of the Connecticut River. The bypass reach of the Connecticut River receives flow from one major tributary, Fall River, which empties into the upstream end of the bypass reach, approximately 0.16 miles below the dam. The drainage area of Fall River is approximately 34.2 mi^2. Station No. 1 discharges into the bypass reach approximately 0.9 miles downstream of the Turners Falls Dam.

Turners Falls Impoundment

The Turners Falls Impoundment, formed by the Turners Falls Dam, extends upstream approximately 20 miles to the base of TransCanada's Vernon Dam in Vernon, VT. To provide storage capacity for the Northfield Mountain Project, the Turners Falls Impoundment elevation may vary, per the FERC license, from a minimum elevation of 176.0 feet msl to a maximum elevation of 185.0 feet msl; this constitutes a 9 foot fluctuation as measured at the Turners Falls Dam. This fluctuation decreases as one travels upstream. The impoundment has a surface area of approximately 2,110 acres and a gross storage volume of approximately 21,500 acre-feet at elevation 185.0 feet msl (as measured at Turners Falls Dam).

The Turners Falls Impoundment, between Turners Falls Dam and Vernon Dam, has a water surface profile that depends upon the flow in the Connecticut River and the storage used for the Northfield Mountain Project. The profile slope steepens as the magnitude of flow increases. At pinch-points or hydraulic controls such as at the French King Gorge, the water level upstream of the hydraulic control is higher than below the gorge.

The bathymetric map of the Turners Falls Impoundment shown in Figure 3.2.1-4 was developed with bathymetry data collected in July 2006 by Hydroterra Environmental Services, LLC.

Table 3.2.1-1: Entities Having Rights to Withdraw Water from Power Canal

Facility Name	Owner	Approximate Hydraulic Capacity (cfs)	FERC Project No.
Southworth Paper Hydro	Southworth Paper	113 cfs	N/A
Turners Falls Hydro, LLC	Turners Falls Hydro	288 cfs	2622
Station No. 1 Hydro	FirstLight Hydro Generating Co.	2,210 cfs	1889
Cabot Hydro	FirstLight Hydro Generating Co.	13,728 cfs	1889
United States Geological Survey Conte Anadromous Fish Laboratory	United States Geological Survey (USGS)	Variable[9]	N/A

Table 3.2.1-2: Generator and Turbine Characteristics of Station No. 1

Unit No.	Generators		Turbines			
	Electrical Capacity (kW)	Amps	Runner Size	Hydraulic Capacity (cfs)	Horsepower (hp)	Speed (rpm)
1	1,500	376	2-48” horizontal runners	560	2100	200
2*	365	—	1-33” horizontal runner	140	590	257
3	1,276	314	2-42” horizontal runners	500	1900	200
4						
5	1,276	252	1-39” horizontal runner	490	1635	200
6						
7	1,276	251	2-42” horizontal runner	520	1955	200
Total	**5,693**			**2,210**		

**Unit No. 2 is directly connected to a 1600 amp, 257 rpm, 115 volt exciter.*

9 Per Exhibit B of the May 25, 1988 conveyance agreement, the allowable withdrawal rate (in cfs) and number of days of withdrawal varies based on the month. It can range from a maximum of 200 cfs for 13 days in October to a minimum of 2 cfs for 28 days in February.

3.2.2 Northfield Mountain Project

The Northfield Mountain Project consists of: a) an upper reservoir and dam/dikes; b) an intake; c) pressure shaft; d) an underground powerhouse; and c) a tailrace. The Turners Falls Impoundment (Connecticut River) serves as a lower reservoir. Key features of the Northfield Mountain Project are shown in Figure 3.2.2-1.

Main Dam

The crest of this structure, known as the Main Dam, is at elevation 1,010 feet msl, and is 30 feet wide, with a 2 foot high rock/earthfill wave berm along the upstream edge. The upstream slope is 1:1.8 (V:H) (the top 15 feet of the upstream slope is at a steeper 1:1.5 slope); downstream slope = 1:1.6. The top of impervious core is at elevation 1,005.25 feet msl. The core is 12 feet wide with 3:1 (V:H) upstream and downstream slopes. The core is founded on sound groutable rock at approximately elevation 860 feet msl. There are sand and gravel filter zones upstream and downstream of the impervious core. Oversize rock zones form the upstream and downstream faces. The impervious core was raised in 1979 on the downstream portion of the crest in the Main Dam to elevation 1,006.25 feet msl from station 3+00 to station 31+00 in response to settlement shortly after construction. This dam contains an intake structure and sub-foundation pipe for possible future water-supply diversion to the Quabbin Reservoir, a principal water supply for the City of Boston and parts of the Greater Boston metropolitan area.

Three Vertical Impervious-Core Rock-Fill Dikes

The three dikes, known as the North, Northwest and West Dikes, are constructed in a similar manner and to the same crest elevation as the main rock fill dam, with a central impervious core-filter and compacted rock-filled embankments. They help form the upper reservoir.

Concrete Gravity Dam

Located at the west end of the intake channel, the concrete gravity dam is 327 feet long and 10-20 feet high, with a crest at elevation 1,010 feet msl. The downstream face has been back-filled to elevation 1002 feet msl. The concrete walls at both ends of the gravity section are constructed to a higher level, allowing a parapet wall to be constructed against the retaining wall on the right side of the intake. The remaining section, approximately perpendicular to the main section, varies from 5-10 feet in height.

Intake Channel

The intake channel directs water from the upper reservoir into the pressure conduit intake. The channel is 1,890 feet long and is excavated in rock with side slopes of 4:1 (V:H). The invert is 130 feet wide at elevation 880 feet msl. There is a small dam (submerged) at the upstream end of the intake channel with a stoplog and gate structure. The purpose of this control structure, a low dam between the upper reservoir and intake channel, is to prevent stormwater from entering the pressure conduit when the intake channel is dewatered. The submerged dam is 63 feet long with a crest at elevation 900 feet msl. It has two manually operated sluice gates (2.75 feet high by 6 feet wide), two 18 foot wide stoplog slots which usually hold eight concrete stoplogs (weighing approximately 3,000 lbs. each).

The intake structure consists of a reinforced concrete intake portal that is 55 feet wide and 80 feet high to the crown of the arched roof. A vertical concrete pier 3.5 feet thick supports the portal roof and provides support for the intake trashracks. The trashrack intake area is approximately 3,920 ft^2, excluding the 3.5 ft thick pier. The velocity in front of the trashracks, when operating at full capacity of 20,000 cfs, is approximately 5.1 feet/second.

Concrete Gravity Spillway Structure

The ungated concrete gravity overflow structure is 550 feet long with a crest elevation of 1,006.5 feet msl. There is a 20 foot long notch at elevation 1,005.0 feet msl near the center of the structure which is designed to concentrate small discharges due to precipitation and runoff when the reservoir is full (which is an extremely rare occurrence). The remaining spillway length has been sized to prevent overtopping of the embankments due to over-pumping.

Pressure Shaft

The pressure conduit system consists of a reinforced concrete intake portal, a 200 foot long concrete lined transition section, a portal 55 feet wide by 80 feet high, an inclined concrete-lined pressure shaft that connects the intake and manifold shaft (31 feet diameter, 853 feet long, inclined 50º from the horizontal), concrete-lined manifold formed by branching of the pressure shaft into two 22 foot diameter conduits and then into four 14 foot diameter tunnels which lead to four steel-lined penstocks (340 feet long, diameter decreases from 14 to 9.5 feet). During pumping operation, water is pumped from the Turners Falls Impoundment via the powerhouse through the pressure shaft to the upper reservoir. During generation, water flows from the intake channel through the pressure shaft to the powerhouse.

Powerhouse

The underground powerhouse is 328 feet long and 70 feet wide. The floor of the spherical valve gallery is at elevation 56 feet msl and the roof is at 190 feet msl. It contains four reversible pump/turbines operating at gross heads ranging from 753 to 824.5 feet. At the time of filing this PAD, the electrical capacities of the units are as follows: Unit 1: 267.9 MW, Unit 2: 291.7 MW, Unit 3: 291.7 MW and Unit 4: 267.9 MW, for a total station nameplate capacity of 1,119.2 MW. Historically, the total station capacity was 1,080 MW (270 MW/unit); however, Units 2 and 3 recently underwent efficiency improvements with the replacement of the turbine runner, and rewind of the motor-generator[10].

When operating in a pumping mode, the approximate hydraulic capacity is 15,200 cfs (3,800 cfs/pump). Alternatively, when operating in a generation mode, the approximate hydraulic capacity is 20,000 cfs (5,000 cfs/turbine).

Tailrace Tunnel

Water flows between the powerhouse and the Turners Falls Impoundment via the tailrace tunnel. There are four draft tubes connected by a manifold to a common tailrace tunnel. The tailrace tunnel is concrete-lined, horseshoe shaped and 5,136 feet long, with a maximum width of 33 feet and a height of 31 feet. The tunnel discharges during generation through a concrete exit structure into the Turners Falls Impoundment. The exit structure includes a transition from the horseshoe shape into a trapezoidal shape. Steel stop logs are used in the exit structure when needed to dewater the tailrace tunnel. A floating boom is provided across the exit channel to provide a barrier to large debris and boaters.

The trapezoidal trashrack opening has the following dimensions: top width: 99’-6”, bottom width: 74’4”, depth: 48’-0”, resulting in a gross area opening of 4,400 ft^2. The bar thickness is 0.75 inches, with a clear-spacing of 6 inches. Under maximum pumping conditions of 15,200 cfs, the velocity in front of the

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[10] On August 17, 2011, and supplemented on January 17, 2012, February 14, 2012, and February 24, 2012, FirstLight filed an amendment application to revise the authorized installed capacity of the Northfield Mountain Project. FERC issued an order amending the license and revising annual charges on March 23, 2012.

rack is 3.5 feet/second. When the barrier net is in place and only three pumps operate (11,400 cfs), the velocity in front of the trash rack is 2.6 feet/second.

Transmission Facilities

Each pair of units is provided with a dual secondary step-up transformer (rated 345/13.8 kV, 666 MVA, 3 phase, 60 cycle) to step from 13.8 kV generating voltage up to 345 kV. Each transformer is located in a vault, excavated in the rock adjacent to the powerhouse. For these two transformers, power is transmitted through two 345 kV pipe type cables, installed in the access tunnel, to the Northfield Switching Station which is located near the access tunnel. Figure 3.2.2-2 shows the Northfield Mountain Project's single line electrical diagram.

Upper Reservoir

Northfield Mountain Upper Reservoir, formed by the Main Dam, the Rockfill Dikes, and the Concrete Gravity Dam, has a gross storage capacity of 17,050 acre-feet. Per the current FERC license for the Northfield Mountain Project, the upper reservoir may operate between 1,000.5 feet msl and 938 feet msl (constituting a 62.5 foot drawdown), which equates to a useable storage capacity of approximately 12,318 acre-feet. This is equivalent to approximately 8,475 MWhs of stored power. The surface area at elevations 938 and 1,000 feet are 134 and 286 acres, respectively. The upper reservoir was constructed to accommodate an elevation of 1004.5 feet msl as approved by FERC in 1976. In addition, the reservoir retains useable storage capacity down to elevation 920 feet msl. The useable storage volume between elevation 1,004.5 feet and 920 feet is approximately 15,327 acre-feet, which is equivalent to approximately 10,465 MWhs of stored power.

As part of the relicensing process, FirstLight will evaluate the feasibility of utilizing more of the upper reservoir storage capacity between elevation 1,004.5 feet msl and 920 feet msl for generation purposes.

The bathymetric map of the upper reservoir shown in Figure 3.2.2-3 was developed with bathymetry data collected in November 2011 by Ocean and Coastal Consultants, Inc.

3.2.3 Fish Passage Facilities

Upstream Fish Passage Facilities

The Turners Falls Project is equipped with three upstream fish passage facilities, including (in order from downstream to upstream): the Cabot fishway, the Spillway fishway, and the Gatehouse fishway (see Figure 3.2.1-1). These fish passage facilities are based on a design recommended by the United States Fish and Wildlife Service (USFWS). Fish ladders of similar design pass Pacific salmon species and American shad on the Columbia River. It was believed that these same designs could be applied to pass Atlantic salmon and American shad, the original target species. American shad is the primary species using these fish passage facilities. There is no upstream fish passage facility associated with the Northfield Mountain Project.

The Cabot fishway is a modified "ice harbor" design; it consists of 66 pools, with each pool situated approximately one foot higher than the previous pool. Fish enter the Cabot fishway below Cabot Station. Fish pass through the Cabot fishway into the power canal; from there, they swim 2.1 miles upstream to the Gatehouse fishway.

Fish that bypass the Cabot fishway move upstream via the bypassed reach, where they will ultimately encounter the Turners Falls Dam. Fish arriving here are passed into the power canal via the Spillway fishway into a flume leading to the gatehouse fishway, where they rejoin fish that have passed to this point via the Cabot Ladder. The Spillway fishway is also of modified ice harbor design, with 42 pools.

Fish from the upstream end of the power canal or from the flume connected to the Spillway fishway, are passed upstream of the gatehouse via the Gatehouse fishway. The Gatehouse fishway is a vertical slot fishway which delivers fish into the Turners Falls Impoundment to continue their journey up the Connecticut River.

The Connecticut River Atlantic Salmon Commission (CRASC[11]) establishes an annual schedule for the operation of upstream fish passage facilities at the Connecticut River dams. The schedules are based on the projected movement of migratory fish and may be adjusted in season to address actual observations. Table 3.2.3-1 lists the 2011 schedule for upstream fish passage operations at the Turners Falls Project.

Downstream Fish Passage Facilities

The downstream fish passage facility is located at Cabot Station, at the downstream terminus of the power canal. Assuming no spill is occurring at Turners Falls Dam, fish moving downstream pass through the gatehouse (which has no racks) and into the power canal. Downstream fish passage facilities at Cabot Station consist of: reduced bar-spacing in the upper 11 feet of the intake racks; a broad-crested weir developed specifically to enhance fish passage at the log sluice; the log sluice itself, which has been resurfaced to provide a passage route; above-water lighting; and a sampling facility.

In addition to downstream passage facilities at Cabot Station, FirstLight employs a guide net to reduce entrainment of emigrating salmon smolts into the Northfield Mountain Project intakes during pumping operation. This guide net is described further below.

As described for upstream passage, the CRASC also establishes an annual schedule for the operation of downstream fish passage facilities at the Connecticut River dams. Table 3.2.3-2 lists the 2011 schedule for downstream fish passage operations at the FirstLight Projects.

Northfield Mountain Guide Net

A fixed-position guide net has been deployed since 1995 to reduce entrainment of Atlantic salmon smolts in flows pumped from the Turners Falls Impoundment to the Northfield Mountain Project's upper reservoir. After the initial evaluation in 1995, further net modifications were field tested in 1996 and 1997. Since then, the guide net has been deployed annually. During the period when the guide net is installed, FirstLight limits the number of pumps operating to a maximum of three. With three pumps operating at their full capacity of approximately 11,400 cfs, the intake velocity at the Northfield trashrack entrance is approximately 2.6 feet/second smolt migration season.

Table 3.2.3-1: Upstream Fish Passage Schedule for Cabot, Gatehouse, and Spillway Fishways

Project	Species	Life Stage	Dates of Operation	Hours of Operation
Turners Falls	salmon	adult	Apr 1-Jul 15	24 hours/day
	salmon	adult	*Sep 15-Nov 15	24 hours/day
	shad & herring	adult	Apr 1-Jul 15	24 hours/day

**Typically, upstream passage flows are not provided during this period due to the lack of salmon.*
Source: CRASC letter to FirstLight, 3/1/2011

[11] CRASC membership consists of the USFWS, National Marine Fisheries Service (NMFS), and state fishery agencies from CT, MA, NH, and VT.

Table 3.2.3-2: Downstream Fish Passage Schedule

Project	Downstream Fish Passage Exit	Species	Life Stage	Dates of Operation	Hours of Operation
Northfield	Guide net	salmon	smolt	Apr 1-Jun 15[1]	24 hours/day
Turners Falls	Log sluice and trash sluice	salmon salmon shad shad eels	smolt adult adult juvenile adult	Apr 7-Jun 15 Oct 15-Dec 31[2] Jun 1-Jul 31 Aug 1-Nov 15 Sep 1-Nov 15	24 hours/day 24 hours/day 24 hours/day 24 hours/day 24 hours/day

[1]*Date of initiating operation is April 1 or as soon as possible after high spring flows subside. Net can be removed after smolt emigration ceases at Cabot sampler upon consultation with the USFWS Coordinator.*
[2]*Downstream passage operation, or monitoring with operation as needed, is required for salmon when salmon are upstream of a location.*
Source: CRASC letter to FirstLight, 3/1/2011

FirstLight Power Resources
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FIRSTLIGHT POWER RESOURCES

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Figure 3.2.1-1
Turners Falls Project Features

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Figure 3.2.1-2: Station No. 1 Single Line Electrical Diagram

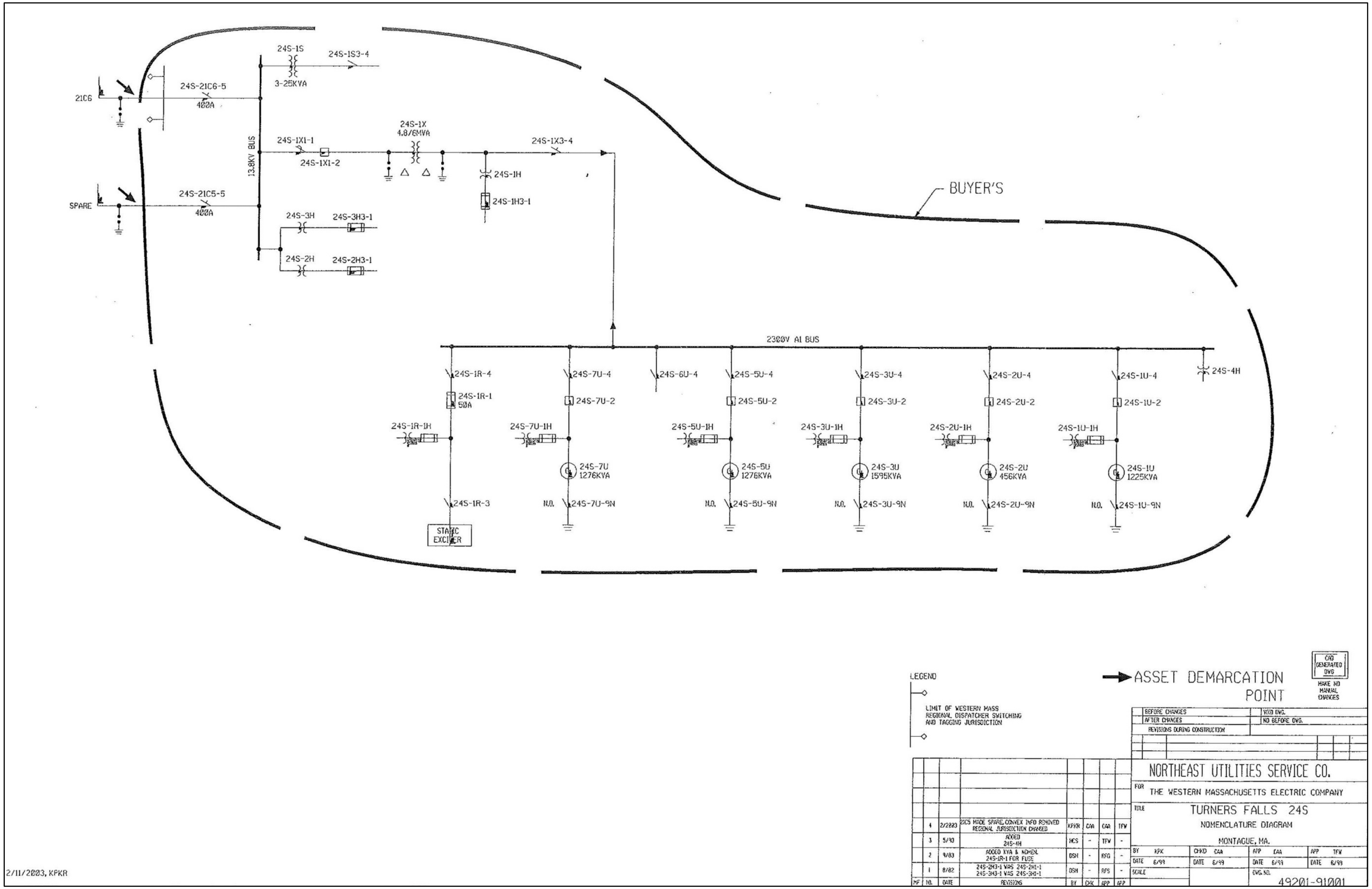
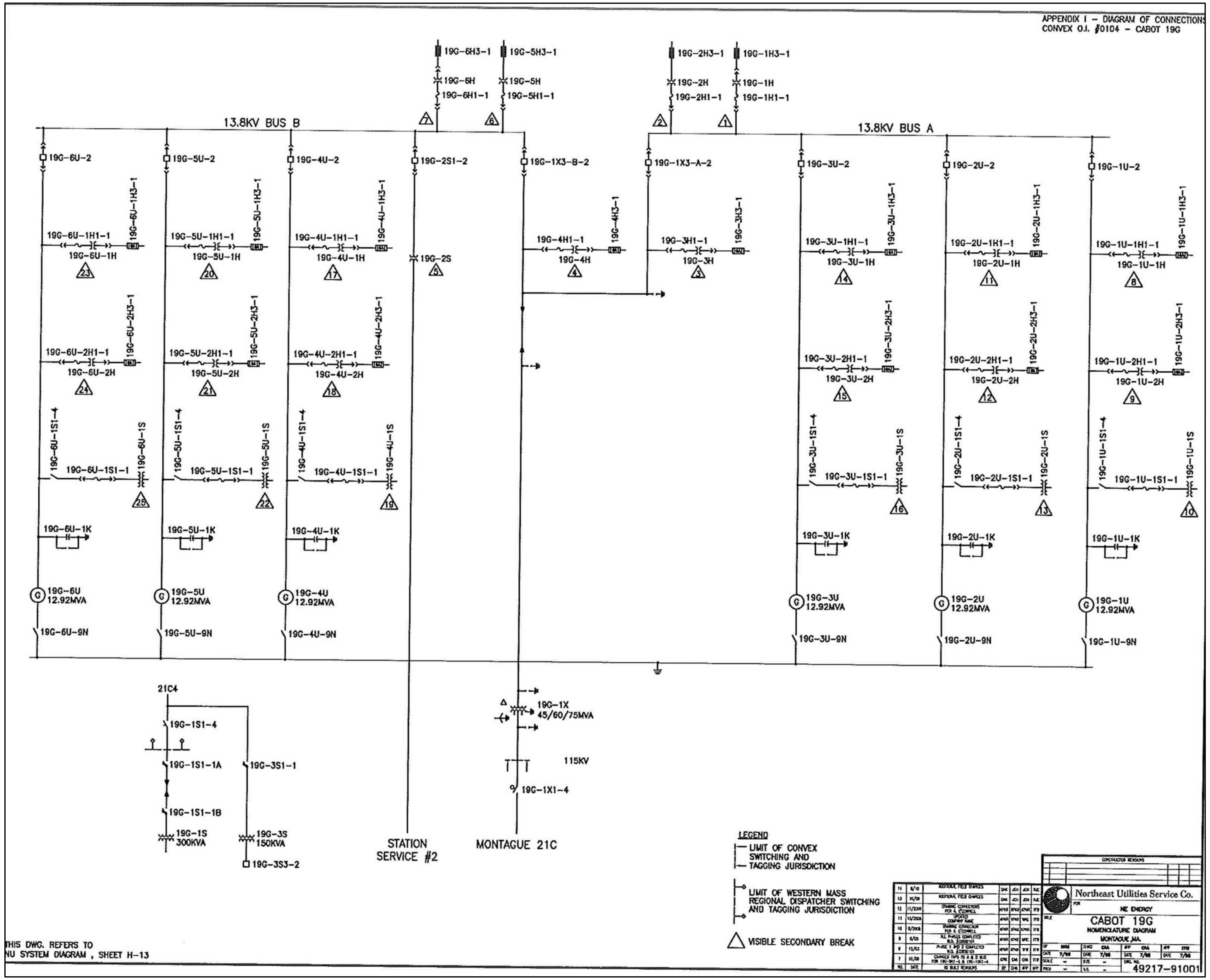
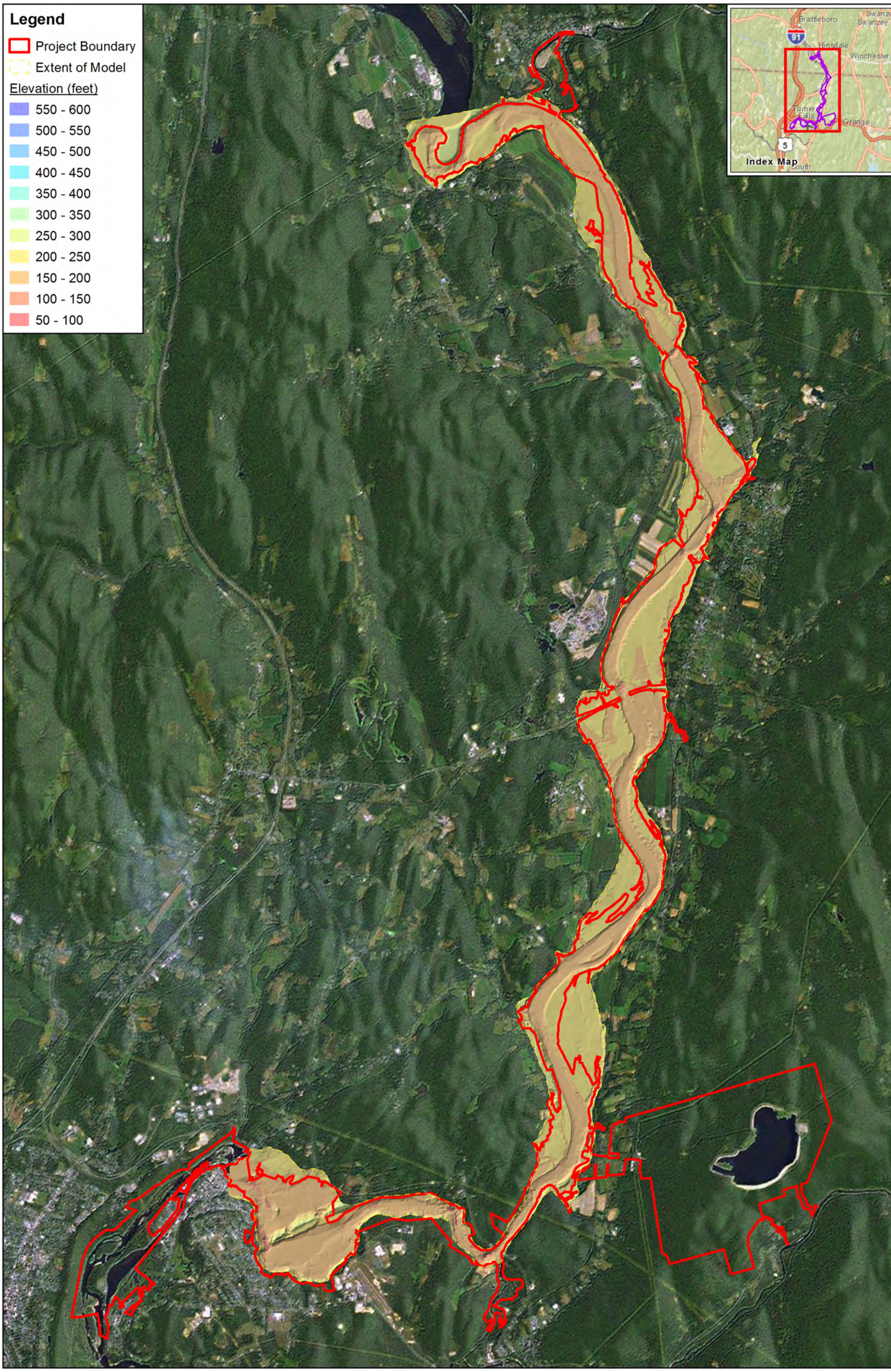


Figure 3.2.1-3: Cabot Station Single Line Electrical Diagram





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0 0.5 1 2 Miles

Figure 3.2.1-4: Bathymetric Map of Turners Falls Impoundment

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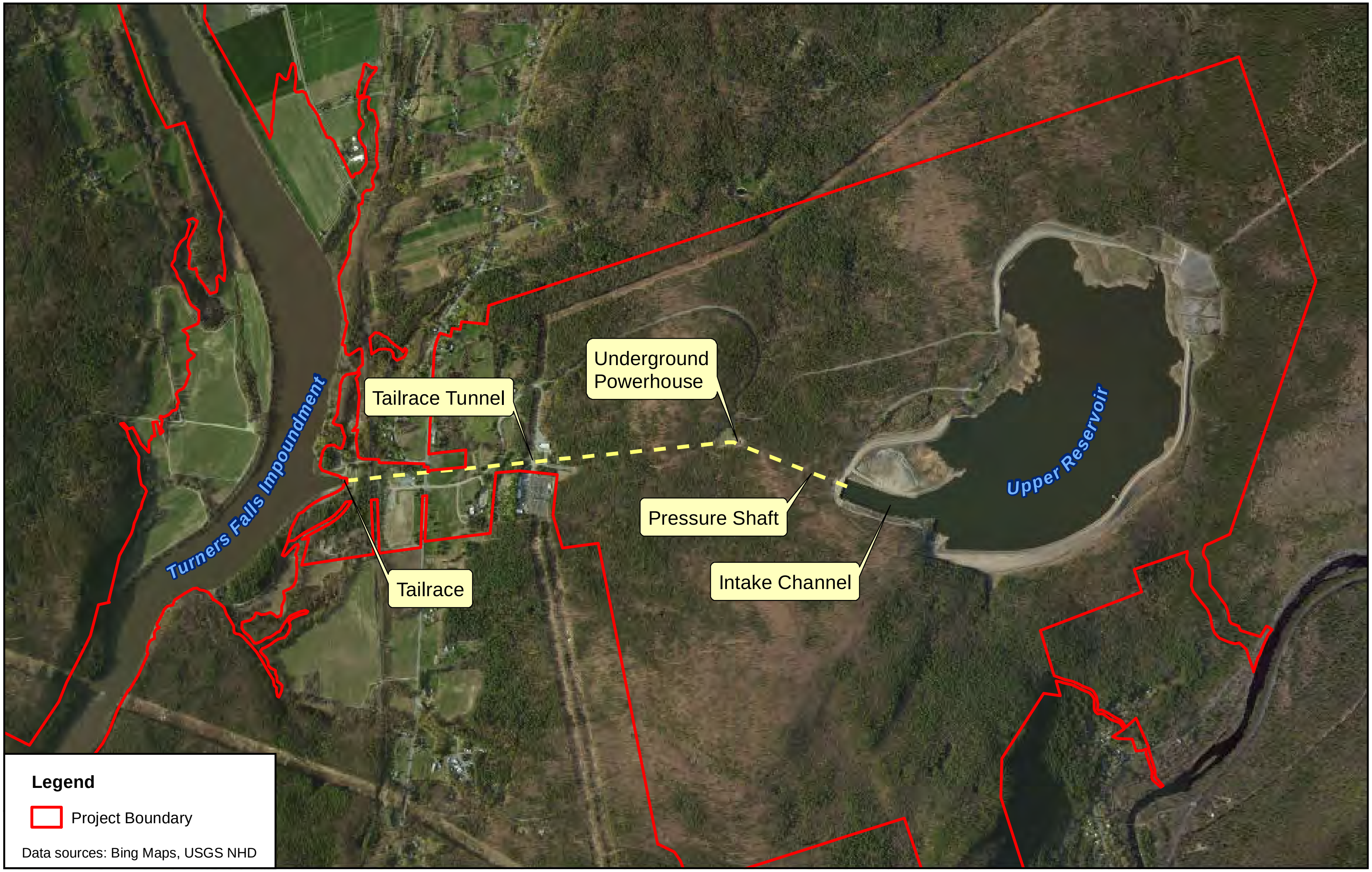

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0 1,000 2,000 4,000 Feet

Figure 3.2.2-1
Northfield Mountain Project Features

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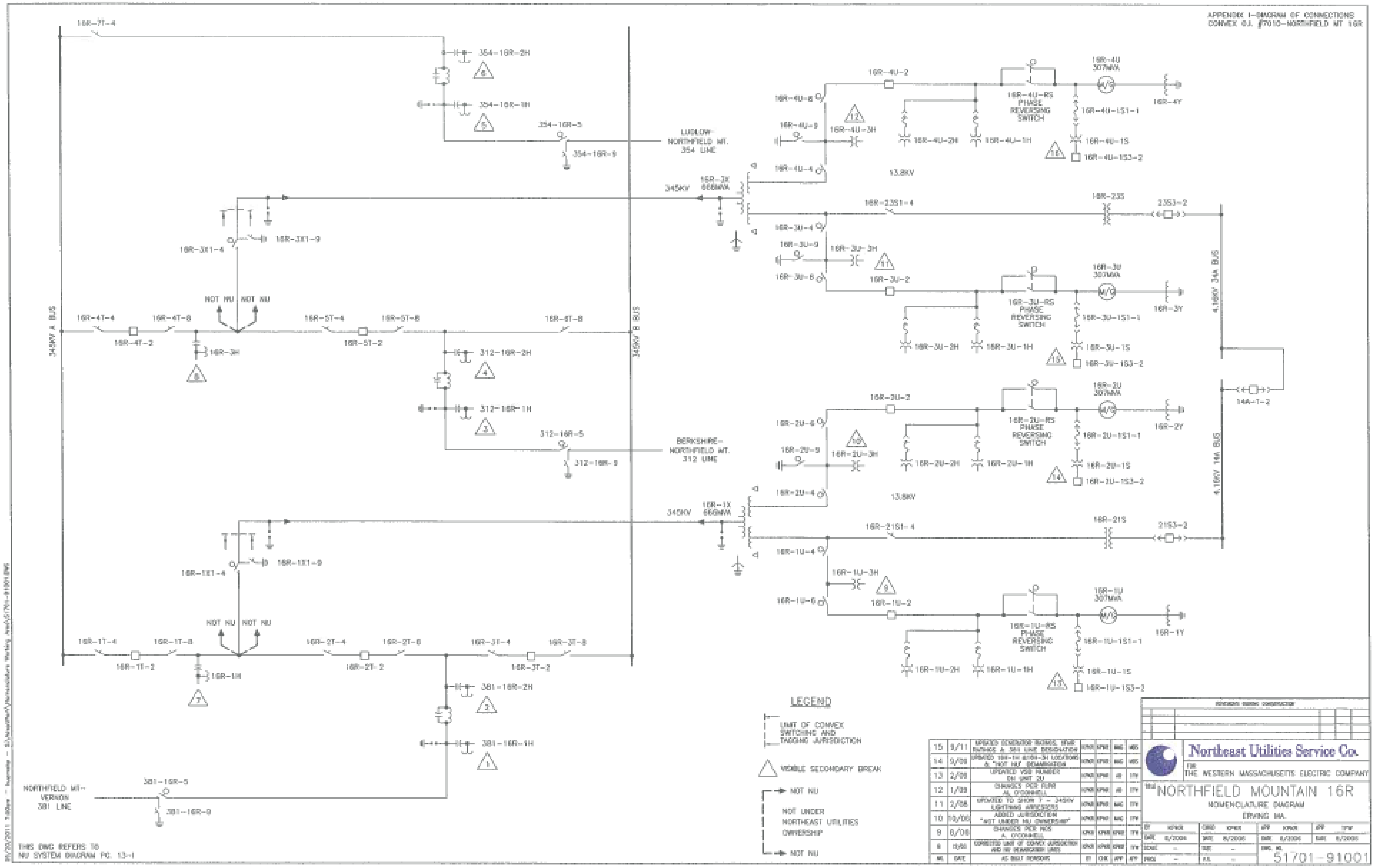
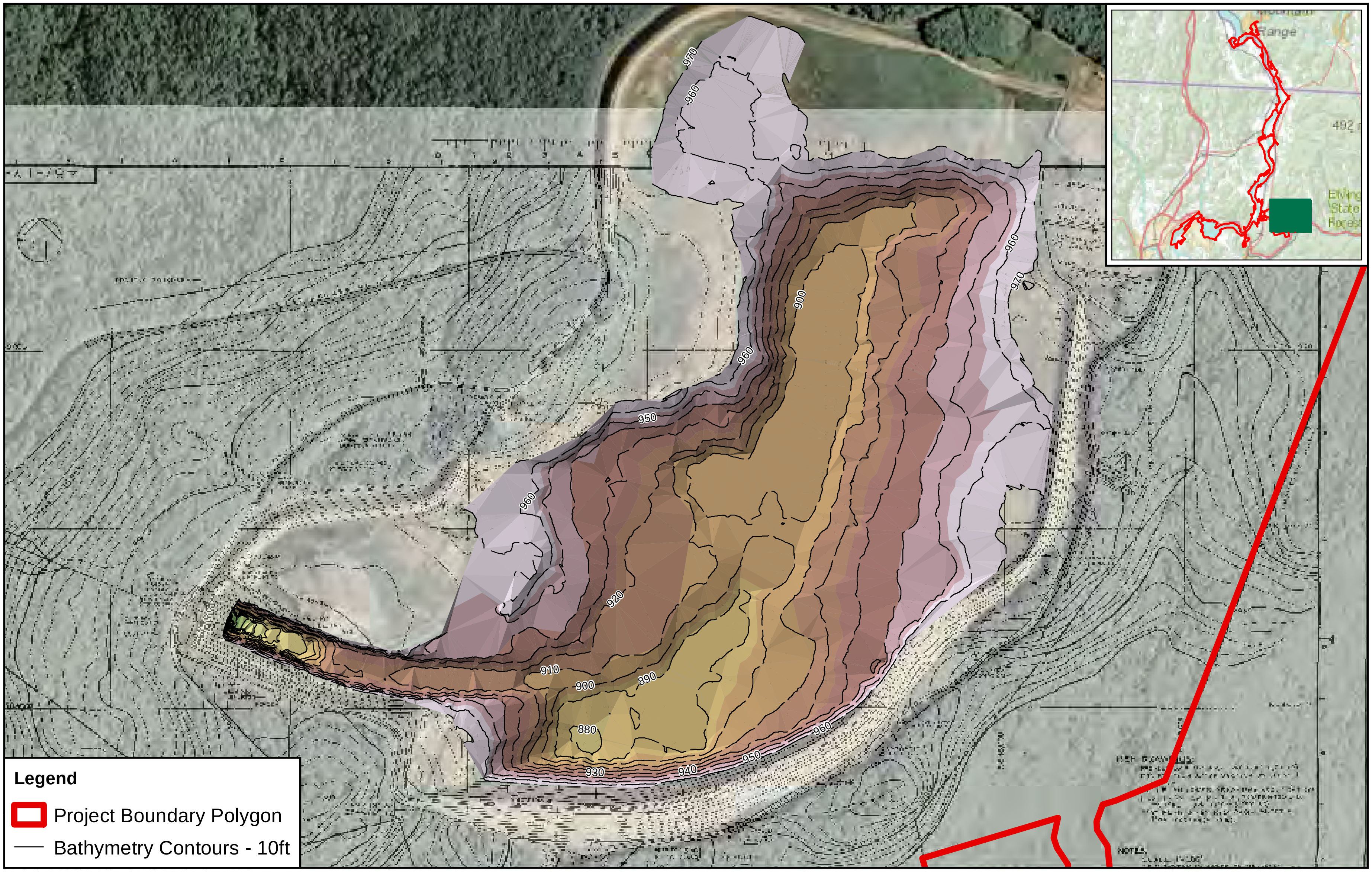
Figure 3.2.2-2: Northfield Mountain Project Single Line Electrical Diagram





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PRE-APPLICATION DOCUMENT

0 375 750 1,500 Feet

Figure 3.2.2-3
Bathymetric Map for Northfield Mountain Upper Reservoir

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3.3 Current Project Operation (18 C.F.R. § 5.6 (d)(2)(iv))

3.3.1 Operational License Requirements

Turners Falls Impoundment Fluctuation

Under the FERC license, the Turners Falls Impoundment elevation may fluctuate between 176.0 feet msl and 185.0 feet msl, as measured at the Turners Falls Dam.

Northfield Mountain Upper Reservoir

Under the FERC license, the Northfield Mountain upper reservoir elevation may fluctuate between 1,000.5 feet msl and 938 feet msl.

Minimum Flow

Under the current FERC license for the Turners Falls Project, FirstLight is required to release a continuous minimum flow of 1,433 cfs or inflow, whichever is less. FirstLight typically maintains the minimum flow requirement through discharges at Cabot and/or Station No. 1.

Per the FERC license, a continuous minimum flow of 200 cfs is maintained in the bypass reach starting on May 1, and increases to 400 cfs when fish passage starts by releasing flow through a bascule gate. The 400 cfs continuous minimum flow is provided through July 15, unless the upstream fish passage season has concluded early in which case the 400 cfs flow is reduced to 120 cfs to protect shortnose sturgeon. The 120 cfs continuous minimum flow is maintained in the bypass reach from the date the fishways are closed (or by July 16) until the river temperature drops below 7°C, which typically occurs around November 15th.

Fishway Requirements

The Turners Falls Project's three fishways (as described in Section 3.2.3) utilize flow for fish passage and attraction. Table 3.3.1-1 lists the design flow capacity and maximum attraction flow for each fishway.

Since originally constructed, the Cabot and Spillway ice harbor designs have been heavily studied and changes have been made to the fishways in consultation with the USFWS, Massachusetts Division of Fish and Wildlife (MADFW) and CRASC with the goal of passing more fish. The ice harbor design includes weirs and orifices to pass flow through the ladder. As currently configured, half of the original fishway weir overflow sections and orifices of the Cabot and Spillway fishways were purposely blocked; in addition, the remaining orifices were purposely half-blocked with the goal of improving passage. These changes limit the total flow conveyance through the fishways; as such, the Cabot and Spillway fishways are estimated to convey roughly half of their design flow.

In practice, the attraction flow at the Cabot and Spillway fishways varies with the tailwater elevation at the fish entrance. FirstLight strives to maintain a one foot differential between the inside (upstream) and outside (downstream) of the entrances.

The Gatehouse fishway design flow and operations are more difficult to define due to numerous adjustments that have occurred to the ladder in consultation with agencies. The Gatehouse fishway has been studied for several years, and the findings have been used to make changes to the facility with the goal of passing more fish. Some of the changes are as follows: two of the three original entrances have been (and remain) closed; the original entrance opening was deepened, and a new entrance was added; and a flow control weir was installed inside the gallery.

In addition, flow through the Gatehouse fishway is largely a function of the Turners Falls Impoundment elevation. The attraction flow is controlled by two gates. The fishway control system opens the gate(s) enough to provide the programmed differential at the old entrance. The programmed differential has varied from one to three feet over several years while FirstLight experiments in consultation with agencies with ways to improve American shad passage.

Relative to downstream fish passage, a flow of approximately 200 cfs is maintained through the log sluice from approximately April 7 through November 15.

Flood Flow Operation

Pursuant to Article 43 of the Northfield Mountain Project license, the Licensee entered into an agreement with the Department of the Army (i.e. United States Army Corps of Engineers (USACE)) for providing coordinated operation of the Turners Falls Project and Northfield Mountain Project during flood conditions on the Connecticut River in accordance with rules and regulations prescribed by the USACE. This agreement, memorialized in the *Reservoir and River Flow Management Procedures* (Stone and Webster Engineering Corp., 1972a) and updated in the *Supplement to the Reservoir and River Flow Management Procedures* (Stone and Webster Engineering Corp., 1972b), governs how the Turners Falls Project and Northfield Mountain Project should operate during flood conditions. In general, the agreement allows FirstLight to operate the Northfield Mountain Project within its FERC license requirements without causing river flows downstream of Turners Falls Dam to significantly exceed those that would have occurred absent the Northfield Mountain Project.

Table 3.3.1-1: Cabot, Spillway and Gatehouse: Design Flows, Actual Flows, and Attraction Flows

Facility	Fishway Passage Design Flow (cfs)	Fishway Passage Actual Flow (cfs)	Maximum Attraction Flow (cfs)
Cabot Fishway	67 cfs	33 cfs	335 cfs
Spillway Fishway	36 cfs	18 cfs	300 cfs
Gatehouse Fishway	235 cfs	235 cfs	270 cfs

3.3.2 Turners Falls Project and Northfield Mountain Project Operations

Operations of the Turners Falls Project and Northfield Mountain Project are governed by the magnitude of river flows, which are largely determined by discharge from the upstream hydropower projects on the river, and the need for power. Below is a brief description of how FirstLight: a) computes the naturally routed flows through the Turners Falls Impoundment; b) computes the target combined storage volume at Northfield; and c) operates the Turners Falls Project and Northfield Mountain Project under various flow ranges.

Inflow

The total instantaneous inflow to the Turners Falls Impoundment is computed as the sum of the Vernon discharge, and tributary inflow from two major rivers with USGS gages- Millers River and Ashuelot River. The incremental drainage area between Vernon Dam and Turners Falls Dam is approximately 897 mi^2 (which accounts for 12.5% of the drainage area at Turners Falls Dam). FirstLight records the total instantaneous inflow from these sources and then adjusts it based on the travel time required to reach the Turners Falls Dam. The adjusted flow is commonly referred to as the natural routed flow. For example, when the instantaneous inflow is 18,000 cfs (power canal capacity), the travel time through the impoundment is approximately 8.5 hours.

Combined Useable Storage Volume in the Northfield Mountain Project System

The combined useable volume in the Northfield Mountain Project is the sum of useable water volumes in the upper and lower reservoirs. At any given time, a comparison of the actual combined useable storage volume and the useable storage in the full upper reservoir (12,318 acre-feet) provides an indication of whether the lower reservoir useable storage volume is adequate for filling the deficit in the upper reservoir. The useable volume in the upper reservoir plus the useable volume in the lower reservoir should equal 12,318 acre-feet, if the system is balanced. At any given time three situations are possible as follows:

- Combined Useable Storage = 12,318 acre-feet. This indicates a balanced condition, where the total storage in the Turners Falls Impoundment and upper reservoir is 12,318 acre-feet.
- Combined Useable Storage < 12,318 acre-feet. This indicates there is insufficient water available in the lower reservoir to refill the upper reservoir. This condition is avoided during normal operation because it could limit the energy production of the Northfield Mountain Project. During periods of low flow, this deficiency can be rectified by curtailing generation at Cabot or Station No. 1 to allow the lower impoundment to fill.
- Combined Useable Storage > 12,318 acre-feet. This indicates there is more than enough water available in the lower reservoir to refill the upper reservoir.

In general, FirstLight strives to maintain a near balanced condition or a slight positive balance (combined usable storage > 12,318 acre-feet).

Minimum, Maximum and Target Elevations

Table 3.3.2-1 specifies the minimum, maximum, and target elevations in the Turners Falls Impoundment (as measured at the dam) and in the power canal. Under most common operating scenarios, FirstLight targets an impoundment elevation of 181.3 feet msl at the dam and 173.5 feet msl in the power canal (as measured in the Cabot forebay). However, depending on the magnitude of river flow and electrical demands, elevations in the Turners Falls Impoundment can range from 185 feet msl to 176 feet msl.

Turners Falls Project and Northfield Mountain Project Operations when Naturally Routed Flows are < 1,433 cfs (Minimum Flow)

When naturally routed flows are very low, i.e. less than 1,433 cfs (river flows are less than 1,433 cfs approximately 3% of the time or stated differently as exceeding 1,433 cfs 97% of the time), FirstLight generally maintains the Turners Falls Impoundment elevation between 180.5 and 182.0 feet msl to create sufficient hydraulic head to pass flow through the gatehouse.

At flows less than 1,433 cfs, Cabot Station does not operate and Station No. 1 operates as a run-of-river facility. Station No. 1 generally operates over two flow ranges as follows: a) at low flows (too low to operate one turbine at Cabot); and b) at flows exceeding Cabot's hydraulic capacity of approximately 13,728 cfs.

Bypass flows are provided at Turners Falls Dam as required for fishery needs during certain periods of the year. If bypass flows are required, they are provided by the bascule gate closest to the gatehouse.

At these low flows (less than 1,433 cfs), the Northfield Mountain Project may operate during peak hours of the day or when the price of power is high, while pumping back typically at night or when the price of power is less. The number of turbines operating and the magnitude of generation flow will vary depending on demand. During downstream salmon smolt migration, only three of the four pumps operate to prevent impingement of fish on the guide net.

Turners Falls Project and Northfield Mountain Project Operations when Naturally Routed Flows are between 1,433 cfs and 13,728 cfs (Cabot Capacity)

Under moderate flow conditions, i.e., naturally routed flows are between 1,433 cfs and 13,728 cfs (river flow exceeds 13,728 cfs approximately 34% of the time), the Turners Falls Impoundment elevation is typically managed around elevation 180.5 feet msl, but fluctuates under these inflow conditions due to Cabot peaking operations and the pumping/generating cycle at the Northfield Mountain Project. Under most circumstances, the impoundment elevation fluctuates between 180.5 and 184.0 feet msl under these inflow conditions. The target elevation in the power canal at the Cabot forebay remains at 173.5 feet msl.

When naturally routed flows are between 1,433 cfs and 13,728 cfs (the approximate hydraulic capacity of Cabot Station), FirstLight will typically operate Cabot Station, while Station No. 1 remains idle. Depending on the inflow, electrical demand or energy pricing, Cabot Station may be operated as a peaking facility, with the number of peaks per day varying with electrical demand and/or price. If demand and/or price is high, such as in the summer and winter, Cabot may be peaked twice a day, in the morning and late afternoon. Outside of these hours, Cabot's generation is typically curtailed to base load needs, by reducing the flow through the gatehouse. Excess inflow to Turners Falls Dam is stored within the Turners Falls Impoundment. If inflow is consistently in the 13,728 cfs range, Cabot will operate continuously at full capacity.

In the summer and winter seasons, the Northfield Mountain Project typically peaks twice a day- in the morning and late afternoon. During other months, commonly called shoulder months, the Northfield Mountain Project may be peaked one to two times a day, pending electrical demand and/or price. In both cases, water is typically pumped back to the upper reservoir during the night or during low energy priced hours.

Turners Falls Project and Northfield Mountain Project Operations when Naturally Routed Flows are between 13,728 cfs and 15,938 cfs (full capacity of Station No. 1 and Cabot)

Under these flow conditions, operations are similar to above; however, Cabot is typically operated at full hydraulic capacity, while the remaining flow would be passed through Station No. 1. River flow exceeds 15,938 cfs approximately 28% of the time.

Turners Falls Project and Northfield Mountain Project Operations when Naturally Routed Flows are between 15,938 cfs and 30,000 cfs

Under normal to somewhat high flows, as the naturally routed inflow to Turners Falls Impoundment exceeds the hydraulic capacity of Cabot and Station No. 1, both facilities operate at full capacity. Per the agreement with the USACE, the maximum Turners Falls Impoundment elevation during inflows of this magnitude is 186.5 feet, although FirstLight typically opens the bascule gates at the Turners Falls Dam, as needed, to maintain the impoundment elevation closer to 180-182 feet msl. River flow exceeds 30,000 cfs approximately 11% of the time.

The Turners Falls Project and the Northfield Mountain Project do not provide any flood protection benefits. For example, the storage volume in the Turners Falls Impoundment is 21,500 acre-feet, which is equivalent to 260,150 cfs-hours. Thus, if the inflow to the Turners Falls Impoundment was continuously 30,000 cfs, and the Turners Falls Impoundment was empty, it would take between 8 and 9 hours to fill the impoundment at an inflow rate of 30,000 cfs. In short, when compared to the magnitude of flood inflows, such as that experienced with Tropical Storm Irene (instantaneous flow of 127,000 cfs as measured on the

Connecticut River at the Montague City USGS gage), neither the Turners Falls Impoundment nor the Northfield Mountain Upper Reservoir provides flood protection.

Per the USACE agreement, FirstLight must release water through Cabot and Station No.1 and over the spillway so that at the start of the Northfield pumping, there is enough water stored in the impoundment to restore the Northfield upper reservoir to its full capacity.

Turners Falls Project and Northfield Mountain Project Operations when Naturally Routed Flows are between 30,000 cfs and 65,000 cfs

When flows are in this high range, Turners Falls Project and Northfield Mountain Project operations are generally the same as above, with one exception: the USACE requires that FirstLight draw the Turners Falls Impoundment elevation down as far as possible, but not below elevation 176.0 feet msl. In drawing the impoundment down, discharges cannot be increased by more than 10,000 cfs per hour above the naturally routed flows. The impoundment elevation is maintained down until the naturally routed flows drop below 30,000 cfs or the actual discharge exceeds 65,000 cfs. When the actual discharge past Turners Falls Dam rises to 65,000 cfs (river flow exceeds 65,000 cfs approximately 1% of the time), the discharge is maintained at 65,000 cfs until the impoundment elevation has fallen to 176.0 feet msl or the impoundment begins to rise, at which point a constant impoundment elevation is maintained.

Turners Falls Project and Northfield Mountain Project Operations when Naturally Routed Flows are between 65,000 cfs and 126,000 cfs

Per the USACE agreement, when the natural routed flow exceeds 65,000 cfs, but is expected to be less than 126,000 cfs (this flow is very rarely exceeded), the outflow at Turners Falls should be regulated according to the operating schedule of the Northfield Mountain Project. If the Northfield Mountain Project is operating, it is required to keep the combined useable volume of the upper and lower reservoirs constant. If the Northfield Mountain Project is not operating, it is required to keep the Turners Falls Impoundment level constant until the spillway gates are wide open.

Turners Falls Project and Northfield Mountain Project Operations when Naturally Routed Flows exceed 126,000 cfs

When the naturally routed flow is expected to be greater than 126,000 cfs, the operating rules continue to require the following: if the Northfield Mountain Project has not been operating in the previous hour, it is required to maintain a constant Turners Falls Impoundment elevation. If the Northfield Mountain Project has been operating in the previous hour, it is required to maintain a constant combined useable storage volume.

Table 3.3.2-1: Reservoir Minimum, Target, and Maximum Elevations at Turners Falls Dam

Location	Minimum Elevation (feet, msl)	Target Elevation (feet, msl)	Maximum Elevation (feet, msl)
Turners Falls Impoundment Elevation (as measured at the dam)	179.0*	181.3**	185.0
Power Canal (as measured at the Cabot forebay)	173.5	173.5	173.5

** Although the FERC license allows FirstLight to draw the Turner Falls Impoundment to elevation 176.0 feet msl, which occurs during certain operating scenarios, FirstLight generally maintains the impoundment higher than 176.0 feet msl to maintain sufficient head at the gatehouse.*
*** Elevation 181.3 feet msl reflects the median Turners Falls Impoundment elevation between 2000 and 2009 as measured at the dam.*

3.4 Other Turners Falls Project and Northfield Mountain Project Information (18 C.F.R. § 5.6 (d)(3)(v))

3.4.1 Current License Requirements

The following is a description of key license requirements for the Turners Falls Project and Northfield Mountain Project. A complete set of license articles, including the Commission's standard license articles applicable to the Turners Falls and Northfield Mountain Projects, is provided in Appendix D.

Turners Falls Project

Article 30 requires the Licensee to pay reasonable annual charges to the United States for the cost of administration of Part I of the Federal Power Act (FPA), based on a currently authorized installed capacity of 67,709 kW.

Article 31 requires the Licensee to implement, and modify when appropriate, an emergency action plan to provide early warning to upstream and downstream inhabitants and property owners in the event of an impending or actual sudden release of water caused by an accident or failure of the Turners Falls Project works.

Article 32 requires the Licensee to operate the Turners Falls Project in accordance with its agreement with the USACE for the coordinated operation of the Turners Falls Project for flood control.

Article 33 requires the Licensee to provide public recreation at the Turners Falls Project in accordance with the Turners Falls Project's approved Recreation Plan.

Article 34 requires the Licensee to maintain a continuous minimum flow of 1,433 cfs or inflow, whichever is less, from the Turners Falls Project into the Connecticut River. Such flows may be temporarily modified in the event of operating emergencies or for protection of resources upon mutual agreement with the MADFW. From May 1 until there are no substantial numbers of juvenile or adult shad in the river reach (no later than October 1), the Licensee must release 400 cfs of the minimum flow from Turners Falls Dam. The Licensee may release the remaining continuous minimum flow from either the Turners Falls Dam or Cabot Station, but must release a sufficient portion from Cabot Station to allow proper operation of the Cabot Station fishway.

Article 35 describes the Licensee's obligations with respect to unrecorded archeological or historical sites discovered during construction or development of project works or other facilities at the Turners Falls Project, and in the event any such sites are discovered, requires the Licensee to consult with the State Historic Preservation Officer to develop a mitigation plan for the protection of significant archeological or historic resources.

Article 36 requires the Licensee to install and operate signs, lights, sirens, barriers or other necessary devices to warn the public of fluctuations in flow and protect recreation users of the Turners Falls Project.

Article 38 requires the Licensee to file annual reports with FERC detailing operation of the Turners Falls Project's fish passage facilities, problems in design or operation, and listing the number, by species, of all fish passed upstream.

Article 40 requires the Licensee to coordinate operation of the Turners Falls Project with operation of the Northfield Mountain Project.

Article 42 requires the Licensee to coordinate operation of the Turners Falls Project, electrically and hydraulically, with other power systems as the Commission may direct in the interest of power and other beneficial public uses of water resources.

Article 43 authorizes the Licensee to grant permission for certain types of use and occupancy of Turners Falls Project lands, and requires the Licensee to consult with federal and state agencies prior to conveying certain interests, pursuant to FERC's standard use and occupancy article.

Northfield Mountain Project

Article 39 requires the Licensee to make modifications to the Northfield Mountain Project works, operate the Northfield Mountain Project, and take such steps as ordered by the Commission, in the interest of boating safety, upon recommendation by the Commission, the USACE, the U.S. Coast Guard, or an interested agency of the Commonwealth of Massachusetts.

Article 40 requires the Licensee, following consultation with the USFWS and fishery agencies of the Commonwealth of Massachusetts, to study or pay for the cost of studies relating to fish protection at the Northfield Mountain Project, and undertake further study if the Commission finds that changed conditions or changed use of the Connecticut River fishery so warrant.

Article 41 requires the Licensee to develop recreational resources at the Northfield Mountain Project.

Article 43 requires the Licensee to enter into an agreement with the USACE for coordinated operation of the Turners Falls and Northfield Projects during flood conditions on the Connecticut River.

Article 45 requires the Licensee to coordinate operation of the Northfield Mountain Project with operation of the Turners Falls Project.

Article 48 requires the Licensee to pay reasonable annual charges to the United States for the cost of administration of Part I of the FPA, based on an authorized installed capacity of 1,119.2 MW.

Article 50 requires the Licensee to implement a cooperative land and water management plan for the Bennett Meadow Wildlife Management Area.

Article 51 requires the Licensee to report to the Commission and the Massachusetts Historical Commission any fossils or archeological artifacts discovered during construction, operation, or maintenance of recreation developments at the Northfield Mountain Project, and authorizes the Commission to require archeological or paleontological surveys or salvage operations deemed necessary to prevent the destruction or loss of such findings.

Article 52 authorizes the Licensee to grant permission for certain types of use and occupancy of Northfield Mountain Project lands, and requires the Licensee to consult with federal and state agencies prior to conveying certain interests, pursuant to FERC's standard use and occupancy article.

3.4.2 Compliance History

A review of compliance information, as per 18 CFR § 5.6(d)(2)(v)(D), shows that the Licensee and its predecessors have never been found to be in non-compliance with the terms and conditions of the Projects' licenses. The Turners Falls Project and Northfield Mountain Project have been subject to periodic FERC inspections. Any matters noted during the inspections have been addressed by the Licensee to the Commission's satisfaction.

3.4.3 Current Net Investment

As per 18 CFR § 5.6(d)(2), FirstLight's net investments (book value) of the Turners Falls Project and Northfield Mountain Project are $290,279,712 and $952,716,241, respectively, as of October 30, 2012.

3.4.4 Proposed Modifications

FirstLight is proposing to evaluate potential modifications to the Turners Falls Project and Northfield Mountain Project at this time. As the licensing process proceeds, FirstLight will conduct further investigations to determine if potential modifications are feasible. The potential modifications that FirstLight is evaluating include the following:

- Upgrading Station No. 1 with new or rehabilitated turbines.
- Closing Station No. 1 and adding a turbine generator at Cabot of similar hydraulic capacity to Station No. 1's.
- Utilizing the full hydraulic capacity of the Cabot turbines including currently unused capacity.
- Utilizing more storage in the Northfield Mountain Project's upper reservoir.
- Increasing the unit and station capacity at the Northfield Mountain Project.

3.4.5 Summary of Turners Falls Project and Northfield Mountain Project Generation

The Turners Falls Project average annual generation for the period 2000 to 2010 was 320,140 MWH. Average monthly energy production for this same period varied from 11,960 MWH in September to 38,016 MWH in April. Table 3.4.5-1 summarizes the Turners Falls Project generation on a monthly and annual basis.

The Northfield Mountain Project average annual generation for the period 2000 to 2009 was 1,143,038 MWH (2010 was excluded due to the extended outage that occurred at the Northfield Mountain Project). Average monthly energy production for this same period varied from 71,466 MWH in February to 118,288 MWH in August. Table 3.4.5-2 and Table 3.4.5-3 summarize Northfield Mountain Project generation, as well as the energy consumed during the pumping phase on a monthly and annual basis.

The Northfield Mountain Project is vitally important to the reliability and efficient operation of the New England electric grid. With the upper reservoir at its FERC licensed maximum elevation, 1,000.5 feet msl, it can operate at full generating capacity output from its four generating units for approximately 8.5 hours and produce 8,475 MWH of power. During high electrical demand periods, such as excessively warm periods in the summer, the Northfield Mountain Project is called upon by ISO New England (ISO-NE) to meet high electrical demands, including significant ramping demands, or held for quick start contingency response as needed to meet the circumstances.

ISO-NE is an independent, non-profit, Regional Transmission Organization, responsible for reliably operating New England's approximately 32,000 MW bulk electric power generation and transmission system. During many periods of the year, ISO-NE calls upon the Northfield Mountain Project to balance the New England transmission system to accommodate both changes in load and generation. In the last 10 years, FirstLight has obtained three temporary amendments from FERC to utilize additional upper reservoir storage for generation during periods of high electrical demand in New England. During these times, possessing reliable energy supplies and significant operating flexibility at the Northfield Mountain Project to address both load and supply changes (e.g. changing interchange schedules, accommodating block loading of other units' commitment and decommitment) is critical to ISO-NE's reliable operation of the power system. The Northfield Mountain Project provides critical energy, operating reserves and operational flexibility to ISO-NE system operation. The fact that ISO-NE, as part of its daily operational planning processes, can rely on the Northfield Mountain Project to supply these operational flexibilities from a certain fuel supply is of high value to ISO-NE and the New England region. In many periods, this significant supply of operational flexibility has avoided the commitment of many other less flexible resources to provide for a more efficient system dispatch. This peak load ability provides rapid response power resources to the grid to prevent regional blackouts.

Storage provides other important reliability benefits to the system. These include helping to manage light load, or excess generation conditions during off peak periods and the ability to respond very quickly to energy and operating reserve needs on the power system during any time of the day or year. New England is deficient in flexible, quick-start capacity today and will remain so for at least the near future. The Northfield Mountain Project can also provide black start capability to deliver power to the grid when all other units are down and unable to start on their own.

The value of the Northfield Mountain Project was demonstrated following the August 14, 2003 major blackout in the New York ISO (NY-ISO) grid. On August 15, ISO-NE parted all electrical ties to the New York electrical system to prevent the blackout from spreading further. When it was time to rejoin the two power grids, ISO-NE requested the connection be made at the Northfield Mountain Project. This facility was selected because:

- it is located at the junction of three 345 kV lines;
- it has a major tie line with the NY-ISO;
- the transmission company switchyard located at Northfield Mountain had the equipment necessary to synchronize the two electric grids, and
- the Northfield Mountain Project generators were large enough to make changes in both frequency and voltage.

Once the lines were energized, final adjustments were made by having the Northfield Mountain Project reduce generation to allow for a smooth synchronization of the two systems. The interconnection of the two systems allowed NY-ISO to begin restoration of the north portion of the NY power grid.

3.4.6 Other Turners Falls Project and Northfield Mountain Project Value

The Turners Falls Project and Northfield Mountain Project also generate property taxes for six towns in three states, employ community personnel, and provide valued recreational and educational resources, including the Northfield Mountain Recreation and Environmental Center (Visitor Center).

Taxes

For fiscal year ending on June 30, 2012 FirstLight paid taxes to the following towns totaling over $9.5 million:

Erving, MA:	$6,249,335
Gill, MA:	$230,626
Montague, MA:	$2,117,498 (Real Estate and Fire District)
Northfield, MA:	$951,358
Hinsdale, NH:	$1,074
Vernon, VT:	$7,177
Total:	$9,557,068

The tax payments are dependent, to some degree, on the energy production at both Projects.

Employment

FirstLight employs approximately 65 full-time people that provide the support needed to operate and maintain the Turners Falls Project and Northfield Mountain Project. Roughly $9 million is expended on salaries annually. In addition to FirstLight employees, FirstLight also contracts with local outside entities to provide maintenance support for the Projects. Contractors' expenses are on the order of $2-$2.9 million annually.

Recreation

As described in the Recreation Resources section of the PAD, FirstLight offers the local community various recreation and educational programs in the area. FirstLight operates, staffs, and maintains the Visitor Center at the base of the Northfield Mountain Project.

FirstLight maintains a four-season recreation facility situated along a beautiful sweep of mountain side, with satellite facilities strung along a 7-mile stretch of the Connecticut River. Northfield Mountain offers cross country skiing, hiking, and mountain biking on 26 miles of trails; camping, canoeing, kayaking at their Barton Cove recreation area; interpretive riverboat cruises and charters on the 44-seat Quinnetukut II; public environmental and recreation programs at their Visitor Center; and school environmental and recreational programs on-site. Other offerings include public picnic areas and a 70-seat, rentable pavilion area at Riverview, camping for boaters at Munn's Ferry, and fishways for free spring viewing of thousands of migrating fish.

Table 3.4.5-1: Turners Falls Project—Summary of Monthly and Annual Generation (MWH) for 2000 to 2010

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	28,432	18,654	38,145	34,688	39,156	26,144	13,313	22,643	10,714	15,350	23,739	23,573	294,551
2001	21,281	19,462	21,789	23,905	27,295	16,773	6,504	1,875	2,766	4,012	9,147	13,482	168,289
2002	12,713	19,935	31,642	38,169	38,051	28,866	13,579	6,776	7,017	11,432	22,380	22,830	253,391
2003	18,684	14,809	24,167	41,200	40,239	21,315	7,551	19,320	15,825	25,252	26,701	26,774	281,836
2004	25,901	15,833	26,903	33,799	35,155	20,759	13,250	22,084	28,301	16,303	23,364	39,848	301,500
2005	34,623	21,565	25,497	39,151	42,809	36,913	20,571	10,860	13,190	27,190	34,807	35,016	342,192
2006	37,182	35,423	31,076	42,935	38,360	41,285	27,079	26,590	12,804	32,698	43,538	43,658	412,628
2007	26,814	17,662	31,725	39,604	41,986	22,144	21,251	10,740	6,579	22,768	36,026	33,569	310,868
2008	38,050	39,282	43,283	37,361	32,209	27,491	28,503	37,856	16,278	23,966	36,272	42,953	403,505
2009	31,690	23,968	44,716	43,861	39,277	29,916	42,117	33,954	10,548	29,548	39,309	40,310	409,215
2010	31,416	27,633	41,142	43,506	32,466	20,856	14,012	13,797	7,541	37,047	38,314	35,832	343,563
Average	**27,890**	**23,112**	**32,735**	**38,016**	**37,000**	**26,587**	**18,885**	**18,772**	**11,960**	**22,324**	**30,327**	**32,531**	**320,140**

Table 3.4.5-2: Northfield Mountain Project—Summary of Monthly and Annual Generation (MWH) for 2000 to 2010

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	109,864	93,567	92,126	89,140	109,320	100,727	137,576	153,957	131,579	123,193	98,718	113,447	1,353,216
2001	101,351	77,503	107,797	121,528	117,901	123,672	137,954	149,880	145,696	138,503	114,467	119,844	1,456,095
2002	95,850	78,303	97,810	103,238	108,275	92,970	111,514	132,978	145,309	125,227	121,123	119,287	1,331,883
2003	95,056	92,116	81,976	65,973	71,618	94,434	96,930	85,811	99,356	61,691	86,925	102,546	1,034,432
2004	99,038	68,077	83,489	75,299	81,302	91,938	89,748	91,846	104,555	87,248	90,696	93,304	1,056,540
2005	81,856	47,618	60,445	58,132	60,958	92,404	104,355	95,351	73,493	77,921	76,339	81,201	910,072
2006	79,856	58,120	76,698	81,847	86,519	79,207	101,082	102,527	91,914	80,443	96,297	100,885	1,035,395
2007	93,798	54,954	43,704	46,464	60,212	87,499	107,016	142,983	139,486	122,630	98,251	103,570	1,100,567
2008	90,188	91,888	101,507	99,094	95,346	116,186	153,354	102,877	82,032	77,478	85,450	84,183	1,179.584
2009	66,037	52,512	61,739	68,409	60,943	79,981	97,749	124,674	93,964	92,274	77,584	96,730	972,596
2010[1]	86,164	73,981	78,598	52,630	672	0	0	0	0	0	18,440	62,204	372,689
Average[2]	**91,289**	**71,466**	**80,729**	**80,913**	**85,239**	**95,902**	**113,728**	**118,288**	**110,738**	**98,661**	**94,585**	**101,500**	**1,143,038**

[1]*The Northfield Mountain Project was out of operation for much of 2010.*
[2]*The average excludes 2010, given that this year was an anomaly due to the Northfield Mountain Project's extended outage.*

Table 3.4.5-3: Northfield Mountain Project—Summary of Monthly and Annual Energy (MWH) Consumption in Pumping Mode for 2000 to 2010

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	157,351	131,094	125,737	129,019	144,954	139,323	190,031	205,477	184,650	167,439	139,645	155,752	1,870,473
2001	138,633	105,502	150,565	164,074	160,922	172,880	187,517	203,549	201,358	191,469	153,844	168,665	1,998,978
2002	136,523	103,437	141,198	133,679	146,994	132,568	146,600	185,188	196,329	174,822	168,801	167,005	1,833,142
2003	130,126	124,585	112,260	98,449	89,020	133,009	134,548	119,934	134,217	84,355	116,700	139,201	1,416,404
2004	141,351	90,200	112,840	103,857	112,097	125,896	112,995	128,896	136,736	119,890	122,353	128,224	1,435,335
2005	110,358	61,864	87,156	74,377	86,454	125,696	138,225	126,601	98,027	109,068	104,009	109,238	1,231,074
2006	109,578	82,360	98,692	107,359	118,492	110,219	133,915	139,214	120,725	113,678	125,271	139,147	1,398,650
2007	132,605	76,064	54,029	62,831	82,046	118,986	146,089	194,557	195,152	165,484	133,335	141,776	1,502,955
2008	127,655	128,575	138,742	141,327	127,381	160,269	212,444	146,638	111,357	104,468	120,801	118,252	1,637,909
2009	90,332	82,182	76,542	97,149	86,154	107,715	135,735	176,610	131,289	126,293	106,205	133,929	1,350,134
2010[1]	126,198	99,201	109,006	71,612	83	0	0	0	0	0	32,244	89,887	528,230
Average[2]	**127,451**	**98,586**	**109,776**	**111,212**	**115,451**	**132,656**	**153,810**	**162,666**	**150,984**	**135,697**	**129,096**	**140,119**	**1,567,506**

[1]*The Northfield Mountain Pumped Storage Project was out of operation for much of 2010.*
[2]*The average excludes 2010, given that this year was an anomaly due to the Northfield Mountain Project's extended outage*

4 DESCRIPTION OF EXISTING ENVIRONMENT AND RESOURCE IMPACTS (18 C.F.R. § 5.6 (d)(3))

4.1 General Description of the River Basin (18 C.F.R. § 5.6 (d)(3)(xiii))

The Connecticut River and its tributaries drain an area of about 11,250 mi^2, constituting the largest river drainage system in New England. From its origin in the Connecticut Lakes Region near the Canadian border, the 410-mile-long Connecticut River flows southward to form the boundary between New Hampshire and Vermont, then through Massachusetts and Connecticut to Long Island Sound (Carr & Kennedy, 2008).

According to the USGS's Watershed Boundary Dataset, the Connecticut River subregion, which is part of the New England region, is divided into two basins at Vernon Dam in Vermont—the Upper Connecticut basin and the Lower Connecticut basin. (For the purposes of this PAD, the Connecticut River subregion may also be referred to as a basin or watershed.) The Turners Falls Project and Northfield Mountain Project boundary falls within the Middle Connecticut subbasin of the Lower Connecticut basin, and almost entirely within the Fall River-Connecticut River watershed within that subbasin (USGS, 2010). Figure 4.1-1 provides an overview of the entire Connecticut River subregion and its major tributaries and mainstem dams, while Figure 4.1-2 shows a close-up of the Middle Connecticut subbasin and tributaries and dams in the Turners Falls Project and Northfield Mountain Project area.

In Massachusetts, the Lower Connecticut River basin covers an area of approximately 2,728 mi^2, occupying all of Franklin and Hampshire Counties, most of Hampden County, the eastern third of Berkshire County, and the western half of Worcester County. In this region, tributary streams entering the Connecticut River from the west originate in the Berkshire Mountains and have steeper gradients than tributary streams originating in the Central Highlands to the east (Simcox, 1992). The Middle Connecticut River subbasin in Massachusetts is bordered by the Deerfield River subbasin to the northwest, the Millers River subbasin to the northeast, the Westfield River subbasin to the southwest, and the Chicopee River subbasin to the southeast (Carr & Kennedy, 2008).

4.1.1 Major Land Uses

Land use in the Connecticut River watershed is approximately 77% forested, 9% agricultural, 7% wetlands, and 7% developed. Land use is generally rural agrarian and undeveloped at the headwaters in northern Vermont and New Hampshire, transitioning to densely populated urban areas in the south-central river valley in Connecticut. Down-river from the city of Hartford, CT, the basin is again largely undeveloped, making the Connecticut River the only major river in the northeastern United States without a significant port, harbor, or urban area at its mouth (Zimmerman, 2006).

The portion of the Connecticut River basin above the USGS stream gaging station in Thompsonville, CT (near the Massachusetts border) encompasses approximately 9,660 mi^2 in New Hampshire, Vermont, and Massachusetts. This region has a population of approximately one million people distributed amongst densely populated urban areas in the southernmost section in Massachusetts to sparsely populated rural and agricultural regions in the northern areas in New Hampshire and Vermont. The agricultural land use in New Hampshire and Vermont is predominantly related to dairy farm operations, while that in Massachusetts primarily consists of orchards, row crops, and some dairy operations. The land use in this portion of the basin is about 80% forested, 9% agricultural, 6% wetlands, and 5% developed (Deacon et al., 2006).

Figure 4.1.1-1 shows land use and land cover in the vicinity of the Turners Falls Project and Northfield Mountain Project.

4.1.2 Major Water Uses

Water uses in the Connecticut River watershed include water supply, dilution of treated or untreated municipal or industrial discharges, contact and non-contact cooling water, water for agricultural irrigation and snow making, and water for power generation (CRJC, 2009). Other than for hydropower, the primary purpose of water withdrawals from the Turners Falls Impoundment is for agricultural irrigation. Section 4.3.1.3 provides more detail on specific water uses in the Turners Falls Project and Northfield Mountain Project area.

4.1.3 Basin Dams

The USACE's National Inventory of Dams (NID) contains 990 dams in the Connecticut River watershed. More than half of these dams (553) are primarily used to support recreation; in many cases "recreation" is designated as the primary purpose, but in fact, many of the impoundments are the result of older mill dams that are no longer used for a specific purpose. Dams used primarily for water supply (131) are the second-most common type of dam, followed by those used for hydroelectric power generation (123) and flood control (75). Water supply dams store the most water in the Connecticut River watershed—particularly the Quabbin Reservoir in the Chicopee subbasin which serves as the primary source of drinking water for the City of Boston and a number of municipalities in the Greater Boston area. Hydroelectric dams are found at many locations along the Connecticut River and its major tributaries. Flood control dams are mostly found on smaller rivers throughout the watershed (USGS, 2011).

Of the dams in the Connecticut River watershed, approximately 64 are considered large, defined as those with the capacity to hold 10% of the mean annual streamflow volume during any particular day (or, in the absence of streamflow information, have a large water storage capacity in relation to their drainage area). Classification of large dams was determined by The Nature Conservancy (TNC) through analysis of streamflow data provided by the USGS (USGS, 2011).

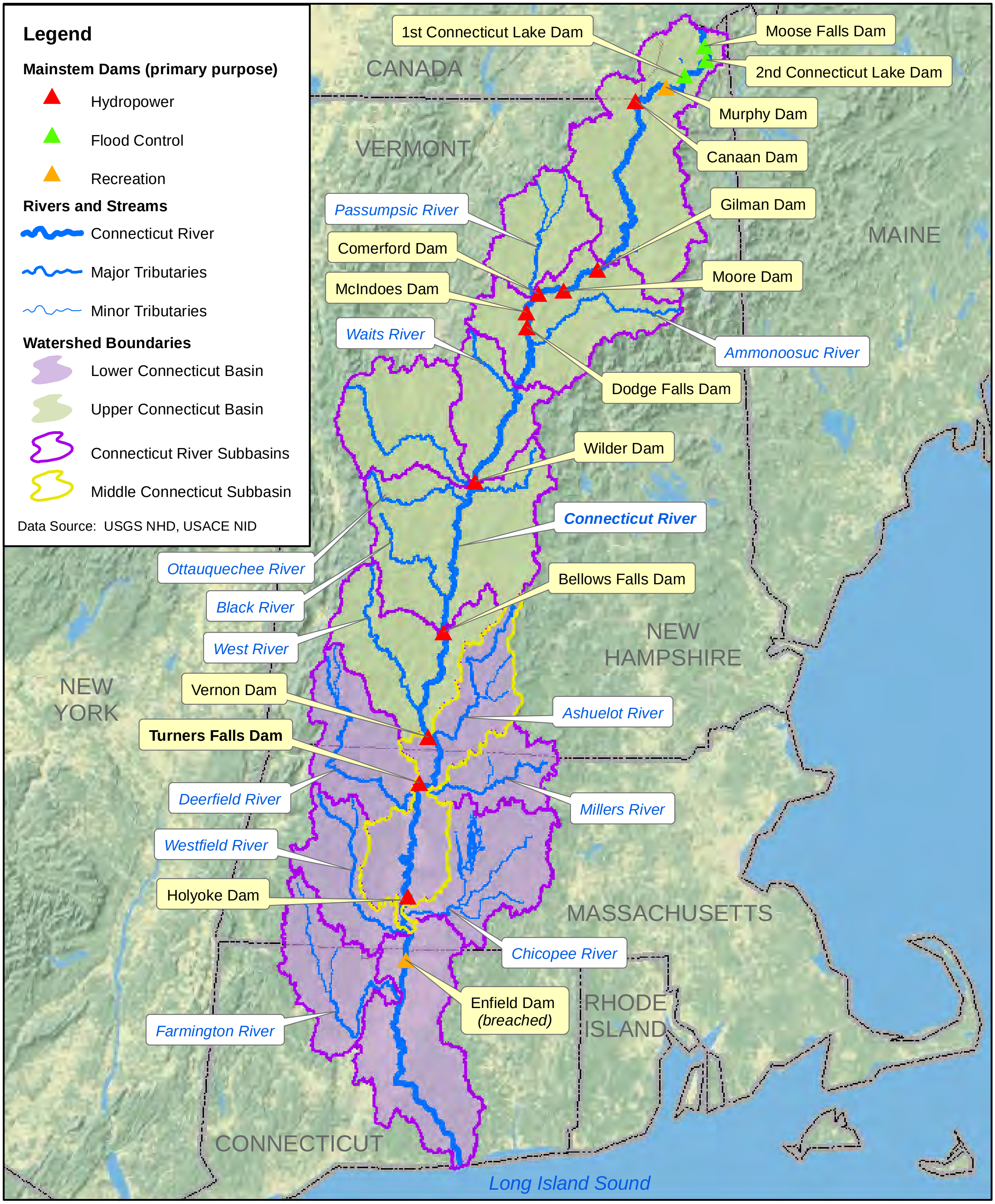
There are 12 hydropower dams along the mainstem Connecticut River, including the Turners Falls Dam. The upstream boundary of the Turners Falls Project and Northfield Mountain Project is the base of Vernon Dam, approximately 20 miles upstream of the Turners Falls Dam. The next hydropower dam downstream of the Turners Falls Dam is Holyoke Dam, approximately 35 miles downstream. Table 3.1-1 lists hydropower projects up to Moore Dam and their characteristics. Figure 4.1-1 depicts all dams along the mainstem Connecticut River, while Figure 4.1-2 shows selected dams in the Turners Falls Project and Northfield Mountain Project area.

4.1.4 Tributary Streams

Major tributaries to the Turners Fall Impoundment include the Ashuelot River in New Hampshire, which drains 420 mi^2 from the east and enters the Connecticut River just below Vernon Dam, and the Millers River, which drains 392 mi^2 from the east and enters downstream of the Northfield Mountain tailrace. Additionally, the Deerfield River, which drains 665 mi^2 from the west, enters the Connecticut River just downstream of the Cabot Station tailrace.

Smaller named streams entering the Turners Falls Impoundment, from upstream to downstream, include Newton Brook, Pauchaug Brook, Bottom Brook, Mill Brook, Mallory Brook, Millers Brook, Bennett Brook, Merriam Brook, Otter Run, Ashuela Brook, Dry Brook, Pine Meadow Brook, and Fourmile Brook (Wandle, 1984).

Figure 4.1-1 depicts major tributaries in the entire Connecticut River watershed, while Figure 4.1-2 shows tributaries in the vicinity of the Turners Falls Project and Northfield Mountain Project.



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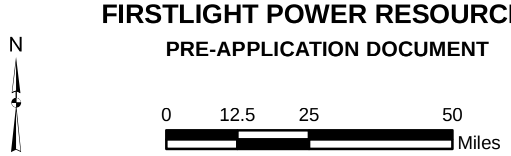

Figure 4.1-1: Connecticut River Watershed, Major Tributaries, and Mainstem Dams

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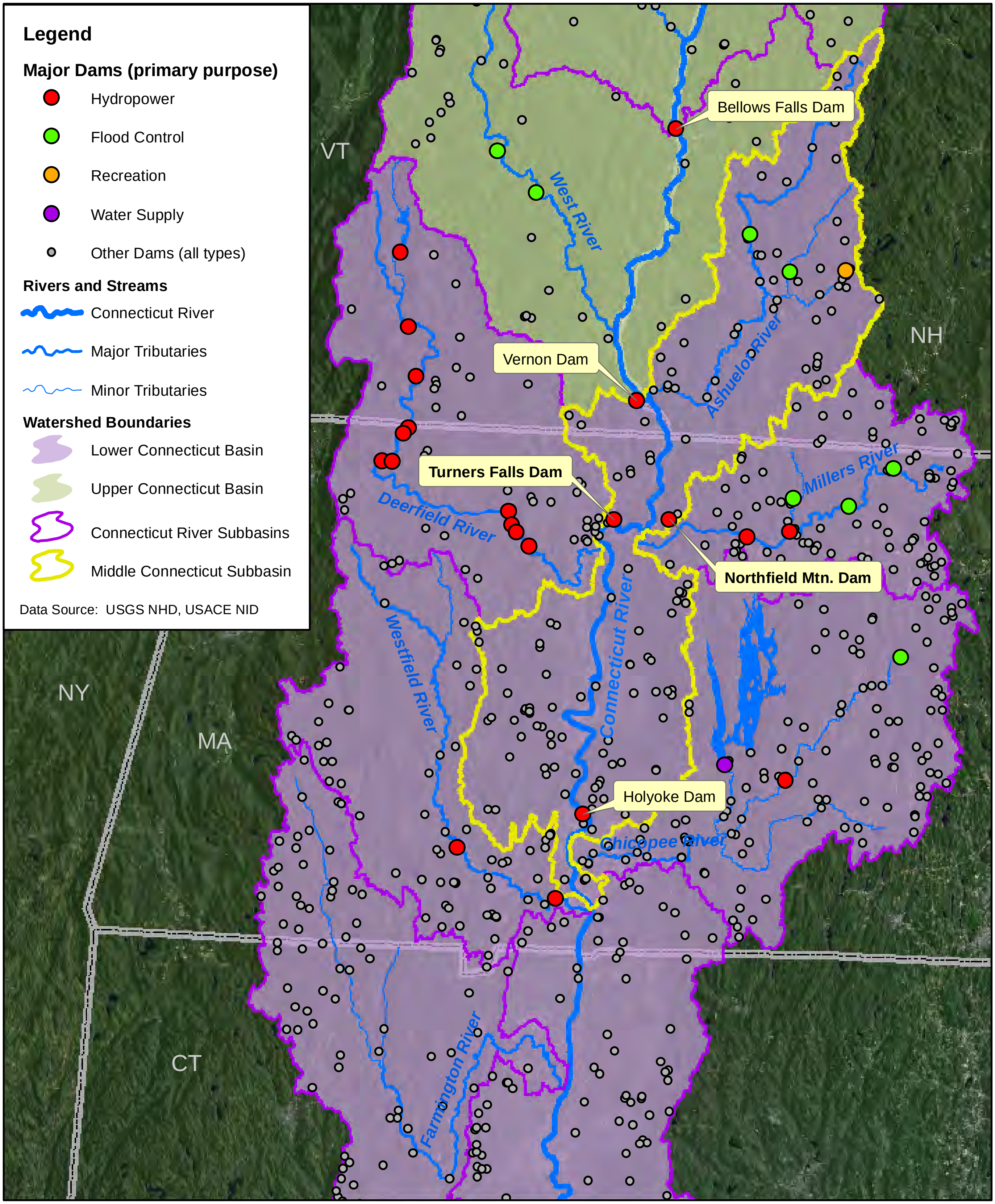

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Figure 4.1-2: Connecticut River Subbasins, Tributaries, and Dams in the Turners Falls Project and Northfield Mountain Project Area

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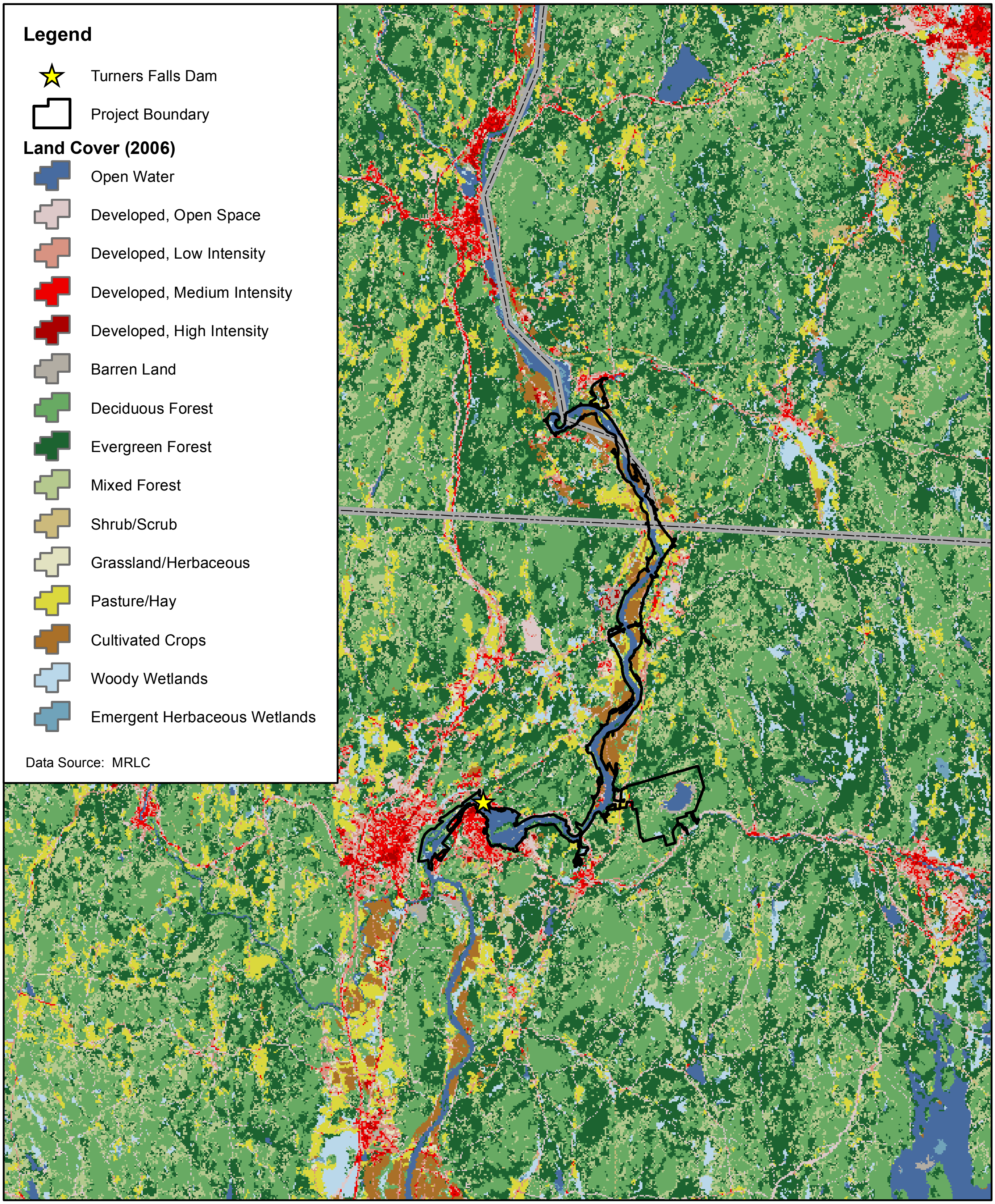

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Figure 4.1.1-1: Land Cover in the Turners Falls Project and Northfield Mountain Project Vicinity

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4.2 Geology and Soils (18 C.F.R. § 5.6 (d)(3)(ii))

4.2.1 Topography

The Turners Falls Project and Northfield Mountain Project are located in the New England Upland section of the New England physiographic province of Massachusetts. The Connecticut River Valley is a dominant feature within this section. The Connecticut River Valley is generally narrow in the vicinity of the Turners Falls Project and Northfield Mountain Project, with some areas of floodplain characterized by river and stream terrace silt, sand, and gravel. Other areas are characterized by steep rocky banks, especially the French King Gorge area, immediately downstream of the Northfield Mountain Project's tailrace (FirstLight, 2007).

The topography of the Connecticut River Valley is mostly level to rolling, with some higher hills. One such hill is Northfield Mountain, where the Northfield Mountain Project is located. The Northfield Mountain Project's upper reservoir is man-made and was formed using impervious core rock fill structures, a concrete gravity dam, natural features, and excavation of a conveyance channel into bedrock.

The distinctive topography and landforms characterizing the Turners Falls Project and Northfield Mountain Project area developed from the weathering and erosion of underlying geologic units is described in the next section.

4.2.2 Geology

4.2.2.1 *Bedrock Geology*

The Connecticut River Valley was formed by erosion of sedimentary rocks before the glacial period. These sedimentary rocks, largely sandstone, shale, and conglomerate, interspersed with volcanic rocks, were formed about 190 to 200 million years ago in the Jurassic and Triassic period. The bordering uplands are underlain by older, less erodible metamorphic and igneous rocks (Simcox, 1992).

The bedrock geology in the vicinity of the Turners Falls and Northfield Mountain Project is illustrated in Figure 4.2.2.1-1 and described further below.

Turners Falls Project

The bedrock geology surrounding the Turners Falls Project is based on a USGS characterization of near-surface bedrock in the New England region (Robinson & Kapo, 2003). Although the dominant bedrock geology surrounding the Turners Falls Project is sedimentary (such as arkose, siltstone, sandstone, shale, and conglomerate), tilted basalt layers have formed distinctive ridges in many parts of the river valley. The Jurassic-age Holyoke basalt results in a prominent north-south trending ridge from southern Connecticut into central Massachusetts, which then curves to trend east-west in the Holyoke Range.

Northfield Mountain Project

At the Northfield Mountain Project, the pressure shaft, powerhouse, and tailrace were excavated through the bedrock of Northfield Mountain. Several geological investigations were conducted as part of the initial licensing and construction of the Northfield Mountain Project (CL&P et al., 1966). These investigations show that Northfield Mountain is the northwest flank of a broad dome structure having a northeast-southwest axis. The rocks comprising this dome are hard, crystalline metasediments of mid-Paleozoic age. In geologic studies, these have been grouped into two formations, the Dry Hill granite gneiss and the Poplar Mountain gneiss. The Dry Hill granite gneiss has a maximum thickness of about 800 feet and is about 460 feet thick at the powerhouse site. This formation forms the crest of Northfield Mountain. It is overlain and underlain by the Poplar Mountain gneiss, which crops out near the discharge portal of the tailrace tunnel. The Dry Hill granite gneiss consists of massive beds or layers of evenly foliated granite gneiss, ranging in thickness up to 150 feet, separated by relatively thinner members of biotite-rich gneiss. The Poplar Mountain gneiss consists of medium to coarse, feldspathic, biotite-rich granite gneiss interbedded with biotite schists and quartzitic members. While these are hard, durable, crystalline rocks, the Poplar Mountain gneiss is more micaceous and thinly foliated than the Dry Hill granite gneiss. The cover over the bedrock in the upper reservoir area is very thin. Bedrock is exposed in many areas at the ground surface and in other areas covered by a thin mantle of glacial outwash.

Faulting within the area of Northfield Mountain appears to be minimal. The major fault of the area is the Border Fault between the Triassic sandstones of the Connecticut Valley and the meta-sediments. Within the vicinity of the Northfield Mountain Project, the fault lies west of the Connecticut River and well away from structures of the facility.

4.2.2.2 *Surficial Geology*

Surficial geology of the Connecticut River Valley region in the Turners Falls Project and Northfield Mountain Project area was recently updated by the USGS (Stone & DiGiacomo-Cohen, 2010), as illustrated in Figure 4.2.2.2-1[12]. Surficial geologic units in the Northfield Mountain Project upper reservoir area predominantly consist of thin glacial till and shallow bedrock. In the vicinity of the Northfield Mountain Project tailrace, surficial geologic units consist of coarse and fine glacial stratified deposits (sorted and stratified sediments composed of gravel, sand, silt, and clay deposited in layers by glacial meltwater) and floodplain alluvium closer to the river.

Along the Turners Falls Impoundment, surficial geologic units consist primarily of floodplain alluvium, swamp deposits, and early post-glacial stream terrace deposits. The French King Gorge area along the Turners Falls Impoundment consists of bedrock outcrops, thin glacial till, and areas of coarse stratified glacial deposits. Further downstream in the area of the Turners Falls Dam, bypass reach and power canal, surficial geologic units include coarse stratified glacial deposits, stream terrace deposits, floodplain alluvium and bedrock outcrops.

4.2.2.3 *Terrace and Floodplain Surfaces*

A description of the stream terrace deposits along the river was provided in a recent geomorphic characterization of the Turners Falls Impoundment area (Field Geology Services, 2007). This characterization is relied on to describe the geologic history of the terrace and floodplain formations adjacent to the Connecticut River in the Turners Falls Impoundment area.

While the width and orientation of the valley through which the Connecticut River flows is the result of ancient geological processes, the valley bottom is composed of a series of terraces stepping up from the river with the highest and, therefore, oldest geomorphic surface formed since the last Ice Age (i.e., < 15,000 years). These terrace surfaces are seen throughout the Turners Falls Impoundment area. The width of the valley is narrowest through the French King Gorge where the river encounters bedrock nearly continuously. However, only 10% of the channel through the Turners Falls Impoundment encounters bedrock, with most of the channel flowing against glacial, lacustrine, or alluvial sediments.

When glacial ice retreated from the Connecticut River Valley at the end of the last Ice Age great quantities of sediment were washed into the valley from the tributaries and from the glacial ice melting to

[12] No surficial geology information is available for New Hampshire.

the north, forming large deltas. One such delta in Rocky Hill, CT naturally damned the width of the valley and created a long narrow lake, known as Lake Hitchcock, that extended as far north as West Burke, VT. The lake's water surface in the Turners Falls Impoundment area was likely more than 150 feet higher than the current level of the Connecticut River (Field Geology Services, 2007). Tributaries built deltas at the lake's margins that are today the highest terraces in the valley. These areas provide an excellent source of sand and gravel, as evidenced by the gravel pits excavated below their surfaces. The delta front sloped down to the lake bottom, which itself was over 75 feet above the current river level; the terrace on which the town of Northfield rests is a remnant of the old lake bottom surface. Eventually the natural dam holding back Lake Hitchcock was broken and the Connecticut River was able to erode through the old lake sediments.

The river's downcutting was stopped when hard bedrock was encountered as was the case at the deep areas within Barton Cove, where a large waterfall previously existed and carved large plunge pools downstream. Upstream, the river was graded to the top of this bedrock barrier and began eroding laterally into the old lake bottom sediments, creating a wide floodplain. This higher floodplain level was abandoned when the river resumed downcutting. Once reaching a new graded level, the river eroded laterally to create its current floodplain in a process that continues until this day.

4.2.3 Soils

The two dominant soil types associated with abandoned and active floodplains in the Turners Falls Impoundment area are the Hadley very fine sandy loam and the Suncook loamy sand (Field Geology Services, 2007). The stratigraphy of sediments underneath these floodplain surfaces is characterized by poorly consolidated alternating fine sand and silt layers.

The Agawam fine sandy loam is the dominant soil type associated with the older and higher terraces, but several other soil types also occur. The stratigraphy underlying each terrace depends largely on the depositional environment in which the terrace surface formed (e.g., deltaic, lacustrine). In most instances the uppermost sediments exposed in these high banks are well stratified sands with the underlying sediments at river level varying between well sorted sand, cobbly to gravelly sand, or varved lacustrine clays. Given the close proximity in which the varied depositional environments were found, the type of sediment exposed at the base of the high banks along the river can vary over short distances. Bedrock ledge is also intermittently seen at the base of the banks and buried in the sediment above.

The soil survey maps for Franklin County, MA are in the process of being updated. Among other sources, an advance copy (subject to change) of this soil survey was obtained to describe the soil resources in the vicinity of the Turners Falls Project and Northfield Mountain Project. Soil survey data were also obtained for Windham County, Vermont and Cheshire County, New Hampshire. Figure 4.2.3-1 (seven pages) depict the soils types within 2,000 feet of the shoreline in the vicinity of the Turners Falls Project and Northfield Mountain Project, or within the Turners Falls Project and Northfield Mountain Project boundaries. Note that the legend for these figures is located at the end of Figure 4.2.3-1. The top ten soil series, in terms of areal coverage, in the vicinity of the Turners Falls Project and Northfield Mountain Project are listed in Table 4.2.3-1.

Table 4.2.3-1: Description of Common Soil Types in the Vicinity of the Turners Falls Project and Northfield Mountain Project.

Series	Percent Areal Coverage	Description
Windsor	21%	The Windsor series consists of very deep, excessively drained soils formed in sandy outwash or eolian deposits. They are nearly level through very steep soils on glaciofluvial landforms.
Agawam	10%	The Agawam series consists of very deep, well drained soils formed in sandy, water deposited materials. They are level to steep soils on outwash plains and high stream terraces.
Unadilla	9%	The Unadilla series consists of deep and very deep, well drained soils formed in silty, lacustrine sediments or old alluvial deposits. These soils are on valley terraces and lacustrine plains.
Hadley	9%	The Hadley series consists of very deep well drained soils formed in silty alluvium. They are nearly level soils on flood plains.
Chatfield	7%	The Chatfield series consists of well drained and somewhat excessively drained soils formed in till derived from parent materials that are very low in iron sulfides. They are moderately deep to bedrock. They are nearly level through very steep soils on glaciated plains, hills, and ridges.
Yatesville-Holyoke complex	7%	The Yatesville series consists of moderately deep, well drained soils formed in a loamy till. Nearly level to moderately steep soils on hills and ridges. The Holyoke series consists of shallow, well drained and somewhat excessively drained soils formed in a thin mantle of till derived mainly from basalt and red sandstone, conglomerate, and shale. Nearly level to very steep soils on bedrock controlled ridges and hills.
Udorthents	6%	Disturbed soils; cut and fill areas, urban land.
Poocham	3%	The Poocham series consists of very deep well drained soils formed in wind or water deposited silts and very fine sands. They are on terrace escarpments and along deeply dissected drainageways.
Merrimac	2%	The Merrimac series consists of very deep, somewhat excessively drained soils formed in outwash. They are nearly level through very steep soils on outwash terraces and plains and other glaciofluvial landforms.
Tunbridge	2%	The Tunbridge series consists of moderately deep, well drained soils on glaciated uplands. They are formed in loamy till.

Note: Other soil types in the Turners Falls Project and Northfield Mountain Project vicinity each account for less than 2% areal coverage. Official soil series descriptions obtained from NRCS. Franklin County, MA soils survey is an "Advance Copy- Subject to Change."

4.2.4 Reservoir Shoreline and Streambanks

4.2.4.1 *Field Studies*

In the Connecticut River, numerous studies have been conducted since 1979 to characterize streambank conditions of the Turners Falls Impoundment, to understand the causes of erosion, and to identify the most appropriate approaches for bank stabilization. A brief history of these studies is presented below.

1979 – US Army Corps of Engineers

The USACE conducted a study on Connecticut River streambank erosion in Massachusetts, New Hampshire, and Vermont (Simons et al., 1979). This study examined a reach of the Connecticut River from Turners Falls Dam, north to the headwaters of the Wilder Hydro Impoundment in Haverhill, NH, a distance of approximately 141 river miles. Within this reach are impoundments associated with the Turners Falls, Vernon, Bellows Falls, and Wilder Hydroelectric Projects, which are subject to water level fluctuations. The 1979 study identified areas of erosion in the reach, analyzed the causes of bank erosion, and developed solution alternatives. The site identification material contained in the report serves as a comparative baseline for the data collected in subsequent efforts so that changes in erosion sites can be identified.

The Simons et al., (1979) study analyzed the causes of erosion and hydraulic forces associated with free-flowing reaches of the Connecticut River as well as impounded reaches subject to water level fluctuations associated with hydropower projects. The report states that hydraulic forces are greatest in free-flowing reaches of the Connecticut River because the velocity and shear stresses are higher compared to impounded reaches where hydraulic forces are lower. The report states that erosional forces due to impoundment fluctuations were found to be 15-18% of the shear stresses caused by flowing water. In general, however, hydraulic forces in free-flowing reaches were found to be 34% greater than impounded reaches, resulting in a significantly increased susceptibility to major bank erosion in free-flowing reaches compared to impounded reaches. Based on this comparison of hydraulic forces, the report states that riverbanks in impoundments with hydropower impoundment fluctuations are subject to a net decrease in these forces of 16% (+18-34) compared to the natural, free-flowing river.

1991 – US Army Corps of Engineers

In 1990, the USACE conducted a reconnaissance level mapping effort using a similar approach as was used in 1979- the report was published in 1991. The primary objective was to identify erosion areas in the reach from Turners Falls Dam north to the Massachusetts state line, and compare this data to the baseline survey. This study reported that approximately one-third of the 148,000 linear feet of shoreline in this reach was undergoing some form of active erosion (USACE, 1991).

1991 – Northeast Utilities

In 1990, the previous licensee for the Northfield Mountain Project [Northeast Utilities Service Company, Inc. for Connecticut Light and Power (CL&P) and Western Massachusetts Electric Company (WMECO)] conducted a study to examine the erosion conditions in the Turners Falls Impoundment – the study was published in 1991 (Northeast Utilities, 1991). Information on riverbanks was presented, including the percentage of exposed or unvegetated soil, and the percentage of remaining vegetated bank that showed signs of bank movement. Maps classifying erosion areas as: low-moderate, moderate, moderate-severe, and severe were prepared. The methodology utilized field observations and related notes, video recordings and other mapping techniques.

1995- Western Massachusetts Electric Company

In 1995, Western Massachusetts Electric Company submitted the following report as required by FERC "Long Term Riverbank Plan for the Connecticut River between Vernon, Vermont and Turners Falls, Massachusetts" (WMECO, 1995). The plan outlined a process for monitoring riverbank conditions, developing management options and consulting with interested parties.

1999 – Erosion Control Plan

In 1999, an Erosion Control Plan (ECP) was developed by Simons & Associates (S&A) for the previous Licensee to address riverbank erosion in the Turners Falls Impoundment. The ECP (S&A, 1999) was developed in response to concerns over riverbank erosion and pursuant to relevant articles of FERC licenses for the Turners Falls and Northfield Mountain Projects. FERC subsequently approved the ECP.

The ECP summarizes field observations made in July 1998 including the distribution of: bank height, bank slope, bank material, degree of vegetation, and risk features along the Turners Falls Impoundment. A list of 20 riverbank segments where erosion was most severe were identified as priority sites to be considered for stabilization. Management measures for erosion control in the ECP included: restoration of eroded riverbank segments, preventative maintenance that will minimize or prevent future erosion, and maintenance and monitoring of the restored sites.

The ECP is being implemented in cooperation with the Connecticut River Streambank Erosion Committee (CRSEC), of which the Licensee is a member. This ad hoc committee provides an established forum for the Licensee to coordinate with resource agencies and local landowners on erosion control projects and issues. One provision in the ECP requires the Licensee to periodically repeat the classification and prioritization process at 3- to 5-year intervals during the remaining term of the current FERC license.

Full River Reconnaissance Studies

To comply with the requirements of the ECP, a series of Full River Reconnaissance (FRR) studies were conducted by the Licensee (and its predecessors) to document existing bank conditions within the Turners Falls Impoundment of the Connecticut River. These studies were conducted by S&A in July of 1998 for the ECP as referenced above (S&A, 1999), New England Environmental (NEE) in July of 2001 (NEE, 2001), NEE in November of 2004 (NEE, 2005), and most recently by S&A in November of 2008 (S&A, 2009). The 2008 FRR report concluded that the rate of erosion in the Turners Falls Impoundment is decreasing, and the erosion control measures implemented by FirstLight in consultation with stakeholders have been effective. FirstLight plans to conduct the next FRR in the fall 2013.

4.2.4.2 *Shoreline and Streambank Characterization*

The Northfield Mountain Project upper reservoir shoreline is composed of constructed dikes created with fill material from excavation areas during the construction of the Northfield Mountain Project. Additional bank types include steep areas cut into bedrock, particularly at the intake canal, and gently sloping unvegetated areas that are alternately exposed and inundated in response to changing water levels.

Streambank characteristics of the Turners Falls Impoundment, such as steepness, material type, degree of vegetative cover, and type and severity of erosion, were documented in the 2008 FRR (S&A, 2009). It was reported that riverbanks in the Turners Falls Impoundment generally consist of an upper bank that is often above water except during high flow conditions, and a lower bank that is frequently submerged. These banks consist of a range of materials from silt or sand to solid rock.

According to the latest data collected as part the 2008 FRR effort (S&A, 2009), 83.3% of the approximately 246,000 linear feet of total riverbank length (including islands) in the Turners Falls Impoundment is stable. Erosion of various types and severity was found in the remaining riverbanks; less than 1% (1,500 feet) of riverbanks were classified as undergoing extensive erosion. The report notes that most of the extensive erosion is caused by the extreme and unique hydraulic conditions just downstream of the Vernon Dam and at the Route 10 Bridge.

Table 4.2.4.2-1 summarizes the bank type of non-eroding banks originally presented in S&A, 2009. Also from S&A, (2009), a distribution of streambank vegetation, sediment composition, and erosion types is presented in Table 4.2.4.2-2.

Table 4.2.4.2-1: Classification of Non-Eroding Banks in 2008.

Non-Eroding Banks	Length (feet)	Percentage*
Rock (natural outcrop)	27,584	11.2
Rip-Rap	25,900	10.5
Bio-Engineering	12,455	5.1
Natural (primarily silt/sand with varying degrees of vegetation)	139,214	56.5

**Percentage of total length*
Source: S&A, 2009

Table 4.2.4.2-2: Distribution of Vegetation, Sediment, and Erosion Types of the Turners Falls Impoundment

Parameter/ Description	% of Overall Riverbank & Island Length
Upper Riverbank Vegetation	
Heavy	35.5
Moderate	59.9
Sparse	3.0
Very Sparse to None	1.7
Lower Riverbank Sediment Type	
Rock	11.2
Boulders	10.0
Cobbles	10.1
Gravel	3.2
Silt/Sand	65.5
Type of Mass-Wasting	
Little/None	83.3
Slide	7.2
Notching	0.1
Undercut	3.9
Overhanging	5.6

Source: S&A, 2009.

4.2.4.3 *Geomorphic Studies*

2007- Field Geology Services Study

Between the 2004 and 2008 FRR, the Licensee retained John Field of Field Geology Services (FGS), a fluvial geomorphologist, to conduct a study of the Turners Falls Impoundment between Vernon, VT and Turners Falls, MA to analyze the causes of bank erosion and identify the most appropriate methods for bank stabilization on this section of river (Field Geology Services, 2007). The study had two principal objectives related to bank erosion and bank stabilization efforts in the Turners Falls Impoundment: 1) determine the success of previous bank stabilization efforts; and 2) identify the most appropriate techniques for bank stabilization given the current hydraulic conditions.

The study reported that bank erosion is currently caused by a complex interaction of multiple factors operating through time and space. Erosion is a naturally occurring phenomenon that is present even on rivers in equilibrium where erosion is offset by an equal amount of deposition in adjacent areas.

Even along unaltered rivers, some erosion is caused by natural flood flows. Riverbanks in the Turners Falls Impoundment are particularly sensitive to natural flood flows due to the dominance of noncohesive fine-grained soils deposited on the bed of Glacial Lake Hitchcock (the large lake that formed in the current Connecticut River valley as ice melted at the end of the last ice age approximately 15,000 years ago). The study reported that natural stability is further compromised because past channel incision through older terrace and floodplain surfaces (former lake bed deposits) confine more floodwaters to the channel rather than spreading out across broad floodplains.

The report states that natural patterns of erosion have, to some extent, been altered by human use of the upstream river and adjacent valley. For example, the flood control dams constructed by the USACE on tributaries to the Connecticut River following the devastating floods of the 1930s and hydropower facilities on the Connecticut River cause variations in flow and water level. The report notes that extensive land clearing along the river, following European settlement, has likely increased the susceptibility of the river banks to erosion.

2012 Report – Analysis of Erosion in the Vicinity of the Route 10 Bridge Spanning the Connecticut River (S&A, 2012a)

Because questions were raised about the feasibility of effective erosion control repairs in the vicinity of the Route 10 Bridge, the Licensee proposed to implement erosion control measures at the site only if a subsequent study determined that Turners Falls Project and Northfield Mountain Project operations are the primary cause of erosion. FERC and other involved parties agreed with this approach. As a result, the Licensee retained S&A to analyze erosion in the vicinity of the Route 10 Bridge (S&A, 2012a), a segment of the riverbank that includes the area just upstream of the Route 10 Bridge on the east bank of the Connecticut River. The report confirms previous findings that this eroded segment of the Connecticut River is the result of unique hydraulic phenomena unrelated to the existence or operation of FirstLight's hydropower facilities in the Turners Falls Impoundment. The erosion is caused by a sharp bend in the river, rapid and dramatic change in depth, and the presence of a rock formation that juts into the flow pattern. These flow patterns cause additional turbulence and acceleration/deceleration of the velocity of the water flowing through this reach.

2012 Report – Riverbank Erosion Comparison along the Connecticut River (S&A, 2012b)

The Licensee also retained S&A to compare geomorphic conditions in the Turners Falls Impoundment to other Connecticut River reaches (S&A, 2012b). The resulting report analyzes erosion sites that were documented photographically in 1998 and again in 2008, in the Holyoke, Turners Falls, Vernon, and Bellow Falls Impoundments. The report notes that erosion was continuing in all but one of the 23 sites evaluated in the Holyoke, Vernon, and Bellow Falls Impoundments. In contrast, in the Turners Falls Impoundment, most of the eroded sites were either stabilized, in the process of stabilization through erosion control measures, or experiencing some degree of natural stabilization. The report also evaluates other segments of the Connecticut River and determines that the segment of the river with the greatest extent of eroding riverbanks is the free-flowing reach of the Connecticut River farther upstream of these four impoundments. Based on these comparisons, the report concludes that the Turners Falls Impoundment is in better condition than all other reaches of river studied.

4.2.4.4 *Streambank Restoration Efforts*

According to the latest data collected as part of 2008 FRR, of the stable riverbanks (where no significant erosion is found), 10.5% (25,900 feet) have been rip-rapped (this includes historical work by the USACE), 5.1% (12,455 feet) have been stabilized with bio-engineering techniques, and 0.8% (2,000 feet) have received preventative maintenance. Since the 2008 FRR, additional erosion control measures have been completed between 2009 and 2012 under Phase 3 of FirstLight's riverbank erosion program, as shown in Figure 4.2.4.4-1. Table 4.2.4.4-1 lists the streambank repair and restoration efforts performed by FirstLight since the approval of the ECP in 1999. Through 2013, a total of 18,605 feet of streambank will have been stabilized by FirstLight under the ECP. FirstLight intends to conduct the next FRR in 2013 to inform the development and implementation of Phase 4 erosion control measures.

Table 4.2.4.4-1: Summary of Riverbank Restoration Initiatives since 1999.

1999 Erosion Control Plan (ECP) Reference				Current Reference Name	ECP Length (ft)	Repaired Length (ft)	Date Stabilized/ Scheduled	Comments
Site #		Location[1] (mile marker)						
1		0.1	L	Adjacent to Vernon Dam	827	-	-	-
2		18.8	L	Turners Falls Rod & Gun	20	240	2004	complete
3		9.4	R	Bennett Meadows	100	100	2005	complete
4		11.0	R	Urgiel Upstream[2]	1150	1200	2001	complete
5		9.2	L	Route 10	730	-	-	-
6		12.5	L	Skalski	1640	1600	2004	complete
7		12.5	R	Flagg	2180	2500	1999-2000	complete
8		8.5	R	Opposite Great Meadow	630	-	-	-
9		5.25	R	Kendall	260	915	2007	complete
10		15.6	L	River Road	500	980	2003	complete
11		11.4	R	Urgiel Downstream[2]	690	980	2005	complete
12		15.4	L	Durkee Point	20	500	2003	complete
13		15.5	R	Split River Farm	20	1725	2009	complete, monitoring ongoing
14		7.3	L	Country Road	230	850	2006	complete, includes Site # 20
15		1.5	R	part Stebbins Island	210	-	-	-
16	a	14.75	R	Upper Split River 1	4000	1360	2010	complete, monitoring ongoing
16	b	14.5	R	Upper Split River 2		1000	2011	complete (additional plantings needed), monitoring ongoing
16	c	14.25	R	Bathory - Gallagher[3]		1250	2012	
16	d	14.0	R	Wallace - Watson[3]	-	1000	2013	
17		19.0	L	Montague	560	1000	2008	complete, preventative maintenance
18		19.0	R	Campground Point	700	1000	2008	complete, preventative maintenance
19		3.1	R	below Davenport Island	450	-	-	-
20		7.0	L	Country Road	480	-	2006	complete, combined with Site # 14
-		17-19	R	Gill Camps (various)	est.	130	2011-12	complete
-		17-19	L	Montague Camps (various)	est.	170	2011-12	complete

[1]"L" is easterly side of river, "R" is westerly side. Vernon Dam is mile-marker 0.0, Turners Falls Dam is approximately mile-marker 20.4.
[2]Includes USEPA section 319 co-funding [reference # 96-03/319 (Crooker), 00-04/319 (Urgiel Upstream), 03-07/319 (Urgiel Downstream)].
[3]These sites are currently proposed—in permitting phase. Lengths are estimated.

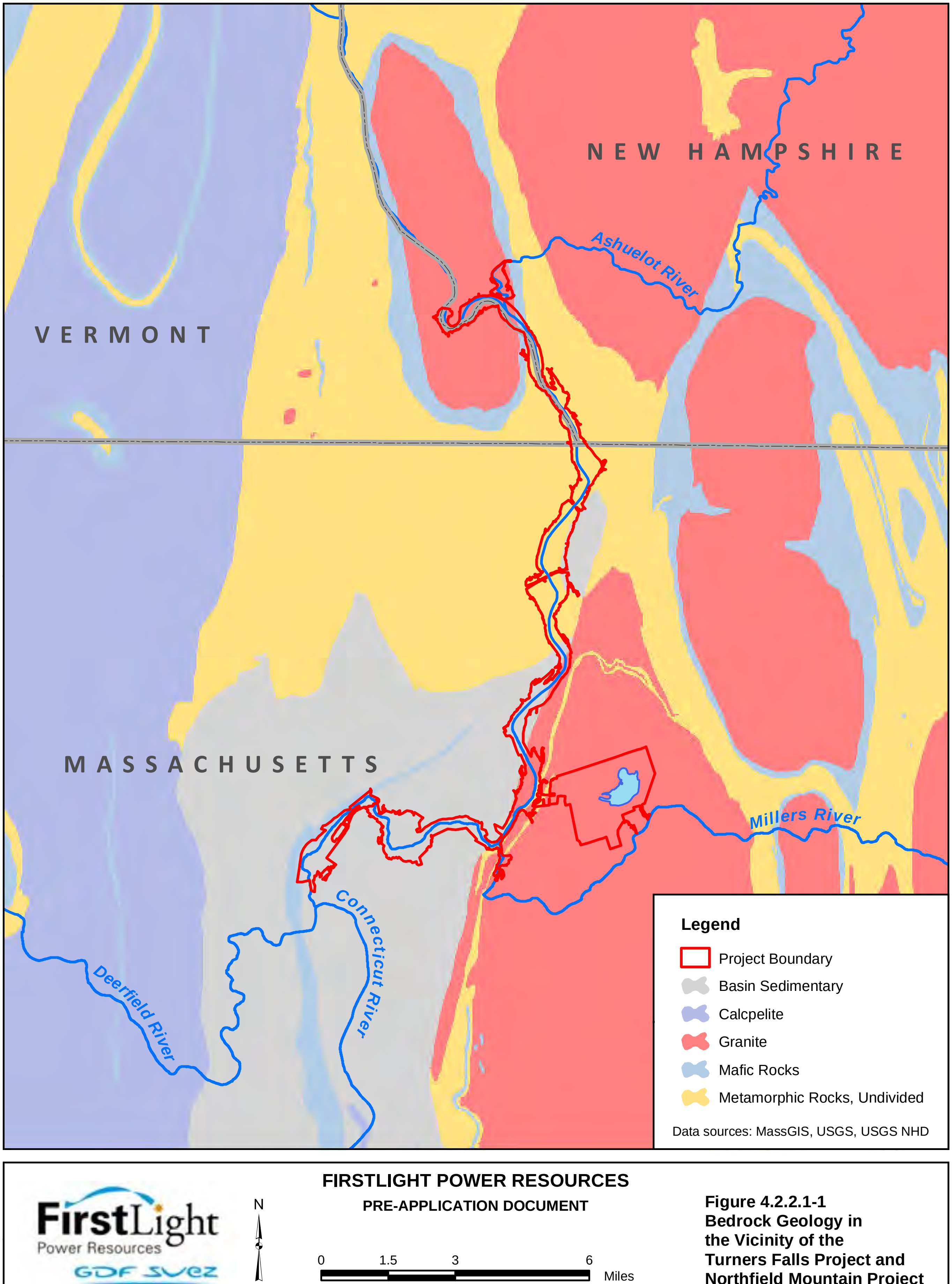

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Figure 4.2.2.1-1
Bedrock Geology in the Vicinity of the Turners Falls Project and Northfield Mountain Project

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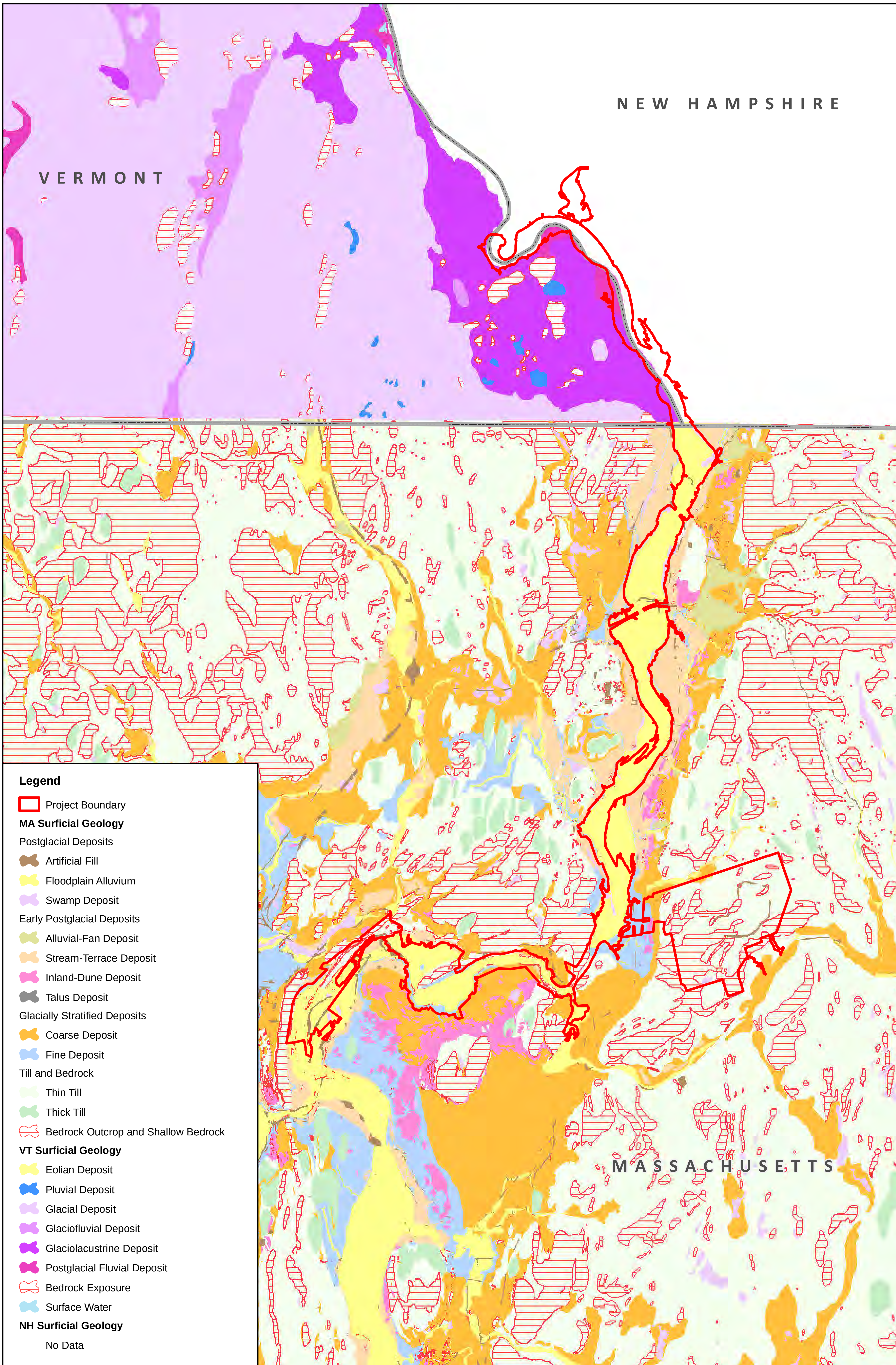

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PRE-APPLICATION DOCUMENT

0 0.75 1.5 3 Miles

Figure 4.2.2.2-1
Surficial Geology in the Vicinity of the Turners Falls Project and Northfield Mountain Project

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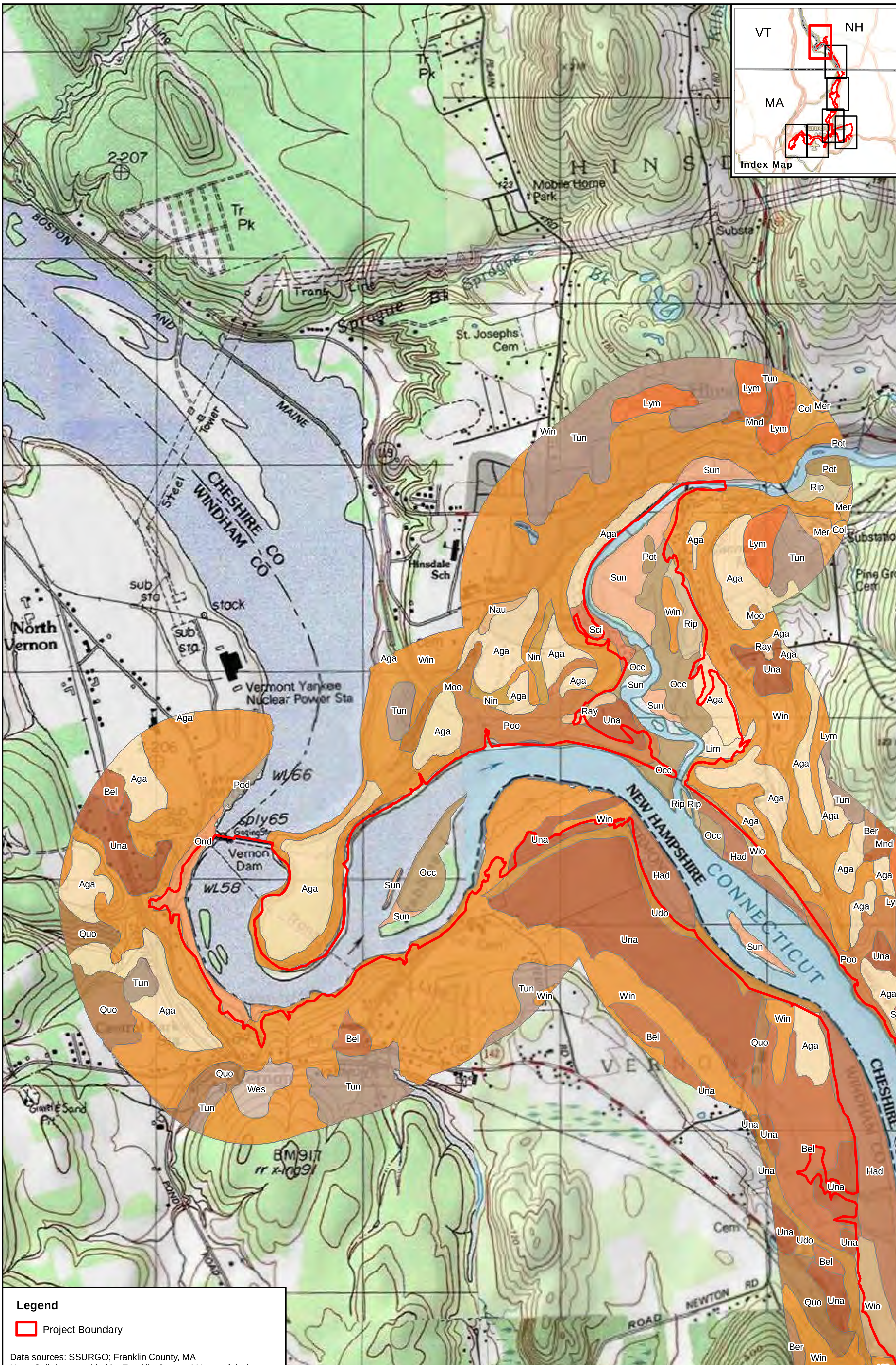

FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

0 750 1,500 3,000 Feet

Figure 4.2.3-1
Soils in the Vicinity of the Turners Falls and Northfield Mountain Projects

Page 1 of 8

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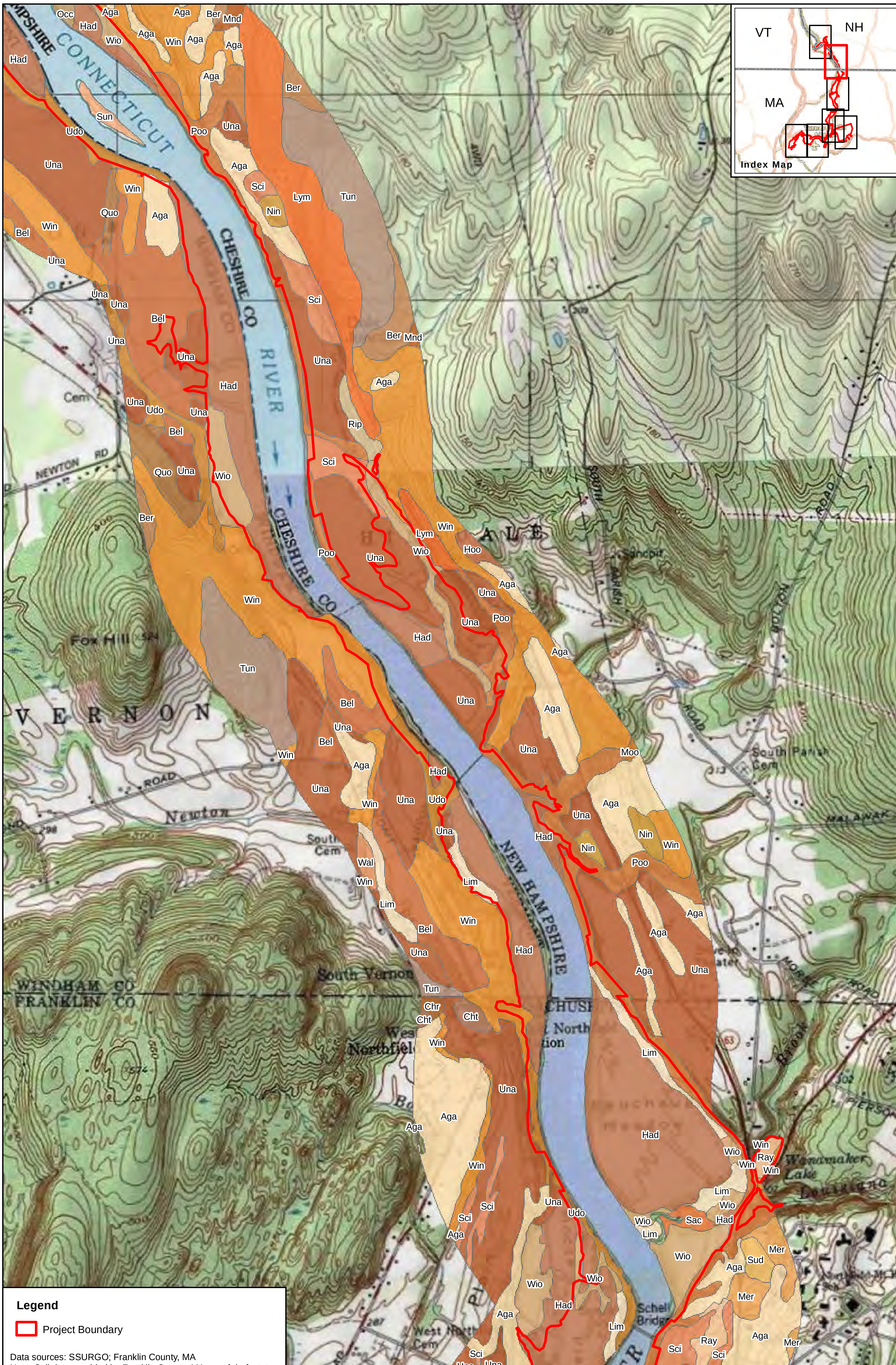

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PRE-APPLICATION DOCUMENT

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Figure 4.2.3-1
Soils in the Vicinity of the Turners Falls and Northfield Mountain Projects

Page 2 of 8

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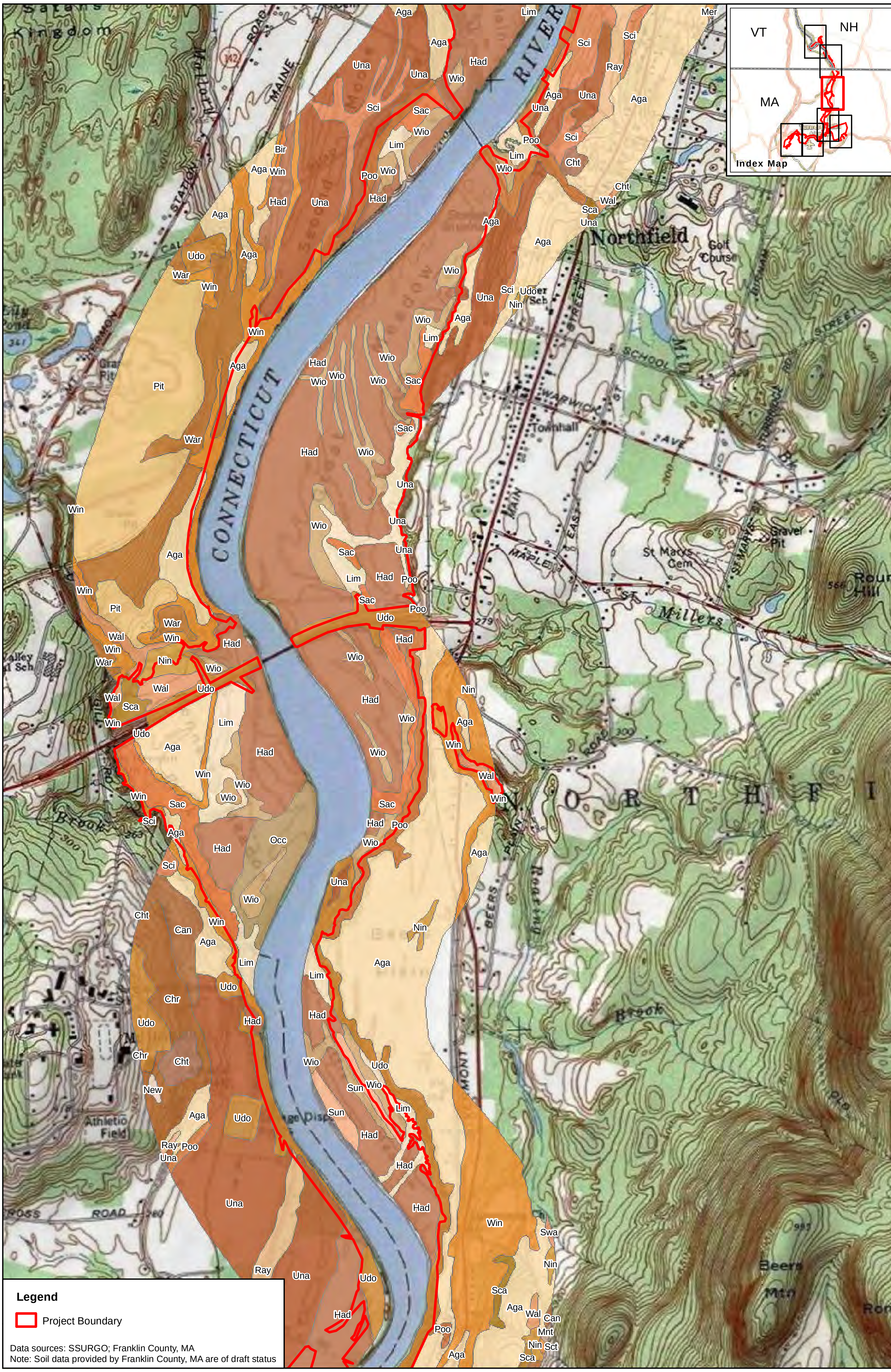

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FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

0 750 1,500 3,000 Feet

Figure 4.2.3-1
Soils in the Vicinity of the Turners Falls and Northfield Mountain Projects

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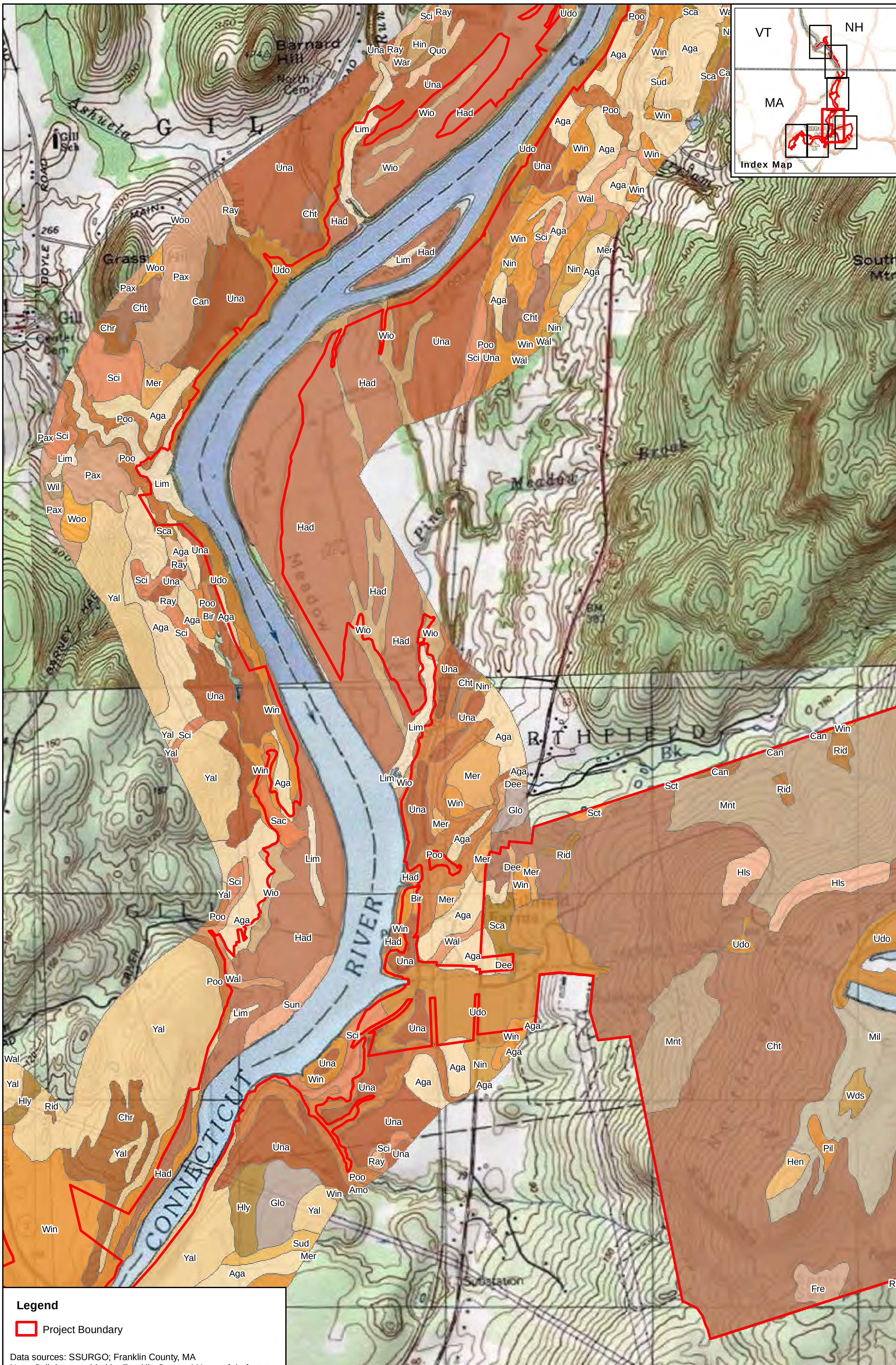

FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

0 750 1,500 3,000 Feet

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FirstLight Power Resources GDF SUEZ

Figure 4.2.3-1
Soils in the Vicinity of the Turners Falls and Northfield Mountain Projects

Page 4 of 8

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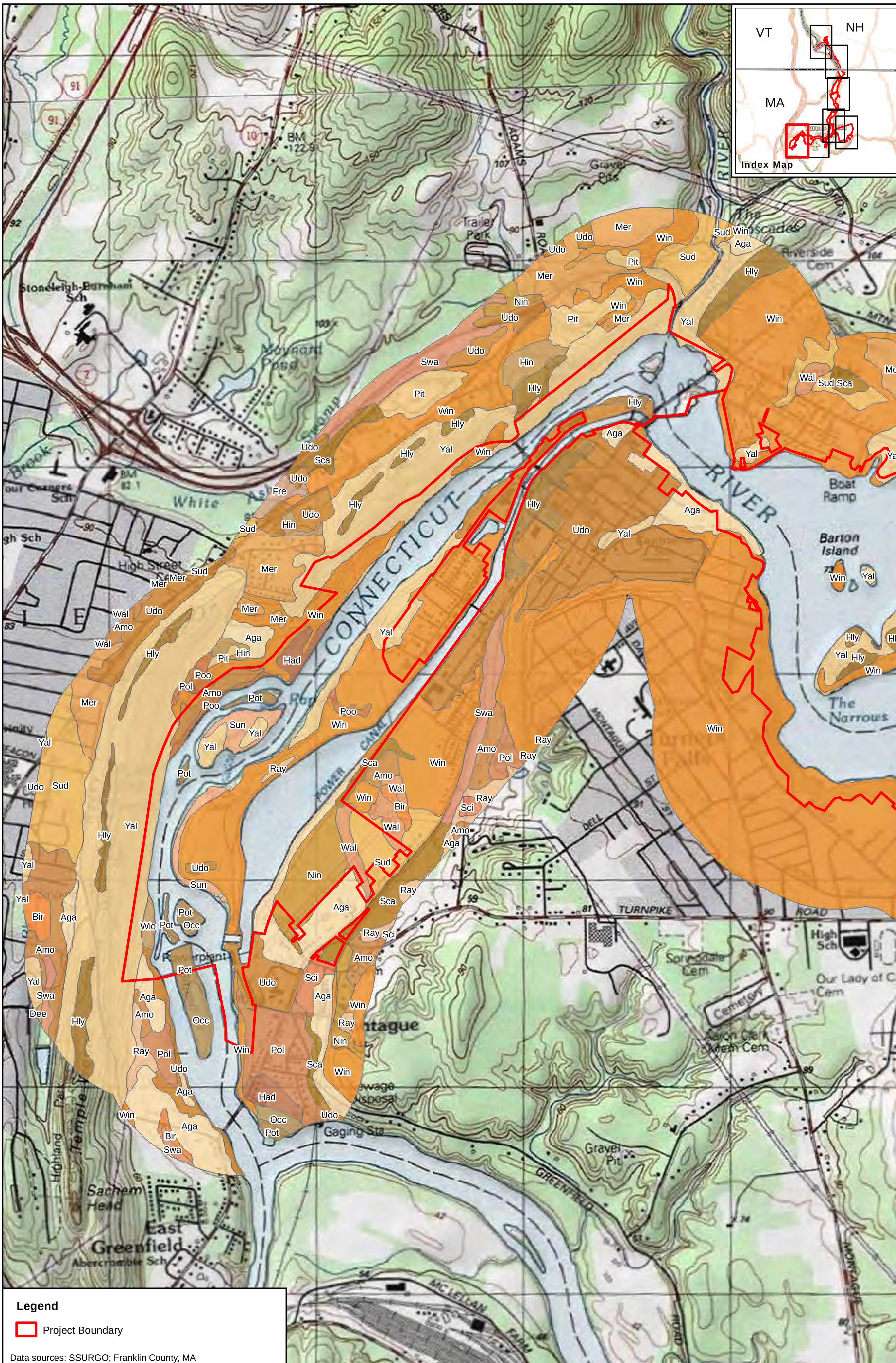

Legend

Project Boundary

Data sources: SSURGO; Franklin County, MA
Note: Soil data provided by Franklin County, MA are of draft status

FirstLight Power Resources
GDF SUEZ

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FIRSTLIGHT POWER RESOURCES
PRE-APPLICATION DOCUMENT

0 750 1,500 3,000 Feet

Figure 4.2.3-1
Soils in the Vicinity of the Turners Falls and Northfield Mountain Projects

Page 5 of 8

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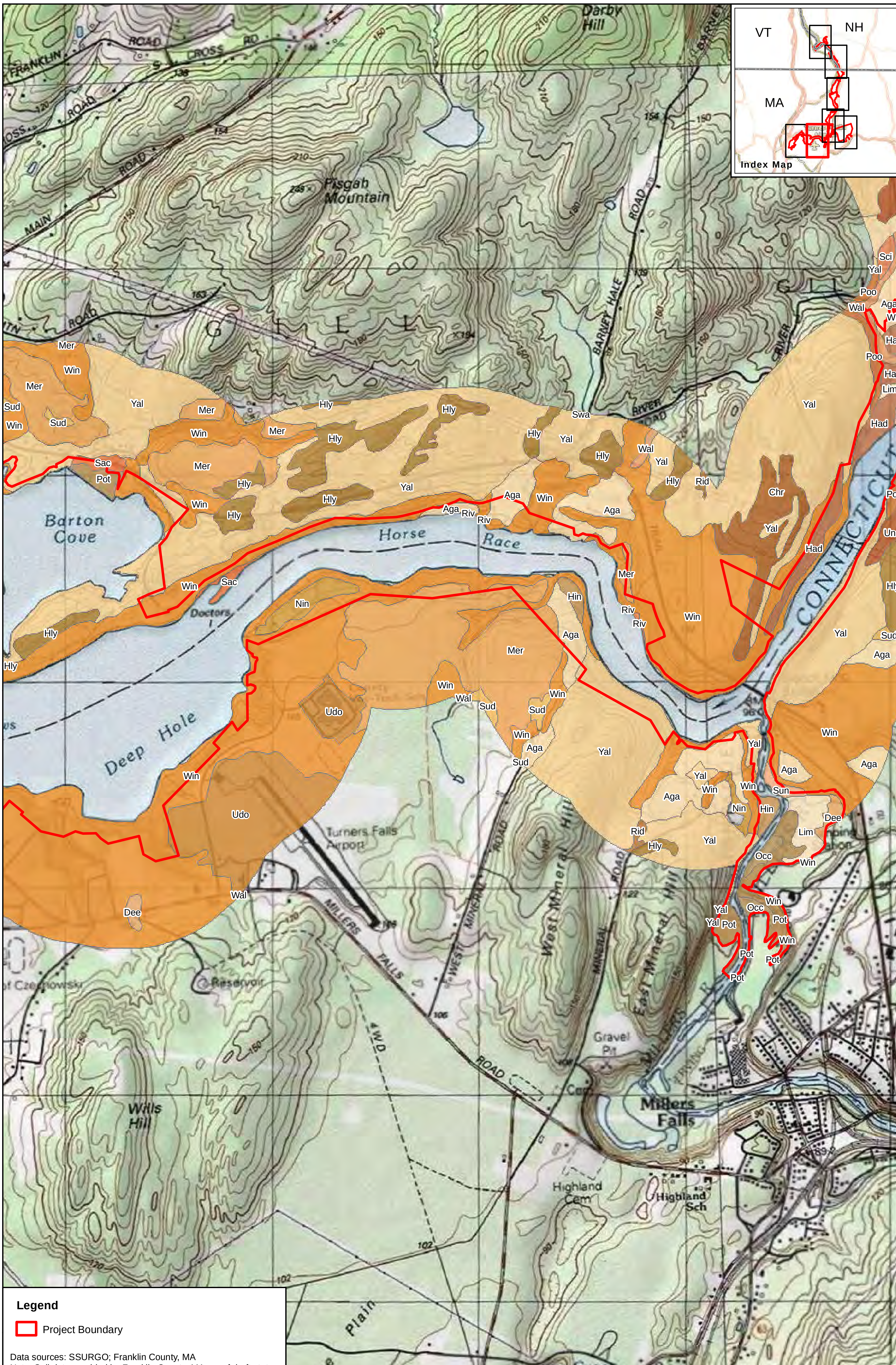

Legend

Project Boundary

Data sources: SSURGO; Franklin County, MA
Note: Soil data provided by Franklin County, MA are of draft status

FirstLight Power Resources

GDF SUEZ

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FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

0 750 1,500 3,000 Feet

Figure 4.2.3-1
Soils in the Vicinity of the Turners Falls and Northfield Mountain Projects

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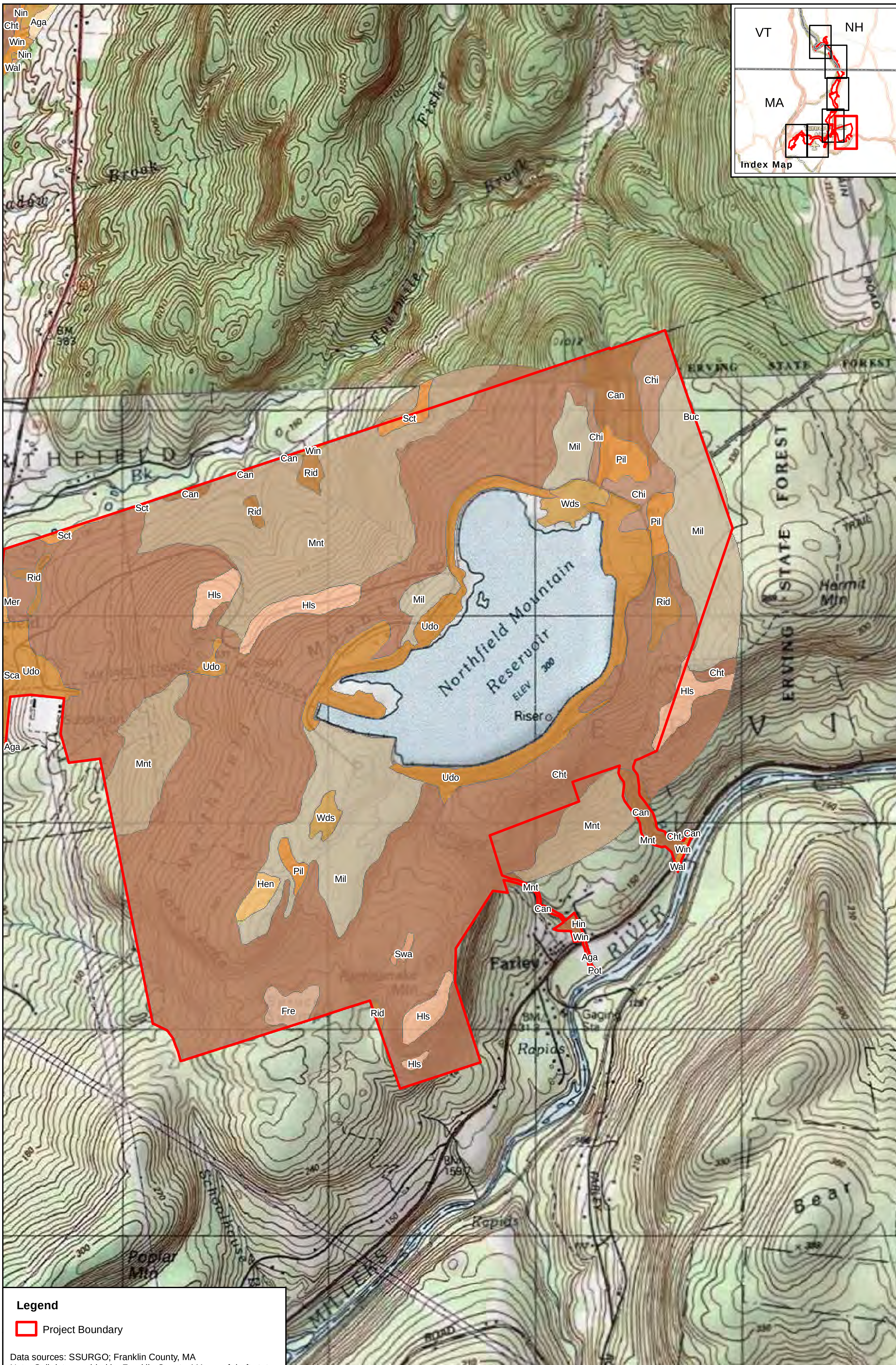

FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

0 750 1,500 3,000 Feet

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Figure 4.2.3-1
Soils in the Vicinity of the Turners Falls and Northfield Mountain Projects

Page 7 of 8

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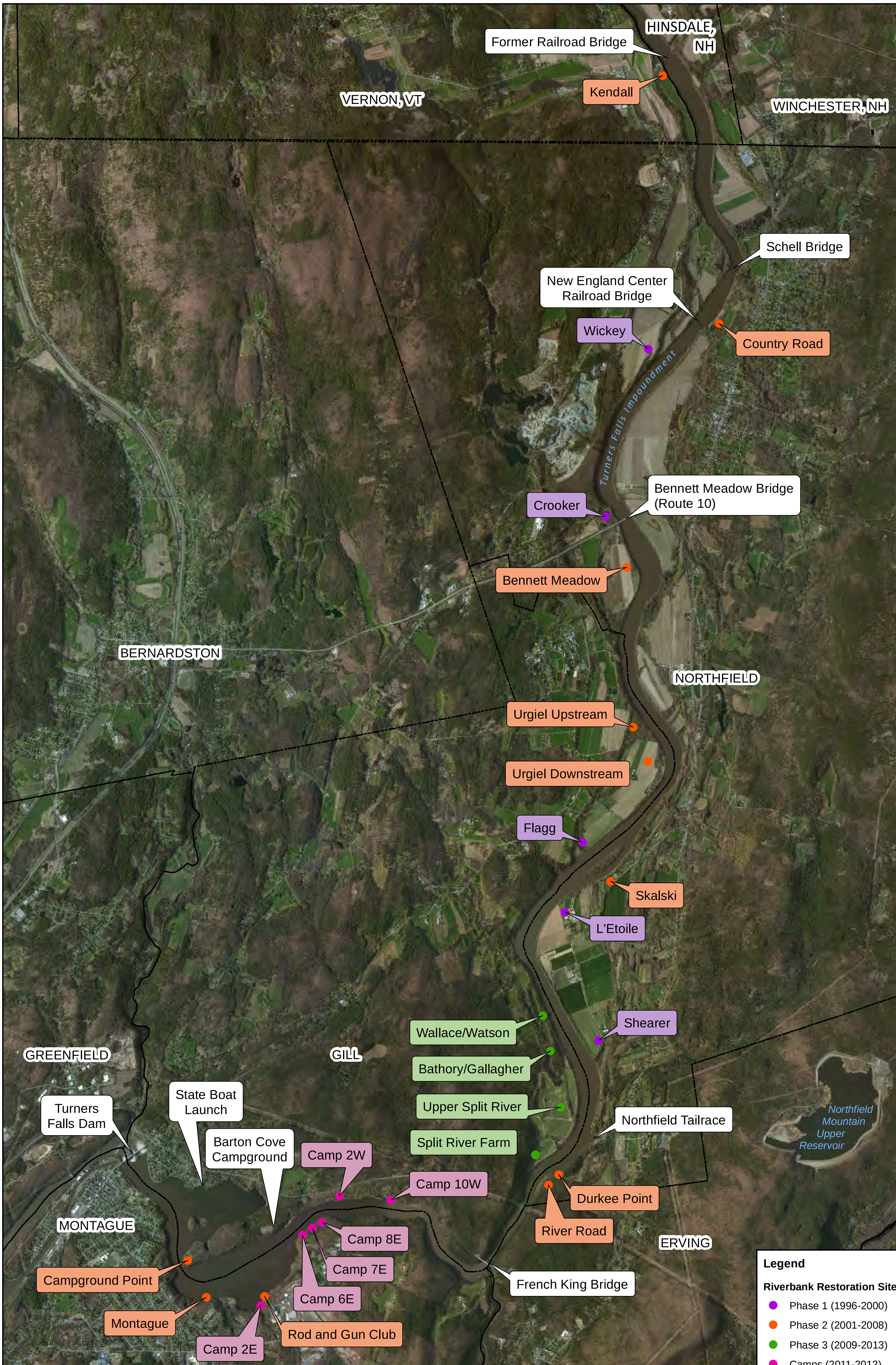
Figure 4.2.3-1:
Legend for Soils in the Vicinity of the
Turners Falls and Northfield Mountain Projects
(Page 8 of 8)

- Aga -- Agawam
- Amo -- Amostown
- Bel -- Belgrade
- Ber -- Berkshire
- Bir -- Birdsall
- Buc -- Bucksport
- Can -- Canton
- Chi -- Chichester
- Chr -- Charlton
- Cht -- Chatfield
- Col -- Colton
- Dee -- Deerfield
- Fre -- Freetown
- Glo -- Gloucester
- Had -- Hadley
- Hen -- Henniker
- Hin -- Hinckley
- Hls -- Hollis
- Hly -- Holyoke
- Hoo -- Hoosic
- Lim -- Limerick
- Lym -- Lyman
- Mer -- Merrimac
- Mil -- Millsite
- Mnd -- Monadnock
- Mnt -- Montauk
- Moo -- Moosilauke
- Nau -- Naumburg
- New -- Newfields
- Nin -- Ninigret
- Occ -- Occum
- Ond -- Ondawa
- Pax -- Paxton
- Pil -- Pillsbury
- Pit -- Pits, gravel
- Pod -- Podunk
- Pol -- Pollux
- Poo -- Poocham
- Pot -- Pootatuck
- Quo -- Quonset
- Ray -- Raynam
- Rid -- Ridgebury
- Rip -- Rippowam
- Riv -- Riverwash
- Sac -- Saco
- Sca -- Scarboro
- Sci -- Scio
- Sct -- Scituate
- Sud -- Sudbury
- Sun -- Suncook
- Swa -- Swansea
- Tun -- Tunbridge
- Udo -- Udorthents
- Una -- Unadilla
- Wal -- Walpole
- War -- Warwick
- Wds -- Woodstock
- Wes -- Westbury
- Wil -- Wilbraham
- Win -- Winsdor
- Wio -- Winooski
- Woo -- Woodbridge
- Yal -- Yalesville-Holyoke complex



FirstLight Power Resources
GDF SUEZ

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FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

0 0.5 1 2 Miles

Figure 4.2.4.4-1
Existing and Proposed Construction Sites
FirstLight - Connecticut River
Turner Falls Impoundment, MA - Vernon Dam, VT

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4.3 Water Resources (18 C.F.R. § 5.6 (d)(3)(iii))

4.3.1 Water Quantity

The Connecticut River drains an area of 11,250 mi^2. Within Massachusetts, the Connecticut River traverses approximately 67 river miles and drains approximately 2,726 square miles. The total watershed area upstream of the Turners Falls Dam is 7,163 mi^2 (Wandle, 1984).

4.3.1.1 *Upstream Dams*

Inflows to the Turners Falls Impoundment are largely controlled by operations at several upstream dams on the Connecticut River. More specifically, five upstream dams operate as seasonal storage reservoirs, where water elevations are typically lowered in the fall and winter, and refilled with the spring freshet. The seasonal operation and re-regulation of discharges from these dams provides benefits to downstream hydropower facilities by curtailing high flows in the spring and increasing low flows in the summer for the benefit of hydropower production. These dams and storage volumes, in upstream to downstream order, include the following:

- First Connecticut Lake, 3.33 billion ft^3
- Second Connecticut Lake, 506 million ft^3
- Lake Francis, 4.326 billion ft^3
- Moore Reservoir, and 4.97 billion ft^3
- Comerford Reservoir. 1.279 billion ft^3

Pursuant to a 1993 Headwater Benefit Agreement among predecessor companies and TransCanada, FirstLight pays an annual headwater benefit fee to TransCanada for the seasonal operation of its storage reservoirs (primarily driven by Moore Reservoir), which provides an incremental increase in generation at Cabot and Station No. 1. The Northfield Mountain Project does not receive any benefit as its operation is independent of river flows.

In addition to the seasonal storage reservoirs, the next three projects (operated by TransCanada) above Turners Falls Dam - namely Vernon, Bellows Falls, and Wilder - operate as peaking hydropower facilities, whereby flows can fluctuate on an hourly basis. Like Turners Falls Dam, the minimum flow at Vernon Dam is equivalent to 0.2 cfs per square mile of drainage area or 1,250 cfs, which is provided from generation. The Vernon Hydroelectric Project has a station hydraulic capacity of 17,130 cfs[13] and when operating at full capacity, it exceeds the full hydraulic capacity of the Turners Falls Project of 15,938 cfs, not accounting for incremental inflow from the 897 mi2 between the two dams. The magnitude and timing of discharges from the Vernon Hydroelectric Project are critical to the operation of the Turners Falls Project and Northfield Mountain Project.

Vernon Hydroelectric Project FERC license Article 304[14] requires TransCanada to coordinate project operations with FirstLight. A letter Agreement amending the original 1993 Headwater Benefit

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[13] FERC Order Amending License and Revising Annual Charges, Project No. 1904-042, July 28, 2006.

[14] Article 304 was added to the license in 1992 (59 FERC ¶62,267) and generally requires the Licensee of Project No. 1904 (Vernon Hydroelectric Project) to develop and file with the Commission a coordination agreement with the licensee of certain downstream facilities in the event that the regional central dispatch system or NEPEX was ever discontinued. The dispatching of these hydropower projects under that system was discontinued several years ago in connection with the restructuring of the New England power markets.

Agreement was filed with FERC on June 20, 2003. The Agreement requires TransCanada to provide FirstLight by 10:00 am each day, with its estimate of total discharge (cfs-hours) expected the next day at the Vernon Project. When TransCanada receives the hourly dispatch schedule for the next day from the ISO-NE, it faxes or emails the schedule for Vernon discharges to FirstLight between 4:00 and 6:00 pm. There is no current requirement, however, for TransCanada to provide an hourly dispatch schedule the day ahead. If any subsequent dispatch schedules are received during the day showing changes in the projected hourly release schedules, the revised schedule for Vernon is faxed or emailed to FirstLight. Not having reliable and timely estimates of Vernon's hourly release schedule the day ahead does prevent FirstLight from the most efficient management of the Turners Falls Impoundment for power production.

4.3.1.2 *USGS Gaging Stations*

USGS streamflow monitoring gages on the Connecticut River and on tributaries to the Connecticut River in the Turners Falls Project and Northfield Mountain Project areas are described below and shown in Figure 4.3.1.2-1.

Connecticut River at North Walpole, NH (No. 01154500, 5,493 mi^2).

This gage is located upstream of the Vernon Dam, in Vernon, VT. Between the North Walpole gage and the Turners Falls Dam are the Vernon Hydroelectric Project, the Vermont Yankee Nuclear Project, and the Northfield Mountain Project. The gage has a period of record from March 1942 to present. USGS notes that the flow measured at this gage is regulated by powerplants and by reservoirs in the watershed, including First Connecticut and Second Connecticut Lakes, Lake Francis, and Moore and Comerford Reservoirs.

Using the gage's period of record, annual and monthly flow duration curves were developed as shown in Figure 4.3.1.2-2 through Figure 4.3.1.2-6. The annual and monthly mean and median flows, and flow per square mile of drainage area, are shown in Table 4.3.1.2-1.

Connecticut River at Vernon, VT (No. 01156500, 6,266 mi^2)

Over 87% of the drainage area at the Turners Falls Dam is from inflow received by the Vernon Hydroelectric Project. The remaining 13% of drainage area is from tributaries to the Turners Falls Impoundment, primarily the Ashuelot and Millers rivers. A USGS gage was located directly below Vernon Dam, and was active from approximately Oct 1944 to Sep 1973, but was discontinued by the USGS when the Turners Falls Dam was raised causing the backwater to extend to the base of Vernon Dam, thus impacting the gage's rating curve. Using the gage's historic average daily flow data (Oct 1944-Sep 1973), an annual and monthly flow duration curves were developed as shown in Figure 4.3.1.2-7 through Figure 4.3.1.2-11. With the Vernon Hydroelectric Project having a hydraulic capacity of 17,130 cfs, on an annual basis, TransCanada can control discharges into the Turners Falls Impoundment approximately 84% of the time; 16% of the time Vernon's hydraulic capacity is exceeded. The annual and monthly mean and median flows, and flow per square mile of drainage area, are shown in Table 4.3.1.2-2.

Ashuelot River at Hinsdale, NH (No. 01161000, 420 mi^2)

The Ashuelot River enters the Turners Falls Impoundment approximately 3.5 miles upstream of the Massachusetts border from the east. Ashuelot River flows are regulated by the USCOE's Surry Mountain Lake 33 miles upstream (since 1942), the USCOE's Otter Brook Lake, 29 miles upstream on Otter Brook (since 1958), and by small hydro plants upstream. The Ashuelot River gage became active in 1907.

Millers River at Erving, MA (No. 01166500, 372 mi^2)

This gage is located 5.5 miles upstream of the mouth of the Millers River. The Millers River enters the Turners Falls Impoundment approximately 4.0 miles upstream of the Turners Falls Dam, immediately downstream of the French King Bridge. Millers River flows are regulated by powerplants and by Lake Monomonac and other reservoirs; high flow is regulated by the USCOE's Birch Hill Reservoir, 22 miles upstream (since 1941) and Tully Lake (since 1948). The Millers River gage became active in 1915.

Deerfield River near West Deerfield, MA (No. 01170000, 557 mi^2)

This gage is located 9.2 miles upstream of the mouth of the Deerfield River, which enters the Connecticut River mainstem approximately 3,500 feet below the Cabot Station tailrace. Deerfield River flows are regulated by Somerset Reservoir (since 1913), by Harriman Reservoir (since 1924), and by several powerplants upstream. The period of record for this gage includes discharge records from March to November 1904, January 1905, March to December 1905, and October 1940 to current year.

Connecticut River at Montague City, MA (No. 01170500, 7,860 mi^2)

This gage is located downstream of Cabot Station and approximately 1,000 feet downstream from the mouth of the Deerfield River (total drainage area of 663 mi^2). The gage has a period of record from April 1940 to present. USGS remarks for the gage indicate that flow is regulated by powerplants and by upstream reservoirs in the watershed.

Using the gage's period of record, annual and monthly flow duration curves were developed as shown in Figures 4.3.1.2-12 through Figure 4.3.1.2-16. The annual and monthly mean and median flows, and flow per square mile of drainage area, are shown in Table 4.3.1.2-3.

Estimated Connecticut River Flow at Turners Falls Dam (7,163 mi^2)

The Connecticut River flow at the Turners Falls Dam was estimated using the Montague and Deerfield River USGS gages for overlapping periods of record. The additional drainage area at the Montague gage compared to the Turners Falls Dam is 697 mi^2, of which the bulk of the increase is attributable to the Deerfield River (557 mi^2 as measured at the USGS gage and 665 mi^2 as measured at its the confluence with the Connecticut River). The Deerfield River gage flow data was prorated by a factor of 1.25 (697/557) to represent the additional inflow from the 697 mi^2 drainage area. This prorated flow was then subtracted from the corresponding flow measured at the Montague gage to estimate flows at Turners Falls Dam.

Annual and monthly flow duration curves for the period Jan 1941 through Sep 2011 were calculated for Turners Falls Dam, and are presented in Figure 4.3.1.2-17 through Figure 4.3.1.2-21. With the Turners Falls Hydroelectric Project having a hydraulic capacity of 15,938 cfs, on an annual basis, FirstLight can control discharges from the Turners Falls Project approximately 71% of the time; 29% of the time the Turners Falls Project's hydraulic capacity is exceeded. The annual and monthly mean and median flows, and flow per square mile of drainage area, are shown in Table 4.3.1.2-4.

Table 4.3.1.2-1: Connecticut River at North Walpole, NH (USGS Gage No. 01154500), Drainage Area= 5,493 mi^2, Period of Record: Mar 1942-Sep 2010 (cfs)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean	7,588	7,113	13,633	27,223	16,225	8,371	5,026	4,291	3,826	6,719	9,169	9,028	9,859
Mean/ mi^2	1.38	1.30	2.48	4.96	2.95	1.52	0.92	0.78	0.70	1.22	1.67	1.64	1.79
Median	5,905	5,830	9,940	23,000	13,700	6,830	3,760	3,120	3,000	6,719	7,635	7,085	6,400
Median/ mi^2	1.08	1.06	1.81	4.19	2.49	1.24	0.68	0.57	0.55	1.22	1.39	1.29	1.17

Data Source: USGS, mean daily flows

Table 4.3.1.2-2: Connecticut River below Vernon Dam (USGS Gage No. 01156500), Drainage Area= 6,266 mi^2, Period of Record: Oct 1944-Sep 1973 (cfs)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean	7,422	7,300	14,558	32,110	18,991	8,750	4,833	3,636	3,704	5,270	8,550	8,809	10,319
Mean/ mi^2	1.18	1.17	2.32	5.12	3.03	1.4	0.77	0.58	0.59	0.84	1.36	1.41	1.65
Median	6,400	6,400	9,400	27,050	15,800	7,030	3,800	3,080	2,970	3,880	7,105	7,170	6,535
Median/ mi^2	1.02	1.02	1.50	4.32	2.52	1.12	0.61	0.49	0.47	0.62	1.13	1.14	1.04

Data Source: USGS, mean daily flows

Table 4.3.1.2-3: Connecticut River at Montague City, MA (USGS Gage No. 01170500), Drainage Area= 7,860 mi^2, Period of Record: Apr 1940-Sep 2010 (cfs)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean	11,987	11,785	21,462	37,707	21,191	12,784	8,970	8,396	6,345	12,563	16,063	16,440	15,737
Mean/ mi^2	1.53	1.50	2.73	4.80	2.70	1.63	1.14	1.07	0.81	1.60	2.04	2.09	2.00
Median	9,500	9,330	15,600	33,800	18,900	9,765	5,600	4,630	4,640	6,690	11,100	11,000	9,640
Median/ mi^2	1.21	1.19	1.98	4.30	2.40	1.24	0.71	0.59	0.59	0.85	1.41	1.40	1.23

Data Source: USGS, mean daily flows

Table 4.3.1.2-4: Estimated Connecticut River at Turners Falls Dam Drainage Area= 7,163 mi^2, Period of Record Jan 1941-Sep 2010 (cfs)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean	10,153	9,884	18,762	34,145	19,158	11,375	8,044	7,472	5,608	11,114	14,252	14,331	13,930
Mean/ mi^2	1.42	1.38	2.62	4.77	2.67	1.59	1.12	1.04	0.78	1.55	1.99	2.00	1.94
Median	7,813	7,713	13,291	30,336	17,170	8,734	4,898	4,107	4,008	5,881	9,813	9,283	8,371
Median/ mi^2	1.09	1.08	1.86	4.24	2.40	1.22	0.68	0.57	0.56	0.82	1.37	1.30	1.17

Data Source: Estimated from manipulation of USGS gages

4.3.1.3 *Overview of Water-Related Project Features*

This section describes the major water-related components of the Turners Falls Project and Northfield Mountain Project, associated gaging stations maintained by the Licensee, and typical water level and flow conditions measured at these gages based on 10 years of data (2000-2009). FirstLight maintains hourly data (elevations, discharges, generation, and pumping) on daily log sheets. These data were used to develop numerous graphs in this section to summarize how the Turners Falls Project and Northfield Mountain Project operate. The hourly data from 2000-2009 were used to develop duration curves of elevation and flow. Both annual and monthly (three months/plot) duration curves were developed to illustrate seasonal variability. All gages referenced below are shown in Figure 4.3.1.3-1. Note that all FirstLight gages that measure the water surface elevation are based on the same msl datum (specifically NGVD 1929 datum).

Northfield Mountain Upper Reservoir Elevation

The licensed operating range of the upper reservoir elevation is between 1000.5 feet msl and 938 feet msl, a range of 62.5 feet. The maximum combined rate of water release from the upper to lower reservoir through the four pump turbines during the Northfield generation cycle is approximately 20,000 cfs. The maximum pumping rate of water from the lower to upper reservoir is approximately 15,200 cfs. Generation can only take place at the Northfield Mountain Project if releases can be stored in the Turners Falls impoundment without increasing the Turners Falls water surface elevation above allowable levels.

FirstLight maintains a water level gage in the upper reservoir. The upper reservoir elevations increase in response to pumping, which usually occurs at night, and decrease during generation, which usually occurs during the day. Figure 4.3.1.3-2 is an annual elevation duration curve for the upper reservoir based on 2000-2009 hourly data. To understand the seasonal variability, Figure 4.3.1.3-3 through Figure 4.3.1.3-6 are monthly upper reservoir elevation duration curves. Table 4.3.1.3-1 shows the mean and median upper reservoir elevations on a monthly and annual basis.

Turners Falls Impoundment Elevation

The licensed Turners Falls impoundment fluctuation ranges from 176.0 feet msl to 185.0 feet msl as measured at the dam. A portion of the nine feet of storage between the maximum and minimum elevations is used for pumping and generating cycles that occur at the Northfield Mountain Project. FirstLight maintains four water level gages in the Turners Falls Impoundment as described below and shown in Figure 4.3.1.3-1.

- River stage immediately below Vernon Dam in the tailrace (former USGS gage site).
- River stage as measured directly below the Northfield Mountain Project tailrace (commonly referred to as gage L2). This gage measures the Northfield Mountain Project tailwater elevation.
- River stage as measured approximately 1,500 feet upstream of the Turners Falls Dam, near the boat barrier (commonly referred to as gage L3).
- River stage as measured at the Turners Falls Dam.

Using data collected from 2000-2009, Turners Falls Impoundment elevation duration curves were developed for the following locations and time periods:

- Figure 4.3.1.3-7: Annual elevation duration curves derived from the four gaging locations.

- Figure 4.3.1.3-8 through Figure 4.3.1.3-19: January through December elevation duration curves derived from the four gaging locations.

Table 4.3.1.3-2 shows the median Turners Impoundment elevation at the four locations and the net difference in elevation relative to the elevation as measured at the Turners Falls Dam.

Table 4.3.1.3-2 shows that during the spring, when flows are higher, the water level from the Turners Falls Dam to base of Vernon Dam is sloped more, which is due primarily to the French King gorge serving as a natural pinch-point. Alternatively, during the summer, when flows are lower, the water level throughout the impoundment is relatively flat.

Turners Falls Power Canal Elevation

The power canal has a design capacity of approximately 18,000 cfs. Station No. 1 has a hydraulic capacity of approximately 2,210 cfs and Cabot Station has a hydraulic capacity of approximately 13,728 cfs (total of 15,938 cfs).

FirstLight maintains a water level gage in the power canal at Keith's Bridge. As noted above, FirstLight strives to maintain a canal elevation of 173.5 feet msl in the Cabot forebay. When Cabot operates in a peaking mode, the gates in the gatehouse automatically adjust to provide the desired flow for peaking; the canal elevation is not fluctuated, but maintained near 173.5 feet msl. Annual and monthly elevation duration curves were developed using hourly data for 2000-2009 as shown in Figures 4.3.1.3-20 through 4.3.1.3-24. The water levels are generally fairly stable in the canal under a range of inflows and operating conditions. In some years, the canal is purposely dewatered, typically in early September for maintenance purposes.

Turners Falls Power Canal Flow

FirstLight computes the discharge through the gatehouse and into the power canal based on the gate opening rating curves and computed head across the gatehouse. Thus, hourly calculated power canal flow is available for the 10 year period of record. Annual and monthly (3 months/figure) power canal flow duration curves were developed using hourly data for 2000-2009 as shown in Figure 4.3.1.3-25 through Figure 4.3.1.3-29. The monthly and annual mean and median power canal flow is shown in Table 4.3.1.3-3.

Turners Falls Dam Discharge

Any river flow in excess of that useable for generation (including storing inflow) or needed to operate upstream and downstream fishways is discharged into the bypass reach via the dam. Turners Falls Dam discharges are calculated based on the bascule and tainter gate rating curves. Discharge is based on the gate opening and the Turners Falls Impoundment elevation. Annual and monthly Turners Falls Dam discharge duration curves were developed using hourly data for 2000-2009 as shown in Figure 4.3.1.3-30 through 4.3.1.3-34. The Turners Falls Dam discharges account for the period when one bascule gate is partially opened to provide attraction flow or other flows. The monthly and annual mean and Turners Falls Dam discharge is shown in Table 4.3.1.3-4.

Turners Falls Bypass Reach

The stretch of Connecticut River from the base of Turners Falls Dam to the discharge from Cabot Station is referred to as the bypass reach. This reach is approximately 2.7 miles long and has a low gradient of approximately 0.3% based on flood insurance profile data. The bypass reach receives flow from:

- Turners Falls Dam discharges when inflows exceed the total maximum hydraulic capacities of the facilities on the power canal and there is no storage capacity in the Turners Falls Impoundment.
- During the fish passage season, attraction flow (via the bascule gate at Turners Falls Dam) and fishway flow from the Spillway fishway.
- Fall River (34 mi^2), a tributary to the Connecticut River, which empties into the upstream end of the bypass reach.
- Station No. 1, when operating.
- Southworth Paper Hydro and Turners Falls Hydro LLC, when operating. These facilities operate only after Cabot and Station No. 1 are operating at full hydraulic capacity.
- USGS Conte Anadromous Fish Laboratory, when flows are needed for the laboratory.

Per the current FERC license, a continuous minimum flow of 200 cfs is maintained in the bypass reach starting on May 1, and increases to 400 cfs when fish passage starts by releasing flow through the bascule gate. The 400 cfs continuous minimum flow is provided through July 15, unless the upstream fish passage season has concluded early in which case the 400 cfs flow is reduced to 120 cfs to protect shortnose sturgeon. The 120 cfs continuous minimum flow is maintained in the bypass reach from the date the fishways are closed (or by July 16) until the river temperature drops below 7°C, which typically occurs around November 15^{th}.

Northfield Mountain Project - Pumping and Generating

FirstLight records hourly generation and pumping in kWH on the log sheets. This information can be used to calculate a rough estimate of the flow used for generation or pumping, using the ratio of design flow (cfs) to design capacity (kW) for both pumping and generating as follows:

Pumping: 15,200 cfs/1,119,200 kW or 1 kWH ~ 0.0136 cfs

Generation: 20,000 cfs/1,119,200 kW or 1 kWH ~ 0.0179 cfs

It is recognized that use of these conversion factors represents a gross estimation of the magnitude of flow used for pumping and generation. That being said, it does give an approximation of the magnitude of pumping and generating flows and trends in these values. Using these conversion factors, the hourly energy consumption (pumping)/generation was converted to flow. Annual and monthly pumping and generating flow duration curves were developed using hourly data for 2000-2009 as shown in Figure 4.3.1.3-35 through Figure 4.3.1.3-39.

Station No. 1 Generation

The approximate hydraulic and electrical capacity of Station No. 1 is 2,210 cfs and 5,963 kW, respectively. Using the same approach as described above for the Northfield Mountain Project, a conversion factor was applied as follows: 1 kWH ~ 0.3706 cfs.

Using this gross estimate to convert logged generation to station flow, the following discharge duration curves were developed. Figure 4.3.1.3-40 is the annual discharge duration curve and Figures 4.3.1.3-40 through Figure 4.3.1.3-44 are the monthly discharge duration curves.

Cabot Station Generation

The approximate hydraulic and electrical capacity of Cabot is 13,728 cfs and 62,016 kW, respectively. Using the same approach as described above, a conversion factor was applied as follows: 1 kWH ~ 0.2214 cfs.

Using this gross estimate to convert logged generation to station flow, the following discharge duration curves were developed. Figure 4.3.1.3-45 is the annual discharge duration curve and Figures 4.3.1.3-45 through Figure 4.3.1.3-49 are the monthly discharge duration curves.

Downstream Reach

The Connecticut River below Cabot Station to the downstream limit of the Turners Falls Project boundary is a riverine reach. Per the current FERC license for the Turners Falls Project, FirstLight is required to release a continuous minimum flow of 1,433 cfs (0.2 cfs per mi^2 of drainage area) or inflow to the reservoir, whichever is less, from the Turners Falls Project into the Connecticut River. FirstLight typically maintains the minimum flow requirement through discharges at Cabot and/or Station 1.

The gradient of the river reach directly downstream of Cabot Station to the General Pierce Bridge is approximately 0.3%. From Cabot Station downstream 6.2 miles to the Montague/Sunderland town line, the river gradient is less than 0.1% based on flood insurance profile data.

Table 4.3.1.3-1: Northfield Mountain Project Upper Reservoir Elevation (ft, msl)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean	982.9	982.4	979.0	977.5	975.8	981.7	981.2	980.7	978.6	977.7	982.0	978.0	979.9
Median	985.8	985.5	986.0	979.7	979.5	984.0	983.9	983.0	980.2	978.8	984.2	982.3	982.3

Data Source: FirstLight, hourly data 2000-2009.

Table 4.3.1.3-2: Turners Falls Impoundment – Median Impoundment Elevation at Four Locations (ft, msl)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
At Dam	180.8	180.9	181.3	180.6	181.4	181.3	181.5	181.4	181.7	181.6	181.1	181.3	181.3
At Boat Barrier	182.2	182.2	182.7	182.2	182.7	182.7	182.8	182.8	182.9	182.8	182.4	182.7	182.6
Delta from Dam Elevation	1.4	1.4	1.9	1.4	1.9	1.9	2.0	2.0	2.1	2.0	1.6	1.9	1.8
At Northfield Tailrace	182.5	182.3	183.3	184.6	183.6	183.1	183.0	182.9	182.9	183.3	183.2	183.4	183.2
Delta from Dam Elevation	1.7	1.5	2.5	3.8	2.8	2.3	2.2	2.1	2.1	2.5	2.4	2.6	2.4
Below Vernon Dam	184.3	183.6	185.5	189.4	186.3	184.4	183.3	183.0	182.9	183.6	185.3	185.2	184.4
Delta from Dam Elevation	3.5	2.8	4.7	8.6	5.5	3.6	2.5	2.2	2.1	2.8	4.5	4.4	3.6

Data Source: FirstLight, hourly data 2000-2009

Table 4.3.1.3-3. Turners Falls Power Canal Flow (cfs)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean	12,615	14,264	15,291	15,710	13,353	9,787	8,730	13,101	8,673	11,622	13,386	13,745	12,677
Median	13,456	14,820	15,877	16,014	15,087	10,652	8,732	15,174	9,796	12,311	13,410	14,428	13,965

Data Source: FirstLight, hourly data 2000-2009

Table 4.3.1.3-4. Turners Falls Dam Discharge into Connecticut River (cfs)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean	13,719	7,359	15,256	21,647	4,908	2,364	3,250	9,624	3,818	14,404	9,773	13,525	9,692
Median	9,292	4,819	10,333	18,385	400	400	400	7,713	1,820	8,054	8,048	9,467	4,682

Data Source: FirstLight, hourly data 2000-2009

4.3.1.4 *Water Withdrawals*

This section summarizes additional surface water withdrawals in the vicinity of the Turners Falls Project. The Massachusetts Water Management Act (MAWMA), which became effective in March 1986, authorizes the Massachusetts Department of Environmental Protection (MDEP) to regulate the quantity of water withdrawn from both surface and groundwater supplies. The MAWMA consists of a registration program (for withdrawals existing in 1988) and a permit program for withdrawals commencing after 1988. Since 1988, persons withdrawing water from ground or surface sources in excess of an annual average of 100,000 gallons per day (GPD) or 9 million gallons in any three month period must either file an annual registration (for existing withdrawals) or apply for a MAWMA Permit (new withdrawals). Non-consumptive uses, such as hydroelectric facilities, are not required to register or obtain MAWMA permits.

The Turners Falls Impoundment is not used as a source of domestic drinking water supply or for industrial purposes. Farms along the impoundment use river water for irrigation.

A list of current MAWMA water registrations and permits was obtained from the MDEP. The water withdrawal registrations and permits within the Connecticut River basin, for the towns of Northfield and Montague (including the Village of Turners Falls) were reviewed. The MDEP shows that the only current surface water withdrawal permitted or registered under the MAWMA from Connecticut River waters is for agricultural purposes: Four Star Farms, in Northfield (MAWMA Permit No.: 9P2-1-06-217.03), is allowed an authorized daily withdrawal volume of 0.167 million gallons per day (MGD or 0.26 cfs) from the Turners Falls Impoundment. Compared to the Connecticut River flow at this location, this withdrawal volume is negligible. In addition to Four Star Farms, Sudbury Nurseries West, LLC at Great Meadow Road in Northfield is currently permitting a withdrawal from the Turners Falls Impoundment under the MAWMA.

In addition to the registered Four Star Farms withdrawal under the MAWMA, FirstLight is aware of four water withdrawals, in the Massachusetts reach of the Turners Falls Impoundment, where no MAWMA water registrations and permits were obtained from the MDEP. From north to south, they include:

- Nourse Farms, Inc. Caldwell Road, West Northfield, MA (two withdrawal locations);
- Smiarowski Brothers, LLC, Great Meadow Road, Northfield, MA;
- Northfield Mount Hermon School, off Main Street, Gill, MA;
- Spilt River Farm, River Road, Gill MA.

There are several entities withdrawing water from the Turners Falls power canal. For a description of water usage on the canal, refer to Table 3.2.1-1 which lists the water users, approximate hydraulic capacity, and FERC project number (where applicable).

4.3.1.5 *Hydrologic Modeling*

TNC, USACE New England District Office, University of Massachusetts Amherst (UMass), and USGS are currently collaborating on the Connecticut River Restoration Study. This hydrologic study is being performed to help determine how management of large mainstem and tributary dams and water systems can be modified for environmental benefits while maintaining beneficial human uses such as water supply, flood control and hydropower generation. One of the study's key outcomes will be the creation of a basin-wide hydrologic model and decision support tool that will allow water managers and other key stakeholders to evaluate environmental and economic outcomes based on various management scenarios.

This study is in progress, and will include the following products:

- Connecticut River basinwide HEC-ResSim model
- Connecticut River basinwide optimization model
- Connecticut River basinwide inflow model
- Enhanced streamflow forecasting capability

FirstLight is using the HEC-ResSim model, developed by the USACE, for their operations model.

4.3.1.6 *2012 Water Level Monitoring Baseline Study*

In 2012, FirstLight developed a draft water level monitoring study plan and provided it to National Marine Fisheries Service (NMFS), USFWS, MADFW and MDEP for review and comment. Based on comments received, the study plan was updated to include additional water level monitoring gages. Shown in Figure 4.3.1.6-1 and listed in Table 4.3.1.6-1 are the locations of the water level recorders that were installed for a portion of 2012.

All water level recorders were surveyed to a common datum allowing for comparison of data. The gages were installed in late April 2012 and operated through early August 2012 (the loggers will remain in place through the fall 2012). The river stage recorders obtained a river stage measurement every 15 minutes. There were issues with vandalism or stolen recorders; hence some water level data is not available. In rare instances, the water level dropped so low as to expose the recorder. The recorders were installed during high flows in the spring and as the year progressed flows dropped considerably, potentially exposing the recorder. In these cases, the recorder was placed further into the river, resurveyed, and any erroneous data eliminated.

Appendix E includes the water level recorder findings. The water level plots were segregated by location to allow for easy comparison as follows: Turners Falls Impoundment (3 recorders), Turners Falls bypass channel (2 recorders), and below Cabot Station (3 recorders, one is the Montague gage). One plot was developed for every two weeks of 15 minute water level data.

Table 4.3.1.6-1: Existing and New Water Level Recorders

Type	***Description***	***Location*** *(relative to Turners Falls facilities)*
Vernon Dam to Turners Falls Dam		
Existing	Immediately upstream of Turners Falls Dam	Immediately upstream of dam
Existing	At boat barrier (below French King Bridge)	0.27 miles above dam
Existing	At Northfield Mountain tailrace (1.3 miles above French King Bridge)	5.27 miles above dam
New	At Route 10 Bridge	10.91 miles above dam
New	West Northfield Road- near VT/NH border	14.38 miles above dam
Existing	Immediately downstream of Vernon Dam	20 miles above dam
Power Canal		
Existing	Near the beginning of the Power Canal just below Gatehouse	Power Canal at Keith's Bridge
Bypass Reach		
New	In bypass reach upstream of Station No. 1	Bypass reach above Station No. 1
New	In bypass reach downstream of Station No 1, but upstream of "Rock Dam"- a natural bedrock drop	Bypass reach between Station No. 1 and Rock Dam
Below Cabot Station		
Existing	At USGS gage in Montague City (below Deerfield River confluence)	0.75 miles below Cabot Station
New	At Route 116 Bridge in Sunderland	10 miles below Cabot Station
New	Across from Rainbow Beach	25 miles below Cabot Station

4.3.2 Water Quality

A multitude of federal, state, and local organizations have studied the water quality of the Connecticut River. Water quality studies and data collection efforts have been completed on a basin-wide scale (Deacon et al., 2006); for state-specific assessments (CRJC, 2009; and Carr & Kennedy, 2008); and by volunteer groups (Donlon, 2008 and 2009).

The following sections discuss applicable water quality standards and classifications applicable to the Turners Falls and Northfield Mountain Projects. The results from water quality investigations pertaining to the Connecticut River and related waterbodies in the Turners Falls Project and Northfield Mountain Project area are also discussed.

4.3.2.1 *Water Quality Standards and Classifications*

Massachusetts

The Massachusetts Surface Water Quality Standards (314 CMR 4.00) assign all inland, coastal, and marine waters to classes according to the intended beneficial uses of those waters. For example, Class A waters are designated as the source of public water supplies and, where compatible with this use, should also be suitable for supporting aquatic life, recreational uses such as swimming and boating, and fish consumption. Class B waters are not designated as a source of public water supplies, but are designated for all of the other Class A uses. Class C waters should be suitable for aquatic life and recreational uses where contact with the water is incidental, such as boating and fishing, but may not be suitable for swimming, diving, or water skiing. Inland waters are also subcategorized as to fishery type (e.g., "warm water fishery") based on the waterbody's natural capacity to support these resources.

The Commonwealth of Massachusetts classifies the entire Connecticut River as Class B, Warm Water Fishery. Applicable water quality standards for Massachusetts are listed in Table 4.3.2.1-1.

New Hampshire

New Hampshire water quality standards apply to the Connecticut River upstream of the Massachusetts border. The state of New Hampshire has designated the entire Connecticut River as Class B.

According to applicable water quality standards for New Hampshire, Class B waters shall: have *Escherichia coli* levels that do not exceed a geometric mean of 126 colonies/100 milliliter (ml, based on at least 3 samples obtained over a 60-day period) or more than 406 colonies/100 ml in any one sample; have no objectionable physical characteristics; and contain a dissolved oxygen content of at least 75% of saturation.

The New Hampshire Rivers Management and Protection Act (RSA 483) provides general guidance for future land use in the New Hampshire corridor of the Connecticut River. Under this act, the Connecticut River is designated as a rural river segment from the point 0.3 miles below the Vernon Dam to the Massachusetts line (RSA 483:15, VIII). The law defines these waters as "*adjacent to lands which are partially or predominantly used for agriculture, forest management and dispersed or clustered residential development. Management of rural river... segments shall maintain and enhance the natural, scenic, and recreational values of the river for agricultural, forest management, public water supply, and other purposes which are compatible with the instream public uses of the river and the management and protection of the resources for which the...segment is designated*" (RSA 483:7-a River Classification Criteria, I(b)).

Vermont

Although the Connecticut River is commonly thought to define the boundary between Vermont and New Hampshire, it is located in New Hampshire (i.e., the state border is on the Vermont shoreline[15]). However, Vermont considers most of the Connecticut River to be a Class B waterbody. Vermont's water numerical quality standards for Class B waters include: *Escherichia coli* are not to exceed 77 organisms/100 ml, and dissolved oxygen levels shall not be less than 5 milligram/liter (mg/l) and 60% saturation at all times (for warm water fish habitat waters). Vermont's water quality standards also include narrative protective criteria.

[15] The border between New Hampshire and Vermont was set by King George II in 1764 as the western bank of the Connecticut River. The U.S. Supreme Court re-affirmed this boundary in 1934 as the ordinary low-water mark on the Vermont shore, and markers were set. In some places, the state line is now inundated by the impoundments of dams built after this time.

Table 4.3.2.1-1: Massachusetts Water Quality Standards for Class B Waters – Warm Water Fisheries

Parameter	Standard
Dissolved Oxygen (DO)	Shall not be less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
Temperature	Temperature shall not exceed 83 °F (28.3 °C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 3 °F (1.7 °C) in rivers and streams designated as cold water fisheries nor 5 °F (2.8 °C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month).
pH	Shall be in the range of 6.5 through 8.3 standard units and not more than 0.5 units outside of the natural background range. There shall be no change from natural background conditions that would impair any use assigned to this Class.
Bacteria – beaches	E. coli: the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml. Enterococci: the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml.
Bacteria – other waters	E. coli: the geometric mean of all samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml. Enterococci: geometric mean of all samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml.
Solids	These waters shall be free from floating, suspended and settleable solids in concentrations and combinations that would impair any use assigned to this Class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
Color and Turbidity	These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class.
Oil and Grease	These waters shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life.
Taste and Odor	None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.

Note: MA Standards also include narrative criteria applicable to all surface waters related to aesthetics, bottom pollutants or alteration, nutrients, radioactivity, and toxic substances.

4.3.2.2 *Water Quality Assessments and Impairments*

Every two years, states must file a document called the "Integrated List" to comply with sections 303d and 305b of the Clean Water Act. The Integrated Lists for Massachusetts and New Hampshire divide the Connecticut River into distinct segments for the purpose of determining water quality uses and impairments. The 2012 Integrated Lists for Massachusetts and New Hampshire report that the entire Connecticut River is water quality impaired. Impaired waters are listed as "Category 5," which indicates that a total maximum daily load (TMDL) study is required for that particular water body.

From upstream to downstream, a description of each water body segment and associated water quality impairments is listed below.

Based on New Hampshire's Watershed Report Card, the Connecticut River from the Vernon Dam downstream to the state line (Segment NHRIV802010501-05) is listed as impaired (Category 5 – TMDL Needed). This segment supports swimming and boating uses, but does not meet state standards for supporting aquatic life due to aluminum, copper, and low pH from unknown sources. New Hampshire's general statewide fish consumption advisory due to mercury applies to this segment of the Connecticut River.

Vermont's Integrated List indicates that the Connecticut River from the Vernon Dam downstream to the state line (Segment VT13-05) is impacted by flow alteration (Part F - Waters Altered by Flow Regulation). The aquatic life support use is impacted by fluctuating flows due to hydropower production.

The entire mainstem Connecticut River in Massachusetts is listed as impaired due to PCBs in fish tissue based on results from the Connecticut River Fish Tissue Contaminant Study (Hellyer, 2006), as discussed further below.

From the New Hampshire/Vermont border to the Route 10 Bridge (Segment MA34-01, 3.5 miles) in Massachusetts, the Connecticut River is listed as impaired by MDEP (Category 5- Waters Requiring a TMDL) due to "other flow regime alterations," and "alteration in stream-side or littoral vegetative covers."

The section of the river between the Route 10 Bridge crossing the Turners Falls Impoundment and the Turners Falls Dam (Segment MA34-02, 10.9 miles) is listed as impaired by MDEP (Category 5- Waters Requiring a TMDL) due to "alteration in stream-side or littoral vegetative covers." Additionally, Barton Cove is listed as impaired for non-native aquatic plants (Eurasian water milfoil).

Downstream of the Turners Falls Dam to the confluence with the Deerfield River (Segment MA34-03, 3 miles), the Connecticut River is listed as impaired (Category 5- Waters Requiring a TMDL) due to total suspended solids, "low flow alterations" and "other flow regime alterations."

From the confluence with the Deerfield River, 34.4 miles downstream to the Holyoke Dam (Segment MA34-04), the Connecticut River is listed as impaired (Category 5- Waters Requiring a TMDL) due to *E. coli* bacteria.

The Northfield Mountain Reservoir (Segment MA34061) is listed as a Massachusetts Category 3 Waters, meaning "No Uses Assessed."

4.3.2.3 *Existing Water Chemistry Studies and Data*

2003 Massachusetts Water Quality Assessment

Water quality sampling in the Connecticut River Watershed was conducted by MDEP in April - September 2003, as part of its five-year rotating watershed monitoring and management schedule (Carr & Kennedy, 2008). This effort includes two locations in the Connecticut River in the Turners Falls Project and Northfield Mountain Project area: Station CT06 on the Connecticut River, at the Route 10 Bridge in Northfield; and Station 02A on the Connecticut River, downstream of the Fourmile Brook confluence in Northfield, and east of Pisgah Mountain Road in Gill (Figure 4.3.2.3-1). The parameters included in the sampling were: dissolved oxygen, pH, conductivity, water temperature, total dissolved solids, total suspended solids, ammonia, nitrate–nitrite, total phosphorus, chlorophyll-a, fecal coliform, and *E. coli* bacteria.

Water quality data collected at stations CT06 and 02A are summarized in Table 4.3.2.3-1 and Table 4.3.2.3-2. The data were used by the MDEP to assess the status of the designated uses as defined in the Massachusetts Surface Water Quality Standards.

Data collected from Station CT06 between April and October 2003 was used to assess water quality conditions as the river entered the state. All measurements were indicative of good water quality conditions (Carr & Kennedy, 2008).

Station 02A is located in the Turners Falls Impoundment of the Connecticut River, downstream of Fourmile Brook confluence, approximately 5.5 river miles downstream of station CT06, in the vicinity of the Northfield Mountain Pumped Storage picnic area. Data were collected from this station between July and September 2003. All measurements were indicative of good water quality conditions (Carr & Kennedy, 2008).

NHDES Water Quality Data

The New Hampshire Department of Environmental Services (NHDES), assisted by the United States Environmental Protection Agency (USEPA), assessed the entire Connecticut River mainstem in New Hampshire in 2004. The parameters included in the sampling were bacteria, dissolved oxygen, pH, specific conductance, temperature, and metals. Sampling locations included the Connecticut River at the Route 10 Bridge in Northfield, and the Ashuelot River at the Route 119 Bridge in Hinsdale.

Results from this effort were reported by the Connecticut River Joint Commissions (CRJC) and indicated that the river's quality fully supports swimming and other forms of recreation, although it was reported that elevated aluminum and copper levels may affect aquatic habitat in the river below Vernon Dam. The copper levels may be related to contributions from the Ashuelot River (CRJC, 2009).

CRWC Volunteer Monitoring

The Connecticut River Watershed Council (CRWC) conducted a volunteer water quality monitoring program in the Connecticut River in 2007 and 2008. Sampling was conducted at six locations, which included four sites in the Connecticut River. One of theses sites was located in the Turners Falls Impoundment, at the Franklin County Boat Club docks at Barton Cove in Gill, MA (Figure 4.3.2.3-1). Parameters included water temperature, dissolved oxygen, conductivity and transparency.

In 2007, measurements were collected on: August 30, September 20, and October 23. In 2008, measurements were collected on: June 11, July 9, August 13, September 9 and 18, and October 7. The data for the Barton Cove site are presented in Table 4.3.2.3-3. The results reported that all the water temperature and dissolved oxygen measurements met the Massachusetts Water Quality Standard for warm water fisheries. Dissolved oxygen at the Barton Cove site ranged from 7.14 mg/l to 9.55 mg/l. Specific conductance readings at the site ranged from 80.7 microsiemens (µS) to 146.2 µS. Transparency was consistently measured as greater than 120 centimeters (cm), indicating very clear water.

In addition, the CRWC, in cooperation with Franklin Regional Council of Governments (FRCOG), the Pioneer Valley Planning Commission (PVPC) and the University of Massachusetts Water Resources Research Center, has conducted water sampling for bacterial analysis in the Turners Falls Impoundment at the state boat launch at Barton Cove for the last several years. Data from 2010-2011 is presented in Table 4.3.2.3-4. Several measurements from this location in 2011 exceeded the Massachusetts Water Quality maximum standard of 235 colonies/100 ml for *E. coli*. River flows were appreciably higher in 2011 compared to 2010. All of the corresponding *E. coli* measurements from 2010 met the Massachusetts Water Quality Standard.

USGS Water Quality Monitoring

Water quality measurements were occasionally taken by the USGS at the Montague City gage site. Data includes physicochemical measurements and nutrients collected most recently in 2006-2007, as shown in Table 4.3.2.3-5. In addition to collecting data from this site, a study of total nitrogen concentrations and loads was conducted by the USGS from December 2002 to September 2005 at 13 river sites in the upper Connecticut River Basin. In this study, the mean annual load and yield of total nitrogen at the Connecticut River at North Walpole, NH, was estimated at 9.60 million pounds/year and 1,750 (pounds/mi^2)/year, respectively. The mean annual load and yield of total nitrogen leaving the upper Connecticut River Basin, as estimated at the Connecticut River at Thompsonville, CT, was 21.6 million pounds/year and 2,230 (pounds/mi^2)/year, respectively (Deacon et al., 2006).

USEPA Connecticut River Fish Tissue Contaminant Study

The Connecticut River Fish Tissue Contaminant Study (Hellyer, 2006) was a collaborative federal and state project designed to provide a baseline of tissue contaminant data from several fish species, to better understand the risk to human health from eating Connecticut River fish, and to learn what threat eating these fish poses to other mammals, birds, and fish. For this study the Connecticut River was divided into eight sampling reaches with Reach 4 being the Turners Falls Impoundment.

Smallmouth bass, yellow perch and white suckers were collected during 2000 from the mainstem of the Connecticut River and composite samples were analyzed for total mercury, PCBs, organochlorine pesticides, and dioxins. Levels of contaminants were compared to USEPA and other current human health subsistence and recreational (sport) fisher and ecological risk screening criteria, and also were statistically compared between reaches and species.

Based on the information from this study, it was reported that fish tissue in the Connecticut River contained contaminants exceeding various human health and ecological risk screening values, and that state health agencies will evaluate existing advisories and consider the need for others, to adequately protect human health (Hellyer, 2006).

Table 4.3.2.3-1: MDEP 2003 Water Quality Data Results – Physical Parameters

Date	Temp (°C)	pH	Conductivity (μS/cm)	TDS (mg/l)	DO (mg/l)	DO (% sat)
Station CT06 – Connecticut River at Route 10 Bridge						
04/29/03	8.9	7.1 c	92.5	59.2	12.1	106
06/02/03	16.6	7.2	122	77.9	9.4	99
08/05/03	23.9	7.2 c	121	77.2	7.7 u	92 u
08/06/03	23.9	7.0 c	120	76.8	7.0	84
09/09/03	21.5	7.3 ic	153	98.0	8.5	97
10/01/03	15.8	7.2	112 u	71.9 u	9.4 u	95 u
Station 02A – Connecticut River downstream of Fourmile Brook confluence						
07/08/03	27.7	7.6	139	90.0	8.3 i	105 i
07/09/03	27.2	7.5	138	89.0	7.8 i	99 i
08/05/03	23.7	7.2 uc	119	78.0	7.6	90
08/06/03	23.7	7.3 c	108	70.0	7.5	88
09/09/03	21.7	7.5 uc	152	99.0	9.3	106

Notes:
i = potentially inaccurate reading
u = unstable reading
c = meter not calibrated or calibration result outside accepted range of calibration standard

Table 4.3.2.3-2: MDEP 2003 Water Quality Data Results – Biological and Chemical Parameters

Date	Time (24 hr)	QA/QC	Fecal coliform (CFU/ 100mL)	E. coli (CFU/ 100mL)	Turbidity (NTU)	Alkalinity (mg/L)	Hardness (mg/L)	Chl-a (mg/m^3)	NH3-N (mg/L)	NO3-NO2-N (mg/L)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
Station CT06 – Connecticut River at Route 10 Bridge													
04/30/03	08:00	-	2	1	1.4	-	-	-	<0.06	-	-	0.021	5.2
06/04/03	08:05	-	20	5	0.40	26	37	-	<0.02	-	-	0.016	2
07/09/03	08:15	-	30	16	0.46	28	44	<1.0	<0.02	-	-	0.011	<2
08/06/03	07:45	-	250	30	1.0	25	33	1.0	0.11	-	-	0.019	4
09/10/03	08:00	-	4	2	-	-	-	<1.0	<0.02	0.17	R	0.010	<2
10/01/03	08:20	-	500	120	-	-	-	-	<0.02	0.14 f	R	R	6
Station 02A – Connecticut River downstream of Fourmile Brook confluence													
07/09/03	09:09	Left	24	20	-	-	-	<1.0	-	-	-	-	-
		Right	40	12	-	-	-	1.1	-	-	-	-	-
		Center	30	10	0.50	30	44	-	<0.06	-	-	0.011	<2
08/06/03	07:55	Left	500	160	-	-	-	-	-	-	-	-	-
		Right	600	70	-	-	-	-	-	-	-	-	-
		Center	1900	130	1.3	23 d	29	1.3	<0.02	-	-	0.020	2
09/10/03	08:12	Left	10	8	-	-	-	-	-	-	-	-	-
		Right	12	10	-	-	-	-	-	-	-	-	-
		Center	<2	<2	-	-	-	1.6	<0.02	0.16	R	0.008	<2

Note: R = data removed due to quality assurance flag in report.

Table 4.3.2.3-3: CRWC 2007-2008 Water Quality Data Results for Barton Cove

Date	Time (24 hr)	Air Temp (°C)	Water Temp (°C)	Transparency (cm)	Specific Conductance (μS)	DO (mg/l)	DO (% sat)
8/30/2007	8:33	22.9	25.2	>120	146.2	7.22	86.1
9/20/2007	8:32	16.7	20.0	>120	138.7	7.33	99.3
10/23/2007	8:33	17.5	17.0	>120	134.8	7.81	82.0
6/11/2008	8:57	21.8	23.7	>120	126.7	9.55	113.1
7/9/2008	8:50	25.8	26.5	>120	104.5	8.52	105.1
8/13/2008	8:33	19.1	20.3	>120	80.7	8.52	93.5
9/9/2008	8:49	19.3	23.1	>120	117.4	7.14	83.3
9/18/2008	10:12	19.3	20.7	—	120.3	8.41	93.3
10/7/2008	8:43	10.8	14.9	>120	126.4	8.06	79.7

Sources: Donlon, 2008 and Donlon, 2009

Table 4.3.2.3-4: CRWC Bacteria Sampling Results for Barton Cove, 2010-2011

Date	E. coli (colonies/100 ml)	Wet Weather Event[1]	Montague Daily Flow (cfs)
6/2/2010	63		4,870
6/9/2010	65		15,900
6/16/2010	80		7,620
6/23/2010	186	Wet	8,780
6/30/2010	17		13,500
7/7/2010	98		4,540
7/14/2010	114		3,440
7/21/2010	23		4,710
7/28/2010	12		5,140
8/4/2010	35		5,650
8/11/2010	224		5,860
8/18/2010	2		2,950
9/8/2010	21		2,960
9/15/2010	3		3,000
9/22/2010	9		2,570
9/29/2010	171	Wet	8,990
10/6/2010	33	Wet	23,200
5/25/2011	1553.1*		25,200
6/1/2011	1046.2*		33,700
6/8/2011	83.9		10,400
6/15/2011	228.2		22,500
6/22/2011	1553.1*		10,600
6/29/2011	224.7	Wet	17,000
7/6/2011	387.3*		9,440
7/20/2011	218.7		5,040
8/3/2011	275.5*		2,670
8/17/2011	488.4*	Wet	26,800
8/24/2011	172.5		12,900

[1] "Wet" signifies wet weather event defined as >0.1 inches of rain in 24 hours.
**Asterisked result indicates exceedance of Massachusetts Criteria for single E. coli sample of 235 colonies/100ml.*
Source: http://www.umass.edu/tei/mwwp/ctrivermonitoring.html

Table 4.3.2.3-5: Select Water Quality Data from USGS Montague City Gage

Date/Time	Discharge (cfs)	pH	Nitrogen, total (mg/l)	Ammonia, as N (mg/l)	Nitrate + Nitrite (mg/l)	Orthophosphate (mg/l)	Phosphorus, total (mg/l)
10/26/2006 9:15	21,600	7.0	0.47	0.011 e	0.190	< 0.018	0.075
12/15/2006 7:30	16,000	7.3	0.46	0.023	0.285	0.013 e	0.040
2/8/2007 11:30	7,790	6.9	0.63	0.034	0.458	0.020	0.033
3/29/2007 11:00	53,800	7.0	0.75	0.030	0.339	0.012 e	0.142
4/20/2007 11:00	78,800	7.0	0.63	0.010 e	0.254	0.011 e	0.160
5/3/2007 11:15	35,200	7.0	0.49	0.011 e	0.268	0.012 e	0.034
5/17/2007 11:45	24,200	7.3	0.52	0.014 e	0.287	0.009 e	0.033
6/28/2007 12:00	2,430	7.3	0.51	0.020 e	0.310	0.013 e	0.016
8/2/2007 12:30	1,790	7.5	0.46	< 0.020	0.257	0.017 e	0.015
9/6/2007 8:00	1,750	7.4	0.39	0.014 e	0.238	0.013 e	0.008
Nutrient Criteria Reference Conditions for Ecoregion VIII Streams - Subecoregion 58 (Northeastern Highlands)							
Minimum			0.34		0.010		0.002
Maximum	-	-	0.84	-	2.850	-	0.450
25th percentile			0.42		0.160		0.005

Notes: "e" = estimated. Nutrient criteria from USEPA, 2001

4.3.2.4 *Water Temperature Studies and Data*

Vermont Yankee Temperature Monitoring

The Vermont Yankee Nuclear Power Station, which has been producing electricity since 1972, is situated on the banks of the Connecticut River in Vernon, Vermont approximately 3/4 of a mile upstream of Vernon Dam. While physically located outside of the Turners Falls Project and Northfield Mountain Project area, the thermal discharges from this facility can affect the water temperature of inflow into the Turners Falls Impoundment. The plant was constructed with cooling towers. In 1978 the facility received a permit to discharge heated water to the Connecticut River in the cooler months of the year.

Vermont Yankee maintains two continuously operating and recording temperature monitoring stations on the Connecticut River to monitor mixing of its warm water discharge. They are located three miles above the discharge site in the Vernon Impoundment, and a half mile below Vernon Dam, well below the discharge site. Monthly monitoring reports are submitted to the Vermont Agency of Natural Resources (CRJC, 2009).

A report released in August 2012 reviewed Vermont Yankee's discharge permit requirements and analyzed water temperature in the Connecticut River in the vicinity of Vermont Yankee Nuclear Power Station (Hickey & Shanahan, 2012). The report, prepared by Hickey and Shanahan, found that use of an equation to compute temperature rise, instead of the use of actual temperature data, has resulted in temperature increases downstream of the Vermont Yankee facility that are far greater than those specified in the permit, and that on most days, the temperature rise exceeds the rise specified in the permit by several degrees and for extended periods of time.

USFWS Temperature Monitoring

The USFWS recently conducted water temperature monitoring of the Connecticut River in the Turners Falls Project and Northfield Mountain Project area from October 2009 to October 2011. Preliminary data were provided to FirstLight by USFWS (K. Sprankle, personal communication, November 9, 2011).

Data collection locations in the vicinity of the Turners Falls Project and Northfield Mountain Project include Vernon Dam tailrace, Turners Falls Impoundment (six locations), and Turners Falls gatehouse, as shown in Figure 4.3.2.3-1. A summary of the minimum, maximum and average water temperatures is shown in Table 4.3.2.4-1. Examples of typical water temperature fluctuations in the summer and the winter are shown in Figure 4.3.2.4-1 and Figure 4.3.2.4-2, respectively.

FirstLight Temperature Model

In 1992 the former Licensee conducted a model of the thermal effects of pumping water to the upper reservoir, then releasing it to the Turners Falls reach of the Connecticut River (Lawler, Matusky & Skelly Engineers, 1993). Sources of heat were friction losses during both the pumping and generating cycles, and the additional surface area for heat exchange provided by the upper reservoir. The maximum temperature difference attributable to Northfield operation was 0.210 °C in the Turners Falls reach of the Connecticut River in the low flow (4,000 cfs river flow) simulation. Model results showed that temperature differences were less at higher river flows. Most of the increase was due to the effect of solar radiation on the upper reservoir.

Table 4.3.2.4-1: Water Temperature Summary for Turners Falls Impoundment, October 2009-October 2011

Station	Logger ID	Start Date	End Date	N	Water Temperature (°F)		
					Max	Min	Average
Turners Falls Gatehouse	2405550	10/1/2009 16:00	10/17/2011 14:20	53708	83.6	32.2	53.7
Turners Falls Impoundment #1	2405551	10/1/2009 16:00	10/11/2011 12:20	53270	82.7	32.0	53.2
Turners Falls Impoundment #2	2405552	10/1/2009 16:00	10/11/2011 12:20	53270	85.0	32.0	53.5
Turners Falls Impoundment #3	2405553	10/1/2009 16:00	11/7/2010 21:20	28961	83.9	32.4	54.8
Turners Falls Impoundment #4	2405554	10/1/2009 16:00	10/8/2010 11:40	26772	83.9	32.4	54.8
Turners Falls Impoundment #5	2405566	10/21/2009 17:00	10/11/2011 13:40	51831	85.6	32.2	53.2
Turners Falls Impoundment #6	2405563	10/21/2009 17:00	10/11/2011 14:00	51832	83.4	32.6	53.5
Below Vernon Dam	2405543	9/28/2009 17:00	10/24/2011 13:20	54422	84.5	32.8	54.0

Notes: Data provided by USFWS. Note limited data for Turners Falls Impoundment #3 and #4 locations. N = number of measurements.

4.3.2.5 *2010 Northfield Siltation and Sediment Management Plan*

The Northfield Mountain Project planned a dewatering outage for May 2010 as part of routine operations and maintenance to maintain protection against powerhouse flooding, and perform preventative long term maintenance programs. The dewatering plan consisted of draining the water from the upper reservoir through the pressure shaft and penstocks, powerhouse, and tailrace tunnel, enabling inspection and maintenance of the project.

On May 1, 2010, FirstLight began the planned three-week dewatering outage with the intent of undertaking various capital projects, including spherical valve seal water control and various piping replacements, dewatering pump/equipment replacements, upper/lower reservoir trash rack repair/replacement, concrete tailrace tunnel roof repairs, and draft tube gate guide rail repairs.

On May 3, 2010, FirstLight became concerned that the ongoing dewatering operation had a higher level of silt than previously expected and notified the USEPA Region 1 office accordingly. Upon further investigation, it became evident that the upper reservoir intake channel silt had dislodged and migrated into the water conveyance tunnels. It was deposited at multiple locations, including a large quantity in the mile-long tailrace tunnel. Dewatering through normal means ceased on May 5, 2010 when all equipment and machinery were shut down and an assessment of the extent of the problem commenced.

FirstLight's response to the incident involved silt removal from four primary areas:

- upper reservoir intake channel;
- lower pressure shaft elbow and four unit penstocks;
- tailrace tunnel; and
- Connecticut River

The extended outage at the Northfield Mountain Project lasted from May 1, 2010 through November 18, 2010. Rewatering of the upper reservoir began on November 19, 2010 and the facility was returned to service on November 21, 2010.

In response to the sedimentation event, FERC requested a plan and/or procedures designed to avoid or minimize the entrainment of silt into the facility's works during similar drawdowns needed in the future. Similarly, the USEPA Administrative Order (issued on August 4, 2010) requested a report identifying measures FirstLight will adopt to prevent discharges of sediments to the Connecticut River associated with draining the upper reservoir.

In July 2011[16], FirstLight proposed and began implementing a four-year sediment monitoring study (2011-2014) in which turbidity and total suspended solids were collected quarterly as well as during targeted periods of high flow in various locations within the Turners Falls Impoundment and the Northfield Mountain's upper reservoir. In addition, once a year, a bathymetric map of the upper reservoir would be produced to monitor sediment changes. Total suspended solids and turbidity grab samples were collected on two occasions during 2011 and the upper reservoir bathymetric mapping was conducted in November 2011 in accordance with the July 2011 Plan.

[16] FirstLight consulted with the USEPA and MDEP on the July 2011 plan before submission to FERC.

Based on the data collected in 2011, as summarized in the December 1, 2011 report to FERC, FirstLight proposed changes to the plan to FERC in February 2012[17]. Rather than quarterly monitoring at various locations over the four years of study, FirstLight proposed, and is currently collecting continuous suspended sediment measurements at the Route 10 Bridge in the Turners Falls Impoundment and at the Northfield Mountain Project (measurements are taken from the water used to pump and generate). FirstLight is also continuing to collect upper reservoir bathymetry annually.

4.3.2.6 *Surface Water Discharges*

Historically, the Connecticut River and its tributaries received untreated industrial and sanitary discharges. Current industrial and sanitary point source discharges are regulated through the National Pollution Discharge Elimination System (NPDES) permit program. Table 4.3.2.6-1 lists the NPDES discharges in the vicinity of the Turner Falls Project. Discharges to the Turners Falls Impoundment include the town of Northfield Water Pollution Control Facility and the Northfield-Mt. Hermon School, which discharges effluent from treated domestic waste.

[17] FirstLight consulted with the USEPA and MDEP on the February 2012 plan before submission to FERC.

Table 4.3.2.6-1: NPDES Discharges in the Project Vicinity

Name	NPDES Permit No.	Flow Capacity (MGD)	Receiving Waters
Town of Northfield WPCF	MA0100200	0.275	Connecticut River
Northfield Mount Hermon School, Gill, Wastewater Treatment Plant	MA0032573	0.45	Connecticut River
Northfield Mountain Station, FirstLight Hydro Generating Company (floor drains and non-contact cooling water)	MA0035530	Not Specified	Connecticut River
Australis Aquaculture LLC	MA0110264	0.30	Connecticut River
Southworth Company Turners Falls Mill Canal Street Facility	MA0005011	2.2	Connecticut River and Power Canal
Hallmark Color Laboratories	MAP250210	Not Specified	Not Specified
Cabot Station, FirstLight Hydro Generating Company (floor drains and non-contact cooling water)	MA0035521	Not Specified	Connecticut River
Town of Montague Wastewater Treatment Facility	MA0100137	1.83	Connecticut River (Downstream of Project)
Town of Hinsdale Wastewater Treatment Facility	NH0100382	0.3	Ashuelot River, Tributary to Connecticut River
TransCanada Vernon Station	VT0000868	0.651	Connecticut River (Upstream of Project)
Entergy Vermont Yankee	VT0000264	Not Specified	Connecticut River (Upstream of Project)

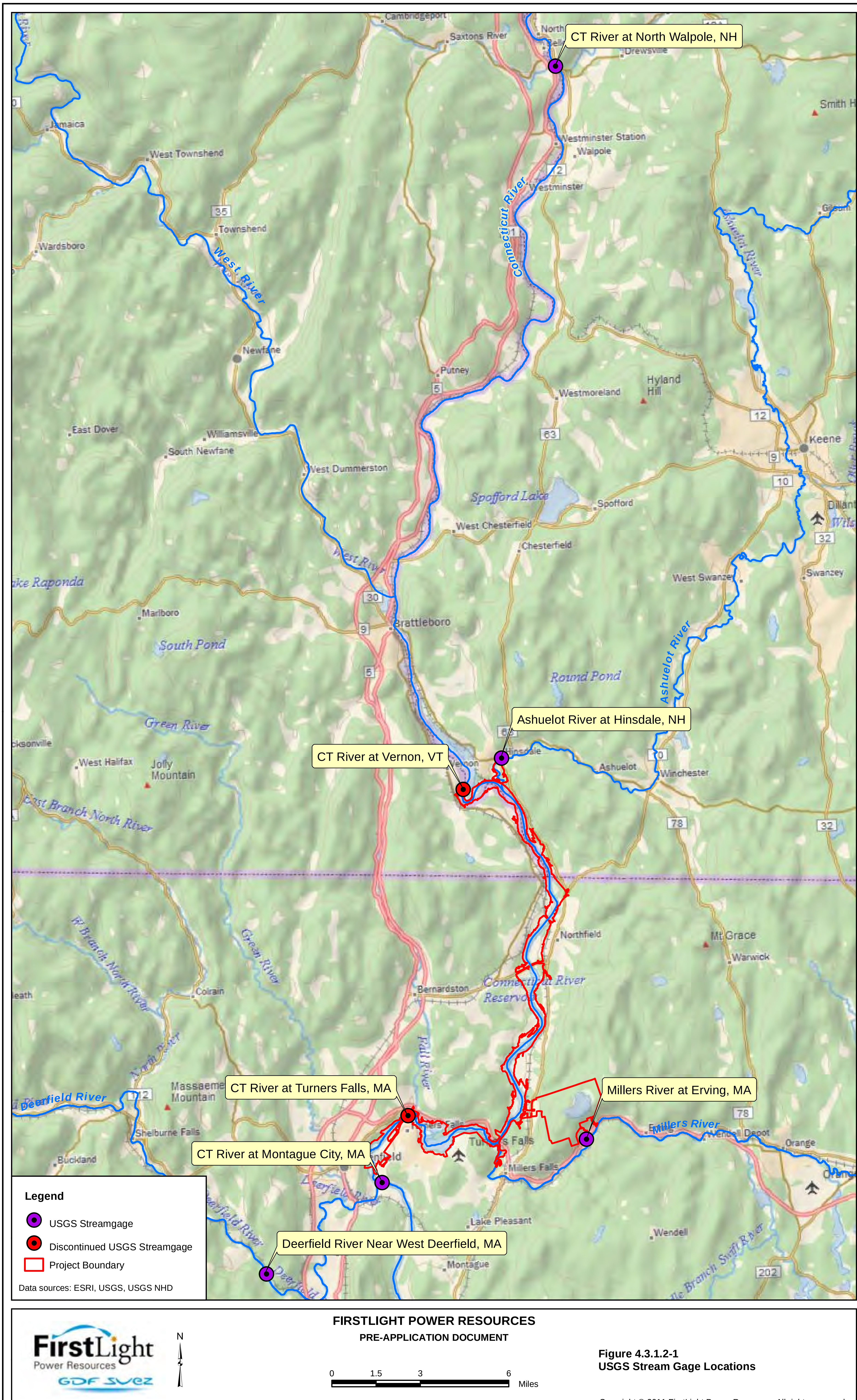

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Figure 4.3.1.2-1
USGS Stream Gage Locations

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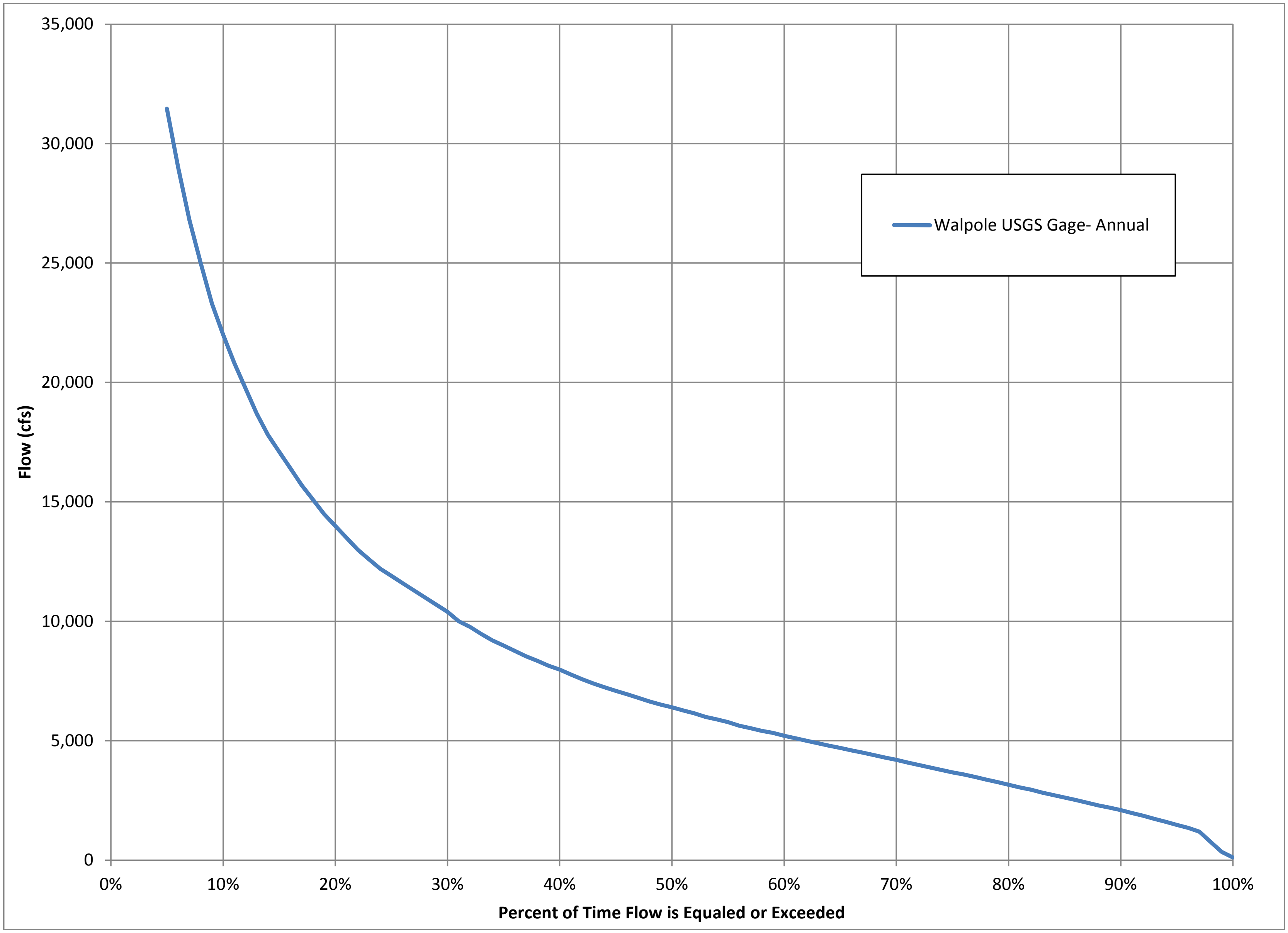


Figure 4.3.1.2-2: Connecticut River at Walpole, NH, Annual Flow Duration Curve, Mar 1942-Sep 2010, Drainage= 5,493 mi^2

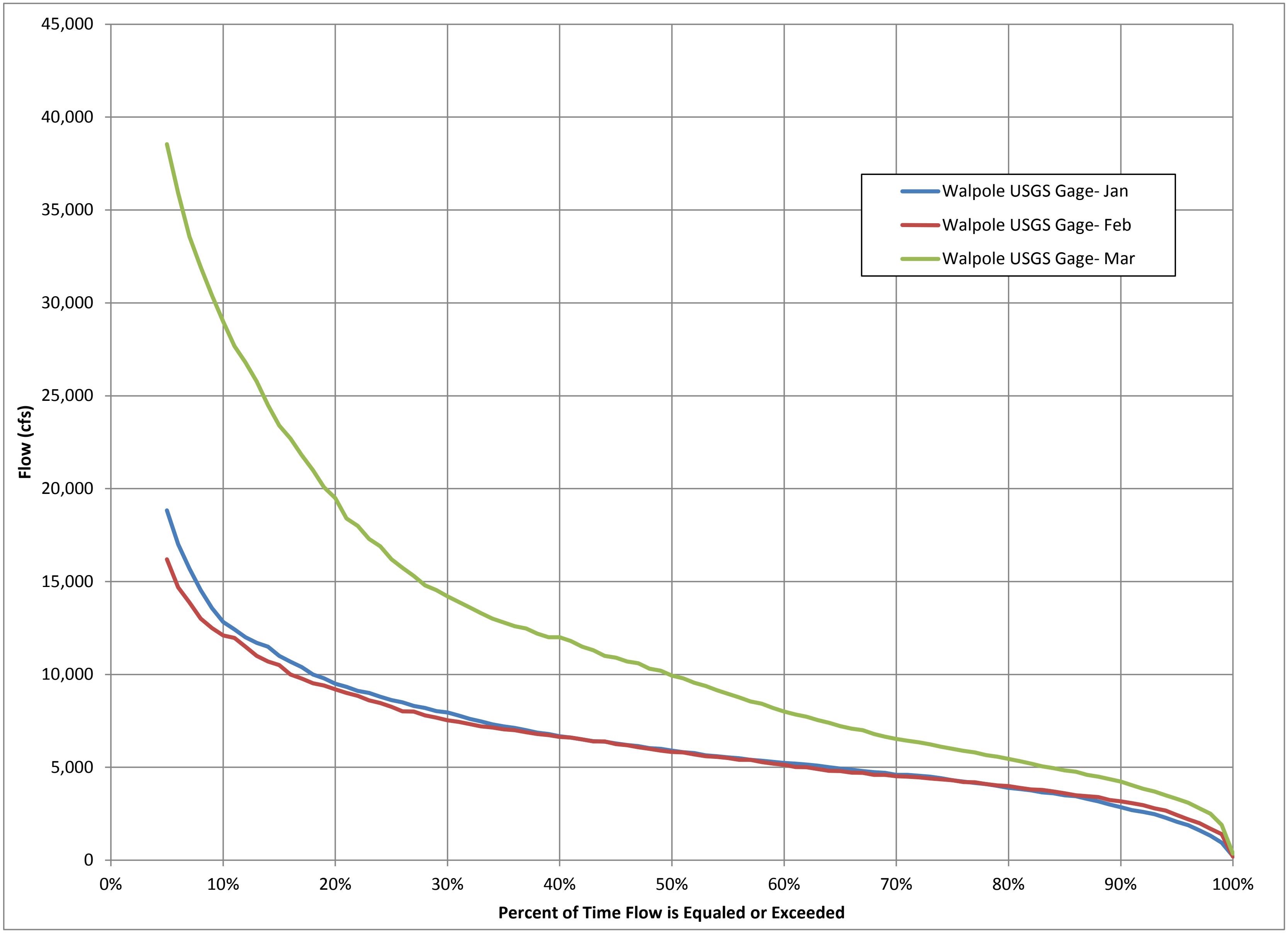


Figure 4.3.1.2-3: Connecticut River at Walpole, NH, Jan-Mar Flow Duration Curve, Mar 1942-Sep 2010, Drainage= 5,493 mi^2

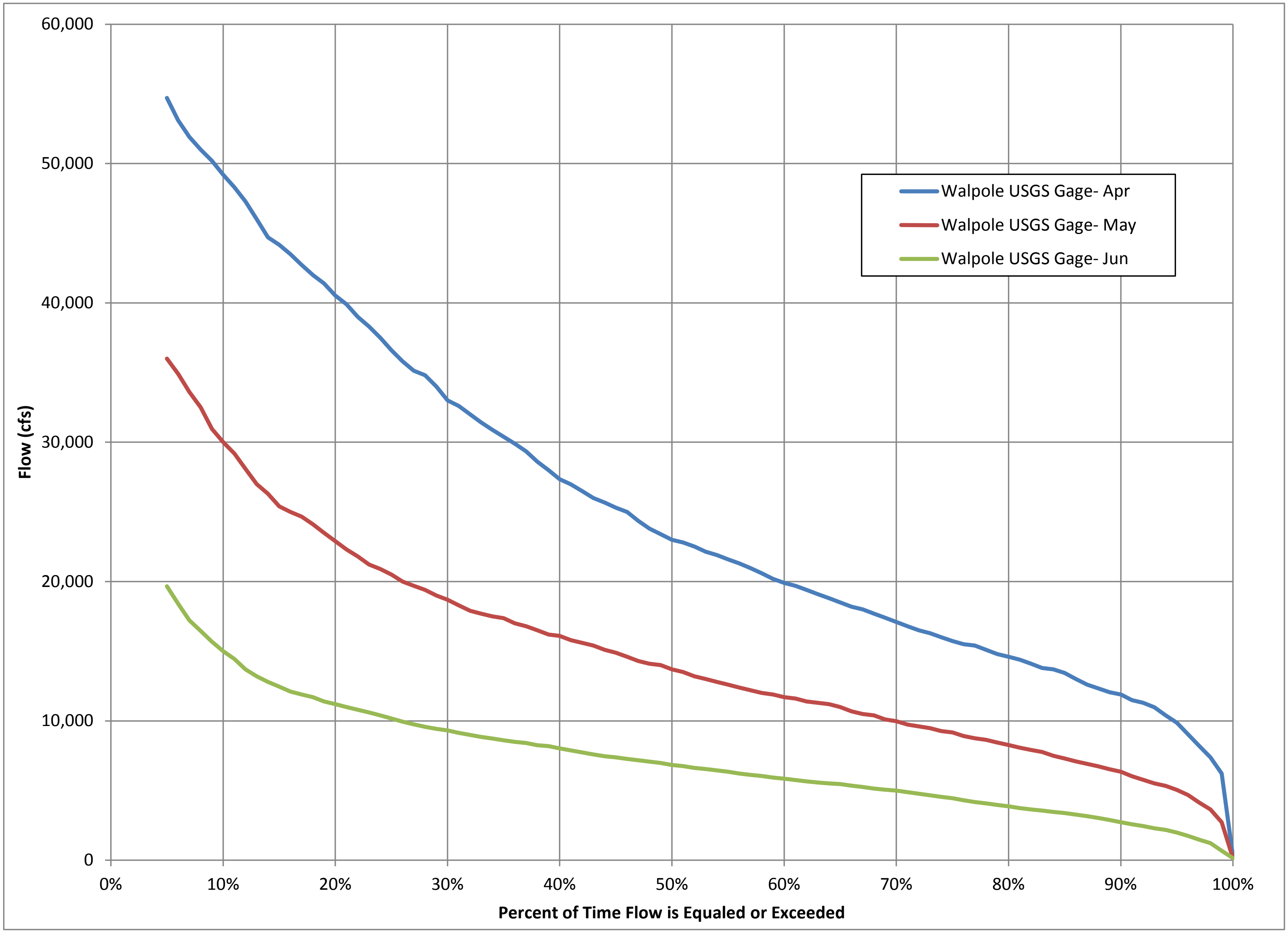


Figure 4.3.1.2-4: Connecticut River at Walpole, NH, Apr-Jun Flow Duration Curve, Mar 1942-Sep 2010, Drainage= 5,493 mi^2

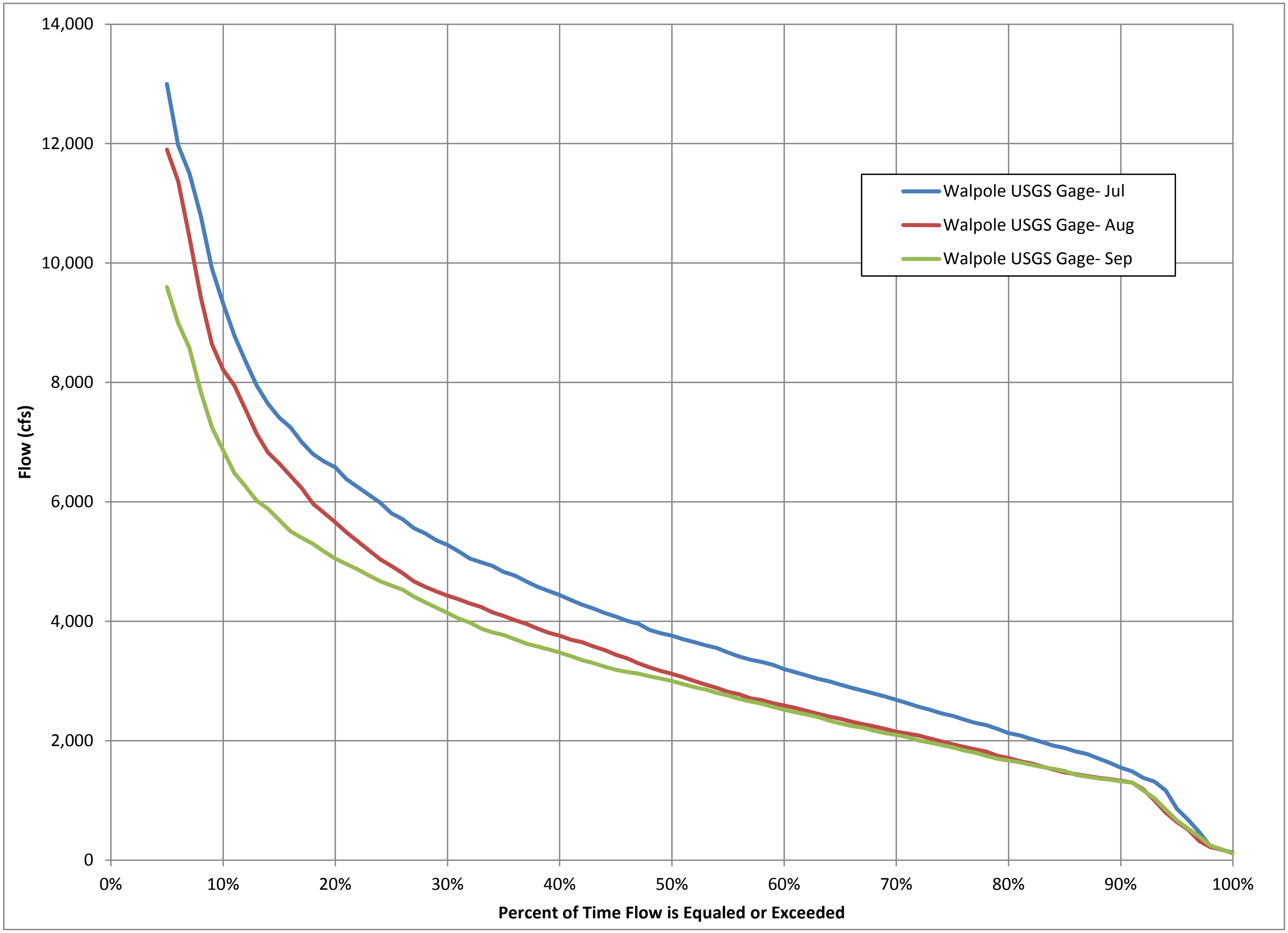


Figure 4.3.1.2-5: Connecticut River at Walpole, NH, Jul-Sep Flow Duration Curve, Mar 1942-Sep 2010, Drainage= 5,493 mi^2

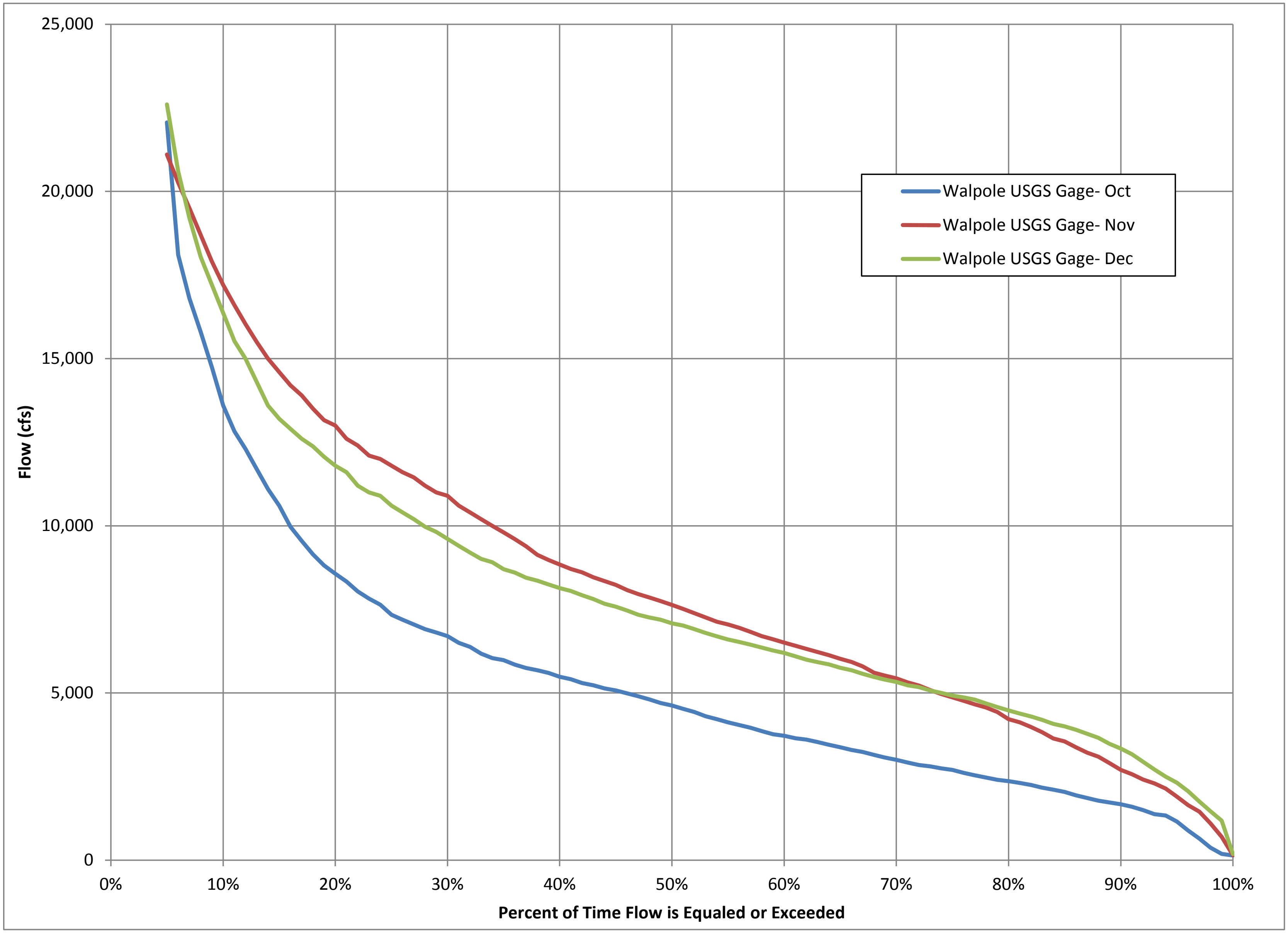


Figure 4.3.1.2-6: Connecticut River at Walpole, NH, Oct-Dec Flow Duration Curve, Mar 1942-Sep 2010, Drainage= 5,493 mi^2

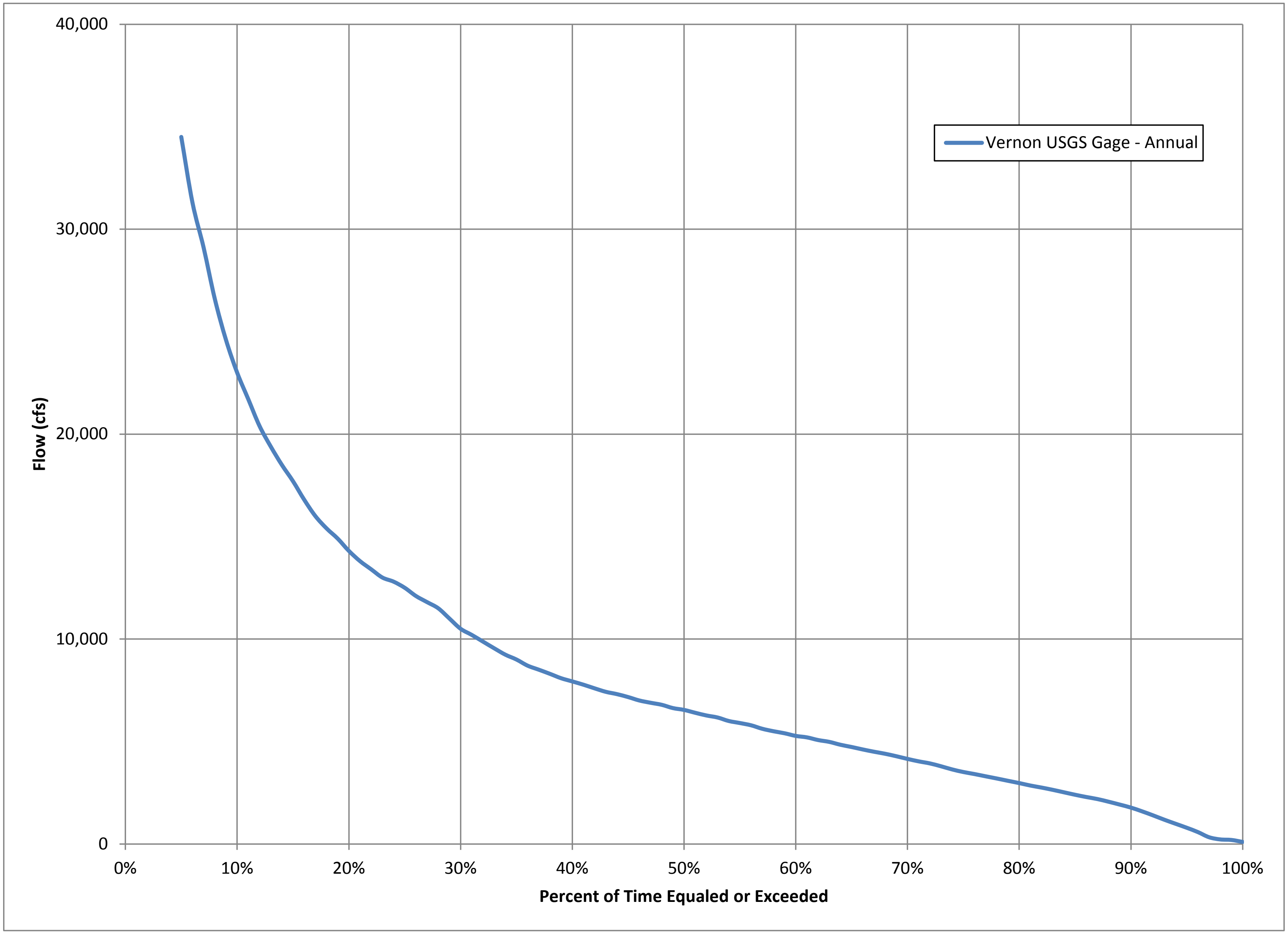


Figure 4.3.1.2-7: Connecticut River below Vernon Dam, VT, Annual Flow Duration Curve, Oct 1944-Sep 1973, Drainage= 6,266 mi^2

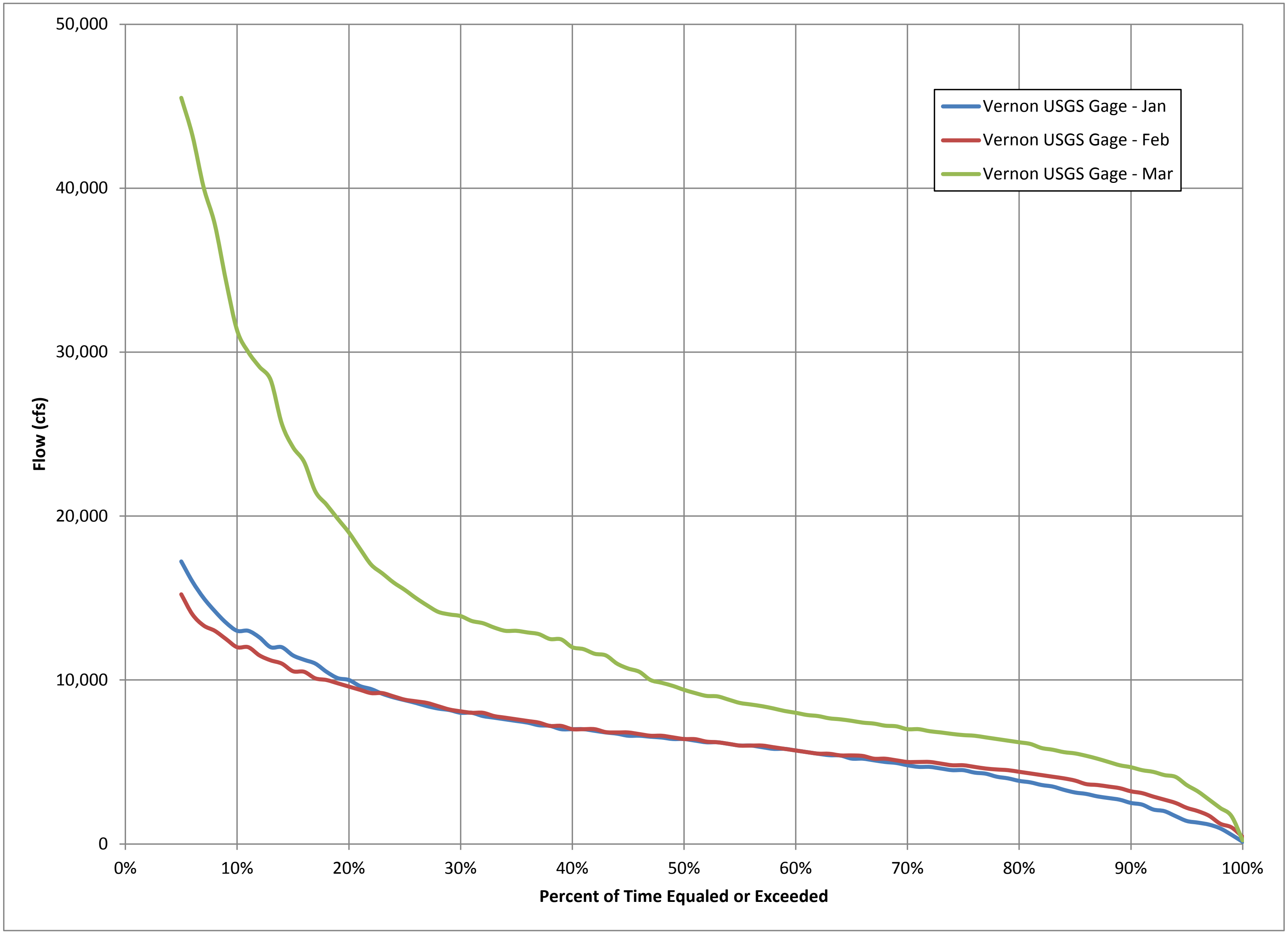


Figure 4.3.1.2-8: Connecticut River below Vernon Dam, VT, Jan-Mar Flow Duration Curve, Oct 1944-Sep 1973, Drainage= 6,266 mi^2

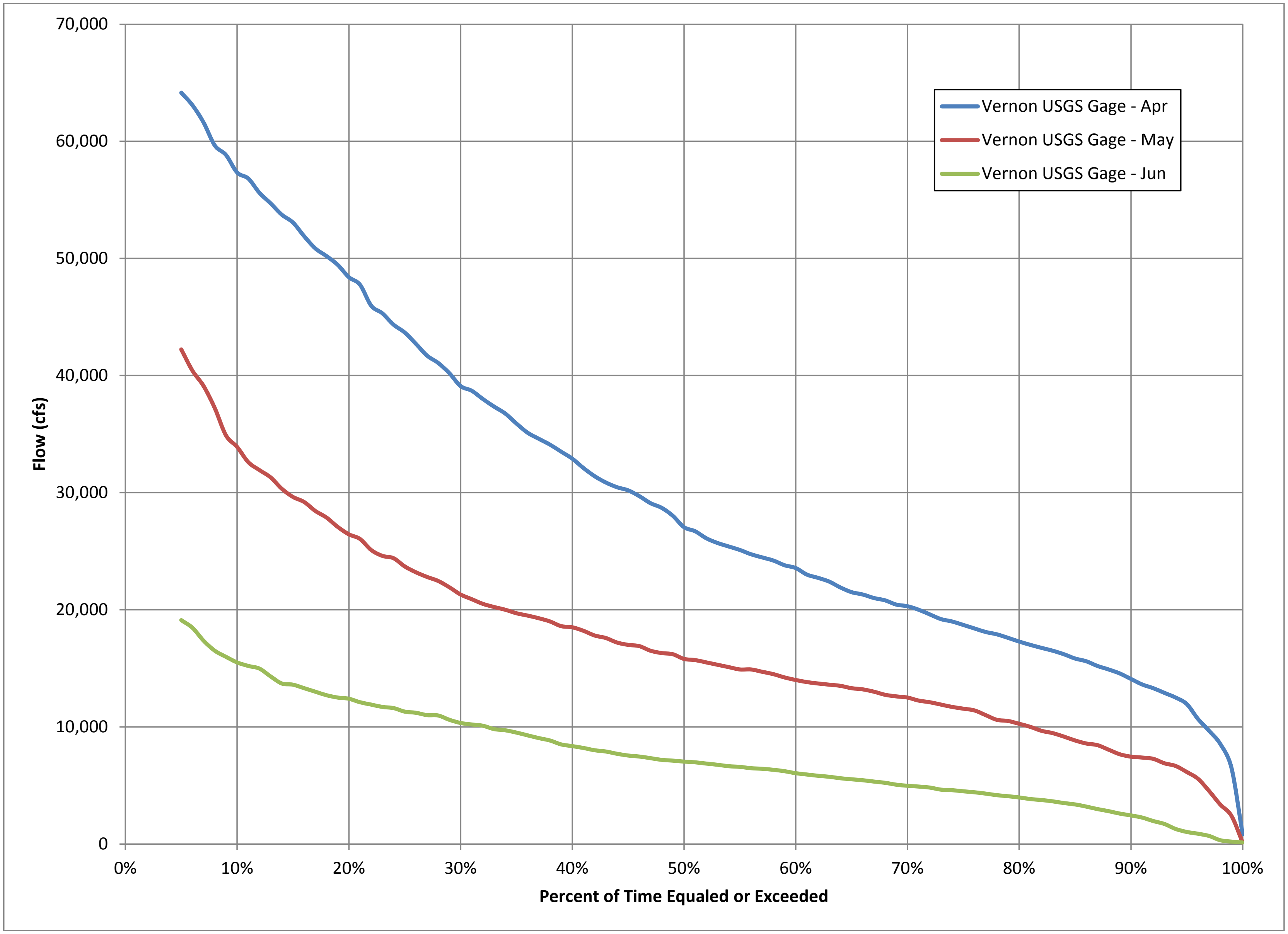


Figure 4.3.1.2-9: Connecticut River below Vernon Dam, VT, Apr-Jun Flow Duration Curve, Oct 1944-Sep 1973, Drainage= 6,266 mi^2

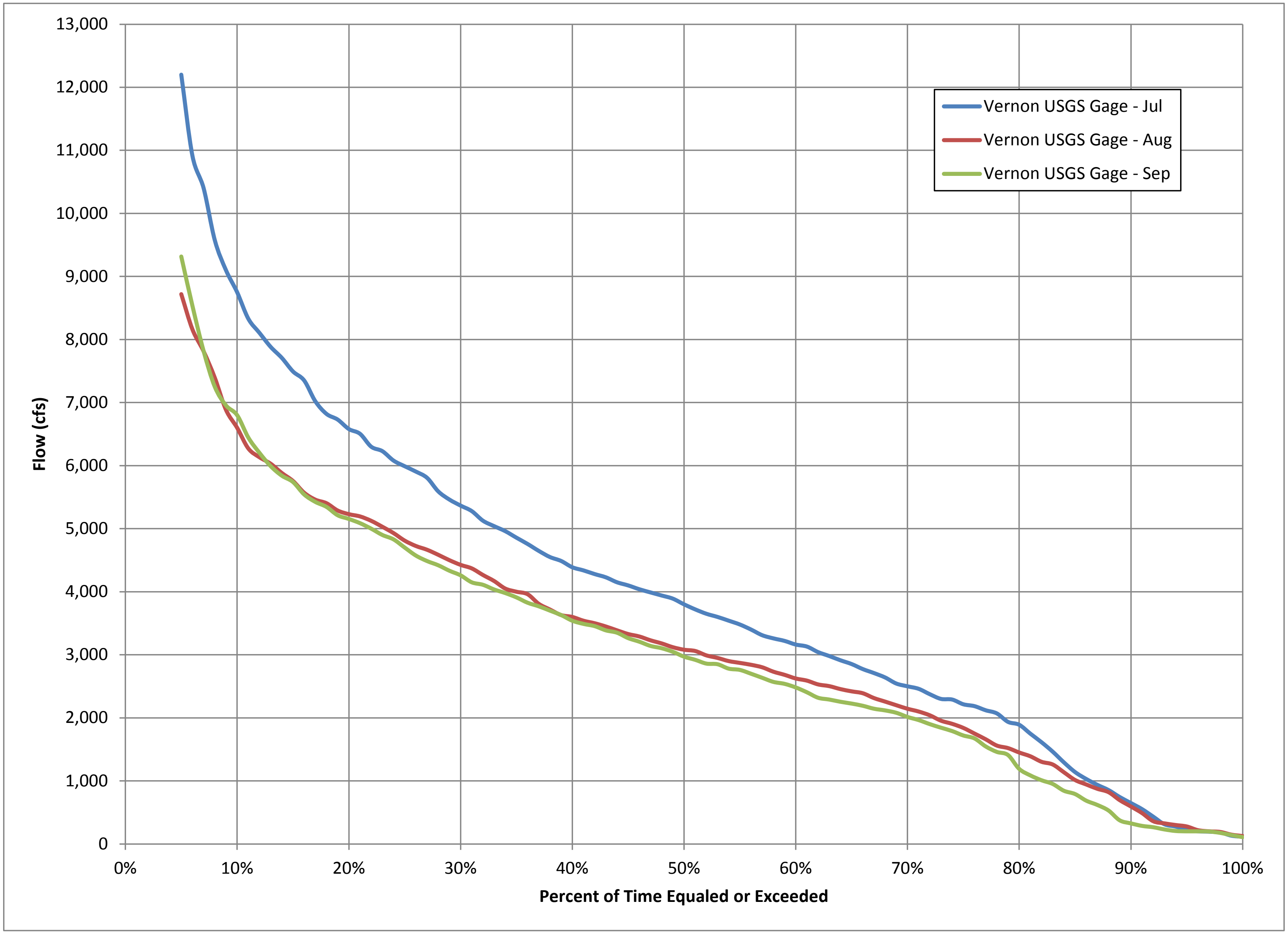


Figure 4.3.1.2-10: Connecticut River below Vernon Dam, VT, Jul-Sep Flow Duration Curve, Oct 1944-Sep 1973, Drainage= 6,266 mi^2

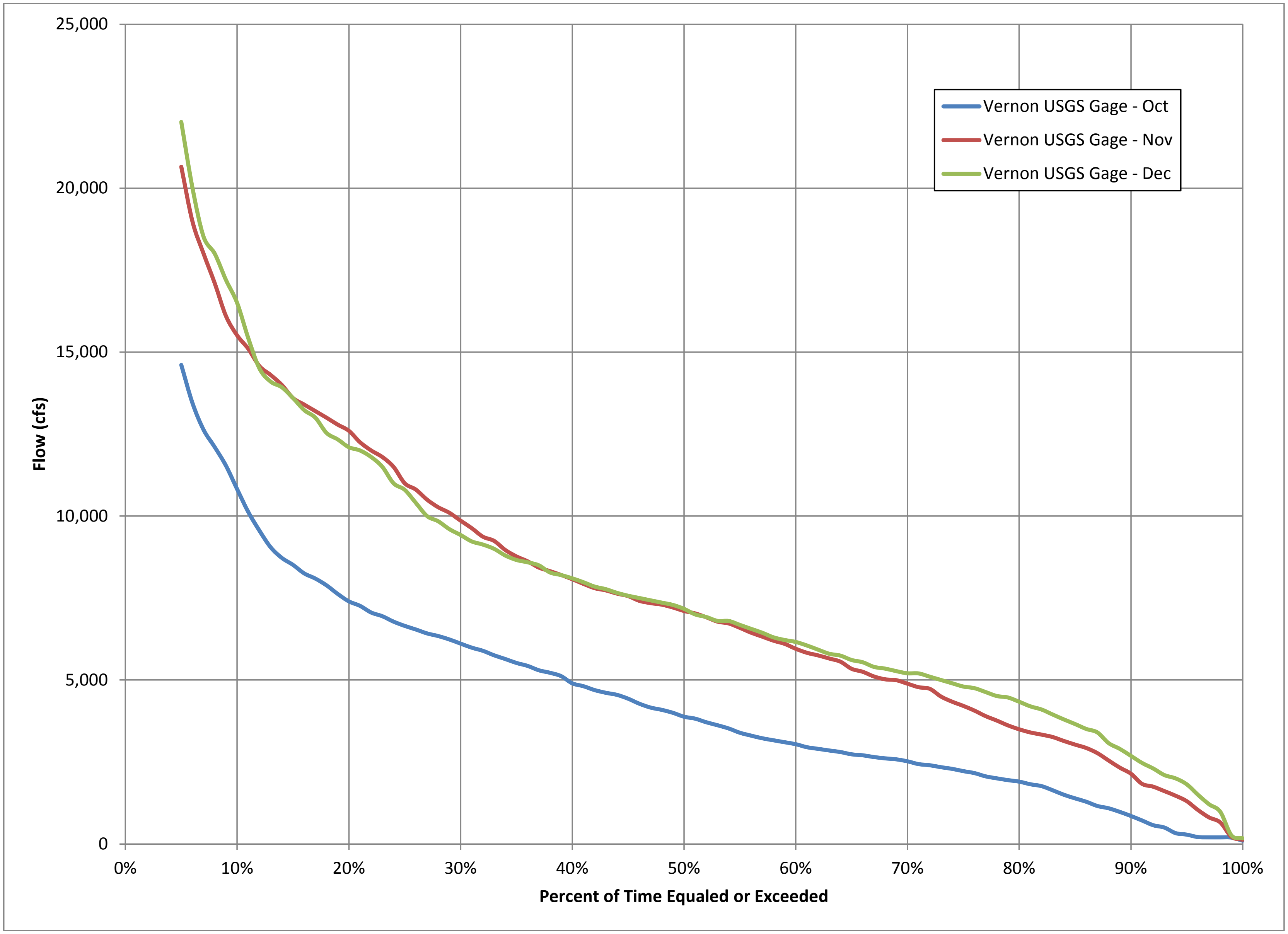


Figure 4.3.1.2-11: Connecticut River below Vernon Dam, VT, Oct-Dec Flow Duration Curve, Oct 1944-Sep 1973, Drainage= 6,266 mi^2

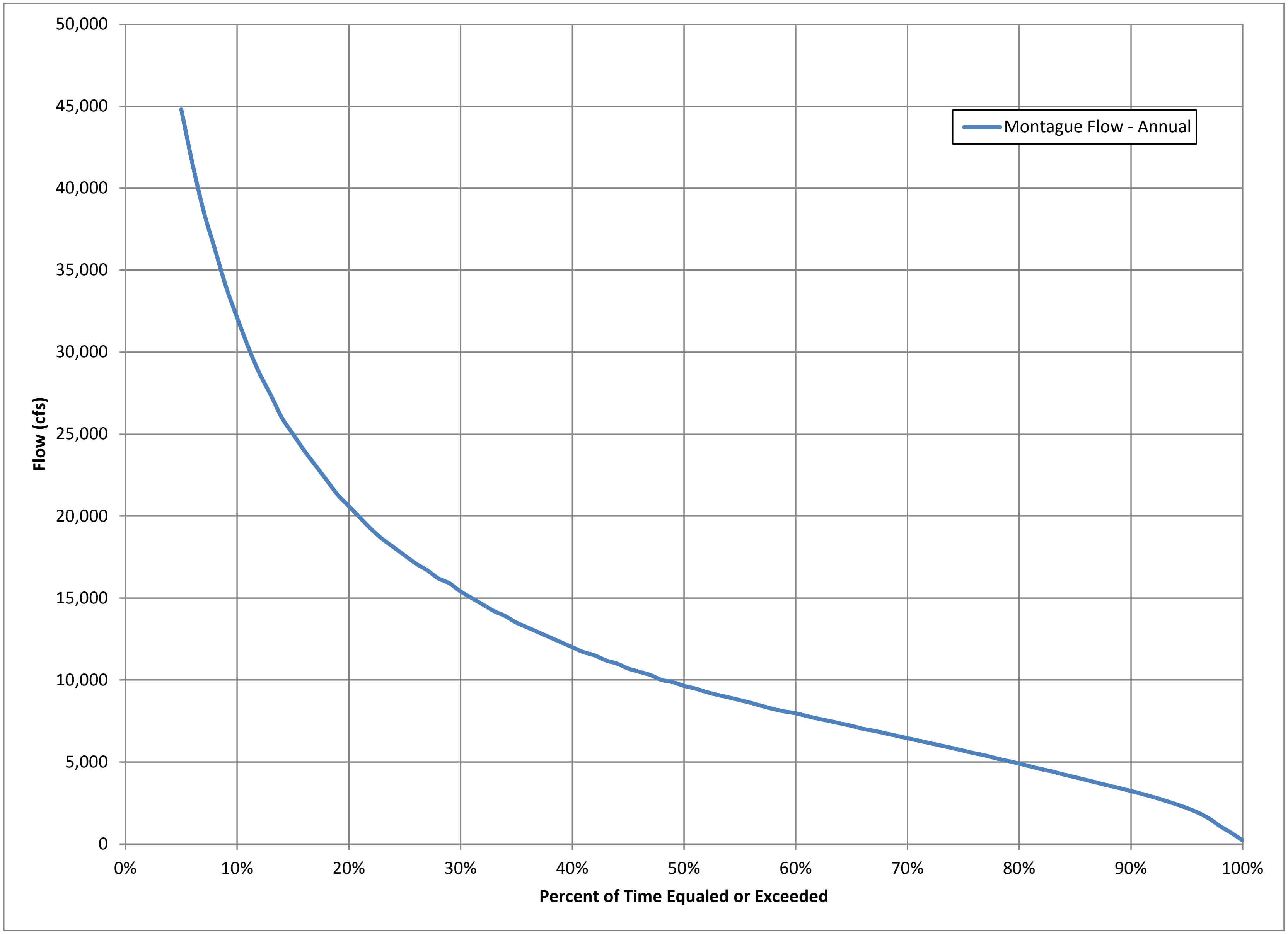


Figure 4.3.1.2-12: Connecticut River at Montague, MA, Annual Flow Duration Curve, Apr 1940-Sep 2010, Drainage= 7,860 mi^2

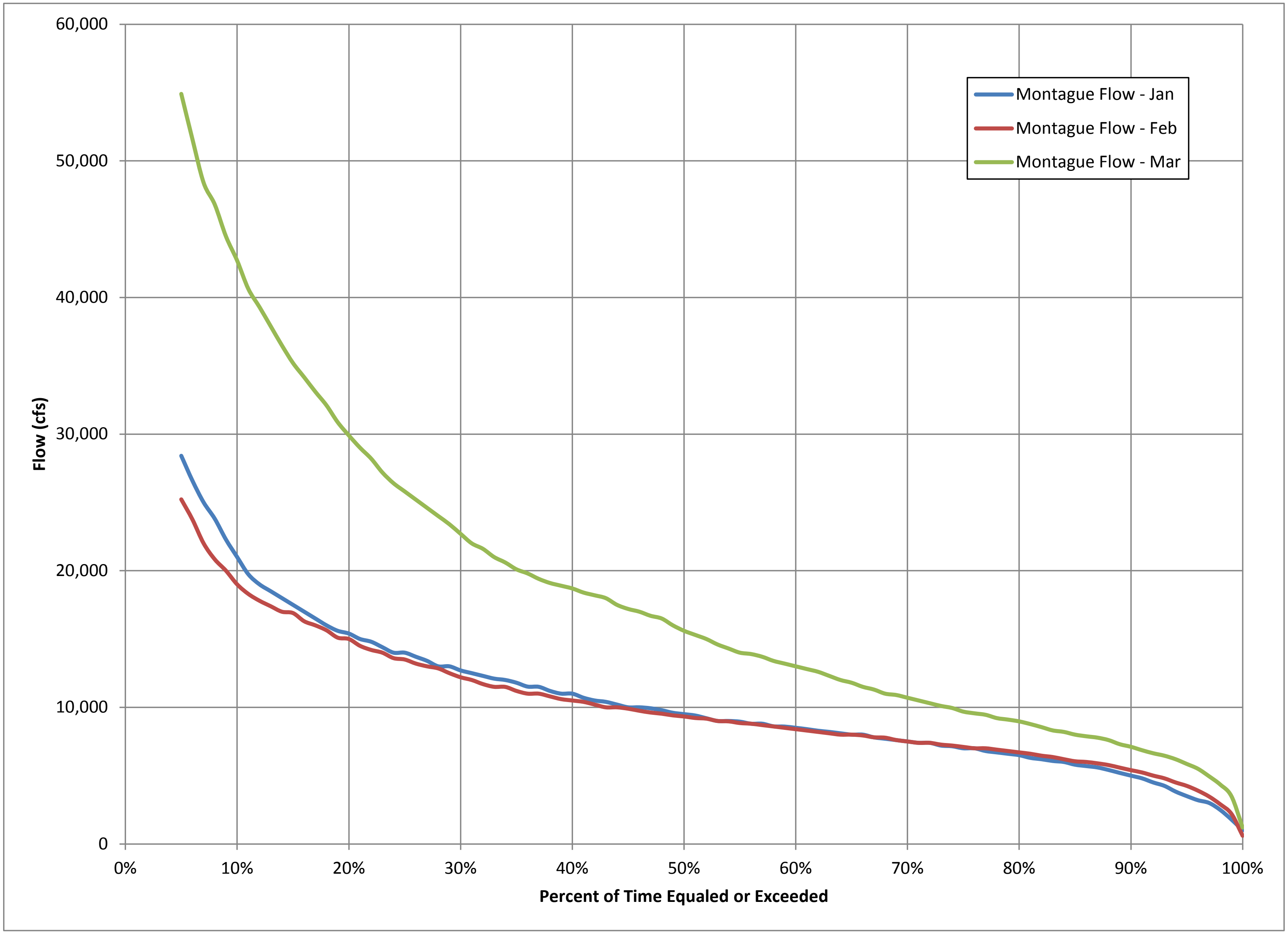


Figure 4.3.1.2-13: Connecticut River at Montague, MA, Jan-Mar Flow Duration Curve, Apr 1940-Sep 2010, Drainage= 7,860 mi^2

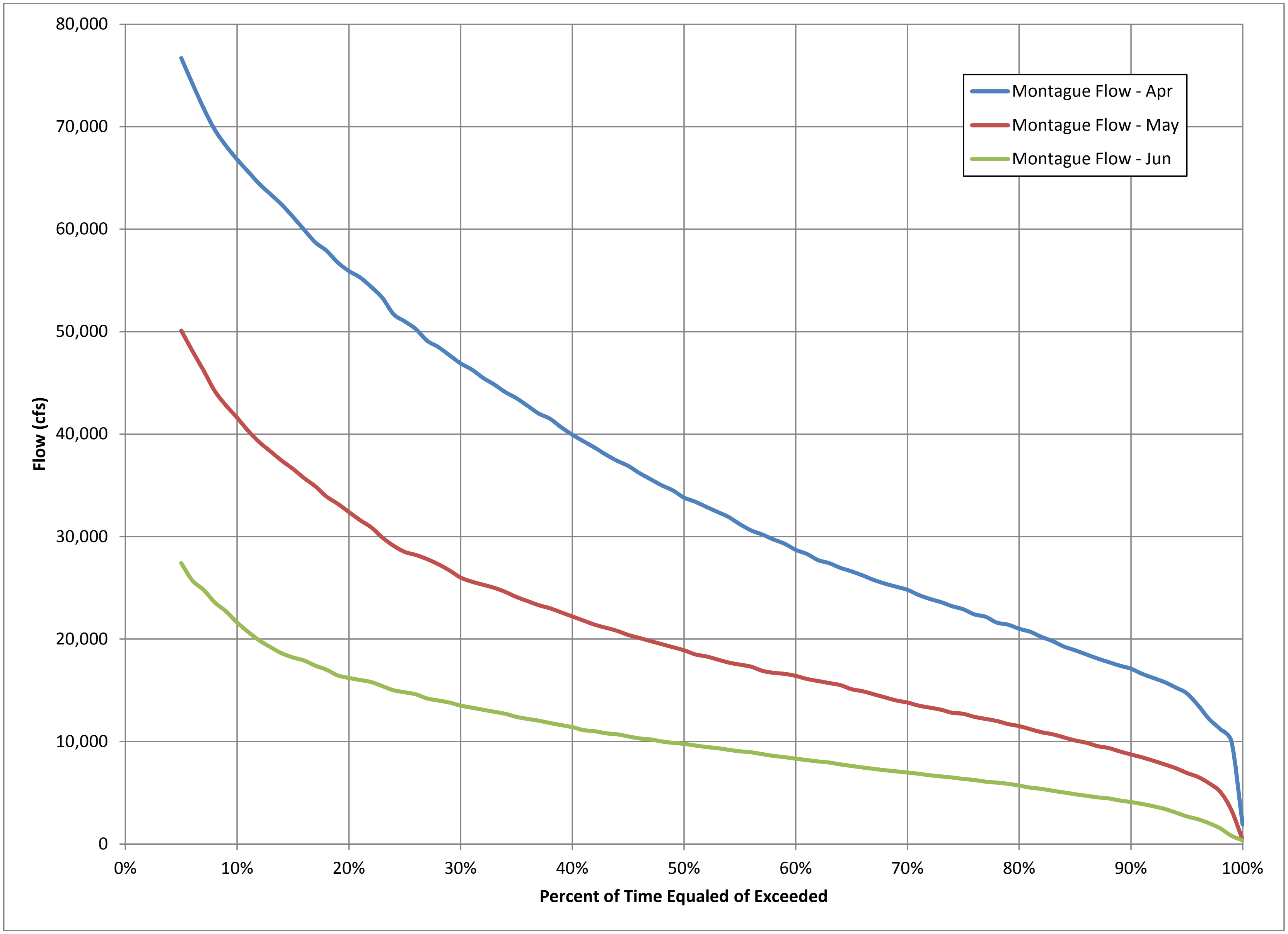


Figure 4.3.1.2-14: Connecticut River at Montague, MA, Apr-Jun Flow Duration Curve, Apr 1940-Sep 2010, Drainage= 7,860 mi^2

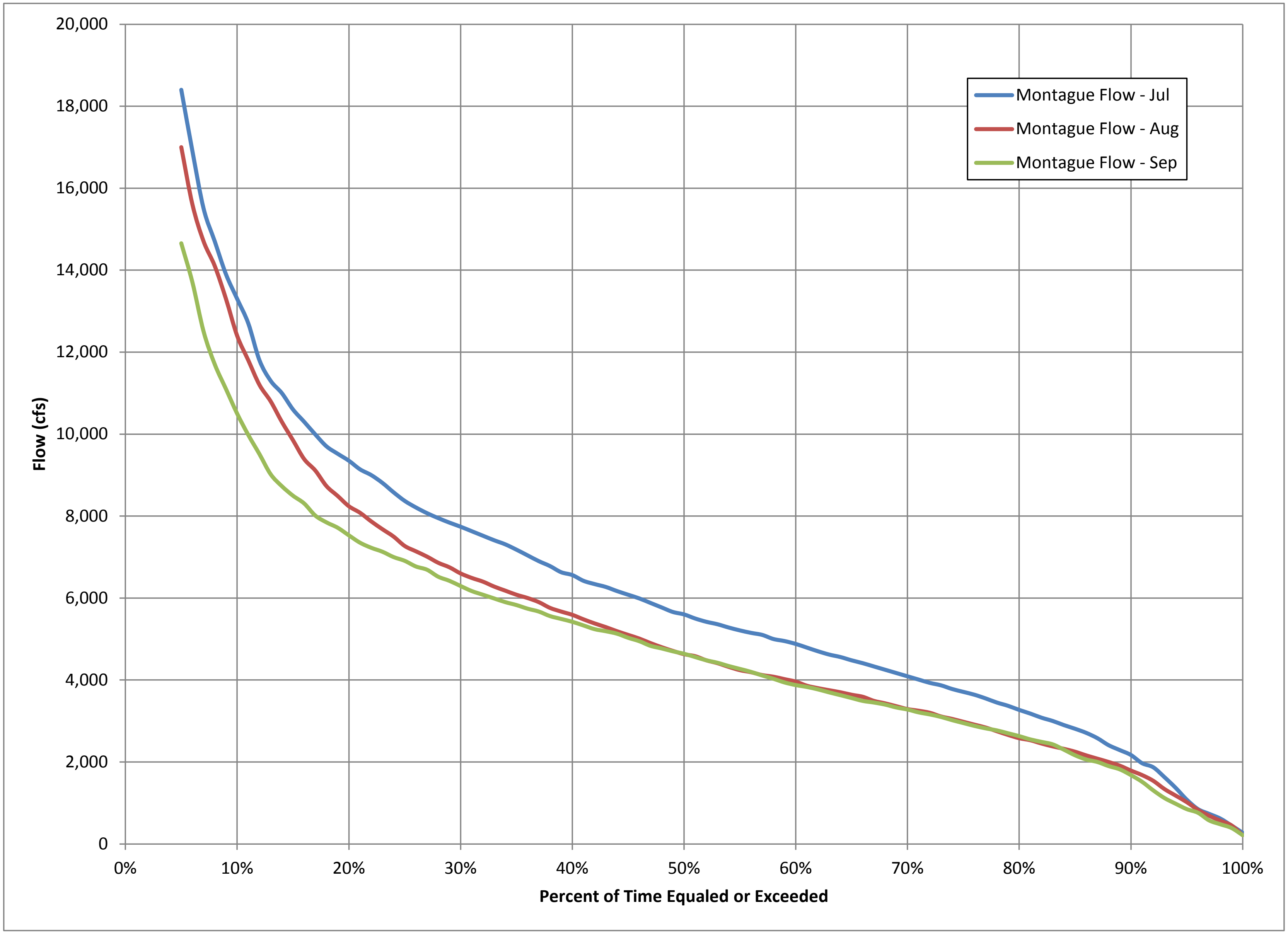


Figure 4.3.1.2-15: Connecticut River at Montague, MA, Jul-Sep Flow Duration Curve, Apr 1940-Sep 2010, Drainage= 7,860 mi^2

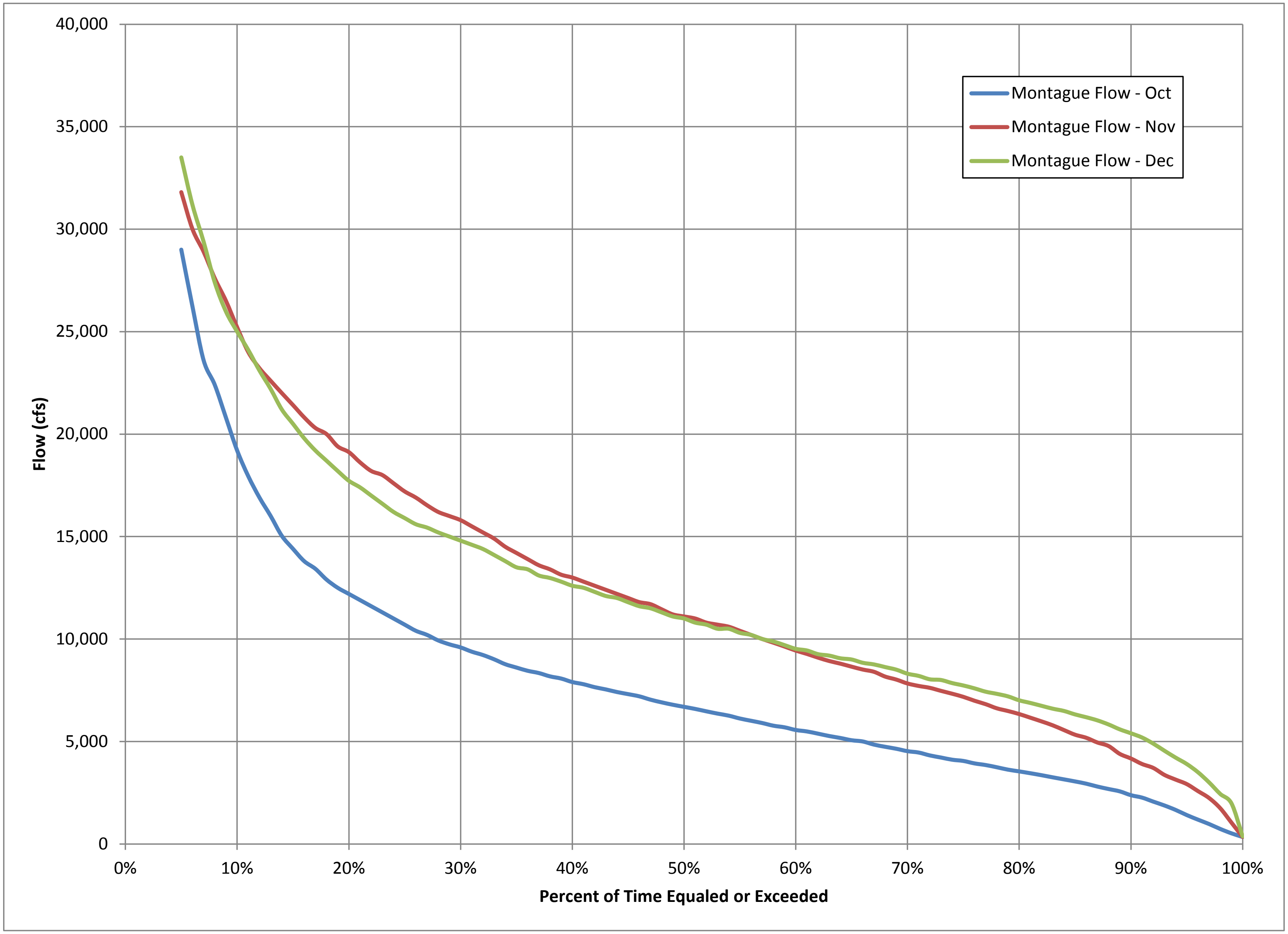


Figure 4.3.1.2-16: Connecticut River at Montague, MA, Oct-Dec Flow Duration Curve, Apr 1940-Sep 2010, Drainage= 7,860 mi^2

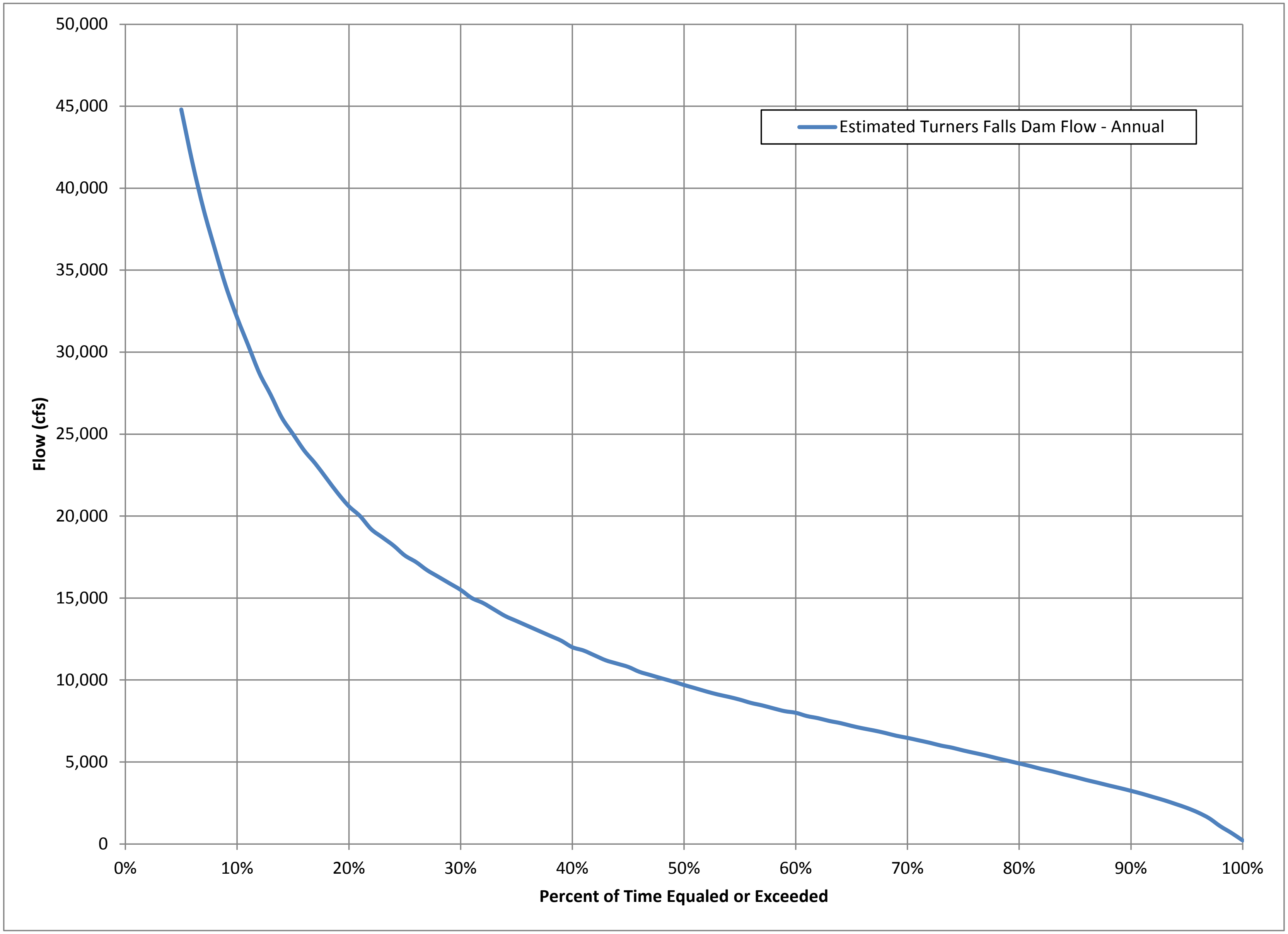


Figure 4.3.1.2-17: Connecticut River at Turners Falls Dam, Annual Flow Duration Curve, Jan 1941-Sep 2010, Drainage= 7,163 mi^2

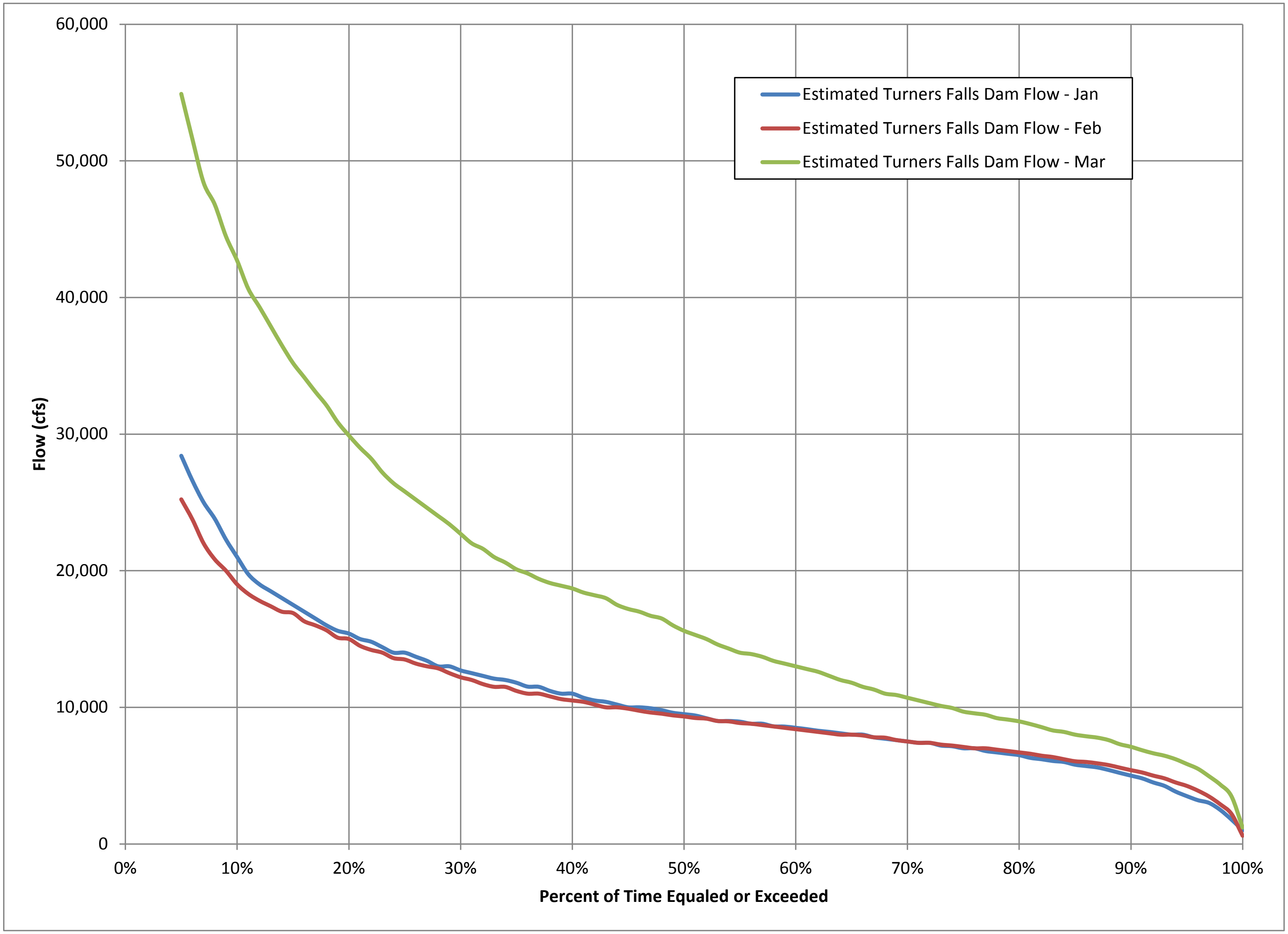


Figure 4.3.1.2-18: Connecticut River at Turners Falls Dam, Jan-Mar Flow Duration Curve, Jan 1941-Sep 2010, Drainage= 7,163 mi^2

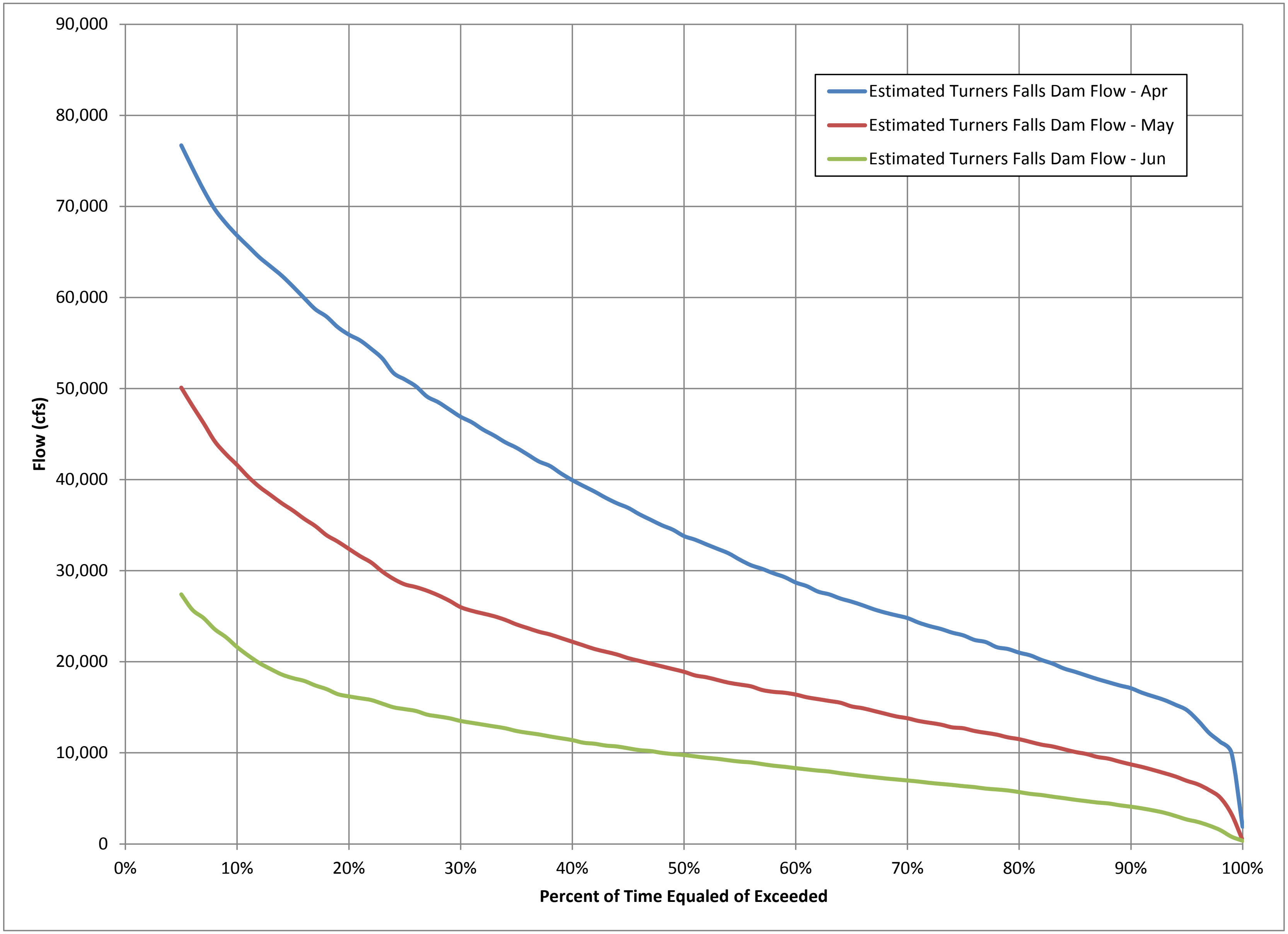


Figure 4.3.1.2-19: Connecticut River at Turners Falls Dam, Apr-Jun Flow Duration Curve, Jan 1941-Sep 2010, Drainage= 7,163 mi^2

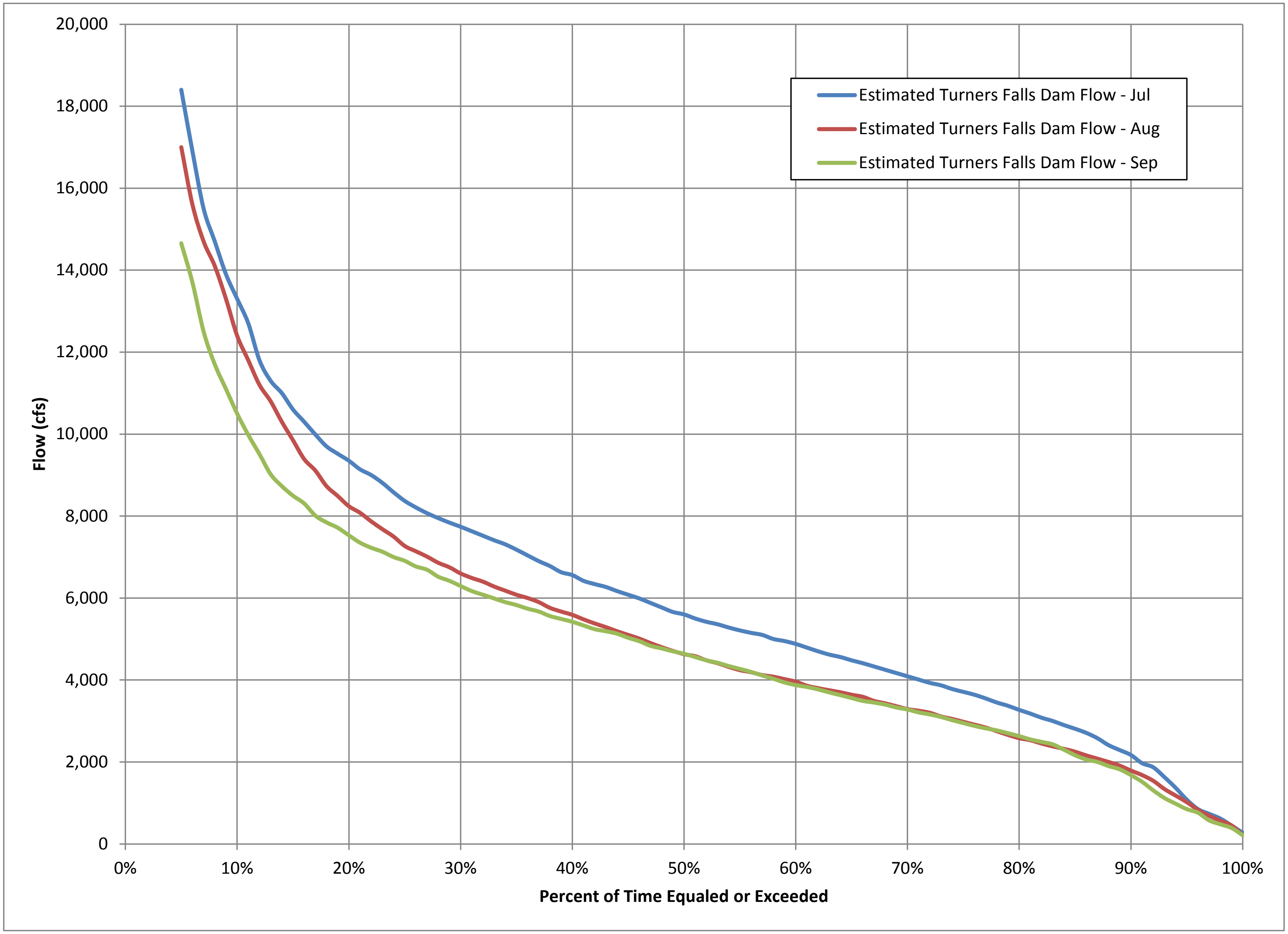


Figure 4.3.1.2-20: Connecticut River at Turners Falls Dam, Jul-Sep Flow Duration Curve, Jan 1941-Sep 2010, Drainage= 7,163 mi^2

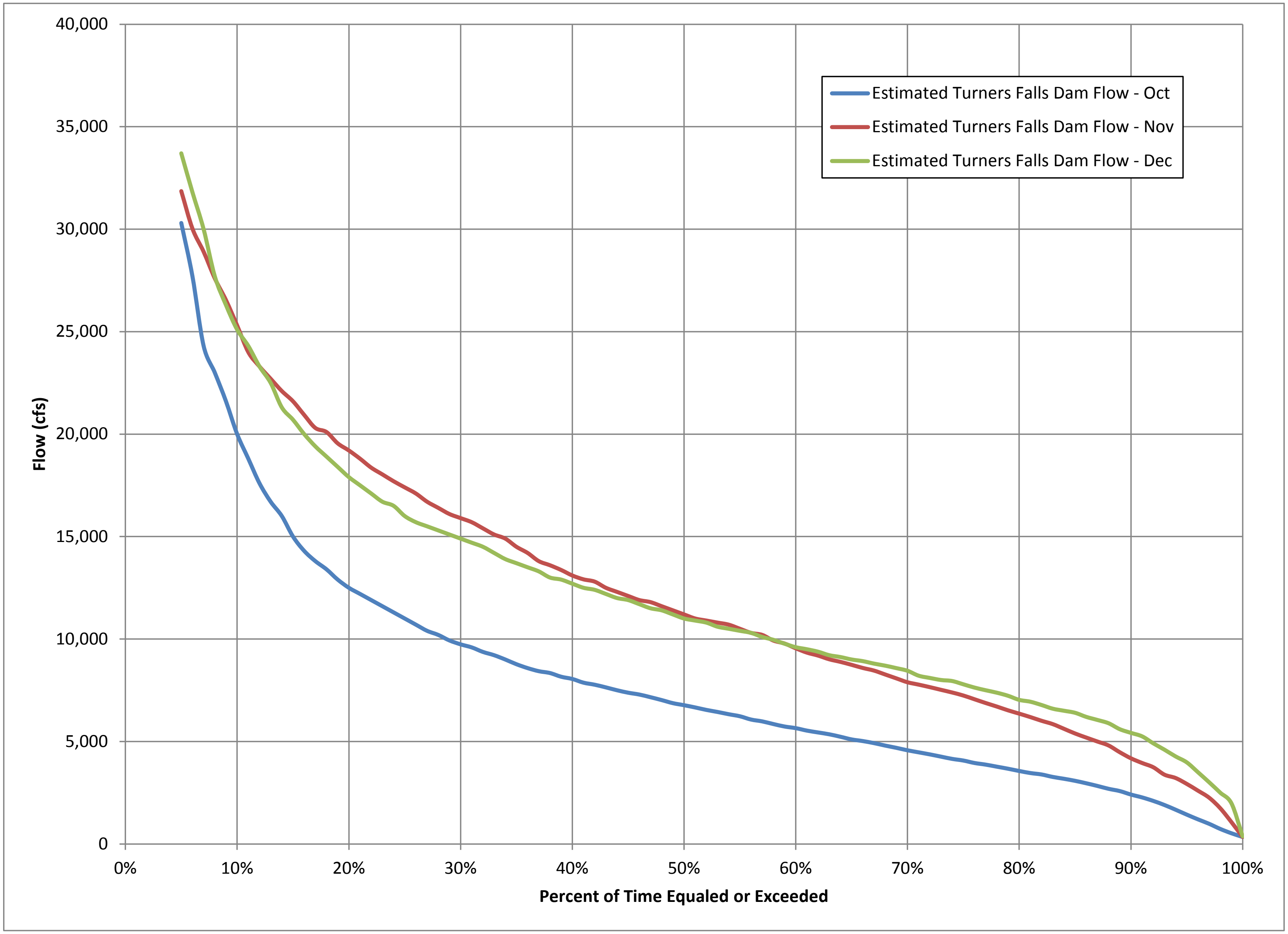
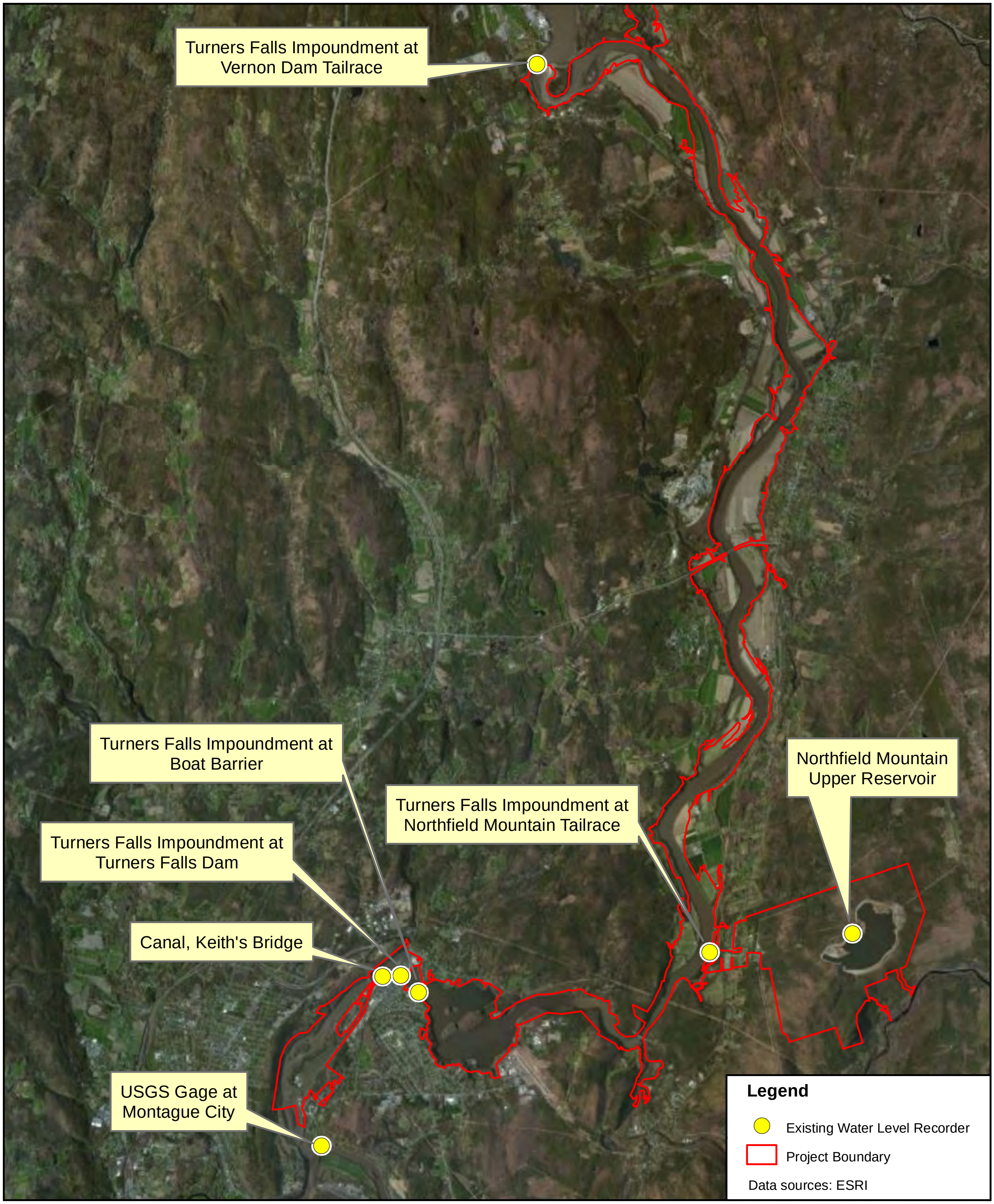


Figure 4.3.1.2-21: Connecticut River at Turners Falls Dam, Oct-Dec Flow Duration Curve, Jan 1941-Sep 2010, Drainage= 7,163 mi^2



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0 0.75 1.5 2.25 3 Miles

Figure 4.3.1.3-1
Existing Water Level Recorders

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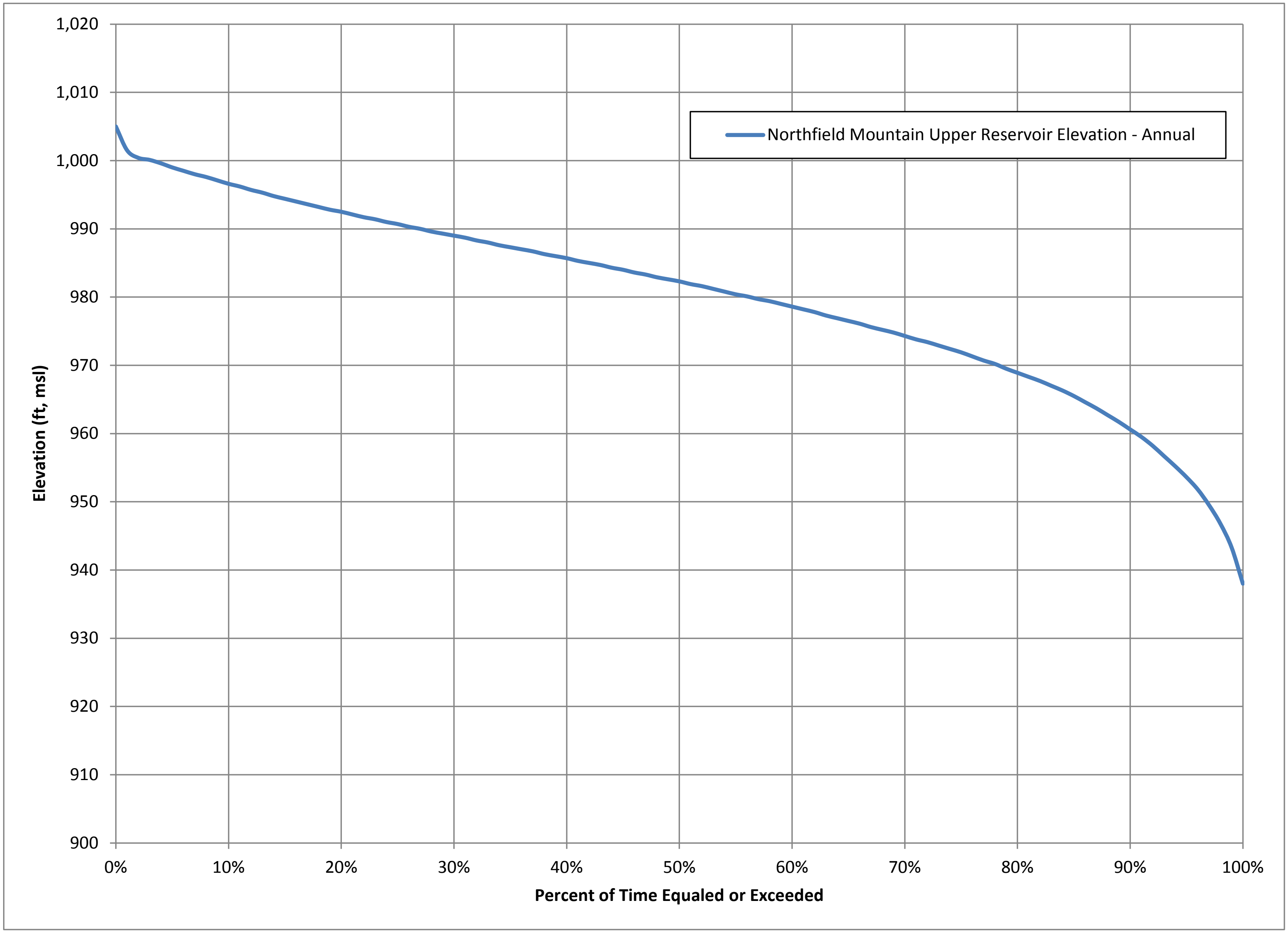


Figure 4.3.1.3-2: Northfield Mountain Upper Reservoir- Annual Elevation Duration Curves, Hourly 2000-2009

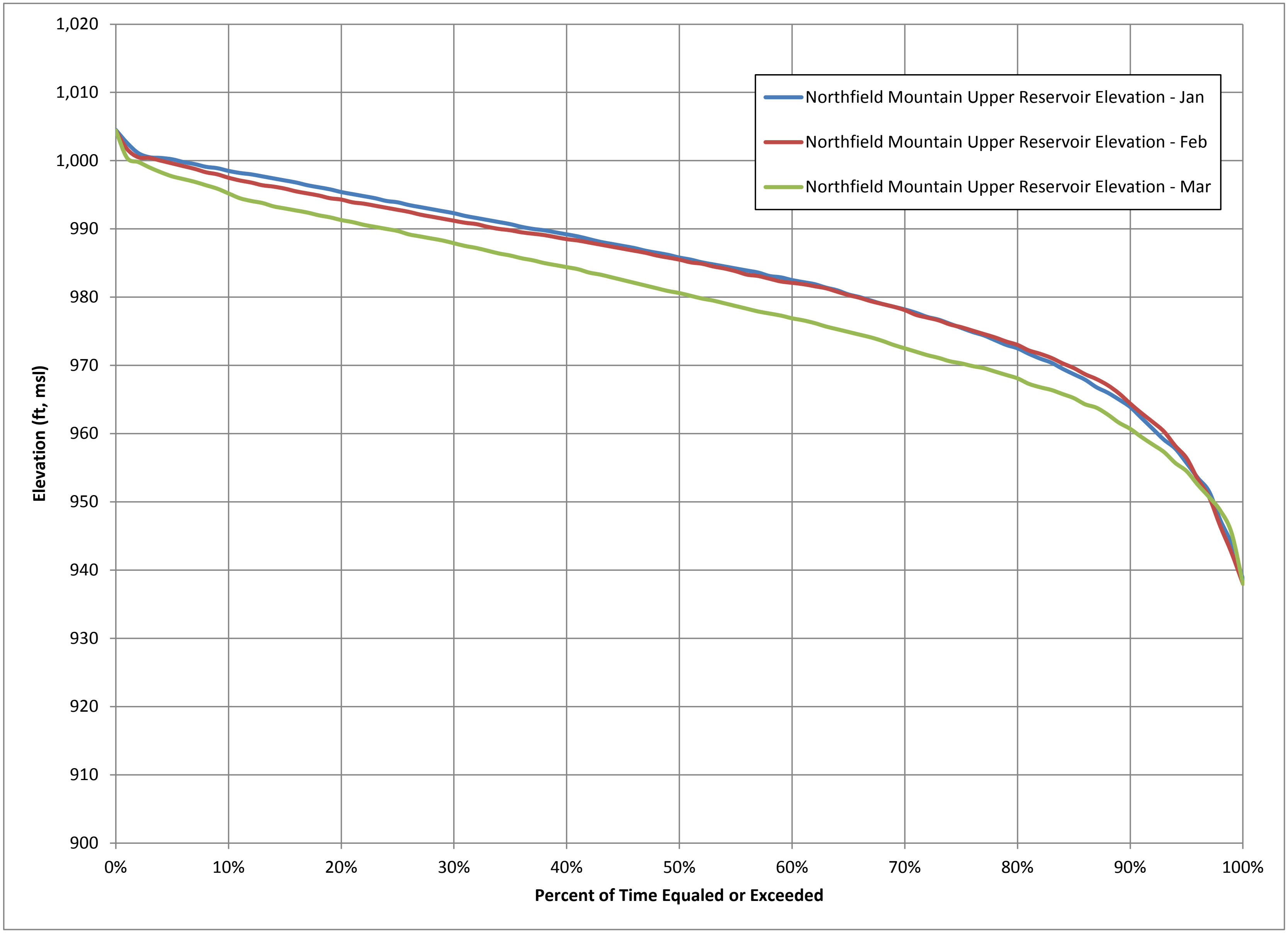


Figure 4.3.1.3-3: Northfield Mountain Upper Reservoir- Jan-Mar Elevation Duration Curves, Hourly 2000-2009

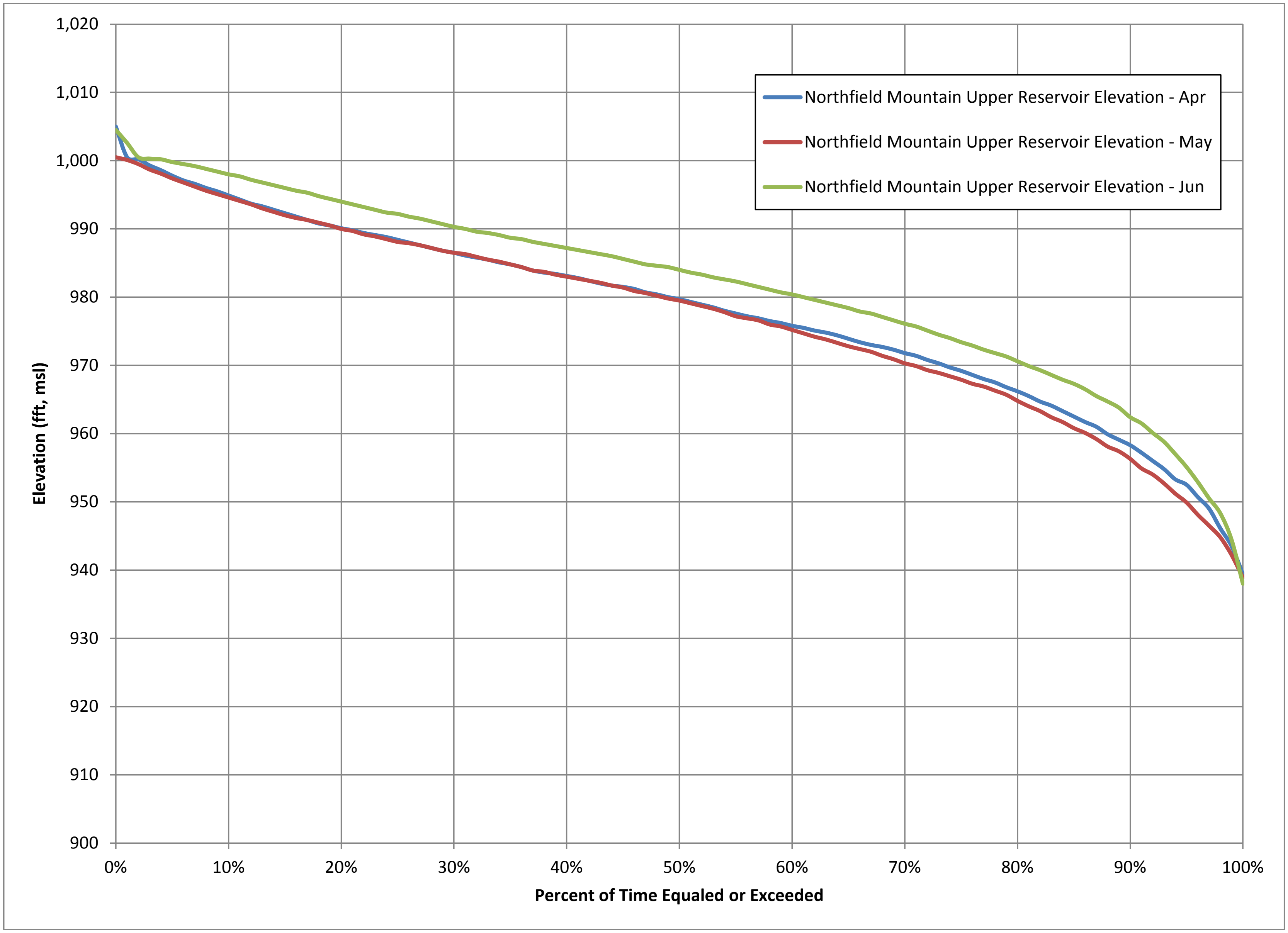


Figure 4.3.1.3-4: Northfield Mountain Upper Reservoir- Apr-Jun Elevation Duration Curves, Hourly 2000-2009

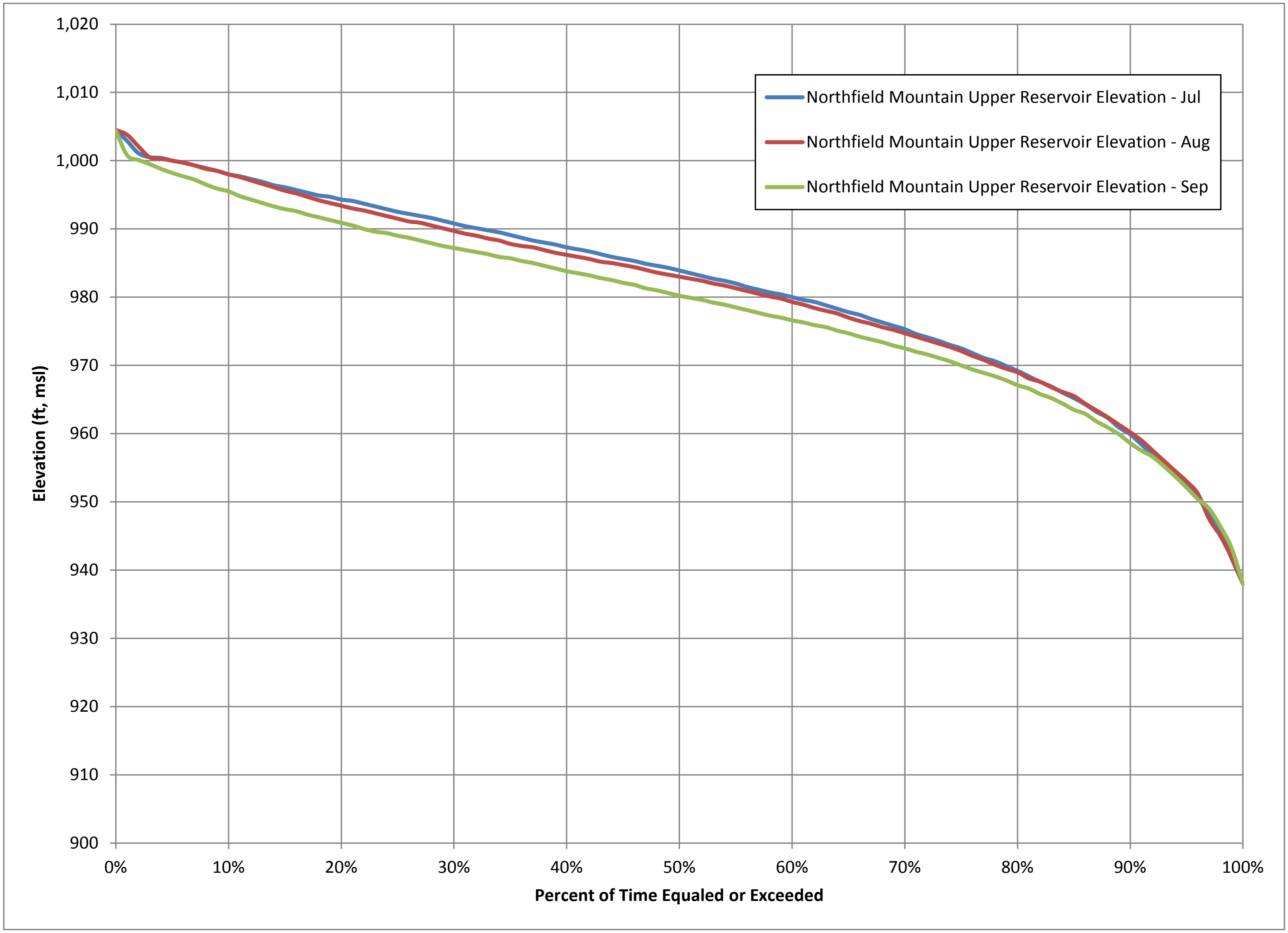


Figure 4.3.1.3-5: Northfield Mountain Upper Reservoir- Jul-Sep Elevation Duration Curves, Hourly 2000-2009

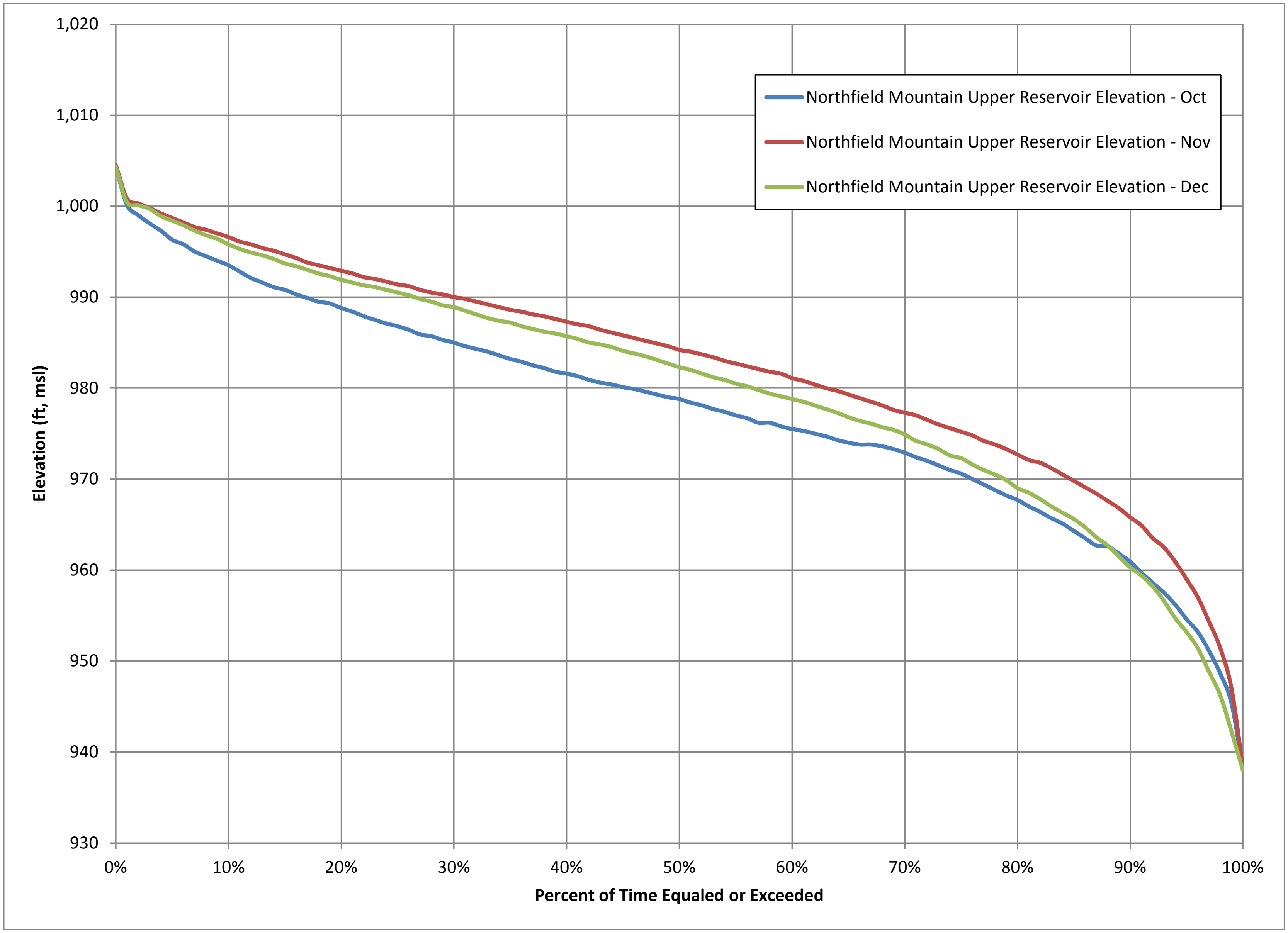


Figure 4.3.1.3-6: Northfield Mountain Upper Reservoir- Oct-Dec Elevation Duration Curves, Hourly 2000-2009

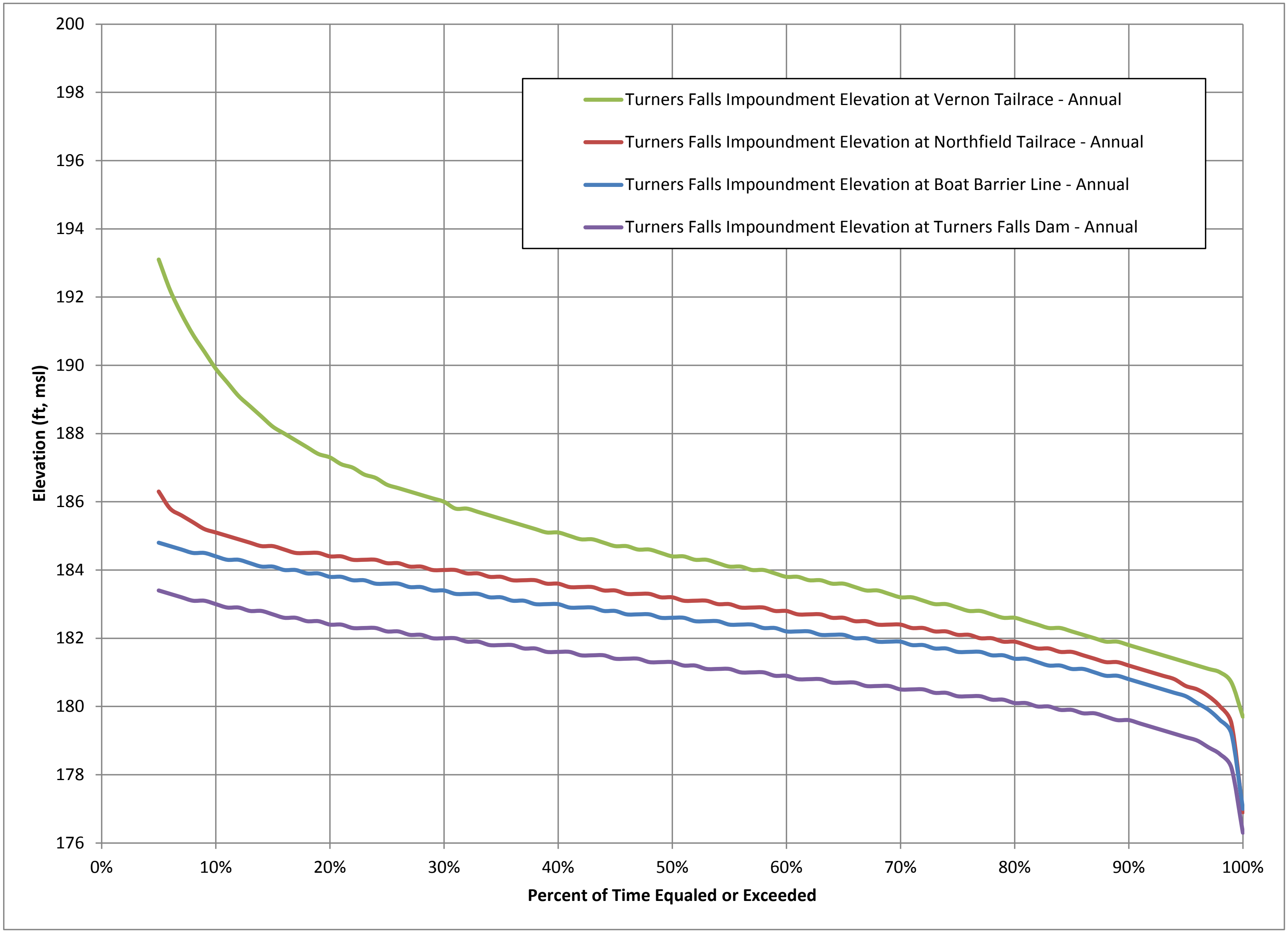


Figure 4.3.1.3-7: Turners Falls Impoundment- Annual Elevation Duration Curves, Hourly 2000-2009

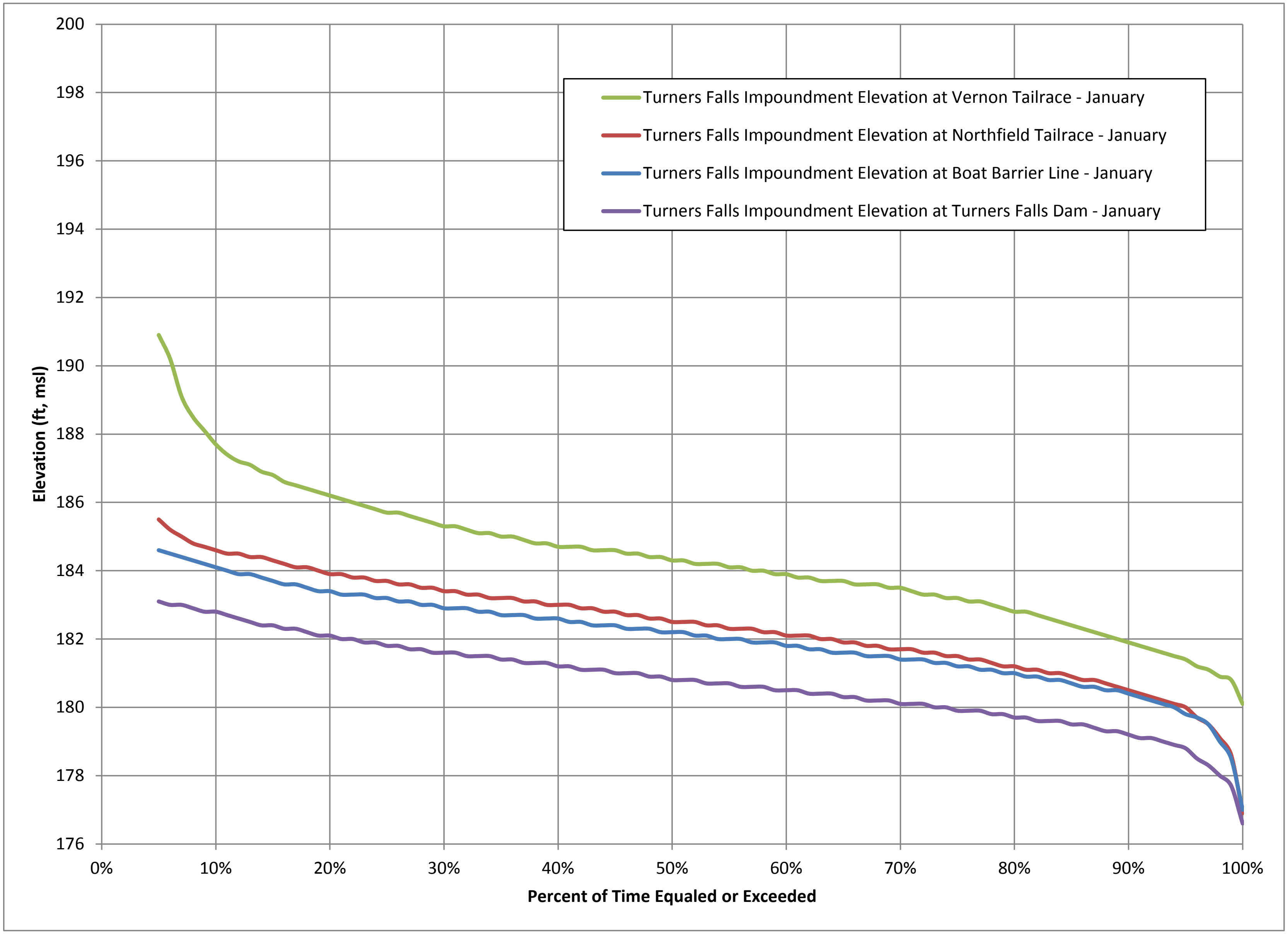


Figure 4.3.1.3-8: Turners Falls Impoundment- Jan Elevation Duration Curves, Hourly 2000-2009

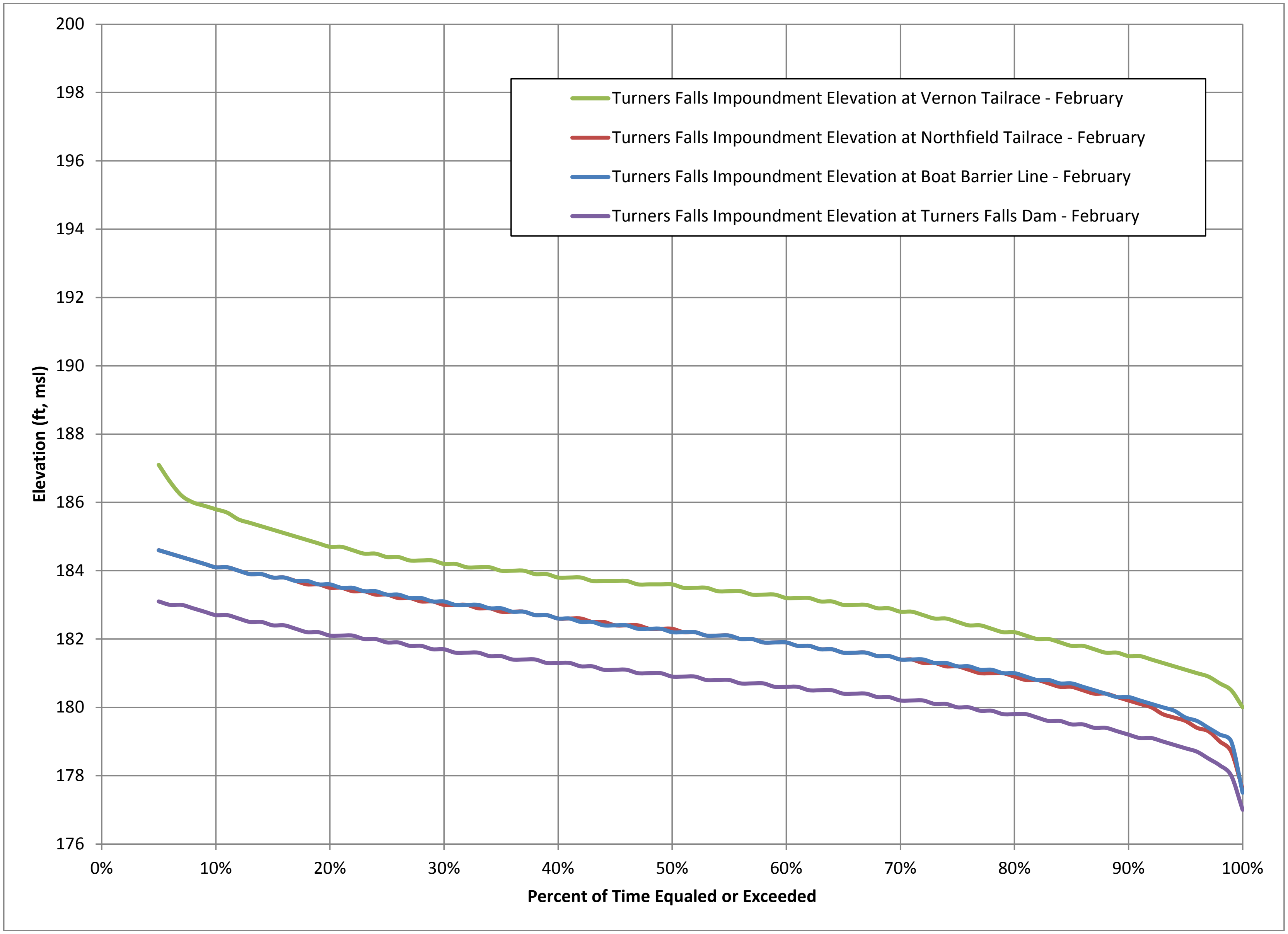


Figure 4.3.1.3-9: Turners Falls Impoundment- Feb Elevation Duration Curves, Hourly 2000-2009

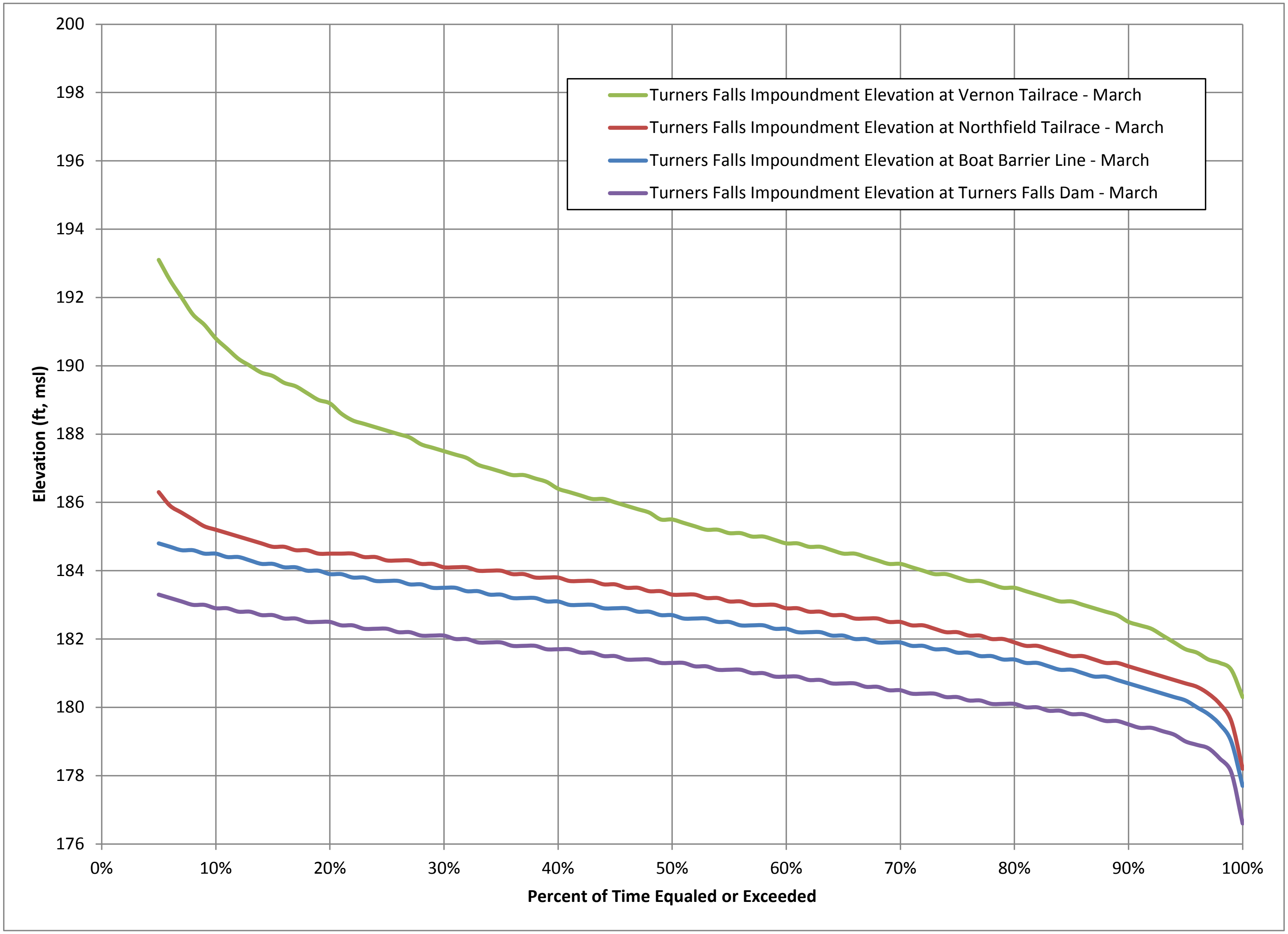


Figure 4.3.1.3-10: Turners Falls Impoundment- Mar Elevation Duration Curves, Hourly 2000-2009

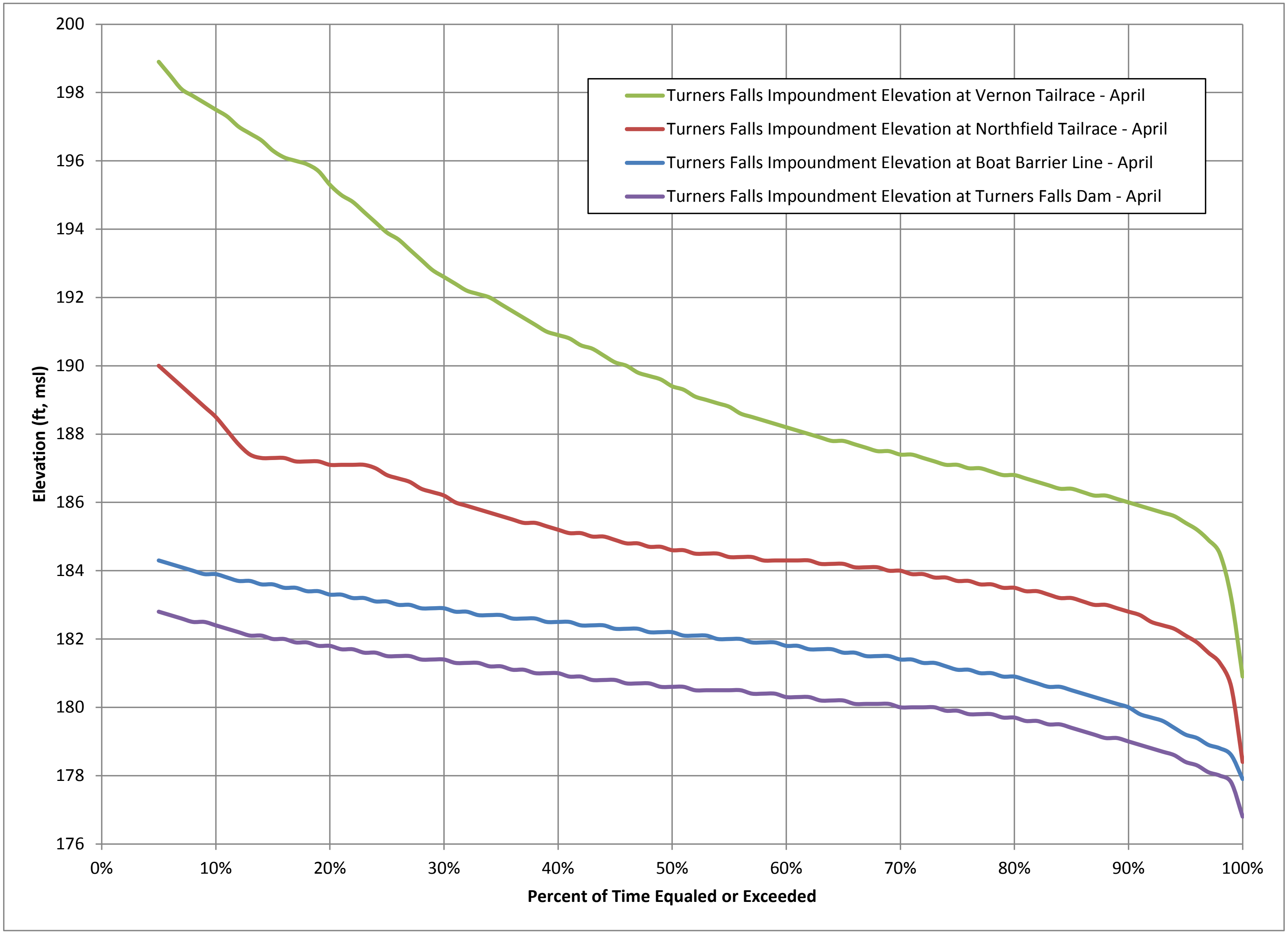


Figure 4.3.1.3-11: Turners Falls Impoundment- Apr Elevation Duration Curves, Hourly 2000-2009

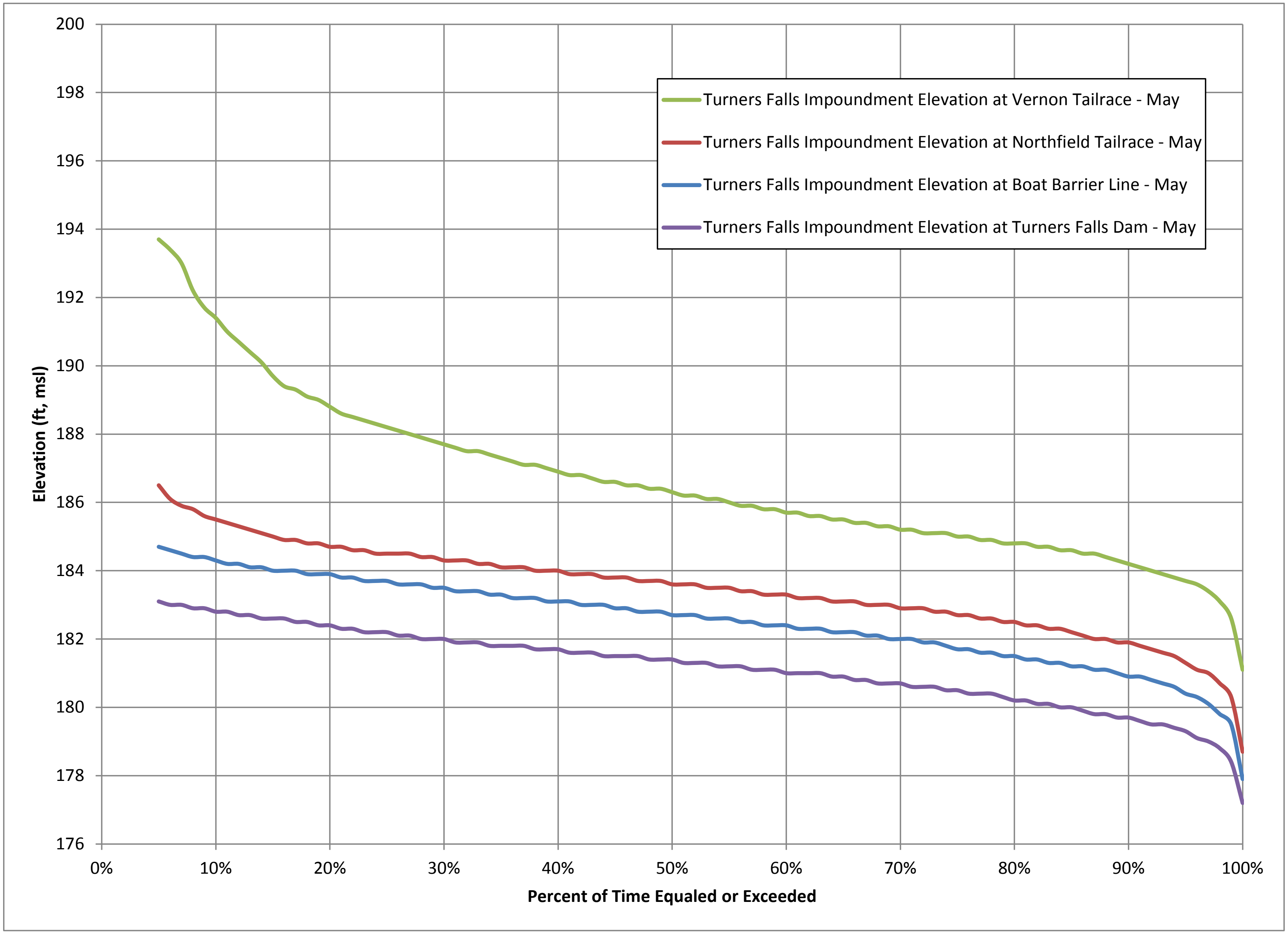


Figure 4.3.1.3-12: Turners Falls Impoundment- May Elevation Duration Curves, Hourly 2000-2009

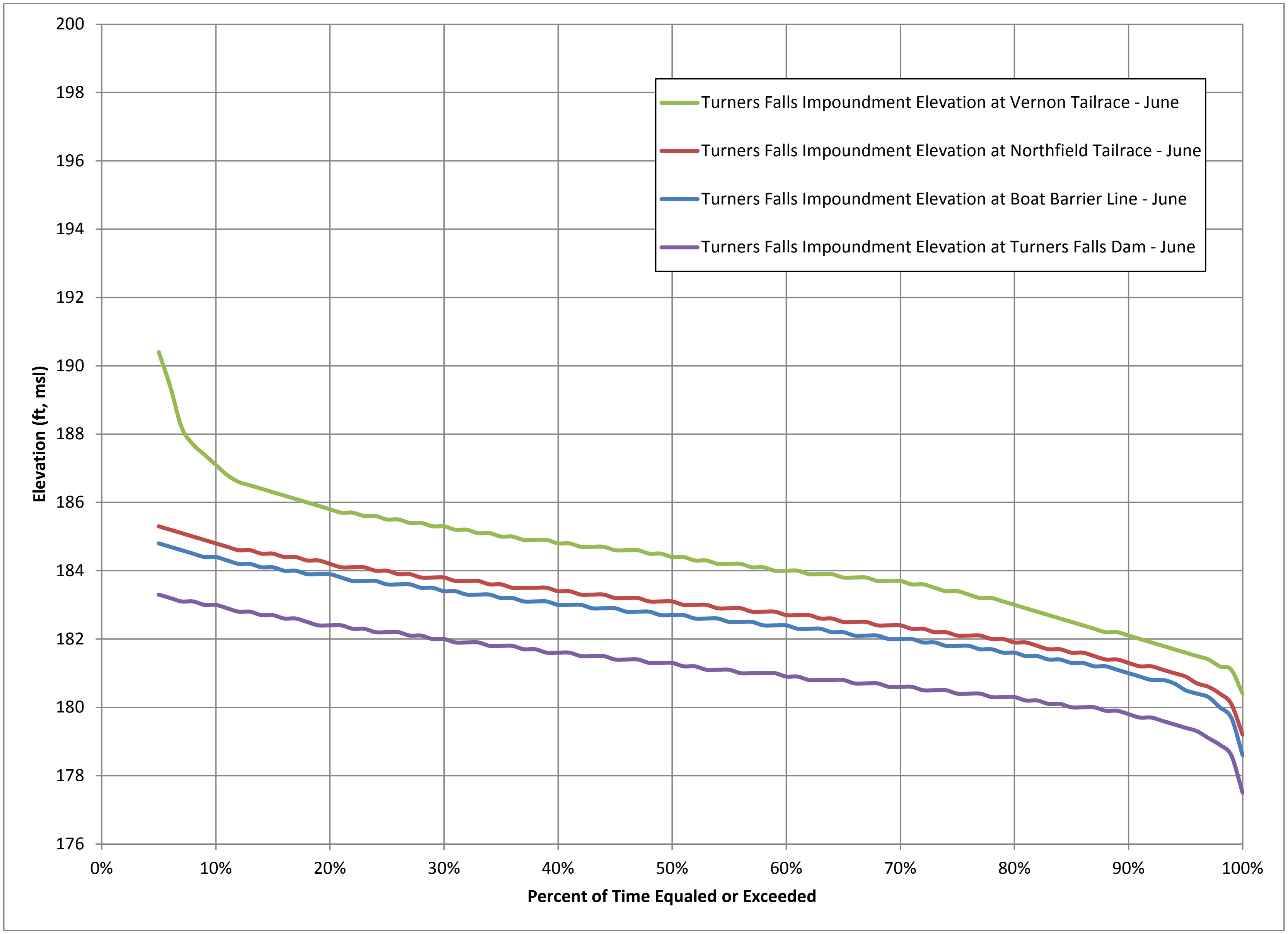


Figure 4.3.1.3-13: Turners Falls Impoundment- Jun Elevation Duration Curves, Hourly 2000-2009

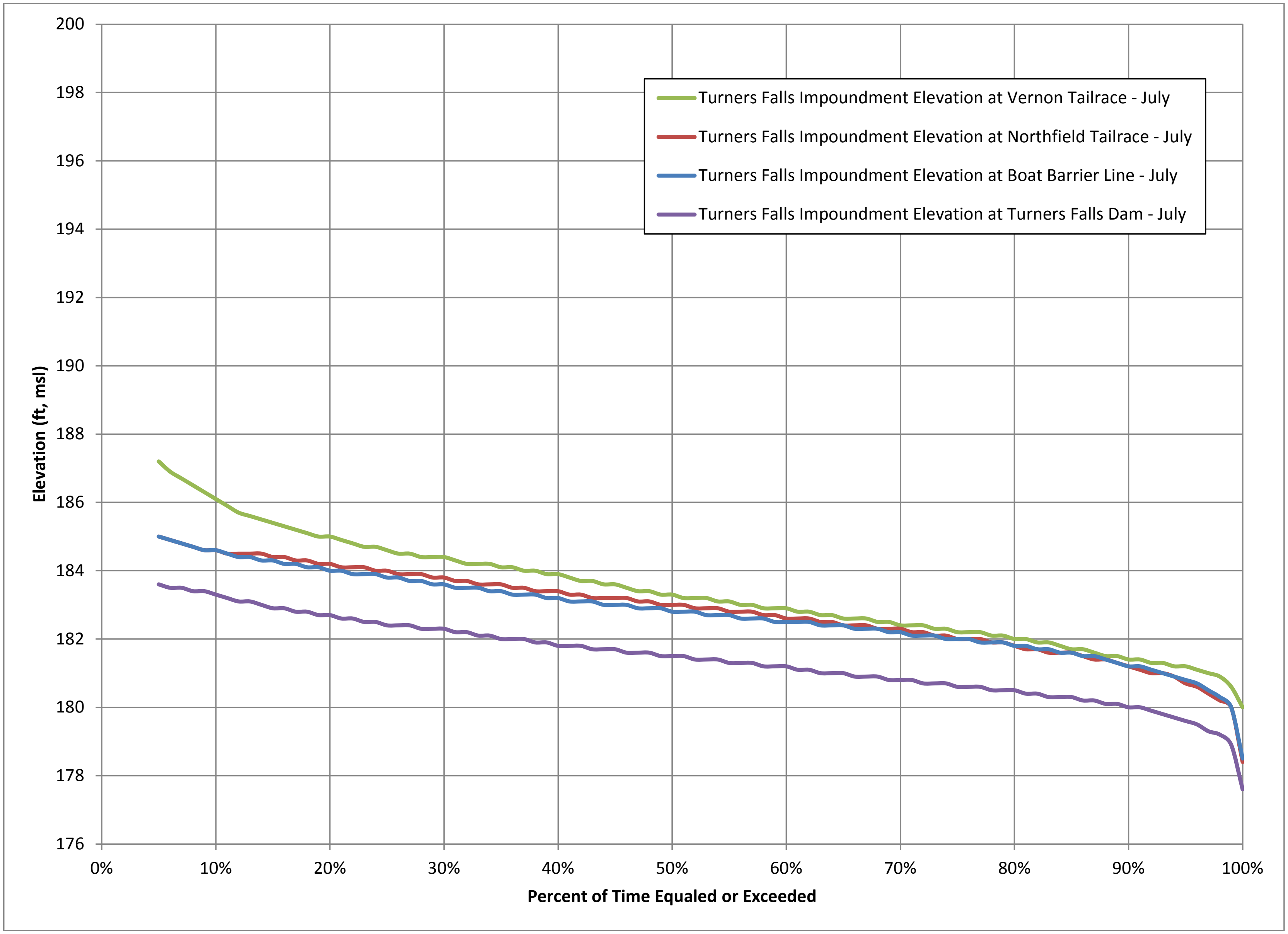


Figure 4.3.1.3-14: Turners Falls Impoundment- Jul Elevation Duration Curves, Hourly 2000-2009

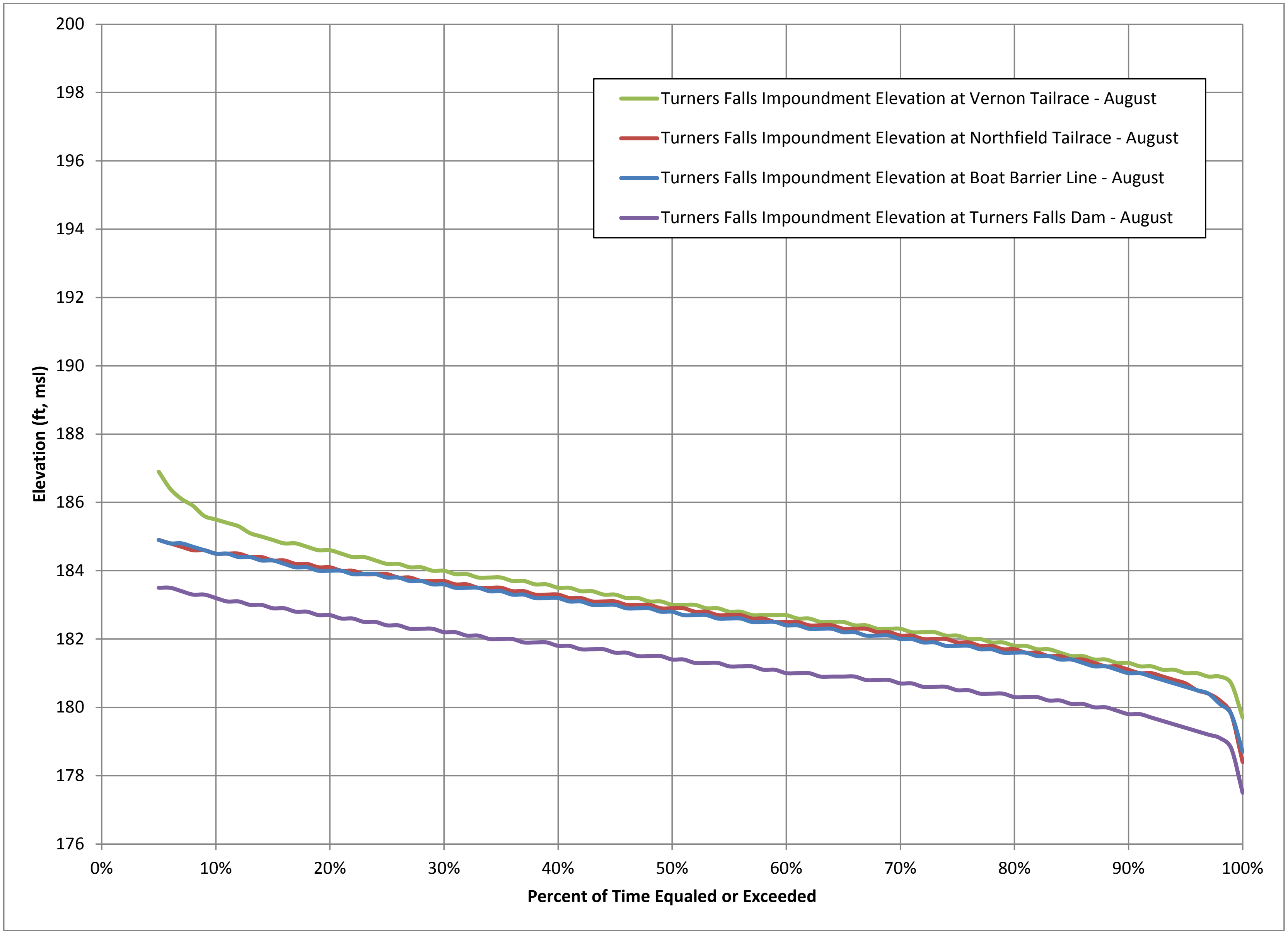


Figure 4.3.1.3-15: Turners Falls Impoundment- Aug Elevation Duration Curves, Hourly 2000-2009

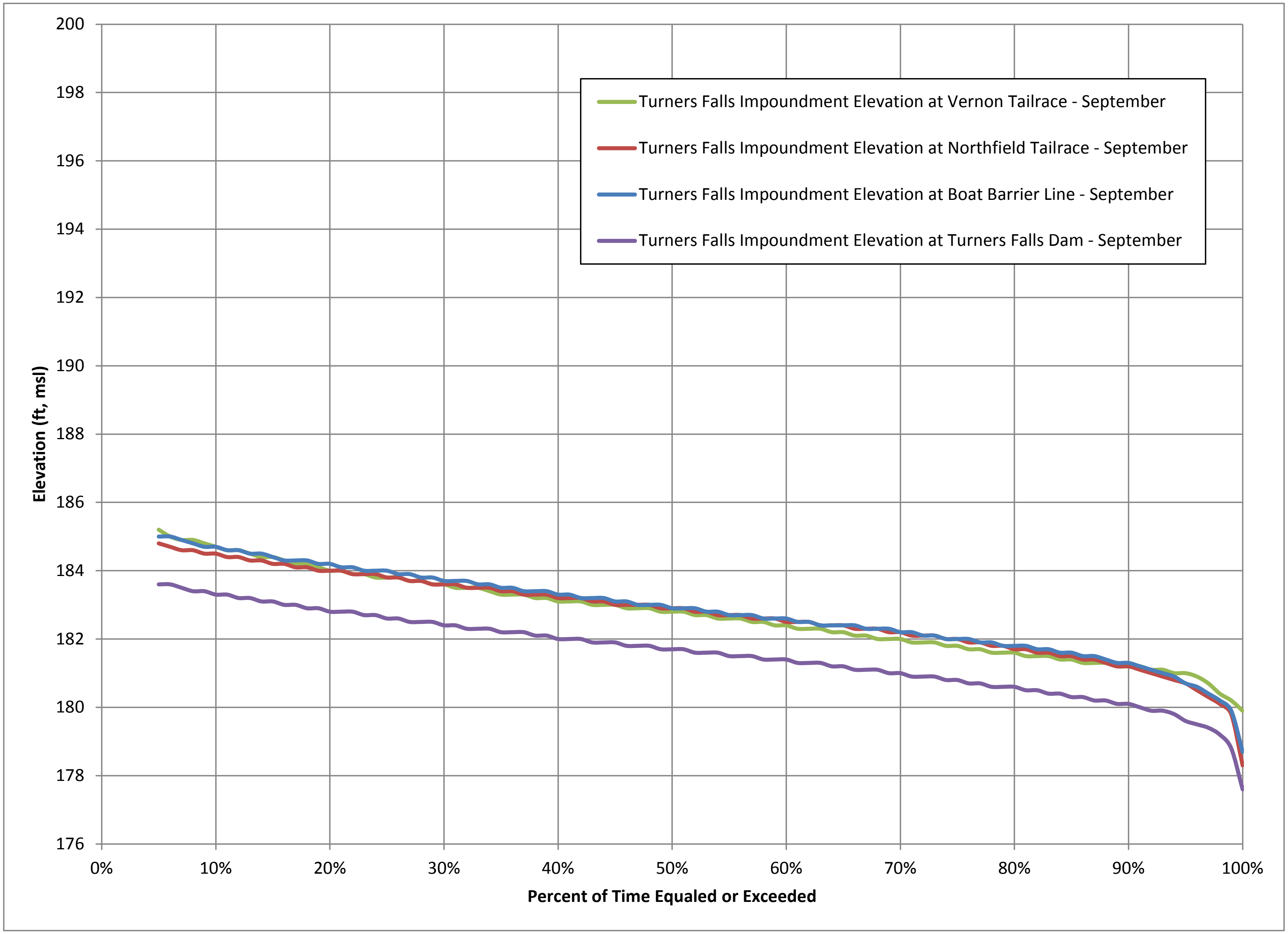


Figure 4.3.1.3-16: Turners Falls Impoundment- Sep Elevation Duration Curves, Hourly 2000-2009

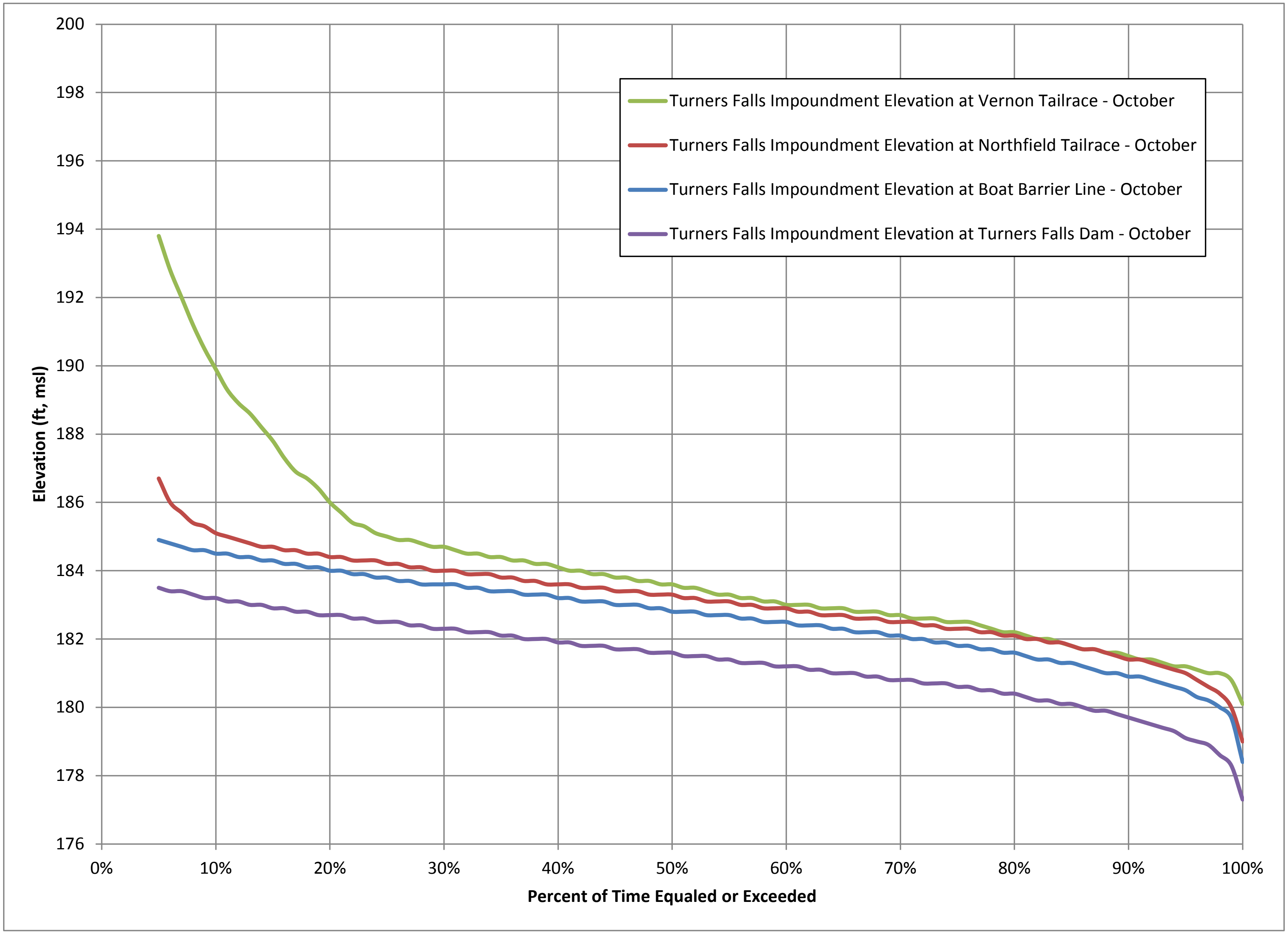


Figure 4.3.1.3-17: Turners Falls Impoundment- Oct Elevation Duration Curves, Hourly 2000-2009

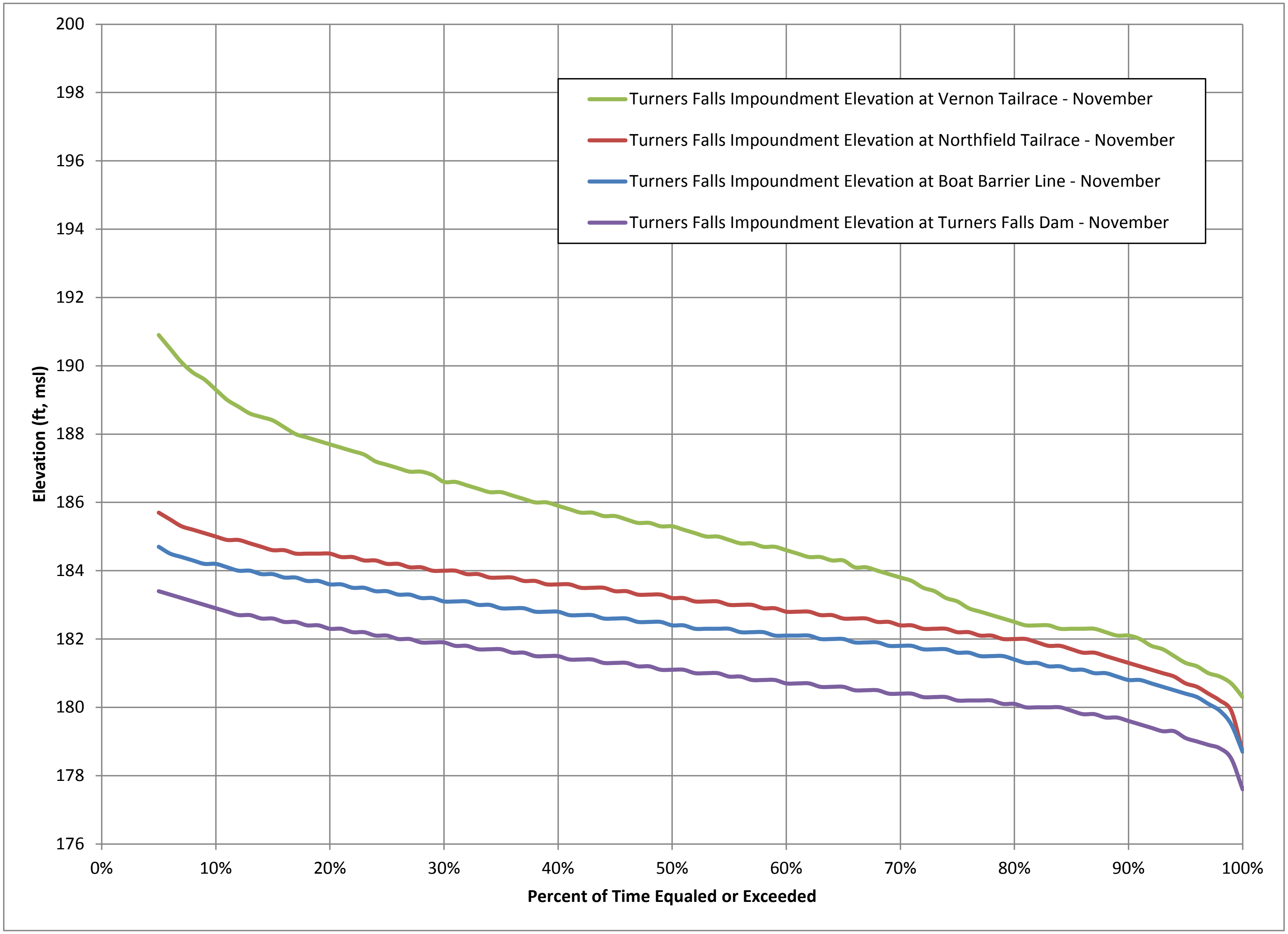


Figure 4.3.1.3-18: Turners Falls Impoundment- Nov Elevation Duration Curves, Hourly 2000-2009

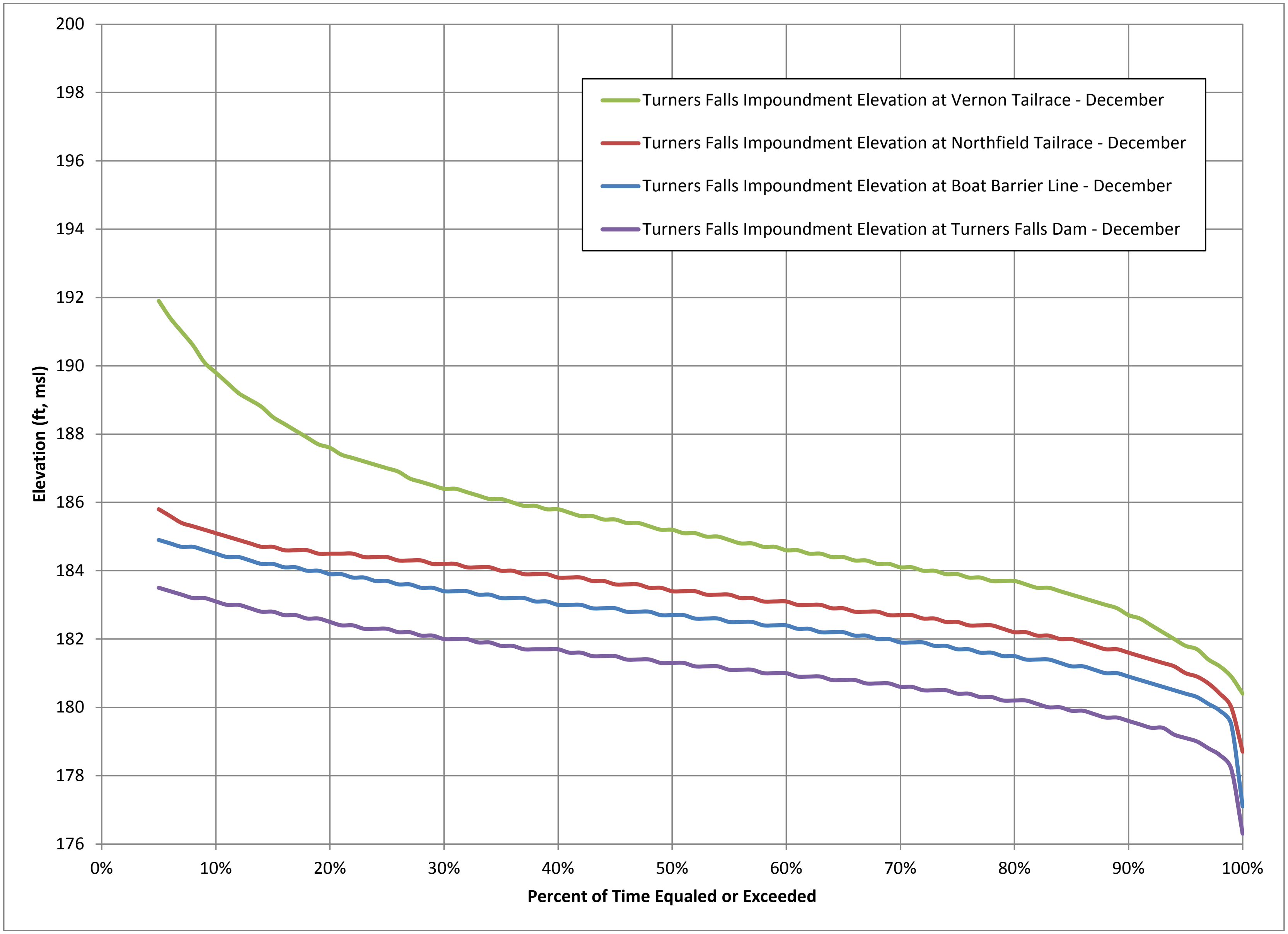


Figure 4.3.1.3-19: Turners Falls Impoundment- Dec Elevation Duration Curves, Hourly 2000-2009

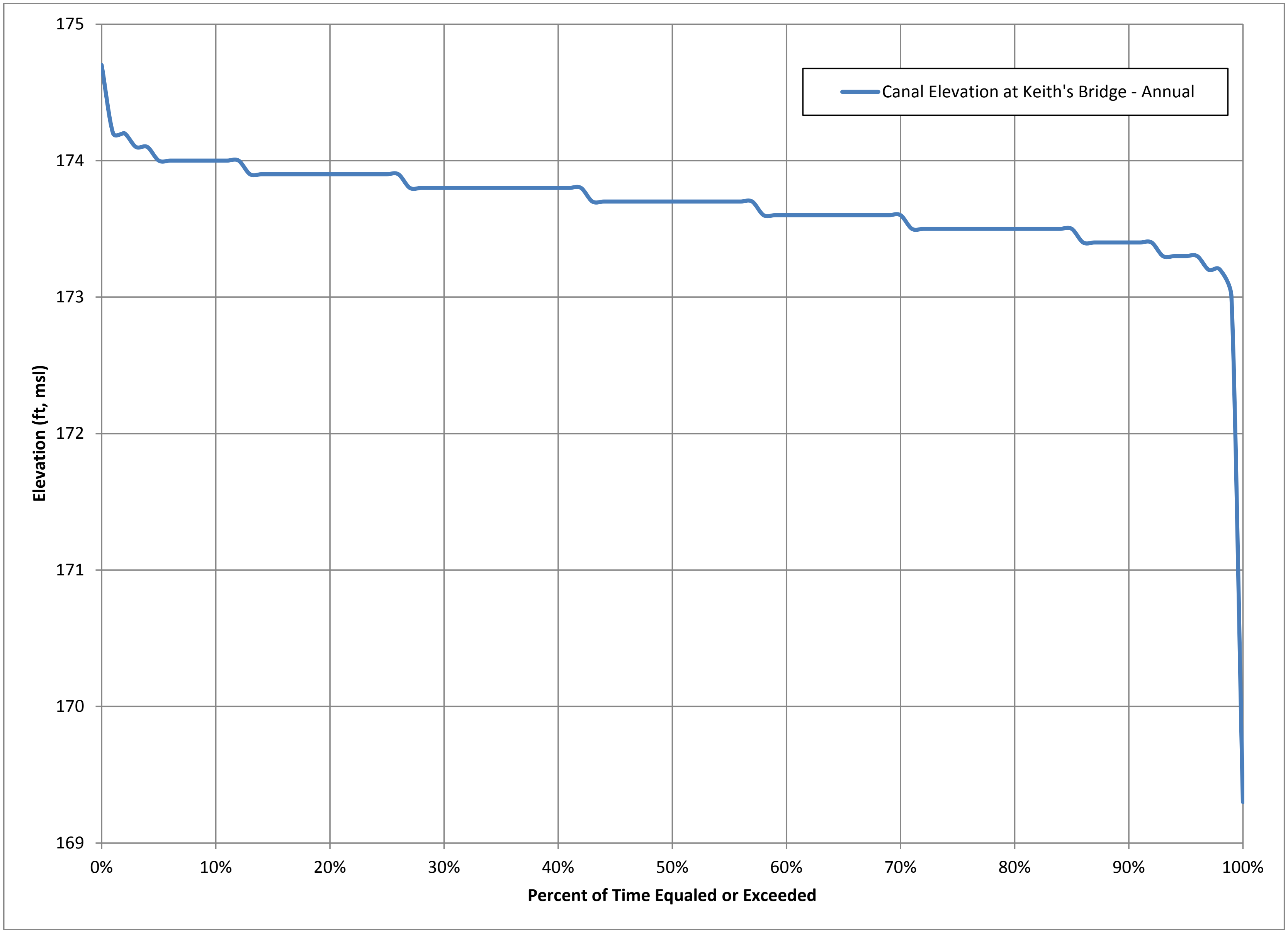
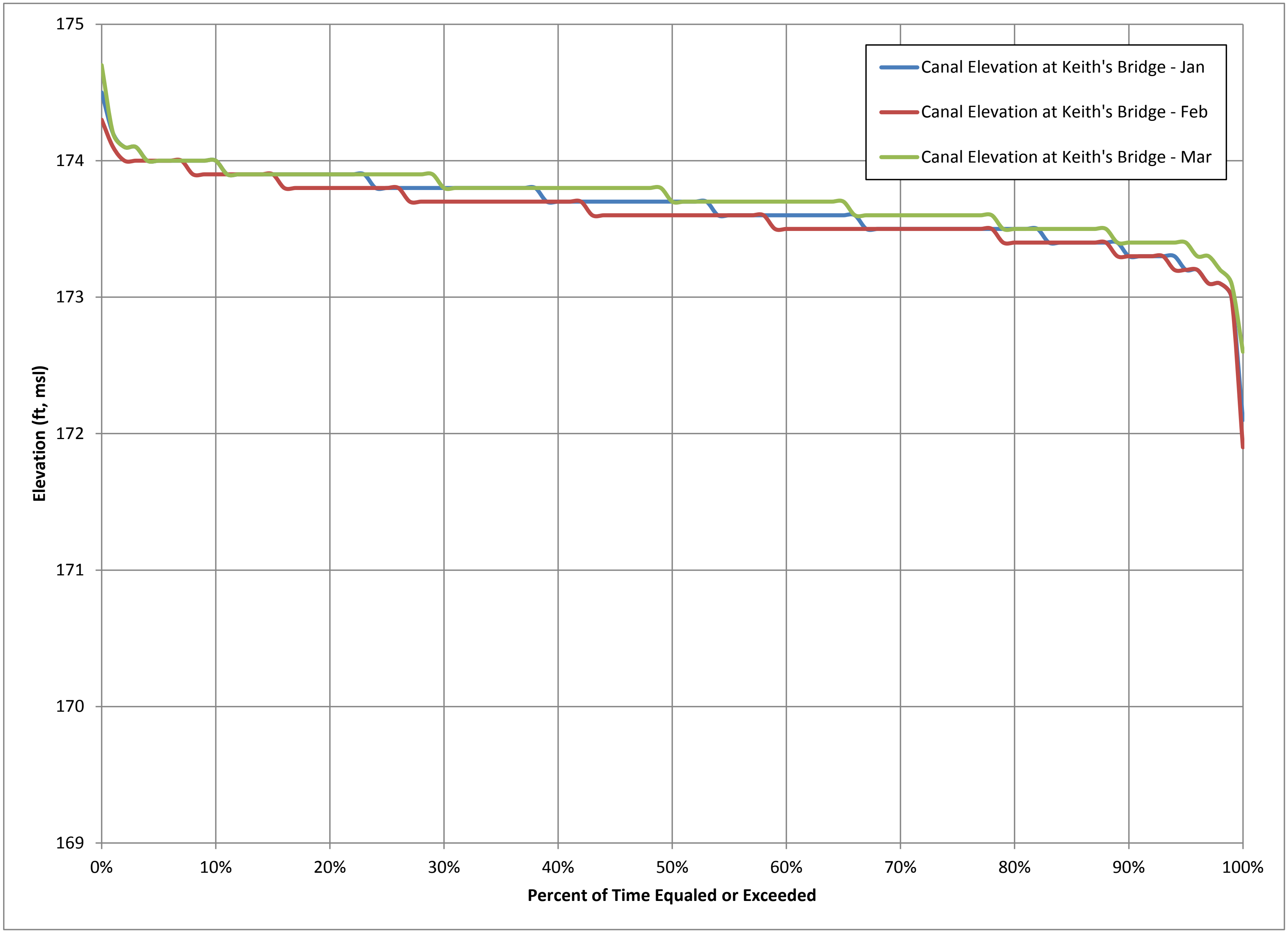


Figure 4.3.1.3-20: Turners Falls Power Canal Elevation- Annual Elevation Duration Curve, Hourly 2000-2009



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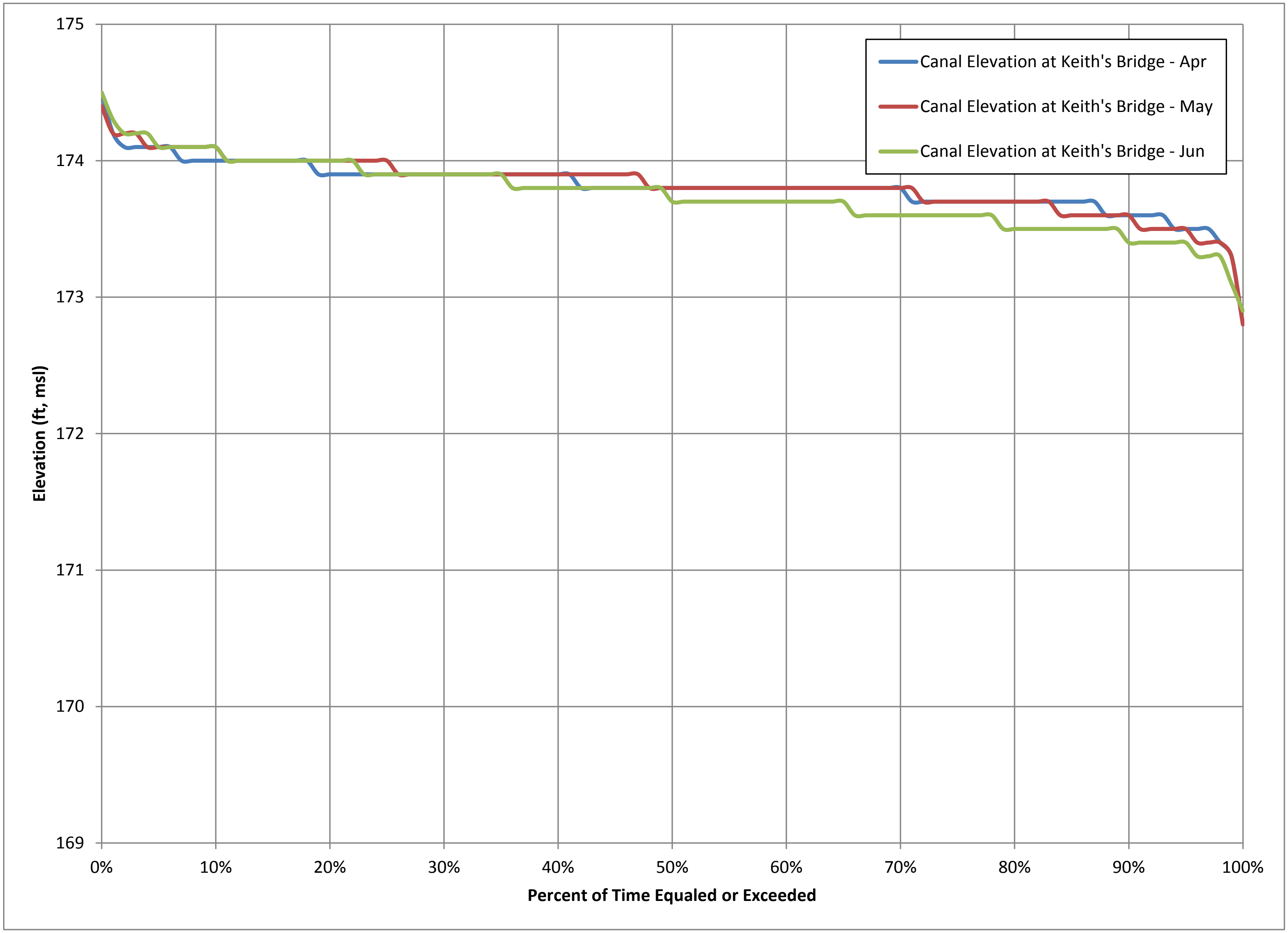

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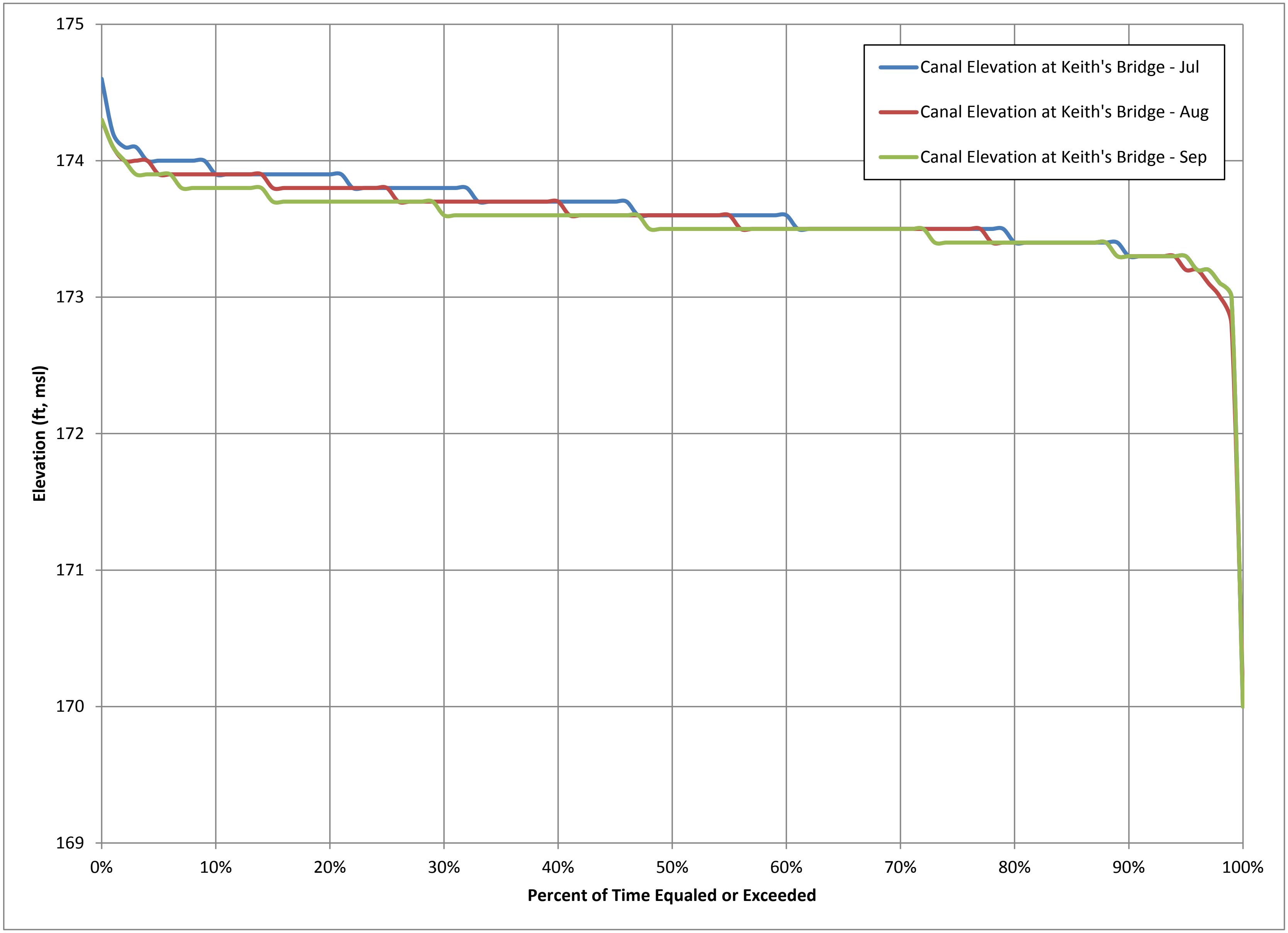

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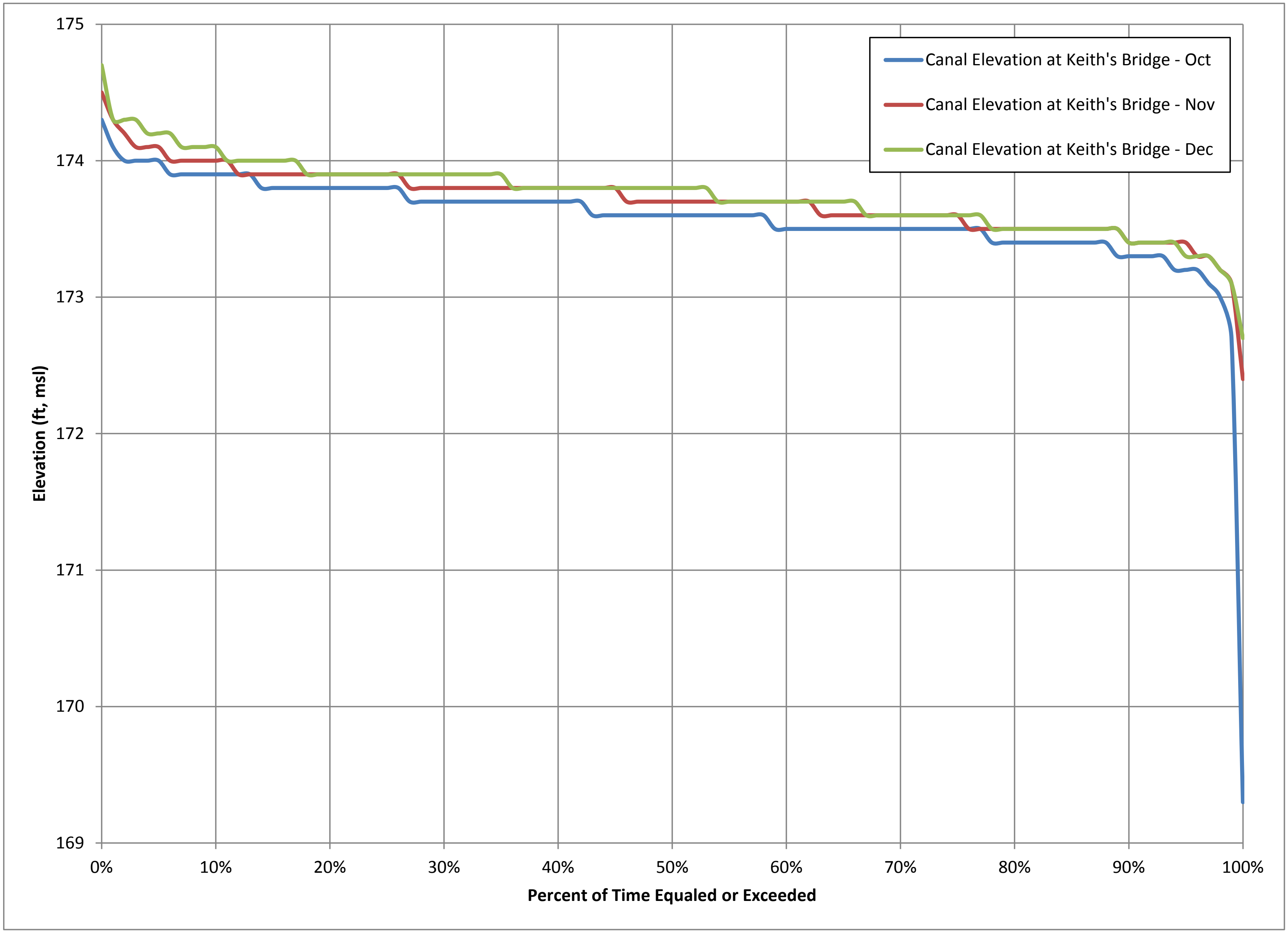

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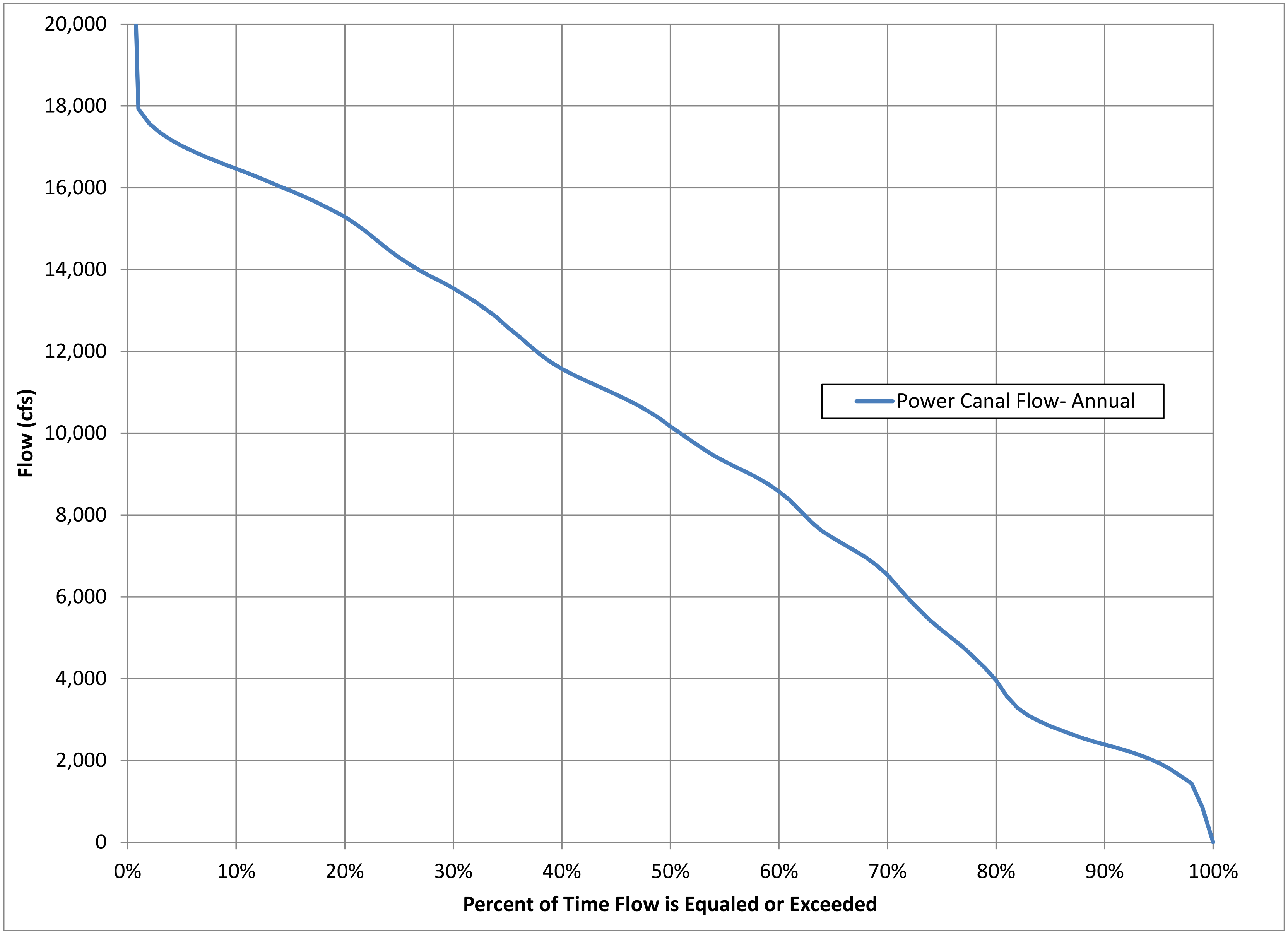
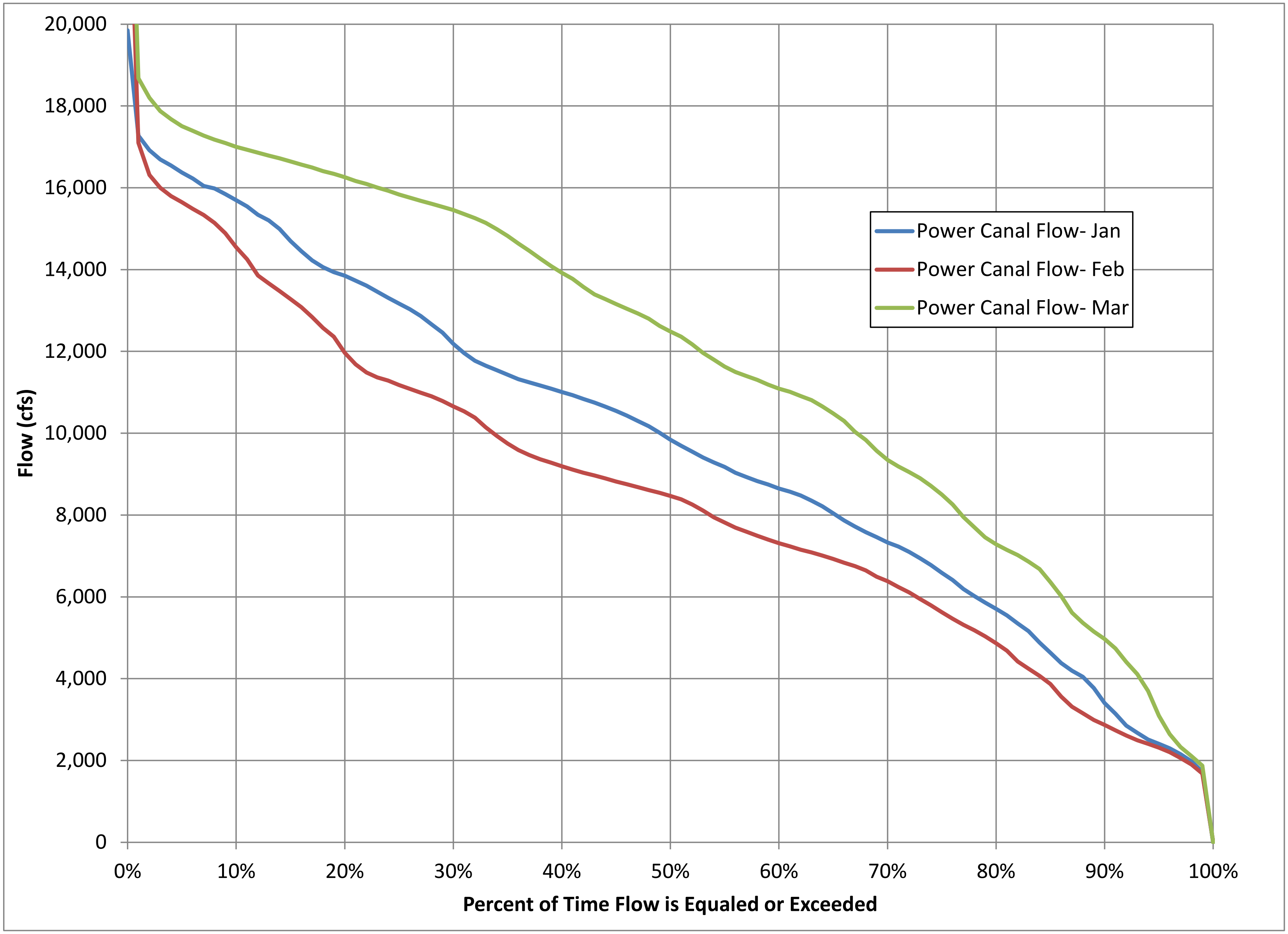


Figure 4.3.1.3-25: Turners Falls Power Canal Flow- Annual Flow Duration Curve, Hourly 2000-2009



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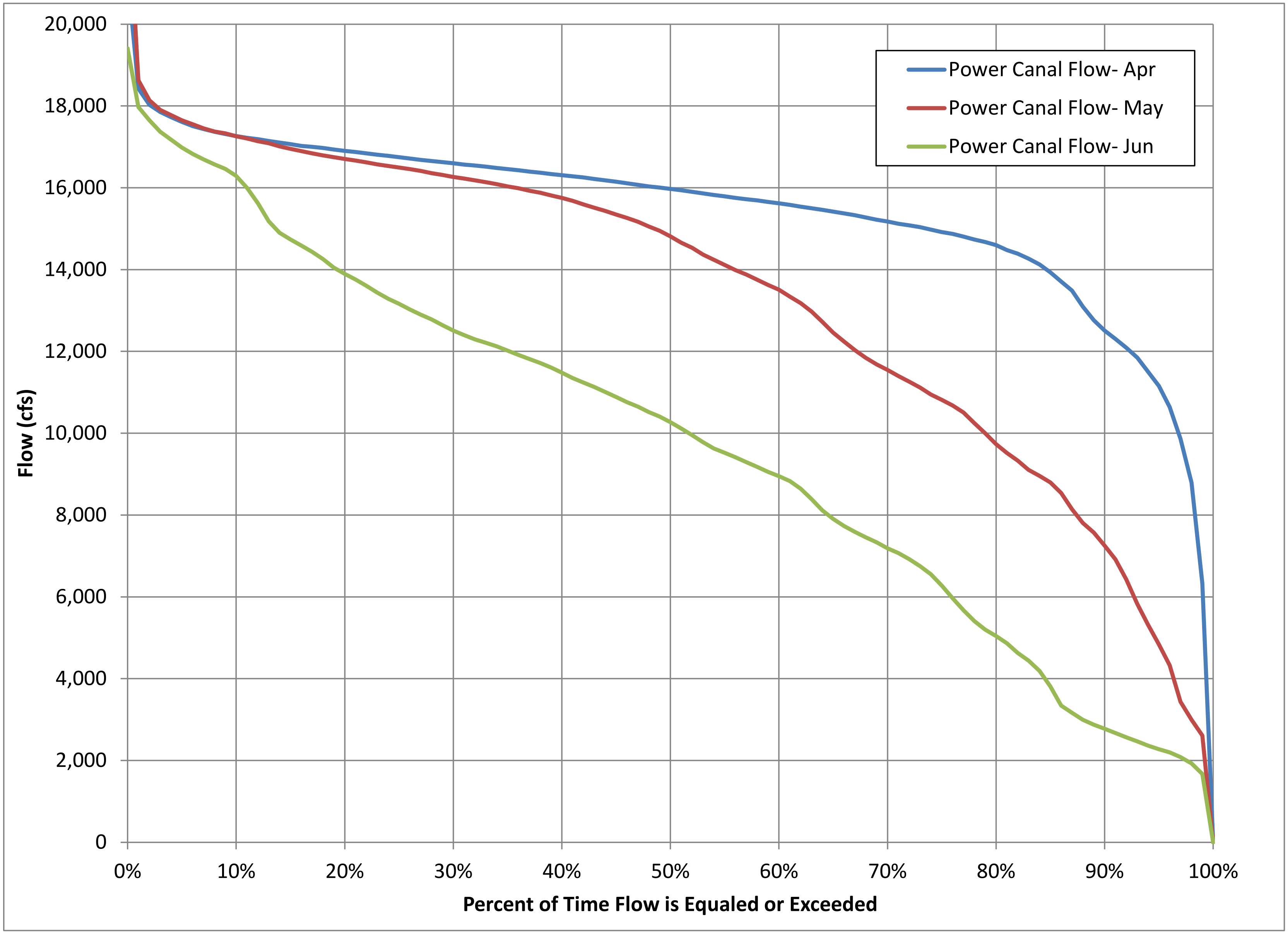

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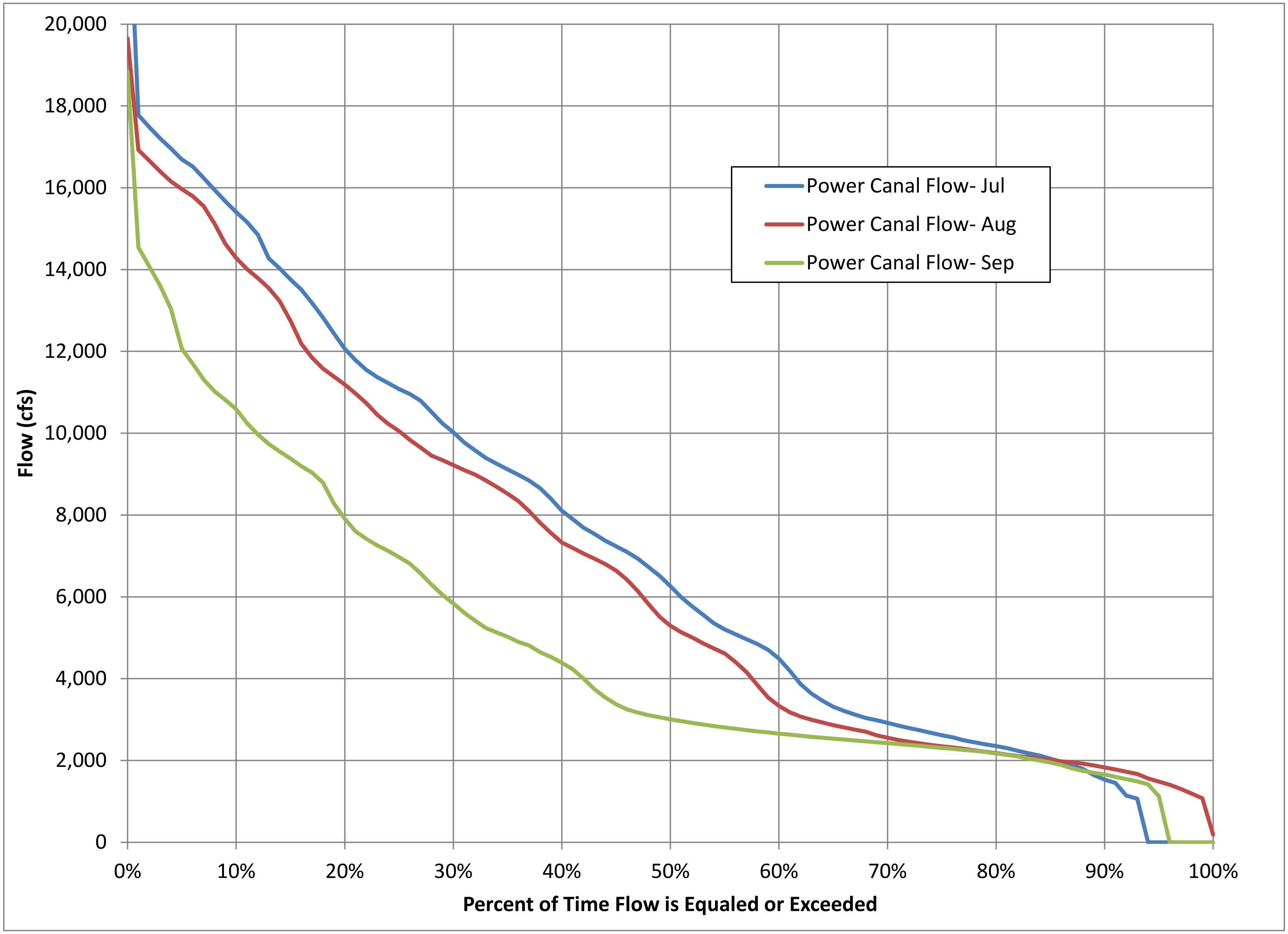


Figure 4.3.1.3-28: Turners Falls Power Canal Flow- Jul-Sep Flow Duration Curves, Hourly 2000-2009

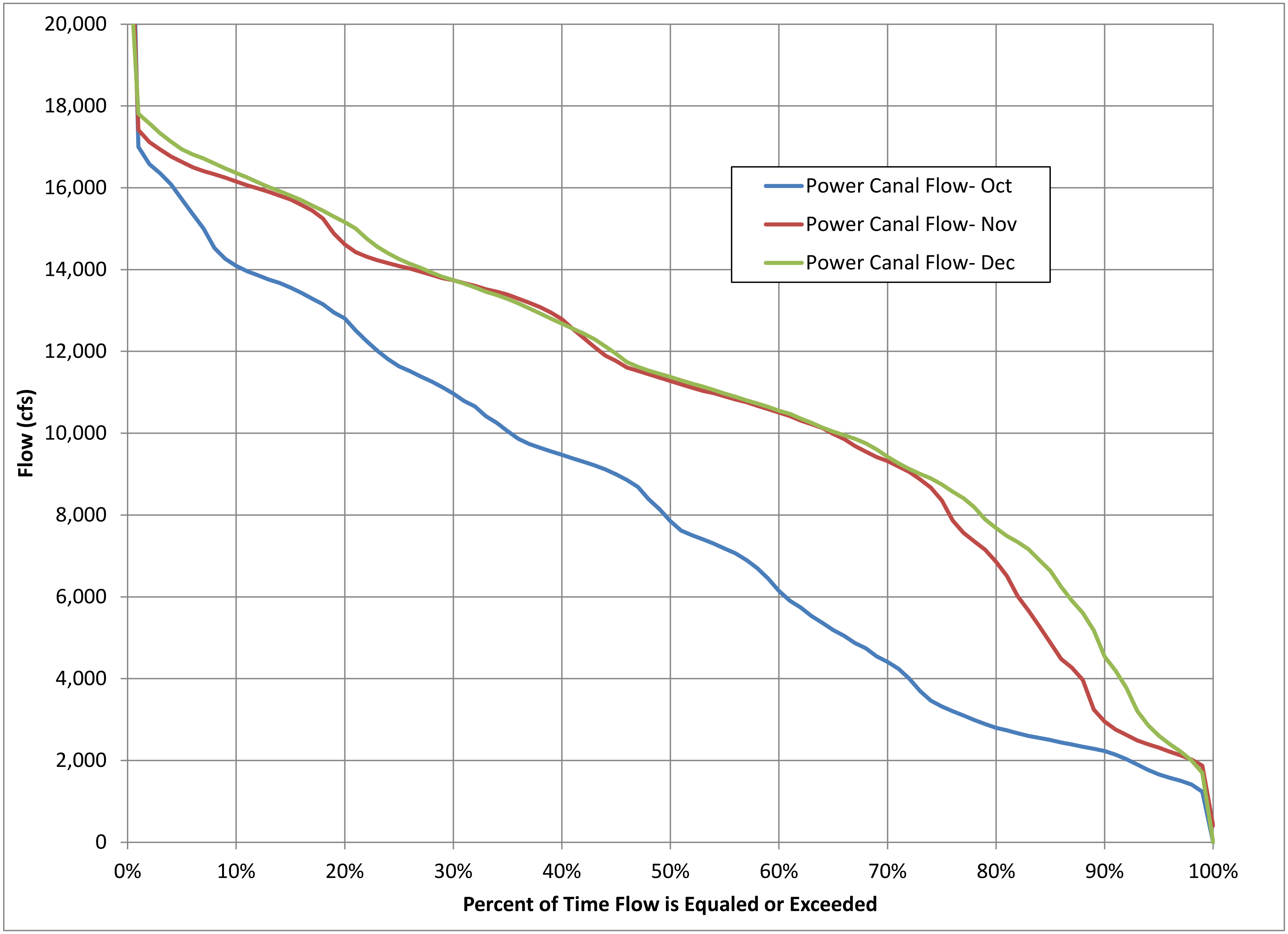


Figure 4.3.1.3-29: Turners Falls Power Canal Flow- Oct-Dec Flow Duration Curves, Hourly 2000-2009

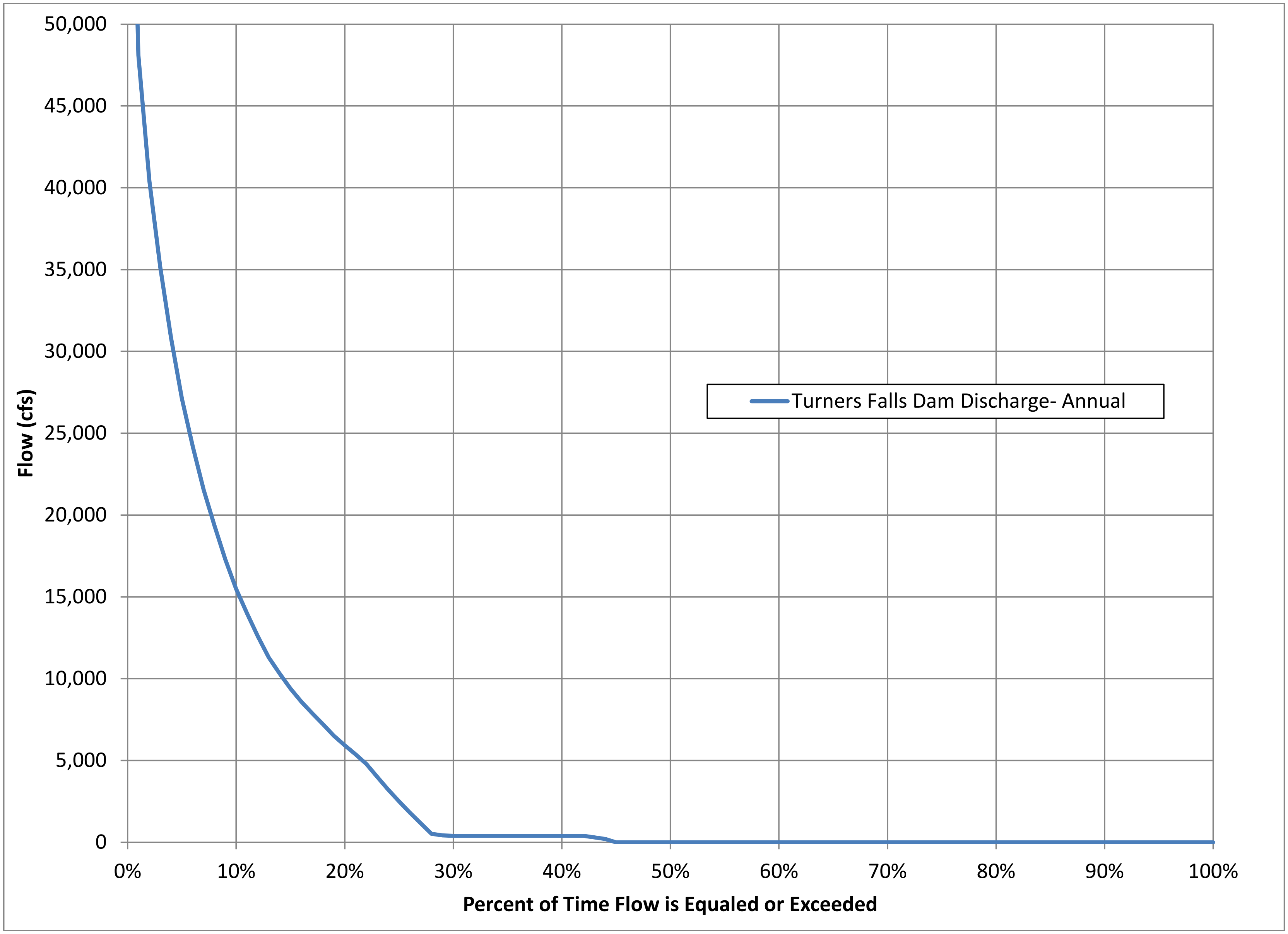


Figure 4.3.1.3-30: Turners Falls Dam Discharge- Annual Flow Duration Curve, Hourly 2000-2009

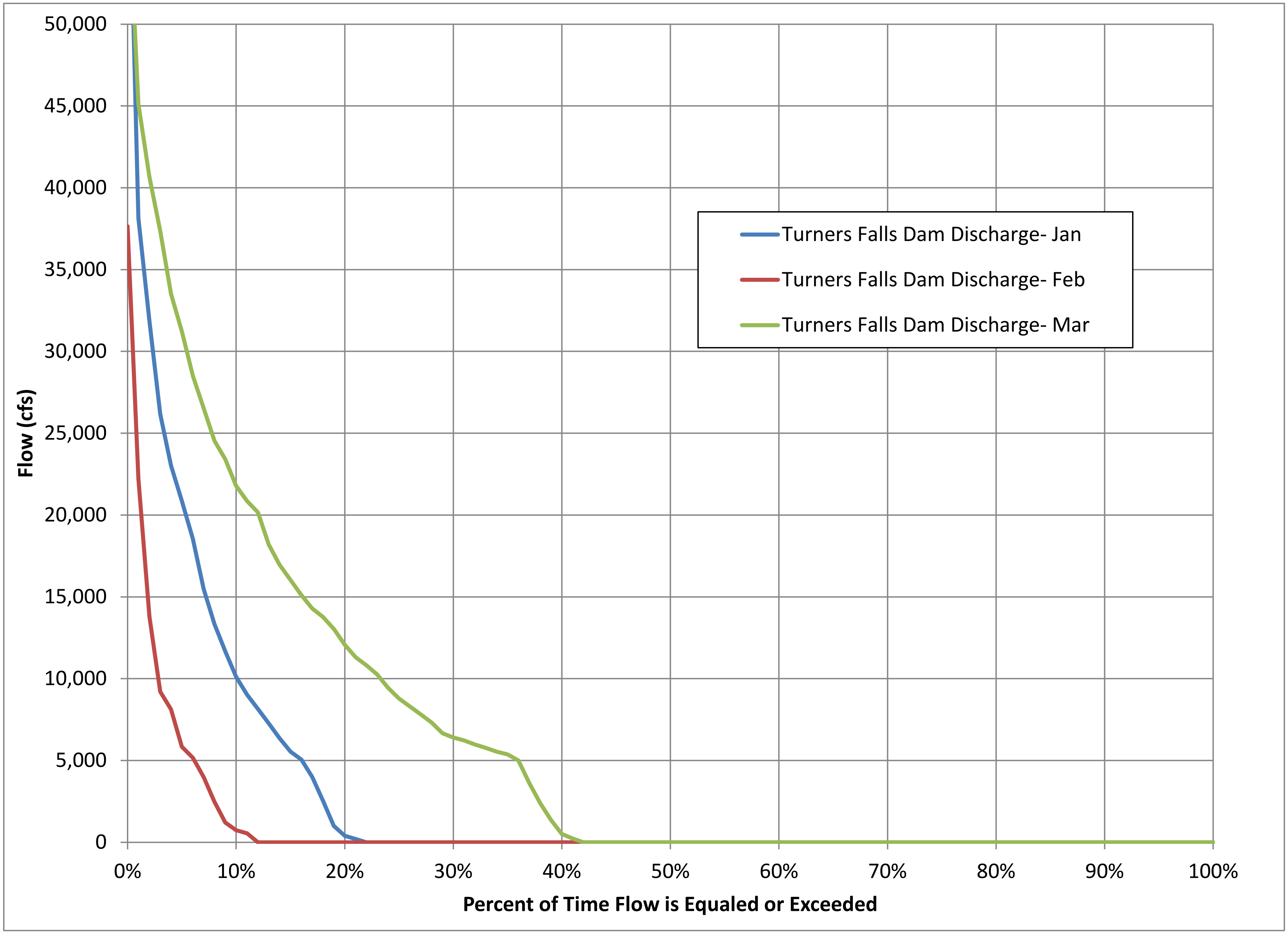


Figure 4.3.1.3-31: Turners Falls Dam Discharge- Jan-Mar Flow Duration Curve, Hourly 2000-2009

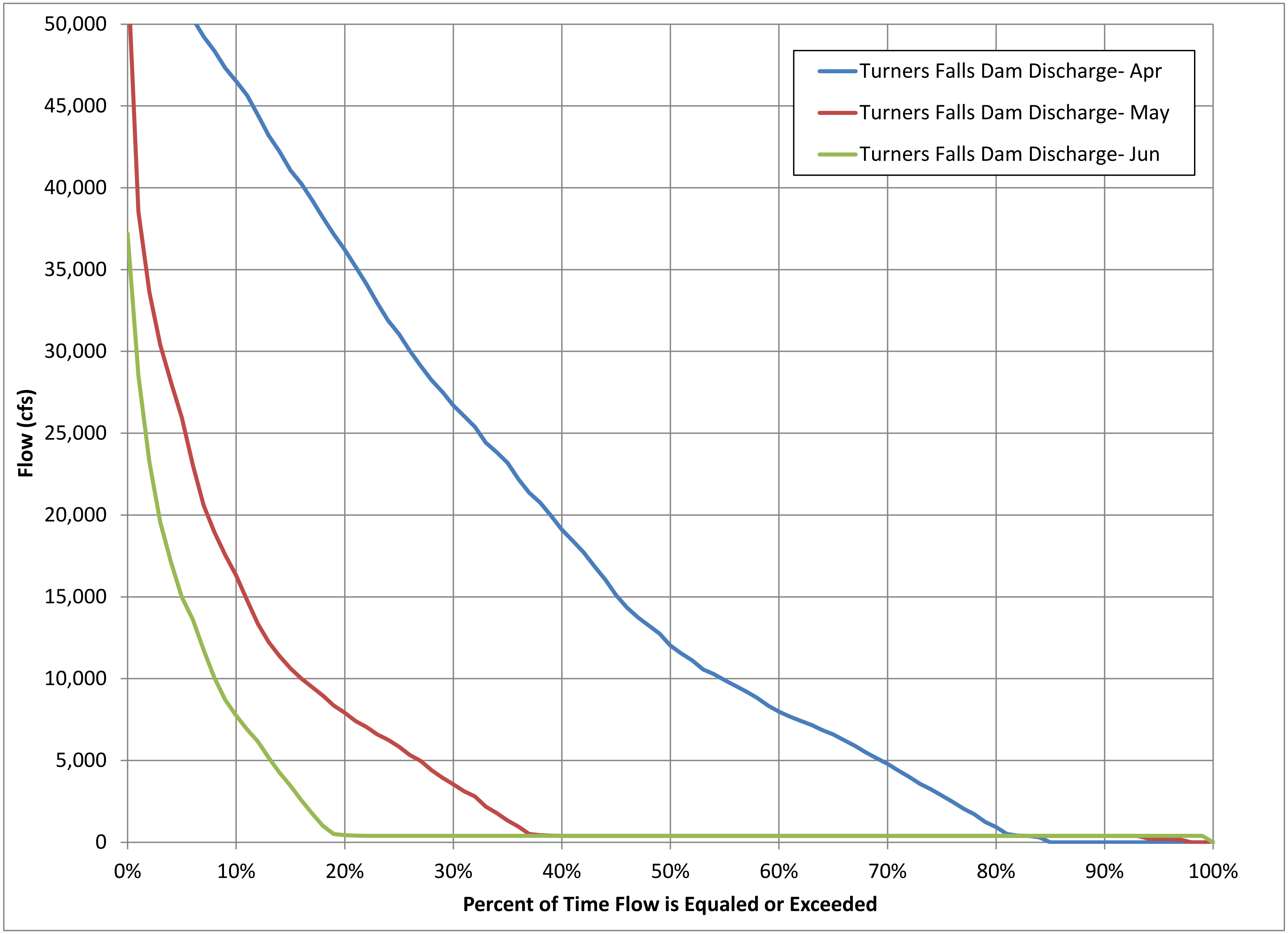


Figure 4.3.1.3-32: Turners Falls Dam Discharge- Apr-Jun Flow Duration Curve, Hourly 2000-2009

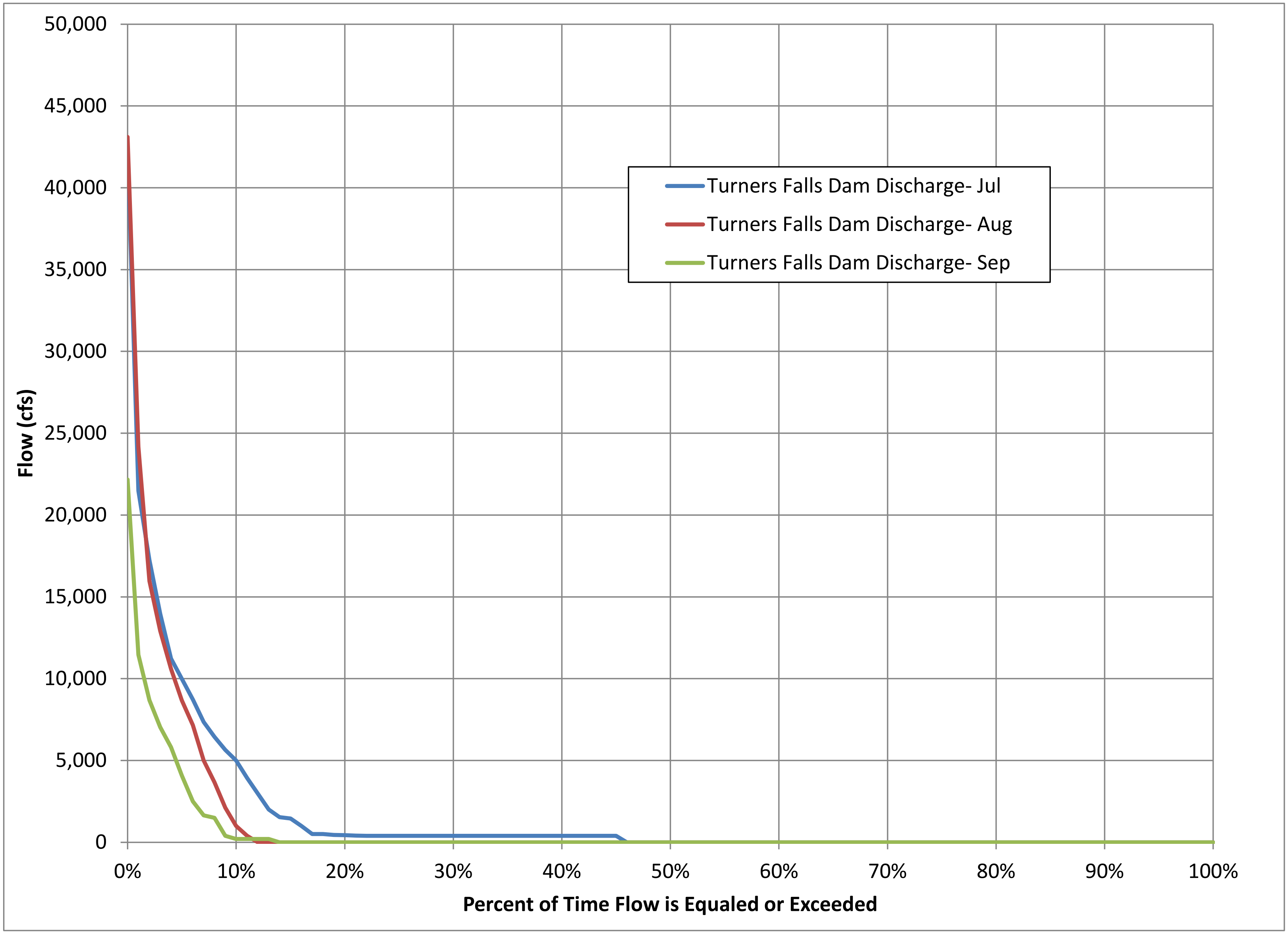


Figure 4.3.1.3-33: Turners Falls Dam Discharge- Jul-Sep Flow Duration Curve, Hourly 2000-2009

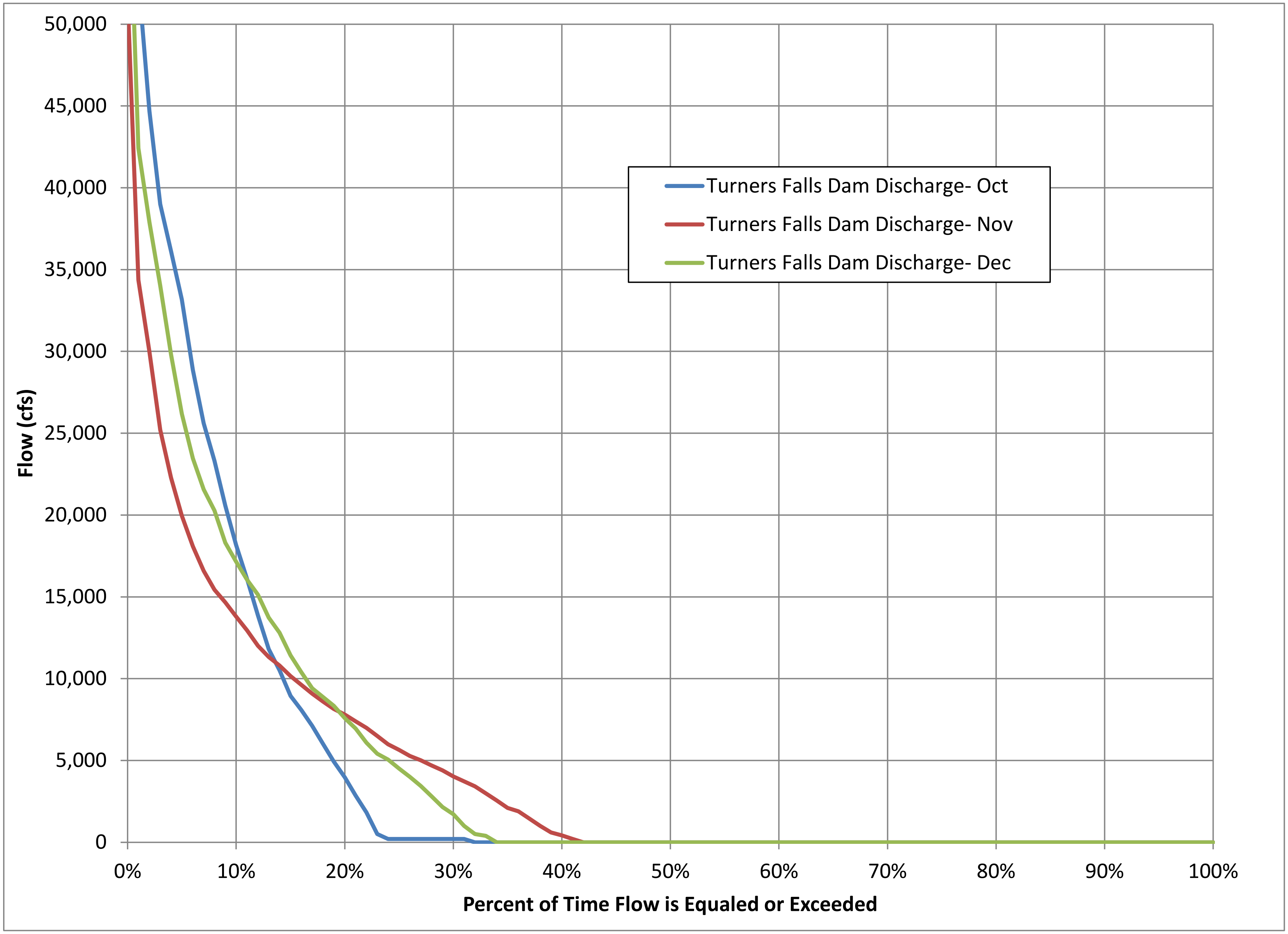


Figure 4.3.1.3-34: Turners Falls Dam Discharge- Oct-Dec Flow Duration Curve, Hourly 2000-2009

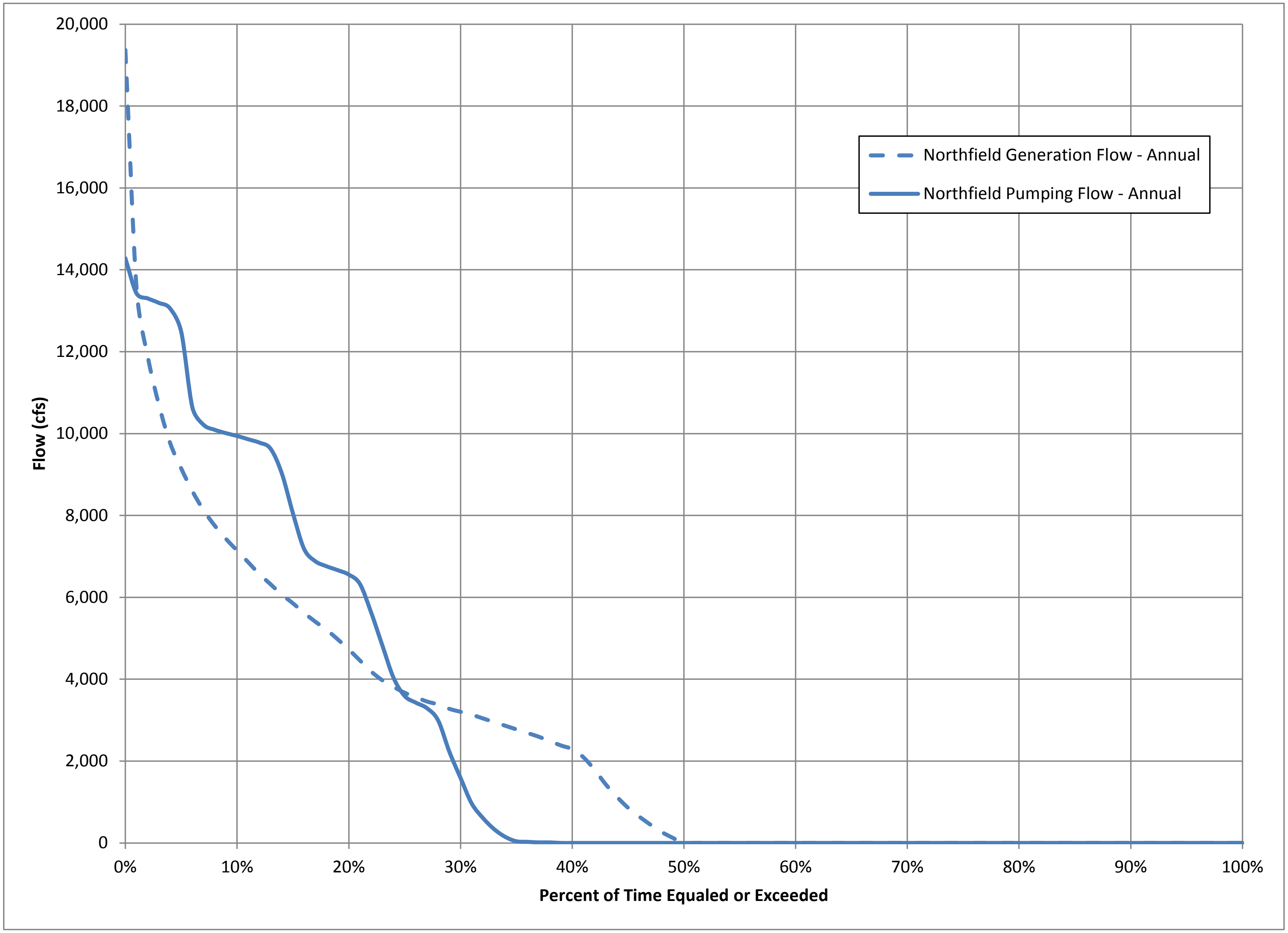


Figure 4.3.1.3-35: Northfield Generation and Pumping Discharge- Annual Flow Duration Curve, Hourly 2000-2009

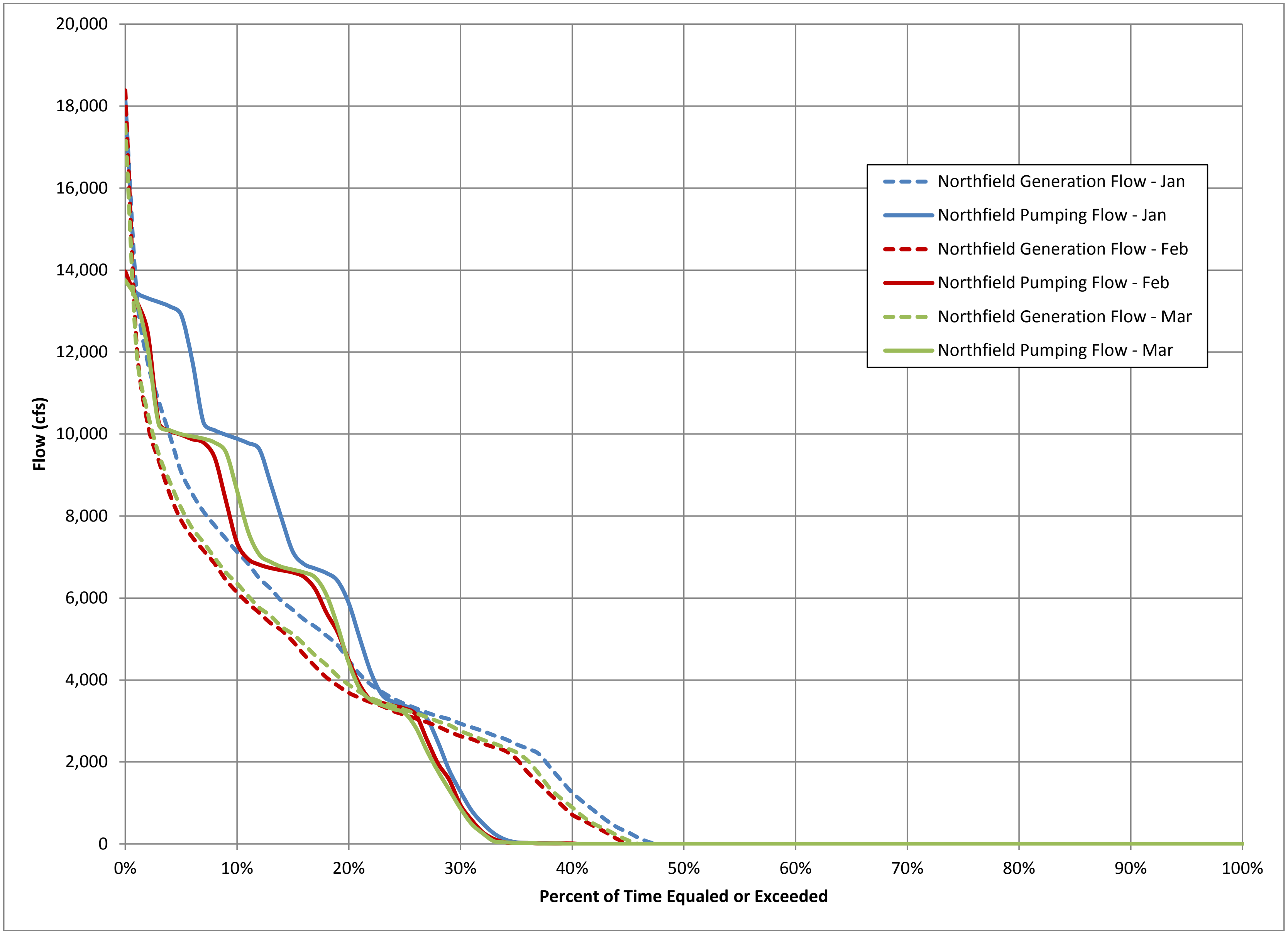


Figure 4.3.1.3-36: Northfield Generation and Pumping Discharge- Jan-Mar Flow Duration Curve, Hourly 2000-2009

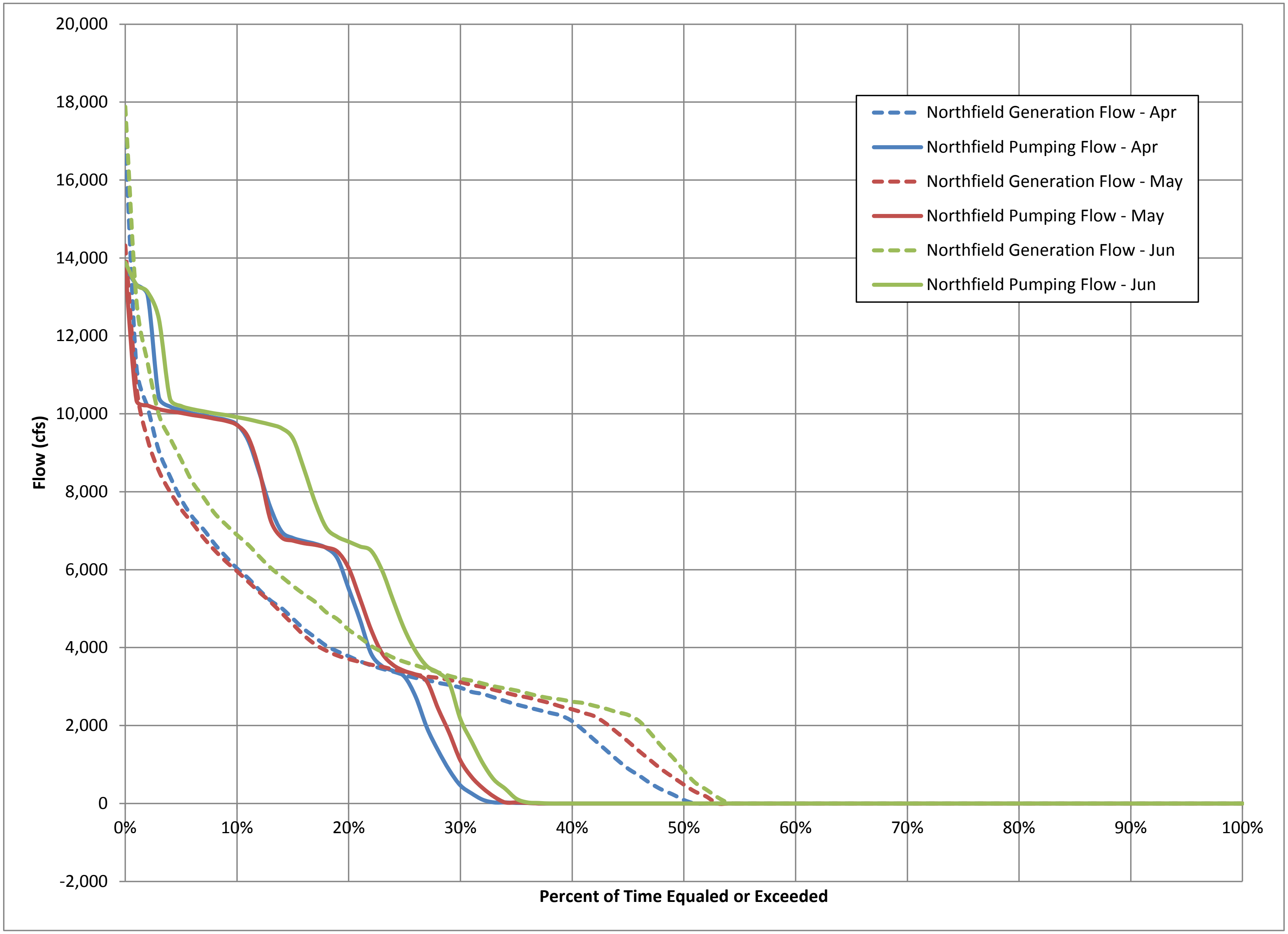


Figure 4.3.1.3-37: Northfield Generation and Pumping Discharge- Apr-Jun Flow Duration Curve, Hourly 2000-2009

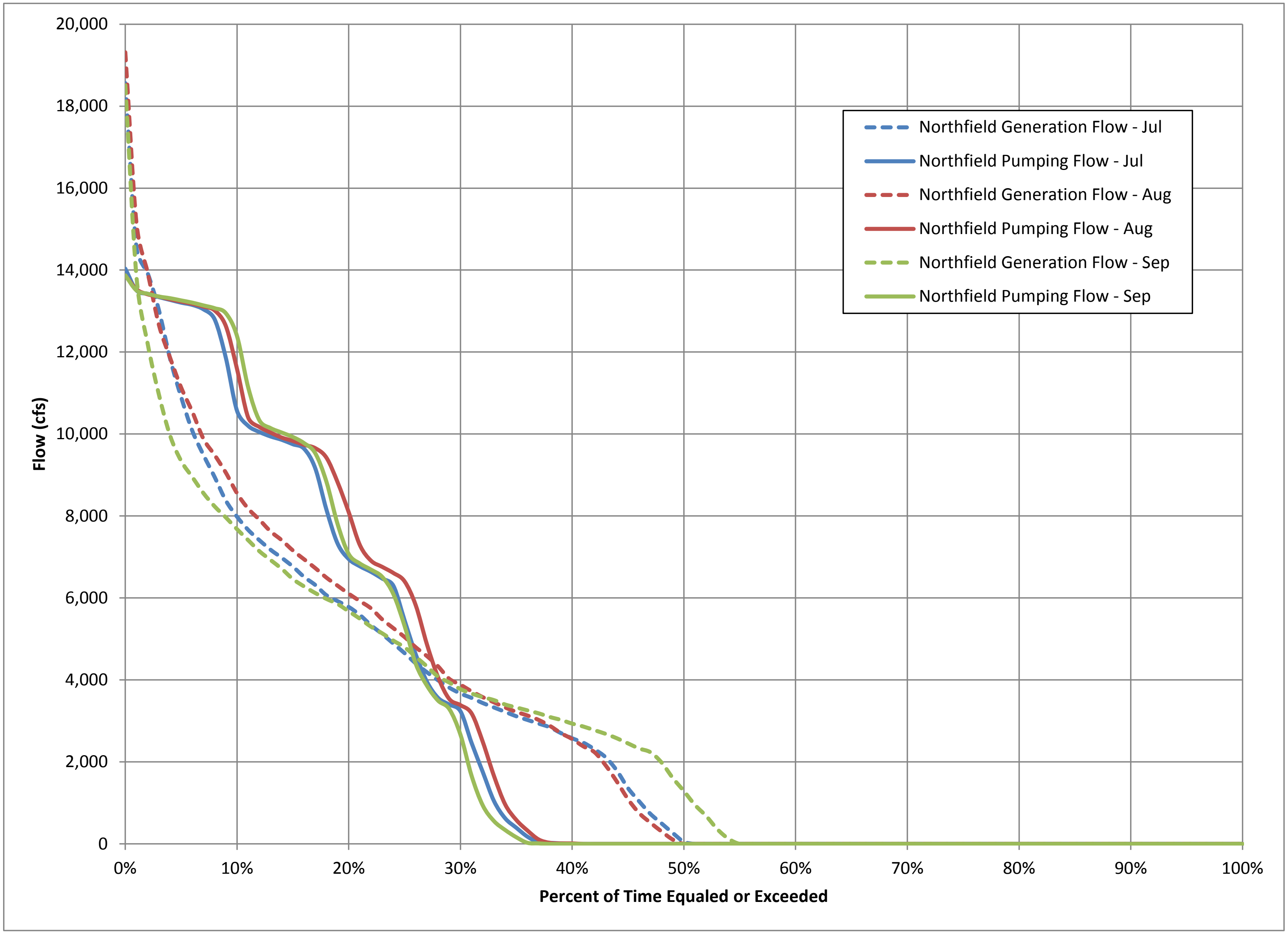


Figure 4.3.1.3-38: Northfield Generation and Pumping Discharge- Jul-Sep Flow Duration Curve, Hourly 2000-2009

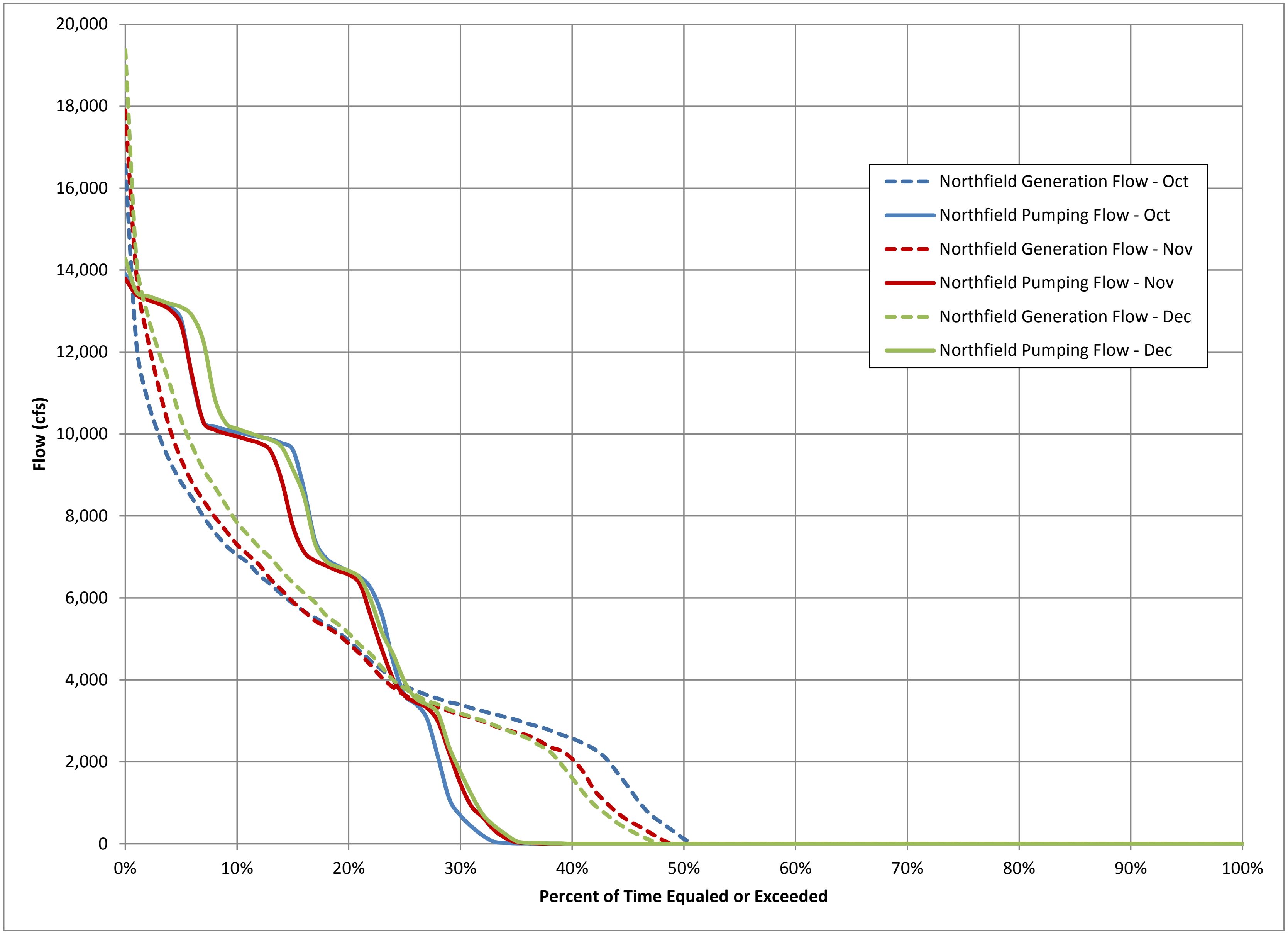


Figure 4.3.1.3-39: Northfield Generation and Pumping Discharge- Oct-Dec Flow Duration Curve, Hourly 2000-2009

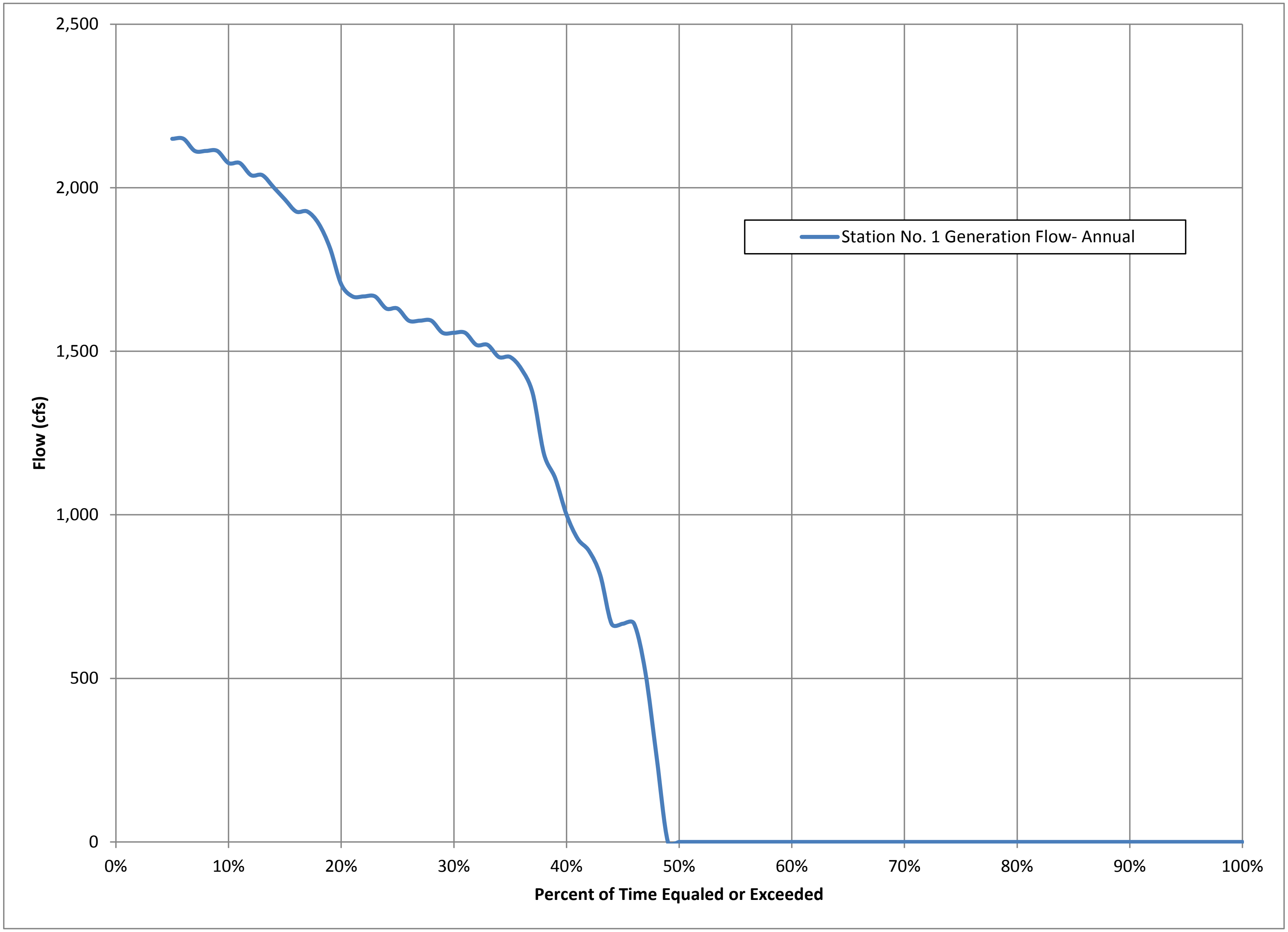


Figure 4.3.1.3-40: Station No. 1 Discharge- Annual Discharge Duration Curve, Hourly 2000-2009

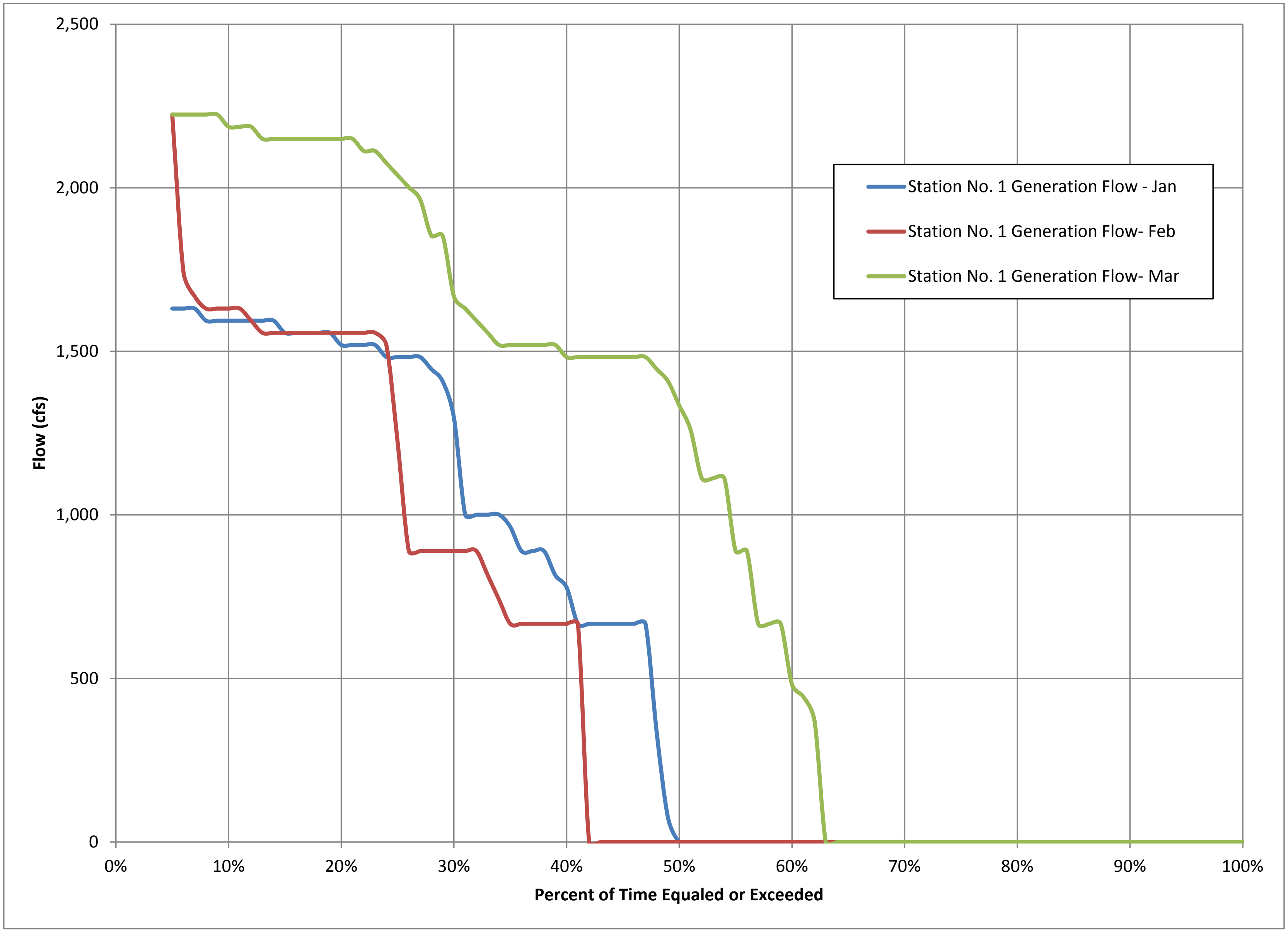


Figure 4.3.1.3-41: Station No. 1 Discharge- Jan-Mar Discharge Duration Curve, Hourly 2000-2009

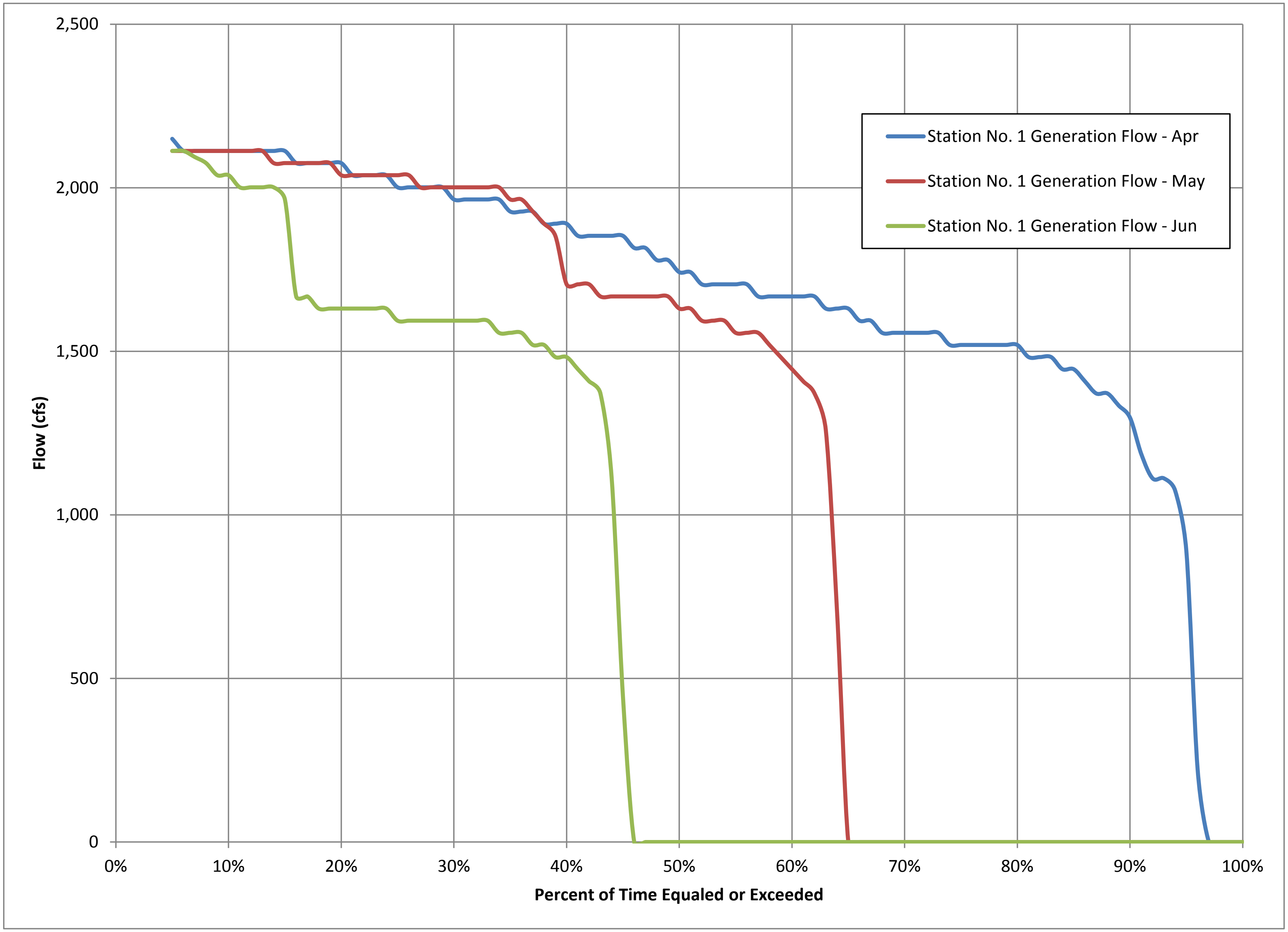


Figure 4.3.1.3-42: Station No. 1 Discharge- Apr-Jun Discharge Duration Curve, Hourly 2000-2009

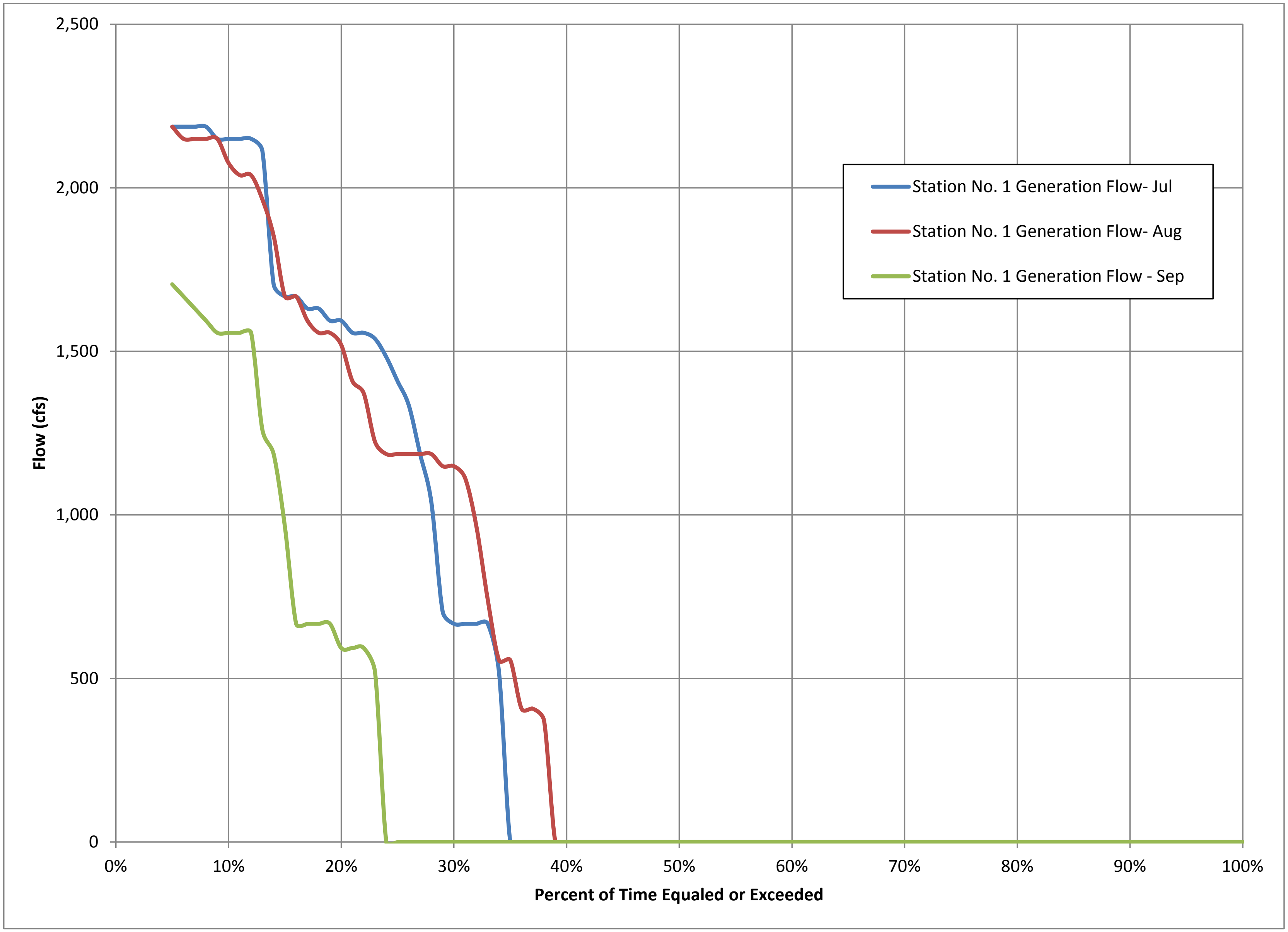


Figure 4.3.1.3-43: Station No. 1 Discharge- Jul-Sep Discharge Duration Curve, Hourly 2000-2009

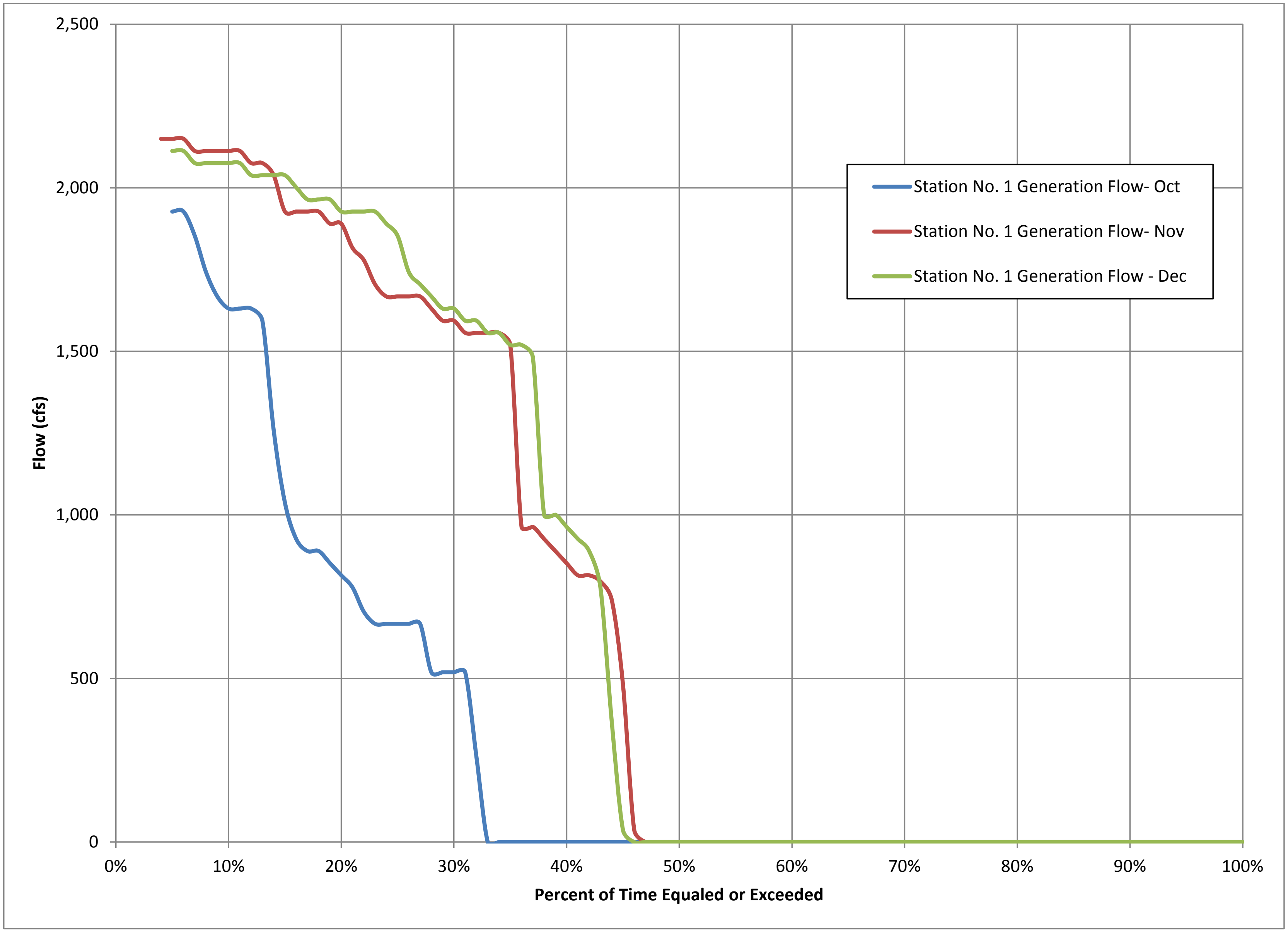


Figure 4.3.1.3-44: Station No. 1 Discharge- Oct-Dec Discharge Duration Curve, Hourly 2000-2009

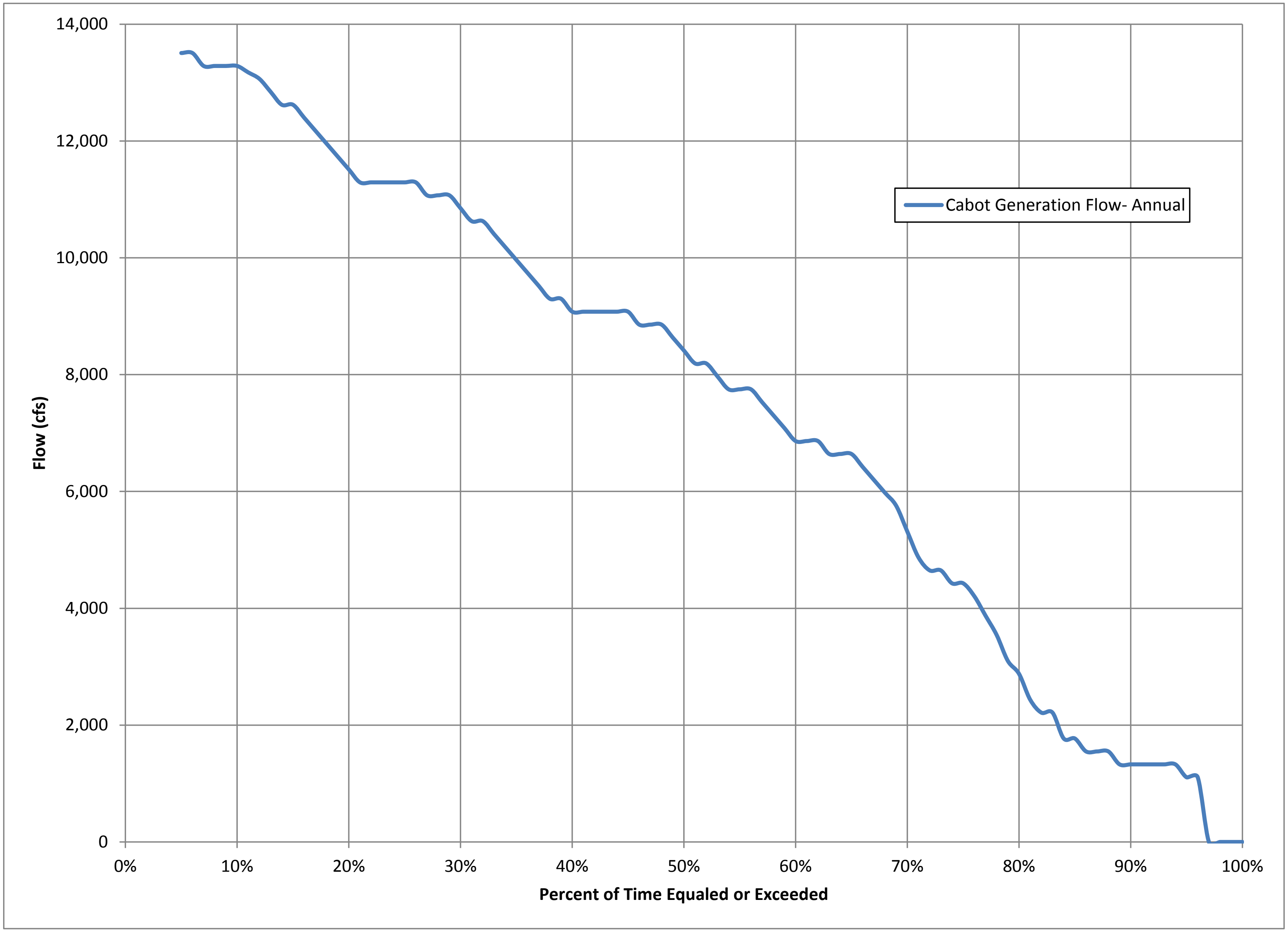


Figure 4.3.1.3-45: Cabot Station Discharge- Annual Discharge Duration Curve, Hourly 2000-2009

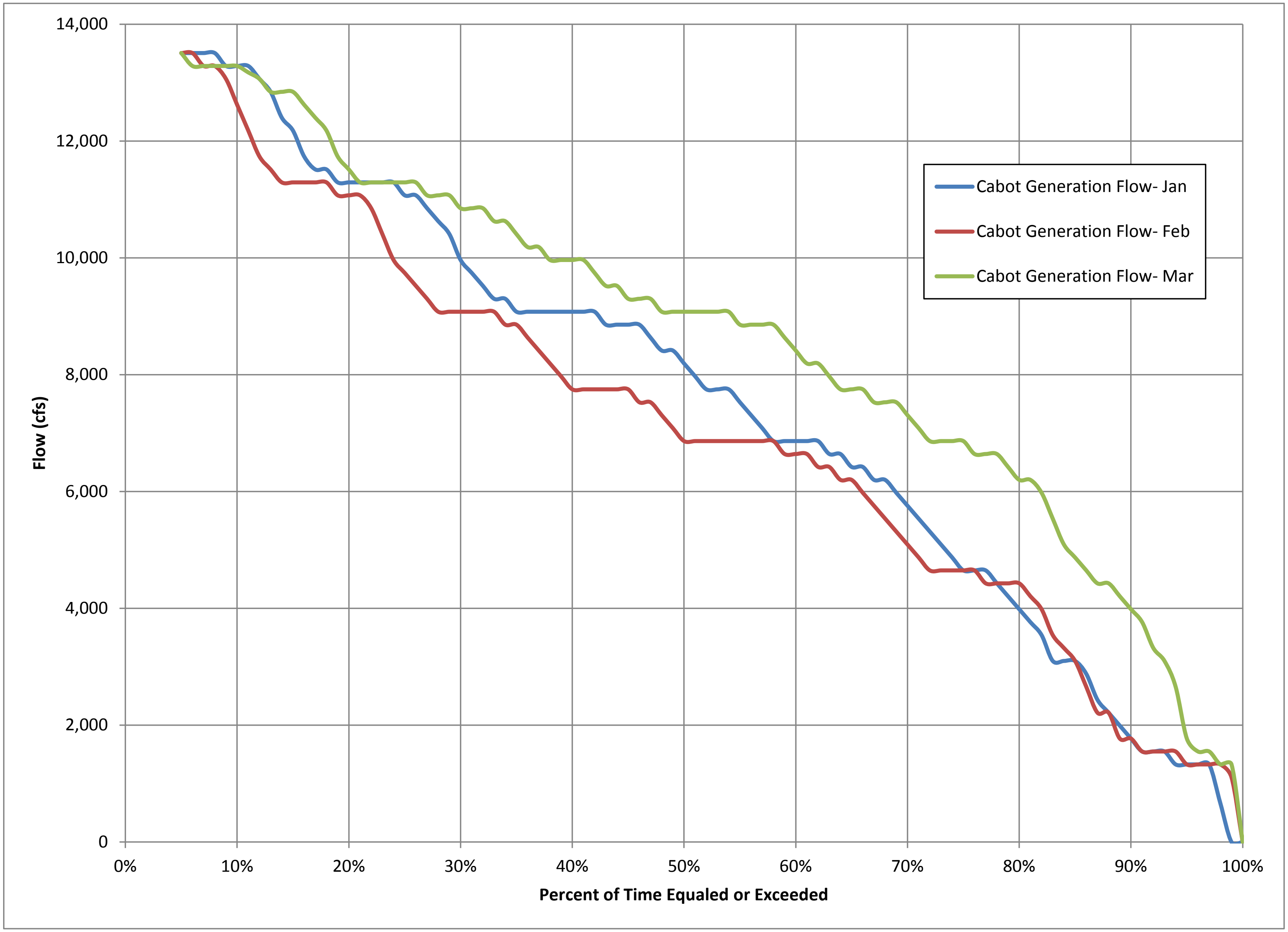


Figure 4.3.1.3-46: Cabot Station Discharge- Jan-Mar Discharge Duration Curve, Hourly 2000-2009

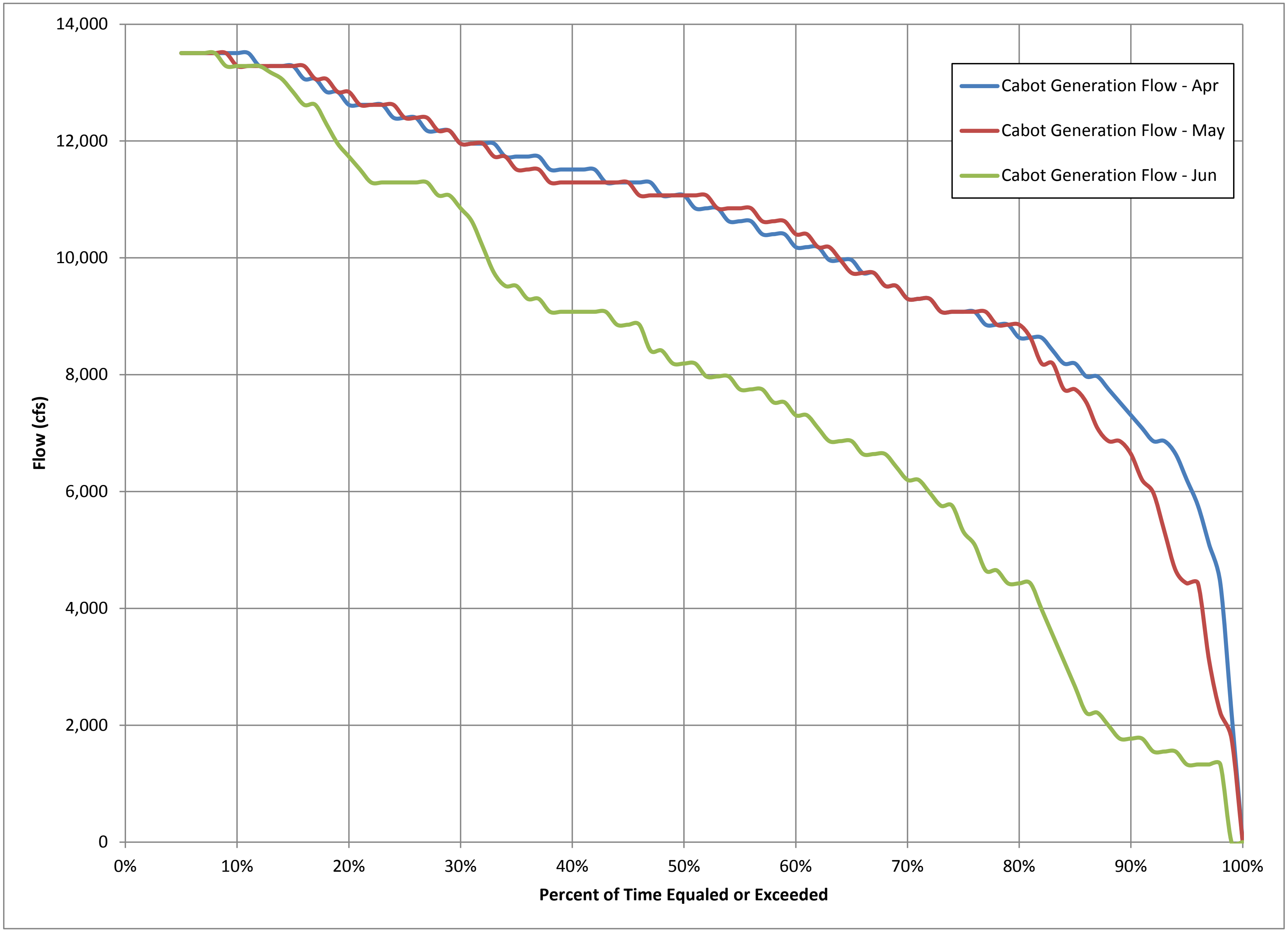


Figure 4.3.1.3-47: Cabot Station Discharge- Apr-Jun Discharge Duration Curve, Hourly 2000-2009

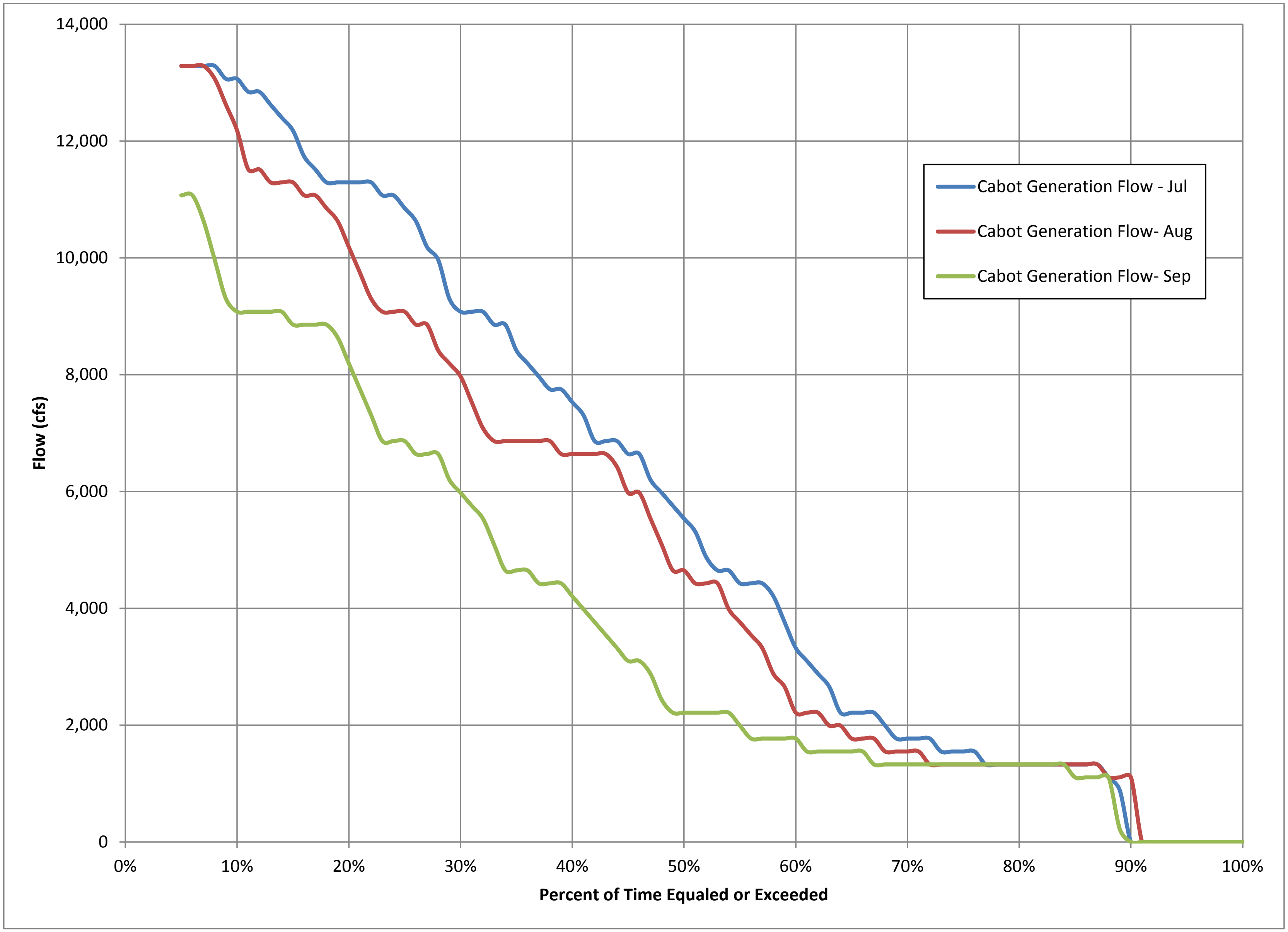


Figure 4.3.1.3-48: Cabot Station Discharge- Jul-Sep Discharge Duration Curve, Hourly 2000-2009

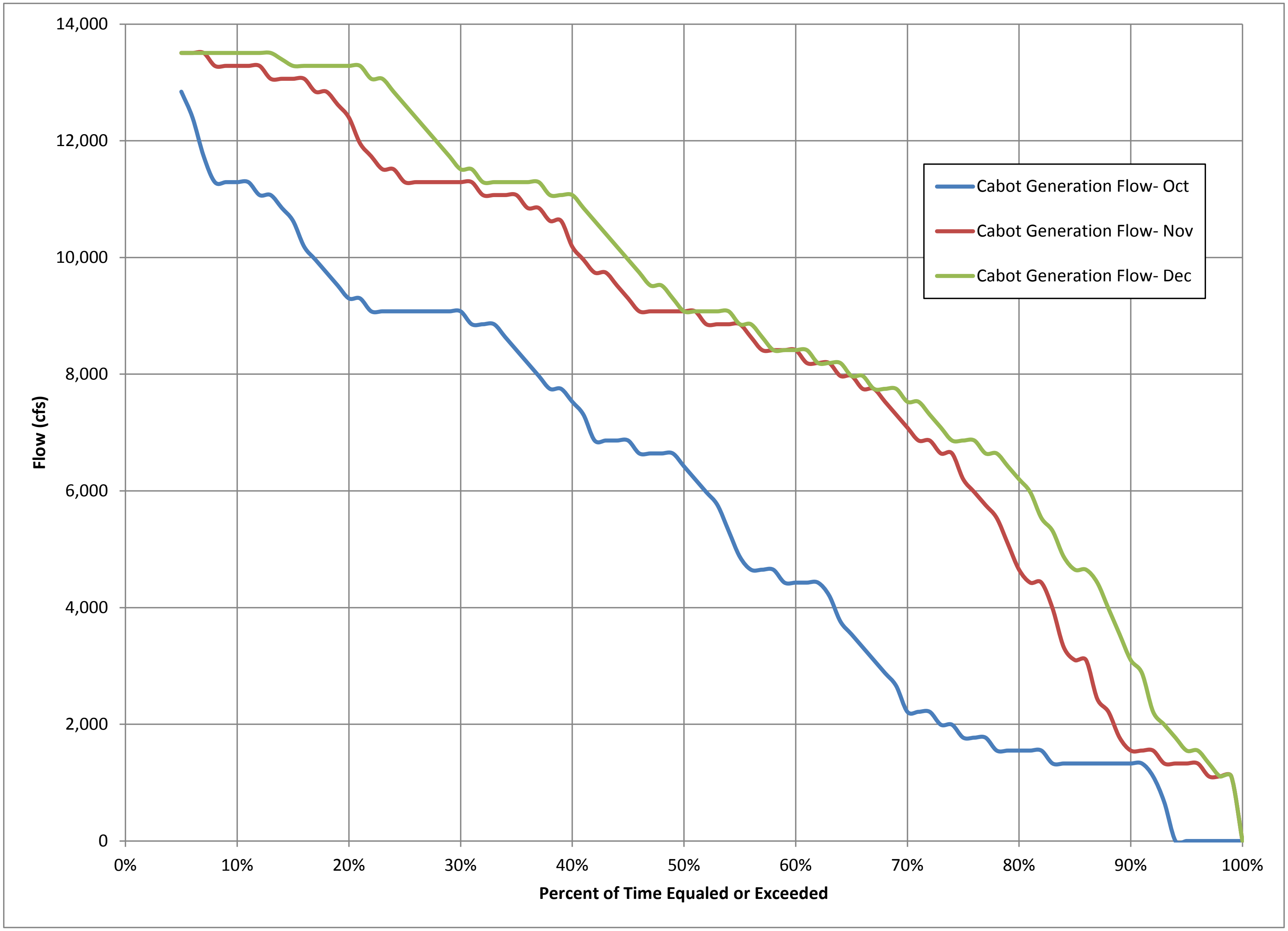
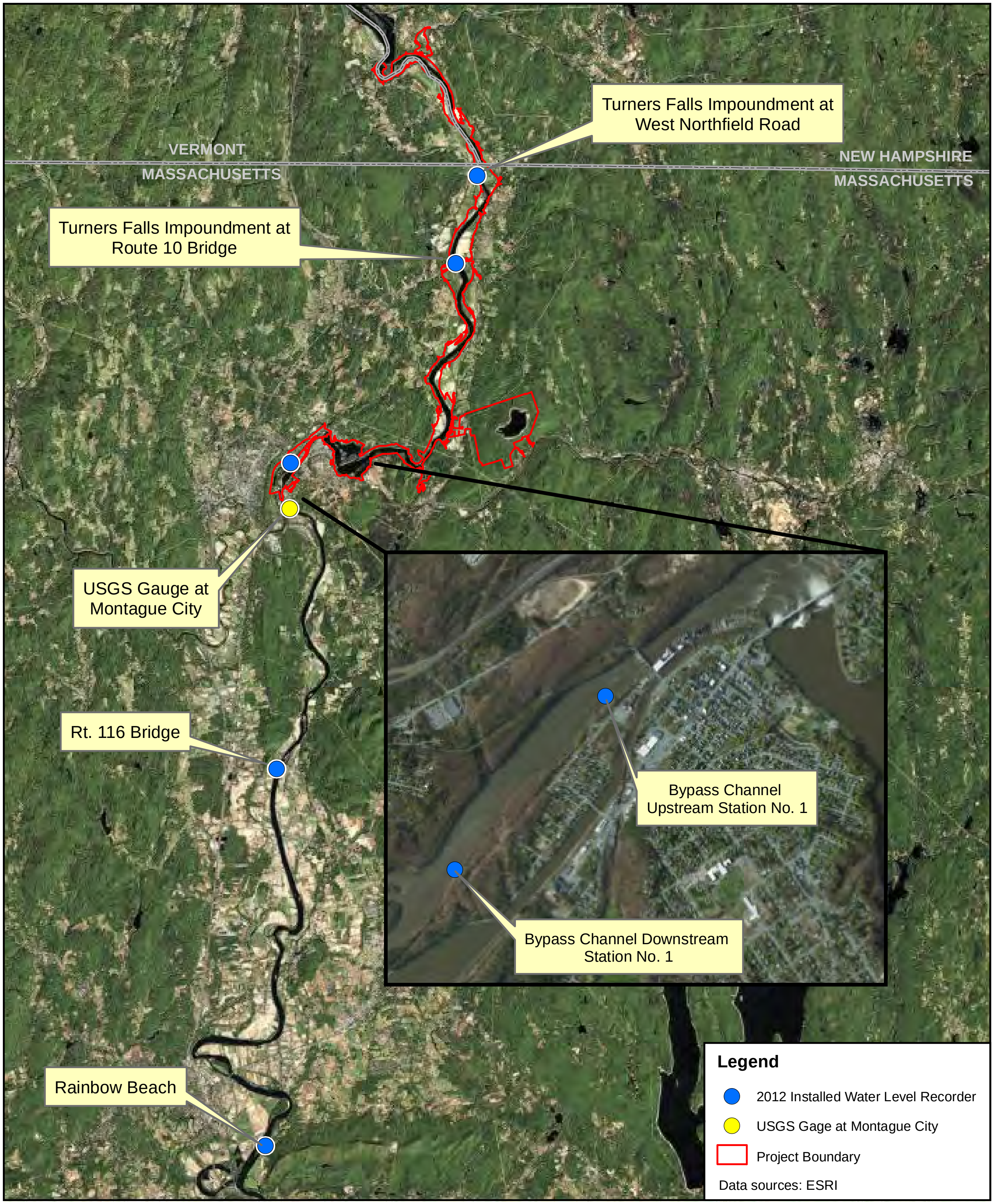


Figure 4.3.1.3-49: Cabot Station Discharge- Oct-Dec Discharge Duration Curve, Hourly 2000-2009



FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

N

0 1.5 3 4.5 6 Miles

Figure 4.3.1.6-1
2012 Installed Water Level Recorders

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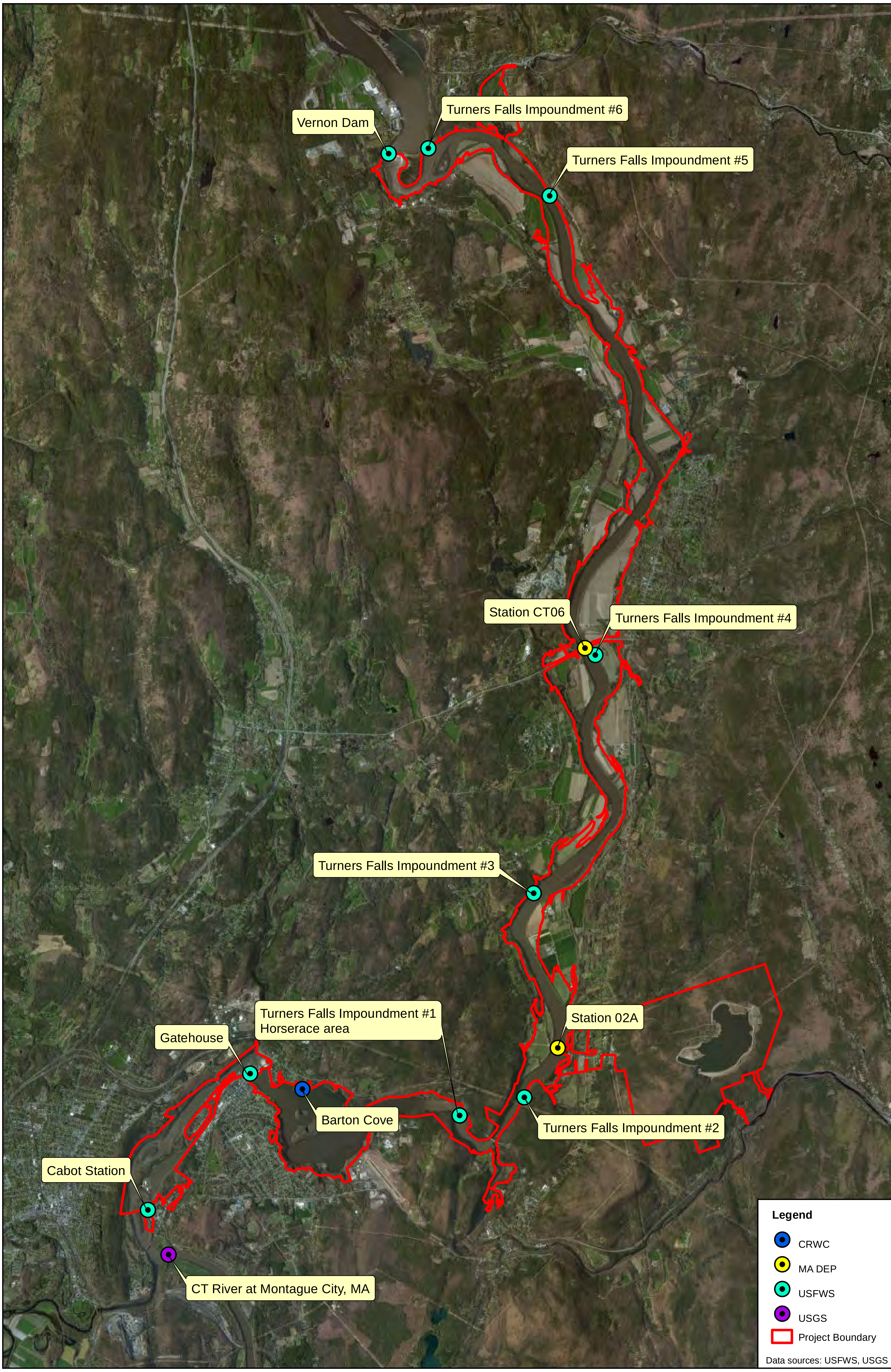

FirstLight Power Resources
GDF SUEZ

N

FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

0 3,000 6,000 12,000 Feet

Figure 4.3.2.3-1
Water Quality Sampling Locations (Agency and Volunteer Groups) in the Vicinity of the Project

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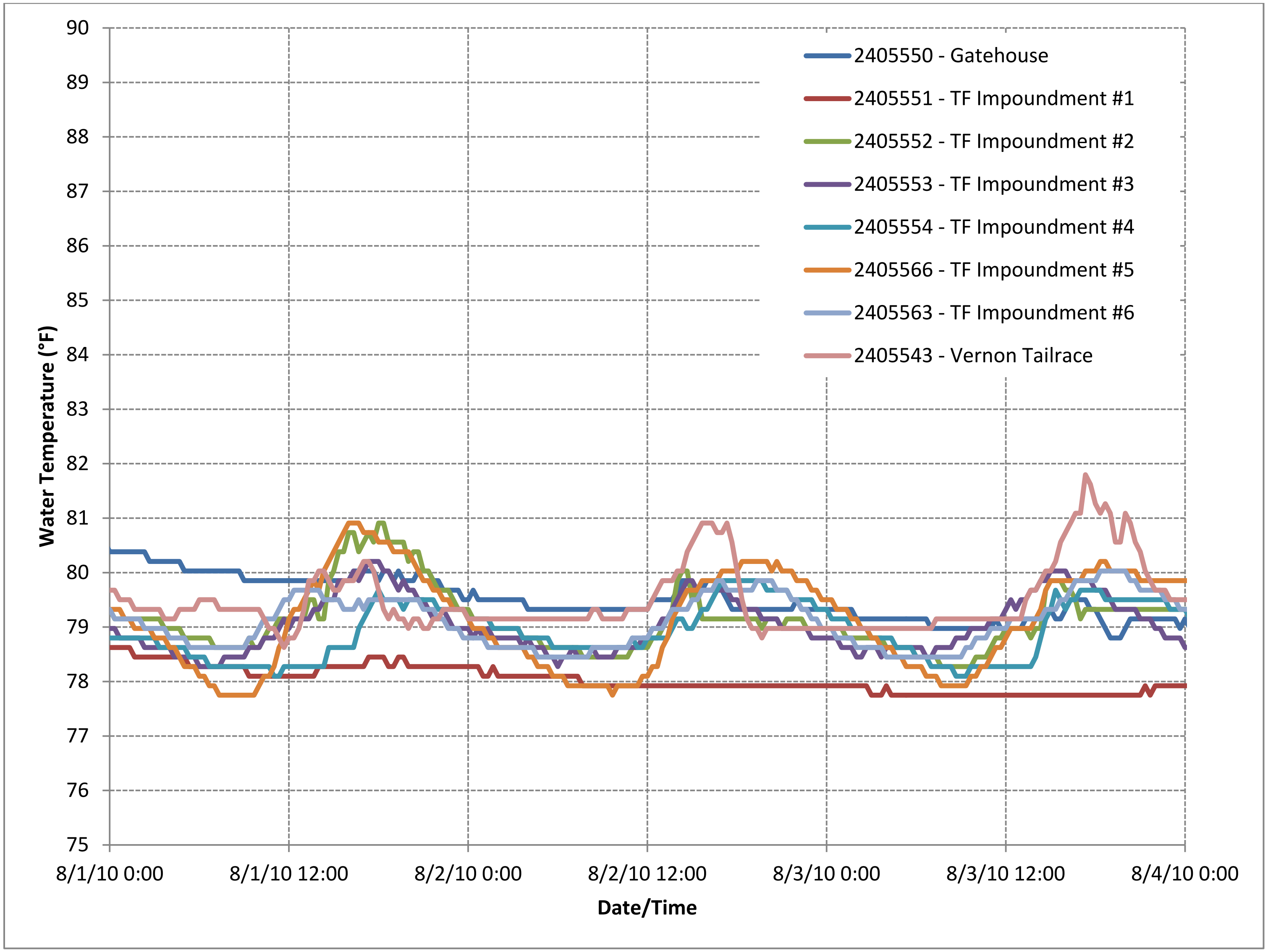
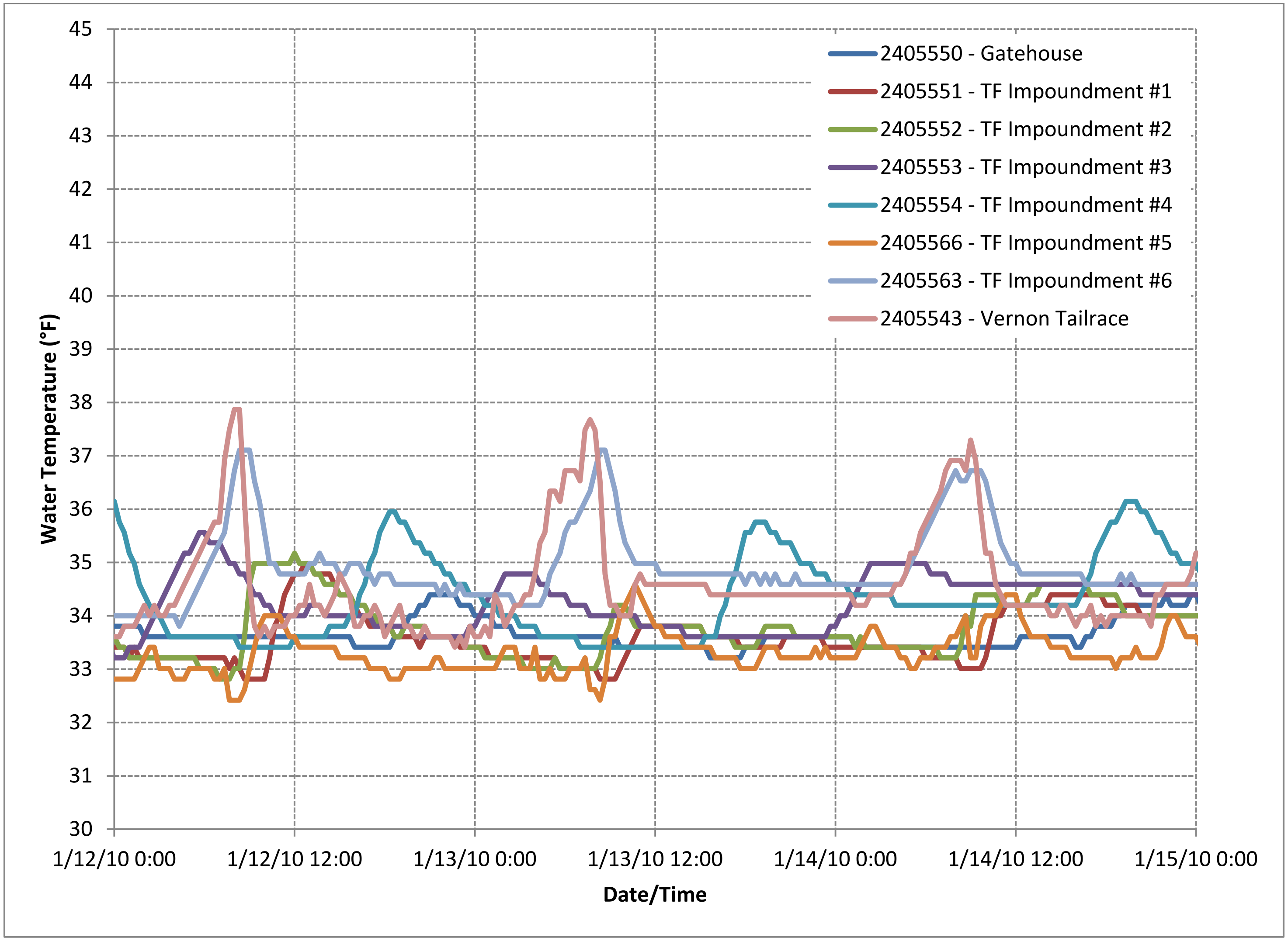
Figure 4.3.2.4-1: USFWS Water Temperature Data, August 1-3, 2010



Note: Data provided by USFWS.

Figure 4.3.2.4-2: USFWS Water Temperature Data, January 12-14, 2010



Note: Data provided by USFWS.

4.4 Fish and Aquatic Resources (18 C.F.R. § 5.6 (d)(3)(iv))

4.4.1 Introduction

The Connecticut River in the vicinity of the Project area is generally narrow, with areas of floodplain and terraces of silt, sand and gravel. The basin is steep and makes for quick drainage to the river during mild rains, snow melts and storms. The Project area from upstream to downstream consist of aquatic habitats associated with the Turners Falls Impoundment, bypass reach, and downstream riverine area.

The Turners Falls Impoundment extends upstream to the Vernon Dam (FERC No. 1904) tailrace. Both lentic and lotic conditions are present in the impoundment. The lower section of the impoundment has several large areas off the channel which are shallow, with weeds and muck bottom habitats characteristic of lentic conditions. Further upstream, above this section, a river channel exists with rock shorelines and lotic conditions. The substrate in this reach is variable ranging from sand to boulders to slate ledge. In July 2012, FirstLight conducted a characterization and mapping of aquatic mesohabitat (habitat classes) in the bypass reach from Turners Falls Dam to the Cabot Station discharge and the approximately 30 mile long segment of the Connecticut River from Cabot Station down to the vicinity of Dinosaur Footprints Reservation. Results presented in FirstLight (2012) are generally discussed relative to each migratory species in Section 4.4.5.

The Connecticut River in the Turners Falls Project and Northfield Mountain Project vicinity supports a variety of cool and warm water resident fish as well as migratory species and the federally endangered shortnose sturgeon. These fish species are discussed in the following sections. Three fish passage ladders are provided at the Turners Falls Project and are described in Section 3.2.3. A general description of the Turners Falls Project and Northfield Mountain Project facilities is available in Section 3.1.

4.4.2 Resident Fish Species

The Connecticut River in the vicinity of the Project supports a variety of warmwater resident fish. These include a mixture of native and non-native species. The Commonwealth of Massachusetts classifies this reach of the Connecticut River as Class B waters, which supports a warm water fishery.

4.4.3 Resident Fish in the Turners Falls Impoundment

Dominant family groups found in the Connecticut River in the Turners Falls Project and Northfield Mountain Project vicinity are the Centrarchidae (sunfishes), Percidae (perches) Catostomidae (suckers), and Cyprinidae (minnows). The centrarchid family includes important warmwater game fishes such as largemouth and smallmouth bass, crappies and sunfish (Hartel et al., 2002). These species tend to be territorial especially during their midspring to midsummer breeding periods and build shallow nests in gravel or sand (Hartel et al., 2002).

Among the Cyprinidae species reported in the Connecticut River are the spottail shiner, fallfish and common shiner. Fallfish, commonly known as chub, are mostly found in pools and riverine habitat but can be found in lakes. This species mainly feeds on aquatic insects, plankton, and other small fishes. Fallfish spawn in the spring and serve as prey for birds and larger piscivorous predatory fishes (UNB, 2009). Common and spottail shiners are small, omnivorous fish that spawn primarily in streams. The shiners typically occur in cool, clear streams with moderate current and gravel bottoms and spawn in eddies from May through July, depending upon water temperatures (NWRC, 1983).

Catostomids are closely related to the Cyprinids and are a highly diverse taxonomic group. They are bottom-feeding omnivores that make up a dominant forage base for the aquatic ecosystem (Eddy & Underhill, 1978). Although the longnose sucker was historically found in the mainstem Connecticut River, recently only the white sucker has been reported This fish will utilize many habitats, but it prefers stream or river pools with sand or silt substrate. This species is a broadcast spawner, using gravel substrate in stream runs and riffles (Hartel et al., 2002).

Percidae are spiny-rayed fishes composed of nine genera with about 165 species (Hartel et al., 2002).. Yellow perch and walleye are two common percids found in the area (Hartel et al., 2002). These fish are shoreline and cover orientated and do not typically undertake large riverwide movements. They prefer to inhabit vegetative areas

A study of resident fish species in the Turners Falls Impoundment was conducted from 1971 to 1975. Eight stations in the impoundment were sampled every other week from April through October with electro-fishing equipment (MDF&G, 1978). Twenty resident fish species were collected during these surveys; detailed data were reported for 14 of these. In 2008 the impoundment was again surveyed via electrofishing. This survey, conducted by Midwest Biodiversity Institute (MBI), was part of a larger USEPA effort to sample the entire Connecticut River from its headwaters at Lake Francis to the freshwater extent of the tidal estuary (Yoder et al., 2010). The percent frequency of the species collected in the 1971-1975 studies were compared to those collected in 2008. The percent frequency of resident fish species documented by these studies is listed in Table 4.4.4-1.

In general, the species composition and percent frequency of the resident fish species were similar between the two sampling studies—i.e., the resident fish populations are dominated by bass, sunfish (pumpkinseed) and perch (yellow perch) species. Some differences in percent frequency were observed; these differences may be attributable to the small sampling period (one day) of the 2008 study, versus the long-term sampling period over several years reflected in the 1971-1975 data set, or to different sampling methods and design.

The most frequently captured species in the early study were yellow perch (at a frequency of 25%). This species was also abundant in the recent study (at a frequency of 17%), but capture frequency of yellow perch in 2008 was surpassed by spottail shiner, which dominated the recent survey at a capture frequency of 57% and may indicate a higher forage base for larger species such as bass. Smallmouth bass and pumpkinseed were recorded in the impoundment in 2008, but less frequently than in the earlier study; this may be attributable to differences in study duration and the influence of a high capture frequency of spottail shiner in the recent study. Largemouth bass, bluegill, white sucker, golden shiner, rock bass and chain pickerel had similar capture frequencies between the two studies. Few walleye, black crappie, white perch and brown bullhead were collected in the 1970s, and were not collected in 2008. Species that were not recorded in the early study, but were documented in 2008 include fallfish and common carp.

4.4.4 Resident Fish in the Connecticut River Below Turners Falls Dam

Similar to the fish in the Turners Falls Impoundment, resident fish species in the areas downstream of the Turners Falls Dam include a mixture of warm water, native and non-native fish species. In 2009, MBI conducted the USEPA-funded electrofishing survey throughout the area. This study found the dominant resident species were fallfish, smallmouth bass, spottail shiner, bluegill and yellow perch (MBI unpublished data).

Table 4.4.4-1: Relative Abundance of Resident Fish Collected via Electrofishing in the Turners Falls Impoundment in the Early 1970s and 2008

Species		Relative Abundance (%)	
Scientific Name	*Common Name*	*1971-1975*	*2008*
Perca flavescens	Yellow perch	25	17
Lepomis gibbosus	Pumpkinseed	16	3
Micropterus dolomieui	Smallmouth bass	15	5
Micropterus dolomieui	Largemouth bass	9	6
Micropterus salmoides	Bluegill	8	3
Notropis hudsonius	Spottail shiner	7	57
Catostomus commersonii	White sucker	5	4
Stizostedio vitreum	Walleye	4	0
Notemigonus crysoleucas	Golden shiner	3	1
Pomoxis nigromaculatus	Black crappie	2	0
Morone americanus	White perch	2	0
Ambloplites rupestris	Rock bass	2	2
Ameiurus nebulosus	Brown bullhead	3	0
Esox niger	Chain pickerel	1	< 1
Semotilus corporalis	Fallfish	0	1
Cyprinus carpio	Common carp	0	< 1

4.4.5 Migratory Fish Species

The Connecticut River in the Turners Falls Project and Northfield Mountain Project vicinity supports a variety of migratory fish species (anadromous and catadromous), shown in Table 4.4.5-1. In addition to these, a population of shortnose sturgeon is known to inhabit the Connecticut River below the Turners Falls Dam.

Table 4.4.5-1: Migratory Fish Species in the Turners Falls and Northfield Mountain Projects' Vicinity

Scientific Name	Common Name
Anadromous Species	
Salmo salar	Atlantic salmon
Alosa sapidissima	American shad
Alosa aestivalis	Blueback herring
Morone saxatilis	Striped bass
Petromyzon marinus	Sea lamprey
Catadromous Species	
Anguilla rostrata	American eel

4.4.5.1 *Connecticut River Anadromous Fish Restoration Program*

The Connecticut River Anadromous Fish Restoration Program (Restoration Program) began in 1967 as a federal and multi-state cooperative program to restore American shad and Atlantic salmon to the Connecticut River. Federal legislation passed in 1983 gave jurisdiction over the Restoration Program to the Connecticut River Atlantic Salmon Commission (CRASC), which as noted in Section 3.2.3 is composed of members from the four states that include parts of the Connecticut River basin (Connecticut, Massachusetts, New Hampshire, and Vermont) and two federal agencies (NMFS, USFWS). Staff at the Turners Falls and Northfield Mountain Projects has worked closely with CRASC agency members, participating in restoration activities and maintaining active communications since the inception of the Restoration Program.

The Restoration Program's main legislated role is to oversee the restoration of Atlantic salmon, but it also maintains an interest in other anadromous species, especially American shad. The Restoration Program supports fish passage at barrier dams. Upstream fish passage facilities exist at five mainstem dams and eight tributary dams, with downstream facilities provided at many additional dams (Gephard & McMenemy, 2004).

The Restoration Program is guided by the Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River (Strategic Salmon Plan), which provides a summary of past and current Atlantic salmon restoration efforts and a vision for focusing interagency restoration activities. The goal of the original Strategic Salmon Plan, when it was introduced in the early 1980's (Stolte, 1982) was to attain a population of 19,265 adult salmon returning to the Connecticut River annually. Of this total, 7,470 were to originate from natural reproduction and 11,795 from artificial propagation of fry and smolts. This population was to support a sport catch of 4,000 salmon. The annual number of adult salmon known to have returned to the Connecticut River, however, has not exceeded 521 (1981).

In 1998, the revised strategic salmon plan addressed the next phase of restoration but did not include numeric goals. Specific milestones to be reached during this second phase included: 1) an increase in the number of fry stocked in the watershed to 10 million; 2) an increase in the number of adults returning to the river; 3) an increase in the number of adults released into the river upstream of trapping facilities to support natural reproduction; 4) completion of the construction of downstream fish passage facilities; 5) re-establishment of hatchery smolt production and stocking; and 6) the beginning of the development of tributary-specific stocks of salmon.

Annual runs of returning Atlantic salmon typically have been in the hundreds *see* (Figure 4.4.5-5). Annual runs of American shad, blueback herring and alewife have experienced declines over the past two decades, for which stock recovery of striped bass is thought to be partially responsible (Savoy & Crecco, 2004). In 2012, however, the largest number of American shad were lifted at Holyoke Dam since 1992. On the other hand, blueback herring abundance remained low. Since the 1990's, gizzard shad and hickory shad have extended their range into the Connecticut River and the number of striped bass that enter the river has dramatically increased during the same time period.

At a meeting of the CRASC on July 10, 2012 the USFWS announced that it will no longer culture salmon for restoration efforts in the Connecticut River Basin. Agency representatives indicated that they supported the salmon restoration for 45 years, but low return rates and the science supporting salmon restoration have caused them to refocus efforts on other anadromous fish. The USFWS will continue to work with state agencies and other conservation interests to restore and sustain other fisheries in the river basin and will redirect fishery facilities and staff to support the conservation of American shad, American eel, river herring, and shortnose sturgeon in the Connecticut River.

4.4.5.2 *Anadromous Fish Species below Turners Falls Dam*

American Shad

American shad migrate into the lower Connecticut River during late March or April, reaching Cabot Station in late April or early to mid- May. When American shad are migrating up the river water temperatures are generally between 12 and 20^{o}C; spawning occurs from 14 to 23^{o}C. River flow is generally declining from the spring peak during the run.

American shad prefer areas dominated by runs and glides, 3 to 18 ft. deep for spawning purposes, and have been observed to spawn over a variety of substrates but prefer sand and gravel bottom with sufficient water velocity to eliminate silt deposits (Stier & Crance, 1985). This type of habitat most closely corresponds to the runs and glides occurring downstream from Cabot but is very limited in the bypass reach. Approximately 77% of the area evaluated in FirstLight (2012), in the 30 mile reach below Cabot tailrace, consist of the "run" mesohabitat type; presence of glide habitat areas are negligible.

Female shad broadcast their eggs (about 290,000 per individual) in open water in a variety of substrates. After spawning, spent shad swim back downstream during June and July, and may survive to spawn more than once. The larvae hatch in three to 12 days, depending on water temperature. The yolk-sac is absorbed in another three to four days, and the larvae are transported by currents into areas of lower velocity, where they begin to feed on plankton. Young-of-the-year (YOY) shad abundance has been shown to be negatively correlated with river flow in June (Crecco & Savoy, 1984), either because of physical displacement of YOY shad into unsuitable habitat, or because of fluctuations in populations of prey organisms that are related to flow.

YOY shad are abundant in many river locations throughout the summer and provide a forage base for predatory fish. Although some YOY shad may move downstream at other times, the seaward migration out of the Connecticut River occurs in September through October, peaking when water temperature is about 9 to 14^{o}C. Most daily movement occurs in evening hours until about 2300 hours, but movement can occur around-the-clock (Hartel at al., 2002). The young migrate to areas in the North Atlantic and remain at sea for four to six years before returning to their native river to spawn.

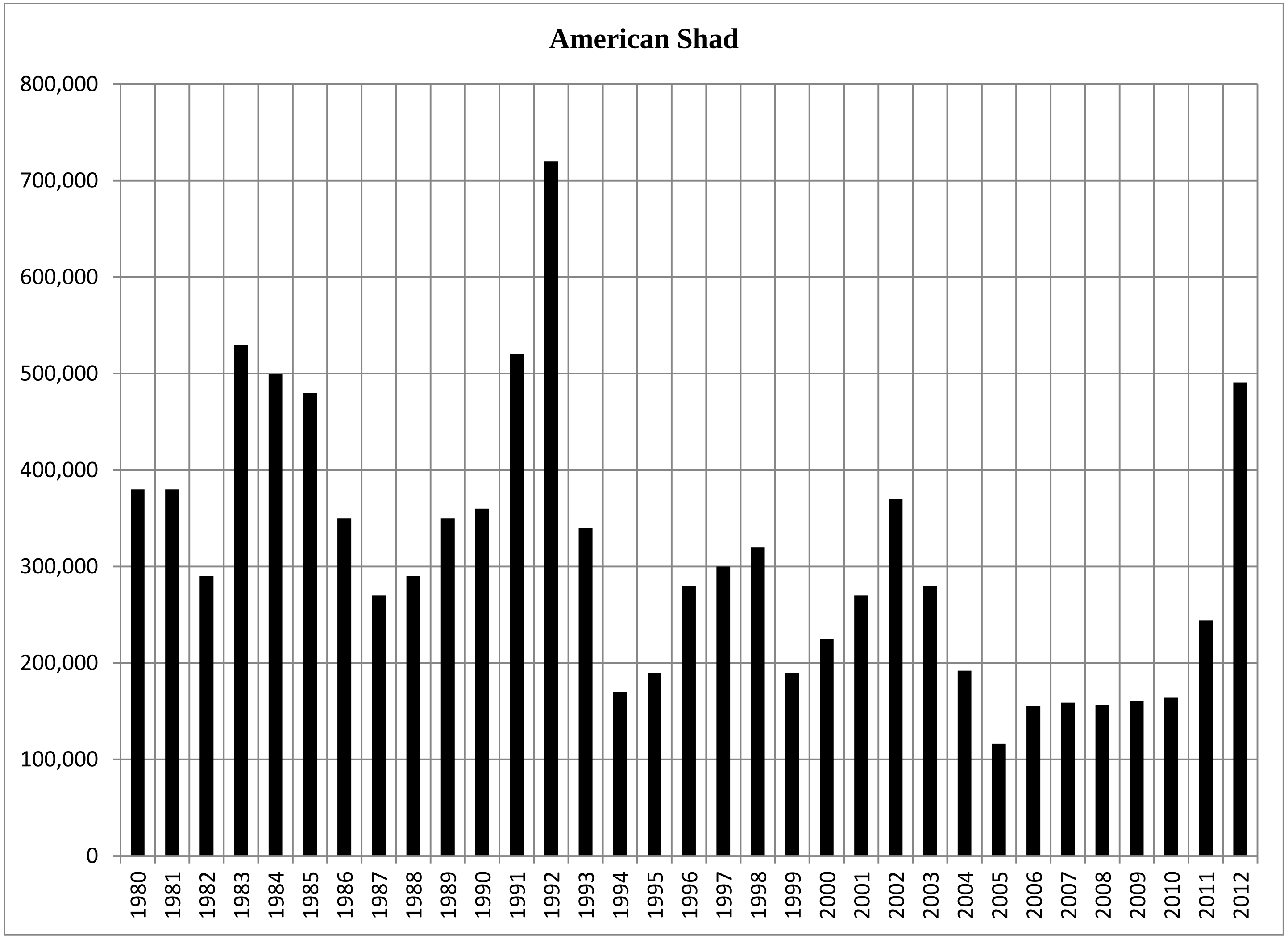
Juveniles are pelagic filter feeders attracted to areas with concentrations of plankton and suitable water quality (Stier & Crance, 1985). Because juveniles are weak swimmers, low-velocity mesohabitats such as pool and backwater habitats may be inherently more attractive than riffles and fast moving runs. Pool and backwater habitats occur in about 57% of the bypass reach and 19% of the reach below Cabot Station. Hightower et al., (2012) noted in southeastern rivers that dissolved oxygen levels lower than 5.0 mg/l were unsuitable for spawning; and that optimal spawning water velocity ranges from approximately 2 to 3 ft/sec; optimal depths range from approximately 6.6 to 11.5 ft, and that gravel/cobble/boulder substrates are preferred to silt/sand or clay.

Most adult shad passed at the Holyoke lift are allowed to migrate upstream to Turners Falls. But some are trapped at the Holyoke fish lift and transported in trucks by state and federal agencies to reaches of the Connecticut River upstream of the Turners Falls and Northfield Mountain Projects.

The annual number of adult shad passing into the impoundment below Turners Falls (Figure 4.4.5-1) rose, with substantial year-to-year variation, until 1992. This trend was followed by a decline in the 1990's. Until the time of decline, a model developed by the Connecticut Department of Energy and Environmental Protection (CTDEEP) (Crecco & Savoy, 1984) had been successful at predicting the abundance of adult shad based on juvenile abundance indices from the appropriate previous years. The model, however, did not predict the 1990's decline. This decline has been noted in other Atlantic coast shad populations as well. Several factors may contribute to the recent decline in the Connecticut River American shad population. Factors include: 1) increased predation mortality, especially by striped bass (Savoy & Crecco, 2004); 2) competition by gizzard shad (Gephard & McMenemy, 2004); and/or 3) reduction of repeat spawners (Leggett et al., 2004). As noted above, however, in 2012 the largest number of American shad were lifted at Holyoke Dam since 1992.

Commercial gillnet fishermen harvest shad during spawning runs in the lower Connecticut River from near its mouth to Glastonbury, CT; sport fishing for shad is also a major attraction, especially in the first two miles downstream of Holyoke Dam and downstream of the breached Enfield Dam.

Figure 4.4.5-1: Annual Number of American Shad Passed into the Holyoke Impoundment below the Turners Falls Project, 1980-2012



Blueback Herring

Together blueback herring and alewife are known as river herring. Alewife use the lower portion of the river but do not pass above the Holyoke Dam. Thus blueback herring is the only river herring found in the Project area (Hartel et al., 2002). Pre-spawning blueback herring enter the Connecticut River at about the same time as American shad. Blueback herring broadcast spawn on hard substrate in swift-flowing tributaries to the lower Connecticut River. Presumably, some spawning also occurs in the mainstem Connecticut River, where swift-flowing habitats with hard substrate are available (Hartel et al., 2002). Females may produce 122,000 to 261,000 eggs; larger fish generally produce more eggs.

Blueback herring elsewhere have been reported to spawn in both swift-flowing, deeper stretches and in slower-flowing tributaries and flooded low-lying areas adjacent to the main stream; substrates may vary from coarse to fine materials (Pardue, 1983). Active spawning may occur over a wide range of water velocities. FirstLight (2012) identified that the uppermost segments of the reach below Cabot consist of riffle habitat with swift-flowing conditions but swift-flowing runs are well distributed throughout the 30 mile reach downstream of Cabot tailrace evaluated in 2012, along with portions of the bypass reach below Turners Falls dam. Most of the runs featuring the hard substrates (*i.e*. cobble gravel) can be found in the first 14 miles of river below the Cabot tailrace. Fines such as sand predominate as substrates in the remaining downstream reaches.

Eggs are initially demersal but become planktonic. Pardue (1983) reports that larvae in Chesapeake Bay remain near or slightly downstream of presumed spawning areas, and in Nova Scotia are associated with relatively shallow (<6.6 ft), sandy, warm areas in and near areas of observed spawning. Preferred spawning areas are runs/riffles with hard substrates that are a short distance upstream from runs, and pools with finer substrates.

Assuming that suitable plankton and water quality exists downstream from the Cabot Station, this reach should provide extensive suitable habitat for this species especially in the transition area between cobble/gravel and finer substrates. Pardue (1983) notes that the species is tolerant of turbidity and juveniles exhibit a diel response to light intensity.

Juveniles remain in the river, feeding on zooplankton, until the fall of the year they hatched; they then emigrate to the sea (Collette & Klein-MacPhee, 2002). These characteristics of their development parallel those of American shad and the young of the two species are difficult to distinguish. Juvenile blueback begin their seaward migration slightly earlier and at higher water temperatures (peaking at 14 to 15^{o}C) than American shad. Adult blueback herring spend three to six years at sea before returning to spawn in their natal streams. The average length of adults is less than 300 mm (Hartel et al., 2002).

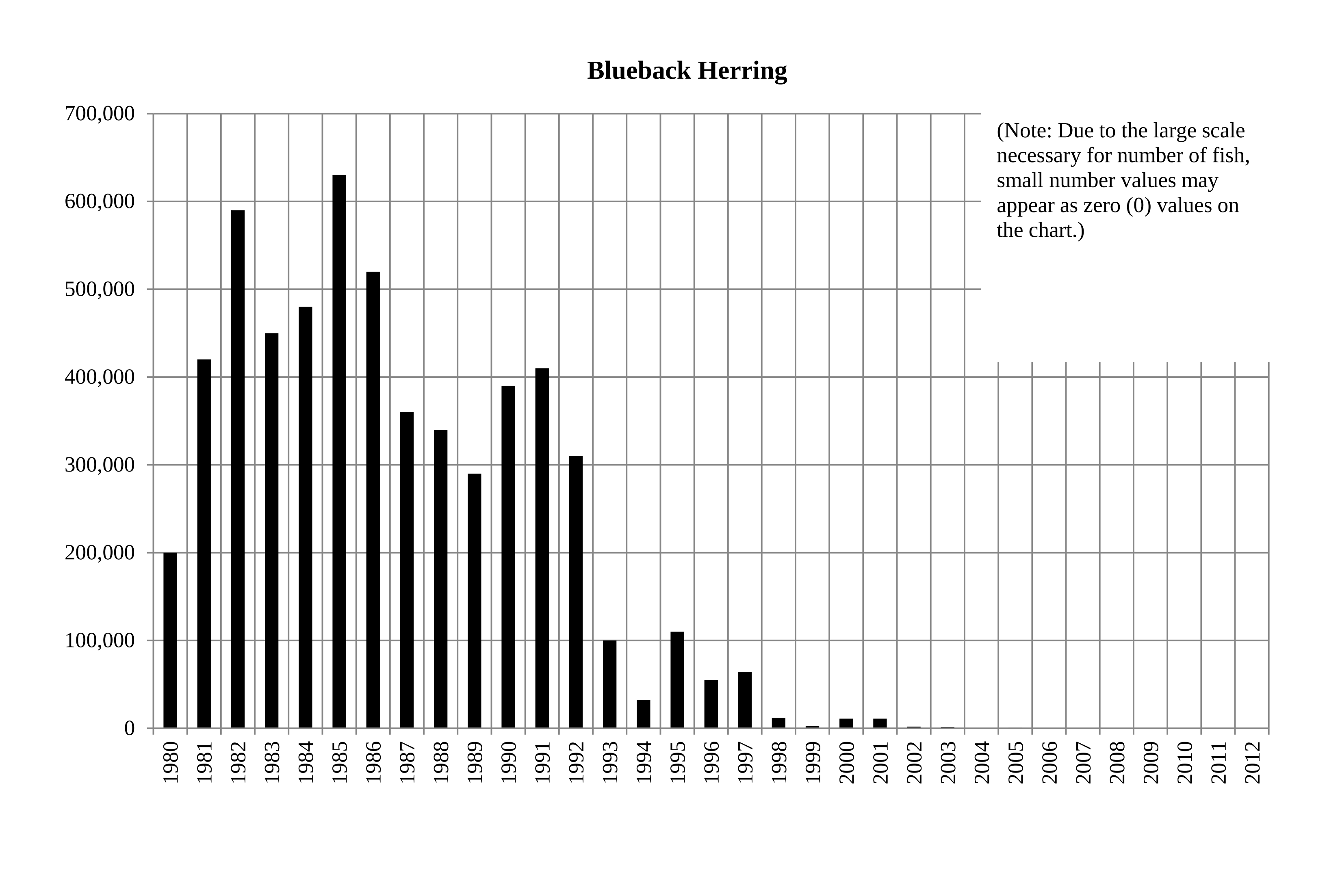
Prior to 1977, fewer than 10,000 blueback herring passed into the Holyoke impoundment annually. Since then, the number passed has been highly variable, ranging from 630,000 in 1985 to 21 in 2006 (Figure 4.4.5-2). Similar to American shad, blueback herring in the Connecticut River and coast-wide experienced a decline in the mid-1990s; however, the decline of blueback herring was much more dramatic (Figure 4.4.5-2) than American shad (*see* Figure 4.4.5-1). Causes for the decline were thought to be similar to those listed for American shad with off-shore bycatch and predation by striped bass most likely accounting for the decline in the Connecticut River.

Blueback herring are not an important sport or commercial species in the Connecticut River, although some are captured for use as bait in coastal fisheries, and they are harvested at sea for human consumption and animal feed.

A petition to list blueback herring as threatened under the federal Endangered Species Act of 1973 (16 U.S.C. §1531 et seq., ESA) was submitted to the NMFS on August 5, 2011 by the Natural Resources

Defense Council. In its 90-day review of the 2011 Petition, NMFS concluded that the Petition presented substantial scientific or commercial information indicating that the petitioned action may be warranted (76 FR 67652-67656), and initiated a status review for the species. NMFS is currently conducting its comprehensive 12-month status review.

Figure 4.4.5-2: Annual Number of Blueback Herring Passed into the Holyoke Impoundment below the Turners Falls Project, 1980-2012

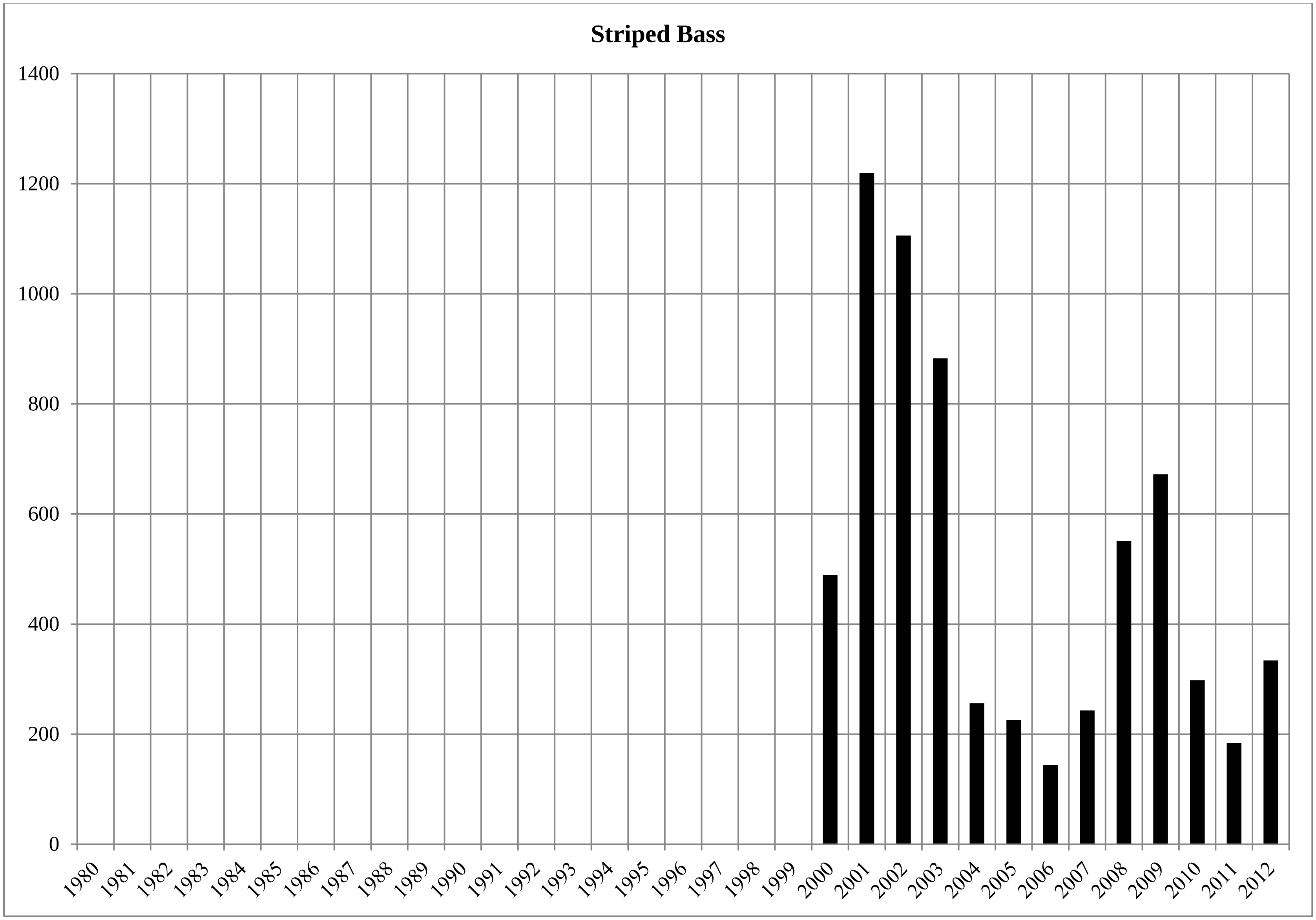


Striped bass

Striped bass are native to Atlantic coastal waters from the St. Lawrence River in Canada to the St. Johns River in Florida, moving into freshwater to spawn or feed. Major spawning areas include the Hudson River and tributaries to Chesapeake Bay, although spawning occurs in rivers from the Maritimes to the southeastern United States. They may grow to several feet in length and are highly predatory, feeding on a variety of fishes and invertebrates. Adult and juvenile striped bass in freshwater habitats feed largely on other fish, and have been shown to feed on river herring, American shad, and American eel. The recent declines in Connecticut River populations of these species have been linked to the resurgence of the Atlantic coast striped bass population (Savoy & Crecco, 2004). During the past decade striped bass have become abundant in the Connecticut River; over 5,700 striped bass have been passed into the Holyoke impoundment below the Turners Falls Project since 2000 (Figure 4.4.5-3).

A three year study supported by the CTDEP was begun in 2005 to assess the abundance, temporal and spatial distribution, and population structure of alewife, blueback herring, and striped bass, and to describe predator/prey interactions between these species in the Connecticut River (Davis & Vokoun, 2009). The study found that striped bass predation is a large source of mortality for migrating adult blueback herring and it was estimated that over 200,000 herring were consumed by striped bass in the Connecticut River in May 2008. Striped bass supports recreational fishing in the Connecticut River. Commercial fishing is not permitted.

Figure 4.4.5-3: Annual Number of Striped Bass Passed into the Holyoke Impoundment below the Turners Falls Project, 2000-2012



Sea Lamprey

Sea lamprey is an anadromous species that spawns in the Connecticut River and its tributaries. This species inhabits the Great Lakes and coastal North America and Europe. Sea lampreys spawn during spring in shallow areas of moderate current with sand, gravel, and rubble substrate.

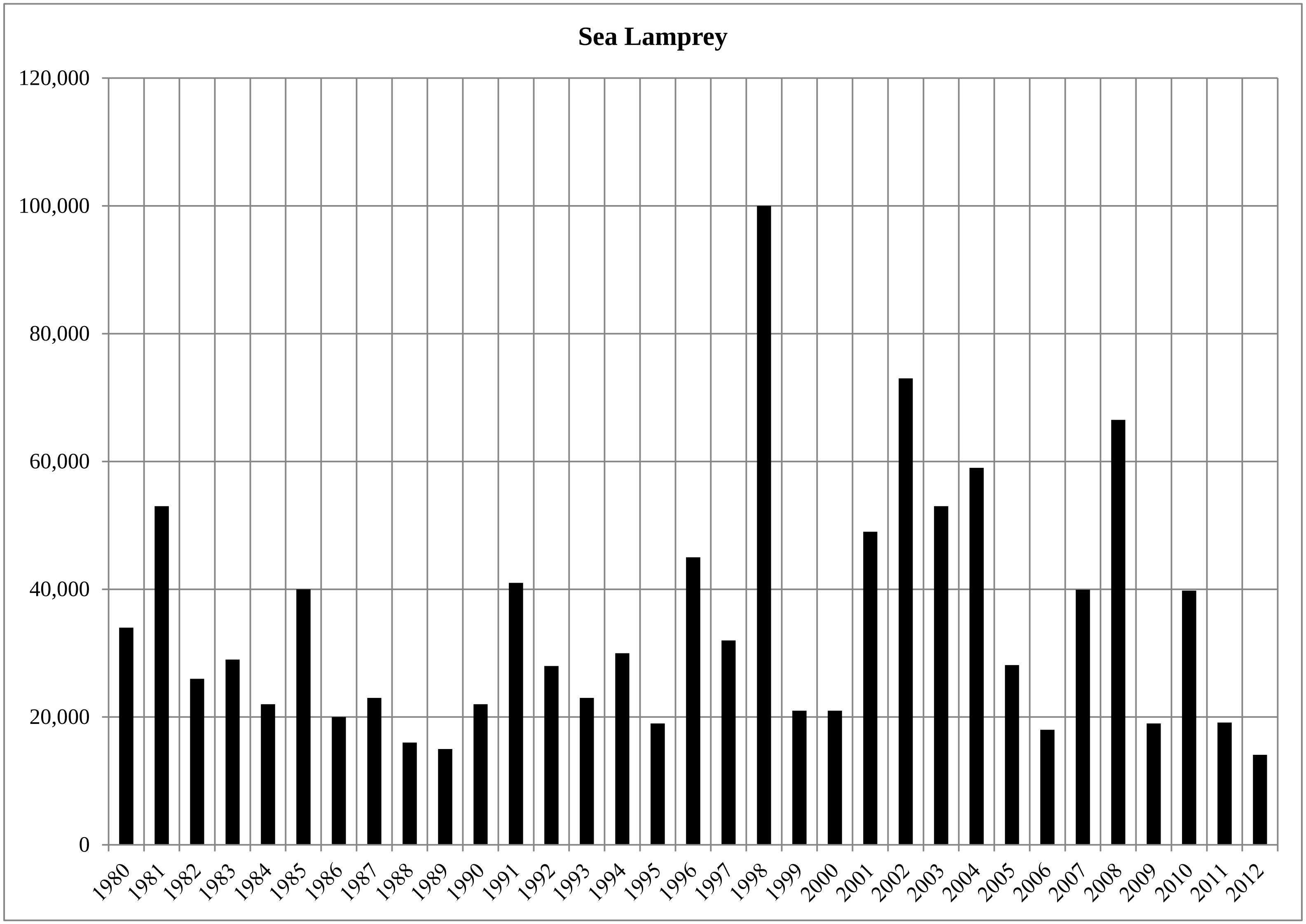
The adults parasitize other fish species, using a sucking disc and rasping teeth and tongue to attach to and penetrate the tissues of prey species. The sucking disc is also used during spawning to construct 1-3 foot diameter nests in the substrate. Similar to other anadromous species, sea lamprey do not feed during their upstream spawning migration and thus are not parasitic while in the river (Hartel et al., 2002). Pre-spawning adults create a depression in the substrate by carrying larger rocks out of the nest area and by sweeping smaller particles out using rapid body movements. The female then deposits eggs, fertilized by the male, moving more rocks and gravel as necessary. Spawning in one nest may continue for 16 hours to 3.5 days. During the spawning run, adults undergo considerable physiological change and deterioration; they die after spawning.

The young hatch and leave the nest two to three weeks after egg deposition. This life stage is referred to as the ammocoete, which burrows into soft sediments and exists as a filter feeder, coming to the sediment surface to feed. This stage lasts up to seven years; the ammocoetes then undergo a transformation into the parasitic adult phase and migrate to sea. Downstream migration occurs in fall and spring, but primarily in the spring.

The annual number of sea lamprey passed into the Holyoke impoundment below the Turners Falls Project in the Connecticut River, 1980 through 2011 is depicted in Figure 4.4.5-4.

The sea lamprey is not of recreational or commercial value in the Connecticut River.

Figure 4.4.5-4: Annual Number of Sea Lamprey Passed into the Holyoke Impoundment below the Turners Falls Project, 1980-2012



Atlantic Salmon

Atlantic salmon were extirpated from the Connecticut River in the late 1700's (Gephard & McMenemy, 2004). A joint effort by the states of Connecticut, Massachusetts, Vermont and New Hampshire to restore Atlantic salmon to the Connecticut River was begun in the late 1960's (Gephard & McMenemy, 2004). As noted in Section 4.4.5.1, however, on July 10, 2012 the USFWS announced that it will no longer culture salmon for restoration efforts in the Connecticut River Basin.

Adult Atlantic salmon occupy areas in the North Atlantic and return to their native rivers (historically including the Connecticut River) to spawn after one to three years at sea. Atlantic salmon spawn in the fall, but often enter freshwater during the preceding spring, remaining downstream of spawning areas until fall. Upstream movement is often triggered by increases in river discharge coupled with cooling water temperature. Spawning may occur in gravel substrates in the headwaters of tributaries where the female digs a nest (called a redd). The female deposits eggs in the redd, the eggs are fertilized, then the female buries the eggs in the gravel. Adult Atlantic salmon may survive to spawn more than once. Adult females may return to sea immediately after spawning; males may emigrate after spawning or may overwinter and return to the sea the following year.

The fry hatch during the spring following spawning. The fry remain buried in the gravel until the yolk-sac is absorbed, then emerge and inhabit fast-flowing water. Post-fry young (parr) remain in freshwater for two or three years before they migrate to the sea as smolts, which are generally 150 to 200 mm long. Most of this freshwater phase occurs in the natal tributary, although some downstream movement prior to the seaward migration may occur. The seaward migration usually takes place in spring when water temperature reaches about 10^{o} C during or immediately following the spring runoff.

Seaward-migrating smolts are vulnerable to avian and piscine predation, and they must pass whatever natural and man-made obstacles exist downstream of the rearing habitat. Potential piscine predators present in the Connecticut River include northern pike, smallmouth and largemouth bass, walleye, American eel, and striped bass. Potential avian predators include osprey, kingfisher, cormorants, and herring and black-backed gulls. Commercial fishing of Atlantic salmon at sea has been temporarily curtailed by international agreement since the 1990's and purchase of commercial fishing rights. A small native subsistence fishery remains off the coast of Greenland. Sport and commercial fishing for Atlantic salmon is not permitted in the Connecticut River basin, although a few adults are inadvertently caught by commercial and/or sport shad fishermen annually (Gephard & McMenemy, 2004).

Downstream at Holyoke Dam, the majority of Atlantic salmon that enter the fish lift are trapped and held for a captive spawning and rearing program (Figure 4.4.5-5). Only one in ten salmon is released from the Holyoke fish lift to proceed upstream. Some of these fish are subsequently captured at upriver fishways; others remain free and may spawn naturally.

Once captured, adult salmon are transported to holding facilities where they are kept until spawning season. Gametes are stripped from the fish and eggs are fertilized. Some of the salmon are reconditioned after spawning and kept to spawn again the following year. The fertilized eggs are transferred to rearing facilities and hatch the following spring. The newly-hatched fry are then released into suitable wild habitat in various Connecticut River tributaries, usually before they reach the feeding stage. Once the salmon fry are released, they develop in natural habitat until they reach the smolt stage and emigrate.

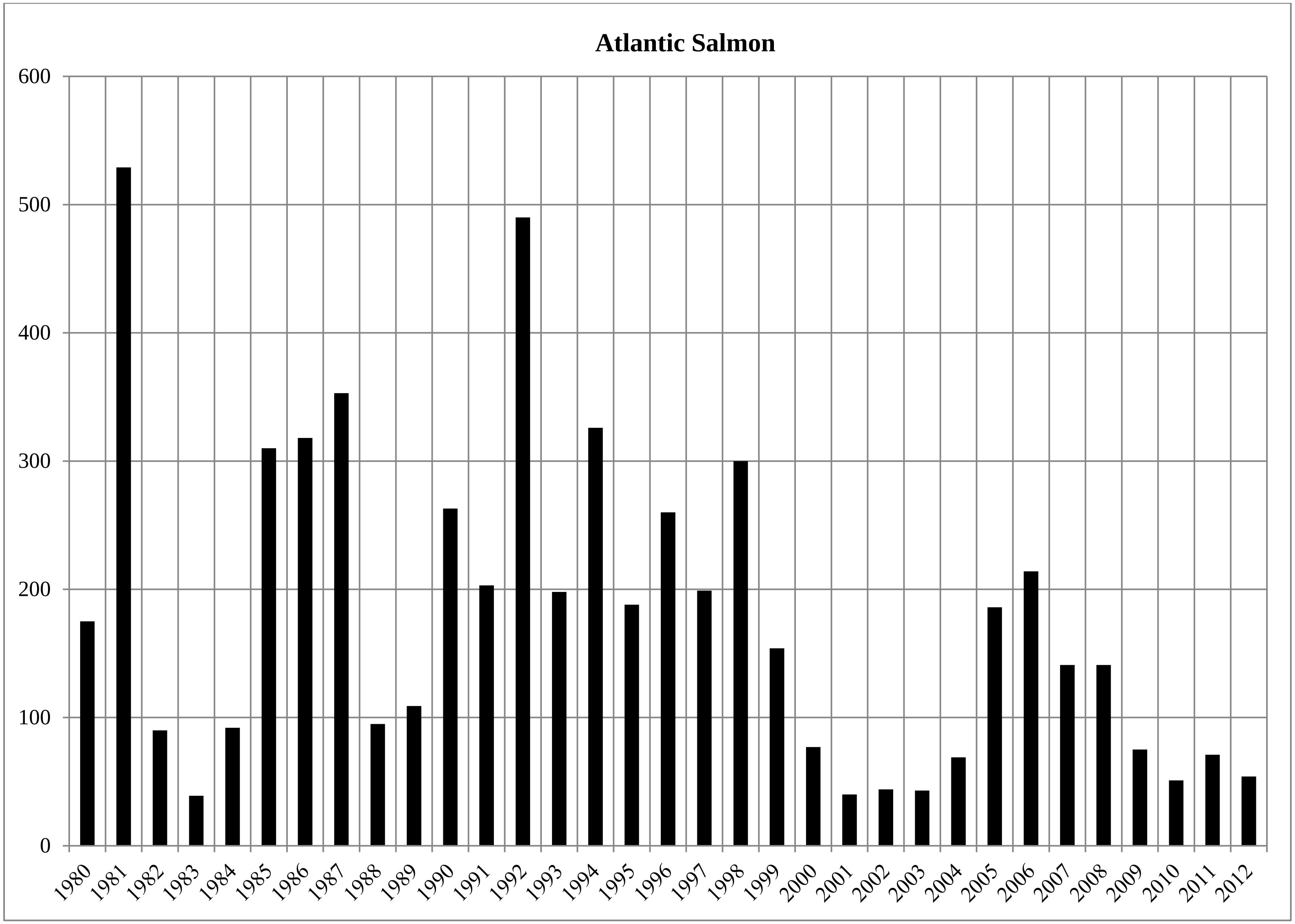
A mark recapture study (funded by FirstLight, Holyoke Gas & Electric, and USFWS) was conducted from 1993 to 2011 to determine the number of Atlantic salmon smolts passing Cabot Station (Table 4.4.5-2). Atlantic salmon smolts were captured at a sampling screen located in a log sluice adjacent to Cabot Station. Smolts that entered the sluice were collected on the screen and diverted to a sorting table adjacent to the sluice where some were marked with a Panjet (Model S1A/F1, Wright Health Group, Ltd, Dundee, Scotland) needleless inoculator which, when loaded with ink, shoots a pressurized stream that leaves a small but visible subdermal mark. Once marked, the fish were released at the log sluice.

Sampling was conducted approximately seven hours a day, seven days per week from the end of April to the end of May. The maximum number of smolts to be marked on any given day was predetermined using a cumulative normal distribution. A goal for the total number of smolts to be marked and released was set annually in cooperation with the Vermont Department of Fish and Wildlife, based on index data from upriver tributaries. Marked and unmarked smolts were recaptured at the Holyoke Canal bypass collection facility located 34 miles downstream from the Cabot Station marking point. All smolts collected at the bypass collection facility were examined for marks, counted, and then released. Sampling at the bypass facility was conducted approximately 12 hours a day, seven days per week. Access to the Holyoke Canal bypass collection facility was restricted in 2012, resulting in the suspension of both marking and recapture activities. Enumeration of smolts passing through the Cabot log sluice continued.

Table 4.4.5-2: Annual Mark/Recapture Estimates of the Number of Atlantic Salmon Smolts Passing Cabot Station, 1993-2011

Year	Estimate
1993	19,851 +/- 4,900
1994	30,516 +/- 6,948
1995	70,244 +/- 39,341
1996	no estimate
1997	29,458 +/- 8,678
1998	65,443 +/- 10,755
1999	no estimate
2000	no estimate
2001	21,488 +/- 5,814
2002	no estimate
2003	80,009 +/- 4 2,141
2004	77,548 +/- 40,749
2005	81,191 +/- 36,139
2006	no estimate
2007	58,991 +/- 30,397
2008	59,131 +/- 38,125
2009	111,130 +/- 37,653
2010	245,110 +/- 129,870
2011	no estimate

Figure 4.4.5-5: Annual Number of Adult Atlantic Salmon in the Connecticut River, 1980-2012



4.4.5.3 *Catadromous Fish Species below Turners Falls Dam*

American Eel

The American eel is a catadromous species whose young enter estuarine or fresh water to feed and mature, and then the adults return to the sea to spawn. After spending five to 20 years in fresh or coastal waters, eels migrate to spawning grounds located in the Sargasso Sea in the South Atlantic (Collette & Klein-MacPhee, 2002). Eggs are fertilized and released in the water column. The eggs, and later the larvae are pelagic, drifting via the Florida Current and the Gulf Stream to coastal North America and Europe. The young eels ultimately leave these currents and move shoreward and either reside in estuarine coastal waters or move into fresh water, following cues that are not well understood.

Eels moving into the estuaries are called glass eels because of their transparent appearance. Once they become pigmented they are referred to as elvers until they gain the yellow cast typical of eels. Eels may reside in an estuary throughout their entire life or move upstream in freshwater during the first few years. At maturation, the species undergoes another color change to the silver eel stage and migrates downstream, usually at night during fall.

While in freshwater, eels occupy many different habitats, from ponds and lakes to relatively small streams. They are predators, feeding on invertebrates and other fish species. Small eels, in turn, are prey for large predators such as striped bass, northern pike, largemouth and smallmouth bass. As habitat generalists, eels would not be expected to demonstrate a pronounced preference or avoidance for any particular type of mesohabitat that exists in the bypass reach or downstream of Cabot Station. Rather, factors such as relative density of other eel and abundance of suitable forage would affect their choice of habitat. Juvenile eels would be expected to inhabit these mesohabitats throughout the year. Detailed information about microhabitat preference (*i.e*. depth, velocity, and substrates) are not available, however, the fact that eels have adapted to a wide range of habitat throughout a very broad range of geography, climate and ecosystem strongly indicates a wide tolerance to such variables.

American eels are an important commercial species in many areas, although no substantial commercial fishery for this species exists in the Connecticut River.

A petition to list the American eel as threatened under the federal Endangered Species Act of 1973 (16 U.S.C. §1531 et seq., ESA) was submitted to the USFWS on April 30, 2010 (2010 Petition) by the Council for Endangered Species Act Reliability (Petitioner). USFWS noticed its 90-day finding on the 2010 Petition on September 29, 2011 (76 CR 60431-60444, Notice). USFWS found that there was not substantial information under any of the other ESA listing considerations (including, e.g., regulatory mechanisms and operation of hydropower facilities) that warranted listing of the American eel species. However, the USFWS concluded that the 2010 Petition presented substantial scientific or commercial information indicating that listing of the American eel may be warranted based only on changes in oceanic conditions due to climate change and initiated a status review of the species.

USFWS has requested submittal of new scientific, commercial, and other information regarding American eel to ensure that its 12-month status review is comprehensive and based on the best available information. In particular, USFWS has requested new information not available or not considered at the time of its previous status review in 2007 (72 FR 4967-4997), in which USFWS had determined that ESA listing of the American eel was not warranted. The most recent request required that any new information be submitted by November 28, 2011. The 12-month review is still ongoing.

4.4.6 Anadromous and Catadromous Fish Species in the Turners Falls Impoundment

Upstream Passage

Upstream fish passage facilities began operating in 1980 at the Turners Falls Project pursuant to a Settlement Agreement signed by FirstLight's predecessor, Western Massachusetts Electric Company, state and federal resource agencies, and non-government organizations. Three fish ladders: the Cabot fish ladder adjacent to Cabot Station; the Spillway fish ladder at Turners Falls Dam; and the Gatehouse fish ladder at the upstream end of the power canal were constructed at the Turners Falls Project. The Cabot and Spillway fish ladders are modified "ice harbor" designs and the Gatehouse fish ladder is a vertical slot ladder. These fish ladders were designed in consultation with USFWS based on Columbia River salmon fish ladder designs. Fish passage structures at the Turners Falls Project are described in detail in Section 3.2.3. Fish migrating upstream can use two different routes to pass. They can bypass Cabot Station by ascending the Cabot Fishway, then ascend the power canal, and utilize the Gatehouse Fishway to bypass the gatehouse, and enter the Turners Falls Impoundment. Alternatively, they can ascend the bypass reach to the base of the Turners Falls Dam, ascend the Spillway Fishway, pass through the Gatehouse collection gallery that crosses the power canal, and then ascend the Gatehouse Fishway to enter the Turners Falls Impoundment.

Table 4.4.6-1 provides a summary of fish passage records for the Turners Falls fish passage facilities for the period of 1980 through 2010. The dates of peak passage have varied throughout the years, ranging from May 18 to June 12 at the Cabot fish ladder; May 15 to June 10 at the Spillway fish ladder and May 24 to June 23 at the Gatehouse fish ladder (Table 4.4.6-2). Appendix G lists the studies conducted to evaluate upstream passage of adult American shad at the Turners Falls fishways.

The number of shad passing through the Turners Falls fishways from 1980 through 1998 did not meet agency expectations. FirstLight's predecessor received a letter from USFWS in 1998 requesting discussion of potential structural and operational fishway improvements. FirstLight responded with a five-year plan written in consultation with USFWS and other members of CRASC to evaluate shad passage and develop concepts for fishway enhancements as appropriate. To that end, FirstLight and its predecessor have supported evaluation of the Cabot and gatehouse fishways conducted by researchers from the Conte Anadromous Fish Research Center (CAFRC).

Evaluation of the Cabot Fishway was conducted from 1999 through 2005. Various modifications of the weirs within sections of the Fishway were evaluated, including some that were the result of a physical hydraulic model of fishway pools constructed at CAFRC (Noreika & Haro, 2005). Although some of the modifications in selected sections of the Fishway produced marginal improvements in passage, none appeared likely to result in significant increases in overall shad passage. Evaluation was discontinued in 2005, and in consultation with representatives of CRASC designs were developed for a fish lift to replace the existing Cabot Fishway.

A new Gatehouse Fishway entrance was constructed in 2007 after several years of evaluation and testing of a prototype structure (CAFRC, 2005). The new entrance includes a 70-foot-long flume built on the side of the canal opposite the original entrance. The flume joins the existing entrance gallery near the Spillway ladder exit. One of the two remaining Gatehouse Fishway entrances was closed to assure adequate flow through the new entrance and the spillway ladder. Starting in 2008, biologists from the CAFRC have evaluated shad passage through the new entrance. Results of these evaluations and review of shad counts conducted by FirstLight have demonstrated that shad successfully pass through the new entrance flume, and have also led to modifications implemented in an *ad hoc* manner since operation of the new entrance was initiated. These improvements have included the installation of flow controls within the Fishway entrance gallery, modification of canal operating protocols, relocation of water level sensors, and installation of a temporary rock ramp from the bottom of the canal to the original entrance (the ramp is no longer in place).

Currently, shad appear to pass readily through the new entrance, but not through the original entrance. Flow control changes intended to ensure adequate flow through the new entrance and to the Spillway Fishway have resulted in excessive velocity and turbulence at the original entrance that may be inhibiting shad passage.

Upstream passage of adult American shad through the Turners Falls Impoundment was studied from 1973 through 1976 (Layzer, 1976). During that time, 6,373 shad were transported to the Turners Falls Impoundment from the Holyoke Dam fish lift. Of those, 125 shad were tagged with ultrasonic transmitters and their movements were monitored. Most shad were found to exhibit one of four behavior patterns: 1) 45% of the tagged fish never migrated through the narrow turbulent area below the French King Bridge; 2) 18% remained within two miles of the Northfield Mountain Project tailrace; 3) 21% migrated upstream passing the Northfield Mountain Project tailrace with little or no delay; and 4) 16% exhibited greater movement up and downstream than fish in the other groups including some movement up to Vernon Dam. Layzer (1976) reported that the distance traveled in the Turners Falls Impoundment was related to water temperature. Shad that were tracked displayed a preference for deeper sections of the river. The Northfield tailrace had no clear effect on shad movement through the impoundment. Some shad turned back upon reaching the Northfield tailrace both during operational and non-operational periods. Others milled at the Northfield tailrace; however, similar milling behavior occurred in other portions of the Impoundment outside the influence of the Project. More recently, the USFWS Connecticut River Coordinator and CAFRC have released radiotagged shad at various points in the river and tracked their movements from the release point to Vernon Dam. Results from that study will be available once data analysis has been completed.

Downstream Passage

FirstLight's predecessor, Northeast Utilities Service Company (NU), CRASC, and its member agencies signed a Memorandum of Agreement (MOA) on downstream fish passage in July 1990. The MOA called for the development of downstream fish passage facilities at the Turners Falls Project. The MOA also called for a study to assess the impact of the Northfield Mountain Project on anadromous fish.

Cabot Station

Following the signing of the MOA, downstream fish passage facilities were designed and constructed at Cabot Station in consultation with the agencies. Downstream passage facilities at Cabot Station comprise: reduced bar-spacing in the upper 11 feet of the intake racks; a broad-crested weir developed specifically to enhance fish passage at the log sluice; the log sluice itself, which has been resurfaced to provide a smooth passage route; above-water lighting; and a sampling facility in the sluice.

The log sluice adjacent to the Cabot Station intake racks is operated for downstream passage of Atlantic salmon smolts, American shad, and American eels according to a schedule recommended by CRASC, with closures during periods of high flow to reduce erosion near the sluice discharge, and for intake rack maintenance as necessary. Under current guidelines, the sluice is operated from April 7 through November annually: from April through mid-June for the downstream passage of Atlantic salmon smolts; during June and July for post-spawned adult shad; from August 1 through November 15 for juvenile shad; and from September 1 through November 15 for adult American eels.

Studies to determine the efficiency of log sluice passage for Atlantic salmon smolts and juvenile clupeids were conducted in the 1990's (Appendix G). The efficiency of the log sluice was determined by sampling the proportion of fish that exited the Project via the log sluice compared to those that left through the turbines. It was estimated that 90% of the juvenile clupeids exited via the log sluice. A series of evaluations of downstream passage of salmon smolts through the sluice began in 1991. The evaluations led to structural and behavioral modifications designed to optimize smolt passage, resulting in the facilities listed above, These facilities were estimated to pass downstream through the sluice 73 to 90% of smolts approaching Cabot Station.

In the fall of 1996 and 1997, the movements of emigrating adult American eels at Cabot Station were tracked with radio and two-dimensional (2D) acoustic telemetry. Downstream movement of eels occurred at night and eels were detected at varying depths (Brown, 2005). Eels entered the forebay up to 15 times before passing and the majority of migrant eels passed downstream through the turbines (Brown, 2005). To further characterize the fine-scale movement of eels approaching the intake from October 4, 2002 to November 21, 2002 and October 6, 2003 to November 30, 2003, three-dimensional (3D) acoustic telemetry was used to monitor eels in the forebay of Cabot Station (Brown, 2005). The behavior of individual eels in the forebay of Cabot Station was variable, but of the 50 eels that were tagged over the two years, 44 passed downstream through the turbines and two used the surface bypass.

The majority of eels passed downstream through the Cabot Station trash racks and continued their downstream migration via the turbines. Upon first encountering the trash racks, 37% of the eels did not exhibit any avoidance or searching behavior (Brown, 2005). Eels swam through the trash racks at a variety of depths and overall, the final location of passage depth was nearly equal between the upper third (0 m to 3.3 m), middle third (3.4 m to 6.6 m), and bottom third (6.7 m to 10 m) of the forebay. Longer battery-powered radio transmitters were used in 2003 to investigate whether eels that passed downstream were detected at Hadley Falls Station. Of the 29 eels passed in 2003, 73% were detected downstream of Hatfield, MA (about 10 miles downstream from Cabot Station) and over 70% of those were detected at Hadley Falls Station (Brown, 2005).

In addition to the two eels that used the bypass, 14 additional eels were observed near the bypass entrance but did not use it as a final route of passage. The combination of low relative flow, the surface location of the bypass, and high illumination at the bypass may have contributed to the ineffectiveness of the surface bypass for passing eels at Cabot Station (Brown, 2005).

Entrainment at Northfield Mountain

At the Northfield Mountain Project, any fish entrained during pump-back are passed from the Turners Falls Impoundment through the penstock and turbine and discharged to the upper reservoir. Any fish entrained in the upper reservoir intakes during hydropower generation are passed from the upper reservoir through the penstock and turbine and discharged to the Turners Falls Impoundment. Features that determine the likelihood of entrainment include the velocity at the intakes, design of the turbines, and the fish species and habitat available in the area. Prior entrainment studies conducted at the Northfield Mountain Project include a strobe light exclusion efficiency study (Cook et al., 1994), a guide net exclusion efficiency study (NUSCO, 1999) and intake netting of shad juveniles in the upper reservoir (LMS, 1993a; LMS, 1993b). These studies were conducted to evaluate and mitigate the impacts of the Northfield Mountain Project operation on anadromous fish species, specifically uprunning adult American shad and Atlantic salmon smolts (Appendix G). Methods included radiotelemetry, entrainment netting, and mark/recapture to investigate entrainment. It was determined an estimated 28.6% of Atlantic salmon were entrained, based on the number of tagged smolts entrained, divided by the total number of smolts passing upstream of the Northfield Mountain intake (LMS, 1993a). This rate was reduced after the installation of the fixed-position guide net to 6.7% (NUSCO, 1999). LMS Engineers (LMS, 1993b) estimated the cropping impact of Northfield Mountain on adult American shad passing the water intake. They utilized four different methods and found that the facility had an impact on adult American shad ranging between 0 and 12.4%.

Barrier Net

Annual installation of a fixed-position guide net to reduce entrainment of Atlantic salmon smolts in flows pumped from the Connecticut River to the Northfield Mountain Project's upper reservoir began in 1995. After an evaluation of the net returned encouraging results in 1995, field testing of modified netting configurations was completed in 1996 and 1997. A radio telemetry study was conducted in 1999 to determine the guidance efficiency of the net (NUSCO, 1999). A limited number of (8 of 120) (6.7%) radio-tagged smolts became entrained at Northfield Mountain. Fourteen migrating smolts (not radio tagged) became entangled in the net. Results also indicated that radio-tagged smolts moved quickly along the net.

Following the 1999 testing, the fixed-position guide net to reduce Atlantic salmon smolt entrainment has been deployed annually. The net is typically installed in mid-to-late-April after the spring freshet. Portions of the net occasionally need to be repaired or replaced because of damage due to debris.

Table 4.4.6-1: Anadromous Fish Passage at the Turners Falls Fish Passage Facilities, 1980-2010

Year	Location	American Shad	Blueback Herring	Striped Bass	Sea Lamprey	Atlantic Salmon	Gizzard* Shad
1980	*Cabot*	687	0	11	187	0	
	Spillway	5	0	0	0	0	
	Gatehouse	298	0	1	66	1	
1981	*Cabot*	224	0	0	1,622	7	
	*Spillway***						
	Gatehouse	200	0	0	935	8	
1982	*Cabot*						
	*Spillway***						
	Gatehouse	11	4	0	210	0	
1983	*Cabot*	26,697	106	6	859	0	
	Spillway	263	1	1	649	0	
	Gatehouse	12,705	28	7	703	0	
1984	*Cabot*	1,831	4	0	334	1	
	Spillway	4,563	12	0	851	1	
	Gatehouse	4,333	21	0	683	1	
1985	*Cabot*	31,000	1,726	0	3,198	2	
	Spillway	843	243	0	3,185	3	
	Gatehouse	3,855	301	0	1,809	3	
1986	*Cabot*	22,144	7,091	0	1,424	5	
	Spillway	5,857	6,248	0	2,230	4	
	Gatehouse	17,858	9,578	0	1,961	10	
1987	*Cabot*	33,114	2,866	0	1,324	2	
	Spillway	3,679	2,841	0	2,921	3	
	Gatehouse	18,959	5,091	0	2,590	12	
1988	*Cabot*	28,546	349	0	335	2	
	Spillway	3,354	865	0	1,912	2	
	Gatehouse	15,787	1,079	0	1,175	7	
1989	*Cabot*	14,403	199	0	578	1	
	Spillway	1,494	279	0	947	0	
	Gatehouse	9,511	510	1	868	2	
1990	*Cabot*	31,056	711	0	1,304	8	1
	Spillway	5,898	768	0	1,013	2	0
	Gatehouse	27,908	1,585	0	1,301	16	13
1991	*Cabot*	87,168	6,433	1	2,089	2	0
	Spillway	6,282	2,718	0	3,026	2	0
	Gatehouse	54,656	7,522	3	4,090	4	1
1992	*Cabot*	94,046	1,765	1	1,836	9	0
	Spillway	11,760	884	0	3,275	6	0
	Gatehouse	60,089	2,157	2	2,710	14	7
1993	*Cabot*	21,045	243	0	711	7	0
	Spillway	898	90	0	2,082	3	0
	Gatehouse	10,221	278	0	1,637	7	0
1994	*Cabot***						
	Spillway	1,507	17	0	1,740	1	0
	Gatehouse	3,729	97	0	1,702	5	0

Table 4.4.6-1 (cont.): Anadromous Fish Passage at the Turners Falls Fish Passage Facilities, 1980-2010

Year	Location	American Shad	Blueback Herring	Striped Bass	Sea Lamprey	Atlantic Salmon	Gizzard* Shad
1995	*Cabot*	33,938	4,234	0	1,417	2	1
	Spillway	543	31	0	1,372	0	0
	Gatehouse	18,369	2,957	0	1,813	4	4
1996	*Cabot***						
	Spillway	2,293	13	0	2,651	4	0
	Gatehouse	16,192	515	0	4,556	3	3
1997	*Cabot*	22,518	231	0	2,374	2	4
	Spillway	3,473	15	0	2,219	1	3
	Gatehouse	9,216	128	0	2,265	2	2
1998	*Cabot*	14,947	2	0	8,707	6	1
	Spillway	4,721	0	0	8,642	2	2
	Gatehouse	10,527	4	0	7,579	5	2
1999	*Cabot*	11,501	5	0	2,014	2	543
	Spillway	4,215	0	8	1,449	2	440
	Gatehouse	6,751	2	0	916	0	275
2000	*Cabot*	12,289	0	0	1,455	0	9
	Spillway	2,240	0	0	1,962	4	358
	Gatehouse	2,590	0	0	1,350	5	199
2001	*Cabot*	20,933	0	0	3,678	0	0
	Spillway	2,344	0	0	5,280	0	0
	Gatehouse	1,540	0	0	2,144	0	0
2002	*Cabot*	7,922	0	0	14,709	0	0
	Spillway	5,372	0	0	12,367	0	0
	Gatehouse	2,870	0	0	10,160	0	0
2003**	*N/A*	**	**	**	**	**	**
2004	*Cabot*	5,933	0	0	13,352	0	0
	Spillway	1,980	0	0	5,821	0	0
	Gatehouse	2,192	0	0	8,418	0	0
2005	*Cabot*	5,404					
	Spillway	1,626					
	Gatehouse	1,581					
2006	*Cabot*	11,991	1	198	5,377	4	9
	Spillway	2,577	0	153	5,133	8	0
	Gatehouse	1,810	0	46	3,005	7	0
2007	*Cabot*	11,130	**	**	11,061	5	
	Spillway	1,793	**	**	5,555	3	
	Gatehouse	2,248	**	**	15,438	5	
2008	*Cabot*	15,089	**	**	**	6	**
	Spillway	627	**	**	**	5	**
	Gatehouse	3,995	**	**	32,035	10	**
2009	*Cabot*	13,391	**	**	**	0	
	Spillway	919	**	**	**	5	
	Gatehouse	3,814	**	**	8,296	8	
2010	*Cabot*	30,232	**	**	**		
	Spillway	2,735	**	**	**		
	Gatehouse	16,768	**	**	6,352		

** 1990 was the first year gizzard shad observed using the ladders was recorded.*
*** Not monitored*
Source: Slater, 2011

Table 4.4.6-2: Temporal Trends of American Shad Passage at the Turners Falls Project, 2001-2010

Year	Date of Highest Daily Passage		
	Spillway Fishway	*Gatehouse Fishway*	*Cabot Fishway*
2001	6/10	6/23	5/28
2002	6/5	6/2	6/1
2003	NA	NA	NA
2004	5/15	5/24	5/18
2005	6/3	5/24	6/12
2006	6/2	6/1	6/2
2007	5/27	6/16	5/30
2008	5/27	6/16	5/30
2009	6/2	6/13	5/23
2010	5/28	5/27	5/25

Source: Slater, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, & 2010

4.4.7 Freshwater Mussels

In 2011, a freshwater mussel survey was conducted in a 20-mile reach of the Turners Falls Impoundment, and a 3.5-mile reach from Turners Falls Dam to the confluence with the Deerfield River (2.7 of the 3.5 miles is in the bypass reach), as well as 2.1 miles of the power canal (Biodrawversity, 2012). The objective of the survey was to assess the distribution, abundance and habitat of freshwater mussels. The impoundment and bypass reach surveys were conducted during low flow in August and the power canal survey was conducted during the September canal drawdown. Five freshwater mussel species were found, including the Eastern Elliptio, Alewife Floater, Eastern Lampmussel, Eastern Floater, and Triangle Floater. The Eastern Elliptio was found at 96.2 percent of the 52 sites sampled and was 100 to 1,000 times more abundant than other species. Over 400 Alewife Floaters were found with the highest densities in the upstream end of the impoundment. Of the few Eastern Lampmussel that were found, they were mostly found in the Turners Falls Impoundment and not in the bypass reach or Power Canal. A total of eight Eastern Floaters were found in the Impoundment and in the power canal. One Triangle Floater was found near the mouth of the Deerfield River. Mussels were found in a wide range of water depths, flow conditions, and substrate conditions.

Freshwater mussels are an important part of the benthic fauna in the impoundment, bypass reach, and power canal. The Eastern Elliptio is the dominant species forming expansive beds along much of the impoundment. The Alewife Floater was broadly distributed in the survey area but in low densities in the canal, bypass reach, and lower two-thirds of the Impoundment. The Eastern Lampmussel was found in limited numbers throughout the survey area. The Triangle Floater was listed as Special Concern in Massachusetts until 2012 when it was removed from the list. Triangle Floaters are numerous in many Connecticut River tributaries including the Ashuelot and Millers Rivers which flow into the Turners Falls Impoundment. No state listed or federally threatened or endangered mussel species were found during the survey.

4.4.8 Shortnose Sturgeon

Description and Lifecycle

Shortnose sturgeon is a federally listed endangered species that typically inhabits slow moving riverine waters or near shore marine waters and periodically migrates into faster moving fresh water areas to spawn. Shortnose sturgeon tend to inhabit the deep channel sections of large rivers. They are known to occur at a wide range of depths ranging up to 30-m, but normally in waters less than 20-m (Dadswell et al., 1984;).

They feed on a variety of benthic and epibenthic invertebrates including mollusks, crustaceans (amphipods, chironomids, isopods), and oligochaete worms (Dadswell et al., 1984). Shortnose sturgeon are long-lived (30-40 years), and mature at late ages in the northern extent of their range. Males mature at five to 10 years, while females mature between seven and 13 years. Shortnose sturgeon exhibit three distinct movement patterns associated with spawning, feeding, and overwintering activities. In spring, as water temperatures rise above 8ºC, pre-spawning shortnose sturgeon move from overwintering grounds to spawning areas. Spawning occurs from April to May and may last from a few days to several weeks depending upon water temperature. Shortnose sturgeon spawning migrations are characterized by rapid, directed and often extensive upstream movement (NMFS, 1998). Female shortnose sturgeon are thought to spawn every three to five years while males spawn every two years. Fecundity estimates range from 27,000 to 208,000 eggs/female (Dadswell et al., 1984).

Shortnose sturgeon eggs are separate when spawned, and become adhesive within approximately 20 minutes of fertilization (Dadswell et al., 1984). Between 8° and 12°C, eggs generally hatch after approximately 13 days. Shortnose sturgeon larvae are blackish-colored, 7-11mm long, and resemble tadpoles (NMFS, 2005). They absorb their yolk sac in 9-12 days and develop into post-yolk sac larvae at about 15-mm total length (NMFS, 2005). Week-old larvae were found to be photonegative and form aggregations with other larvae in concealment. Larvae are believed to begin downstream migrations at about 20-mm total length. Laboratory studies suggest that young sturgeon move downstream in two steps; a 2 to 3-day migration by larvae followed by a residency period by YOY, then a resumption of migration by yearlings in the second summer of life (Kynard, 1997).

Adults normally depart from their spawning grounds soon after spawning and movements include rapid, directed movements to downstream feeding areas in spring followed by local meandering in summer and winter (Dadswell et al., 1984; Buckley & Kynard, 1985; O'Herron et al. 1993). Post-spawning migrations are associated with rising spring water temperature and river discharge (Kieffer & Kynard, 1993).

Connecticut River Population Distinction

Prior to the installation of dams on the Connecticut River, shortnose sturgeon migrated and spawned freely within the lower reaches of the River. The best historical data suggests that, prior to the Holyoke Dam being built, shortnose sturgeon were able to pass upstream of the Hadley Falls area during the spring freshet (NMFS, 2005). Turners Falls is believed to have been the upper end of their natural range in the Connecticut River due to the height of the natural falls.

The Holyoke Dam, built in 1849, initially blocked sturgeon from entering or leaving the 36 mile reach of river between Holyoke and Turners Falls. Some sturgeon may have been able to use the Hadley Boat Lock to gain limited upriver access, and some downstream passage over the dam may have occurred during times of high flow.

From 1849 to 1955, shortnose sturgeon above the Holyoke Dam were essentially cut off from those below the dam. The first successful fishway to pass fish upstream, an elevator, was installed at the tailrace at Holyoke in 1955. In 1976, the existing tailrace fish lift at Holyoke was improved, and a lift was installed in the bypass area at the Holyoke Dam. These improvements allowed shortnose sturgeon to pass above Holyoke Dam and access the Connecticut River up to their historic limit at Turners Falls Dam. Shortnose sturgeon have not been observed in the Turners Falls fishways. The population above the Holyoke Dam is referred to as the "upper river population" and is considered separate from the "lower river population," which occurs below the Holyoke Dam.

Distribution and Spawning Success of the Upper River Shortnose Sturgeon

During summer, the shortnose sturgeon population above Holyoke Dam congregates near the confluence of the Deerfield River; this group overwinters at Whitmore, a few miles downstream from Cabot Station. The concentration area used by adult fish in the Connecticut River is in reaches where natural or artificial features cause a decrease in river flow, possibly creating suitable substrate conditions for freshwater mussels (Kieffer & Kynard, 1993), a major prey item for adult sturgeon (Dadswell et al., 1984). Both adults and juveniles have been found to use the same river reaches in the Connecticut River and have ranges of about 10 km during spring, summer and fall (Savoy, 1991; Seibel, 1991). In the winter sturgeon move less than 2 km and assemble together in deep water (Seibel, 1991). The migration of juvenile and adult shortnose sturgeon from the Holyoke impoundment to points downstream of the Holyoke Dam appears to be a natural event coincidental with increased river discharges (Seibel, 1991; Kynard, 1997).

Shortnose sturgeon in the upper river population spawn from the last week of April to mid-May, after the spring freshet (Taubert, 1980; Buckley & Kynard, 1985; Kynard, 1997). The spawning period is estimated to last from five to 17 days, occurring during the same 26-day period each year (April 27 – May

22) (NMFS, 2005). Shortnose sturgeon are believed to spawn at discrete sites within the river (Kieffer & Kynard, 1993). Spawning occurs over channel habitats containing gravel, rubble, or rock-cobble substrates (Dadswell et al., 1984; NMFS, 1998). Additional environmental conditions associated with spawning activity include decreasing river discharge following the spring freshet, water temperatures ranging from 8 - 12ºC, and bottom water velocities of 0.4 to 0.7 m/sec (Dadswell et al., 1984; NMFS, 1998).

Successful spawning has been documented at two sites in Montague (Vinogradov, 1997), just downstream of Cabot Station at the Turners Falls Project. This area is just downstream of the species' historical limit in the Connecticut River at Turners Falls (RM 123) (NMFS, 2005). Sturgeon eggs and larvae were captured at the Montague sites in 1993, 1994, and 1995 (Vinogradov, 1997). This area is the 0.9 mi reach from the natural rock formation called Rock Dam to 656 feet downstream of Cabot Station, where river depths are less than 33-feet and all common types of river habitat are present. Much of the river bottom in the area is rock and rubble. The 0.3-mi. long reach downstream of Cabot Station contains rubble/boulder shoals that can be exposed briefly in spring during low river discharge and low Cabot Station generation (Kieffer & Kynard, 2007).

Kieffer and Kynard conducted a multiyear study (1993-2003) of the pre-spawning migration and spawning of Connecticut River shortnose sturgeon (NMFS, 2005). A total of 450 males and 55 females were captured and measured at Montague during 1993-2003. Abundance estimates at the Montague site during spawning ranged from 14 to 360 adults. Spawning was documented to have succeeded in 1993, 1994, 1995, 1998, 1999, 2000 and 2003 and spawning failed in 1996, 1997, 2001 and 2002. Females spawned in water depths of 1-5 m. Bottom water velocity at spawning sites was a mean of 70-cm/s. Females spawned over cobble/rubble substrate (101-300 mm diameter).

Population Estimates and Condition Factors

No information exists on the size of shortnose sturgeon population in the Connecticut River prior to the late 1970s. At that time the abundance of the upper river group was estimated by mark-recapture techniques using Carlin tagging (Taubert, 1980). Estimates of total adult abundance calculated in the early 1980s range from 297 to 516 in the upper river population to 800 in the lower river population (NMFS, 2005). Population estimates conducted in the 1990's indicated populations in the same range (NMFS, 2005). The total upper river population estimates ranged from 297 to 714 adult shortnose sturgeon, and the size of the spawning population was estimated at 47 and 98 for the years 1992 and 1993, respectively. The lower river population estimate for sturgeon larger than 50-cm total length was based on a Carlin and PIT tag study from 1991 to 1993. An estimate of 875 adult shortnose sturgeon was calculated by these studies. Savoy (2004) estimated that the lower river population may be as high as 1,000 individuals, based on tagging studies from 1988-2002. Other estimates of the total adult population in the Connecticut River have reached 1,200 (NMFS, 2005) and based on recent numbers, the total population may be as high as 1,400 fish (Savoy, 2004).

Taubert (1980) reported that upper river shortnose sturgeon exhibited relatively good growth in length until 8 to 10 years, after which it declined rapidly. The average length of shortnose sturgeon at age 10 was 70.1-cm total length, but shortnose sturgeon at age 25 was only 90-cm total length. The largest shortnose sturgeon recorded by Taubert was 111-cm total length. While most of the shortnose sturgeon collected by Taulbert (1980) ranged between 8 and 18 years of age, shortnose sturgeon over 25 years were not unusual.

4.4.9 Essential Fish Habitat Species

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established a new requirement to describe and identify "essential fish habitat" (EFH) in each federal fishery management plan. NOAA Fisheries Service issued EFH regulations in January 2002. The Magnuson-Stevens Act requires federal agencies to consult with NOAA Fisheries Service when any activity proposed to be permitted, funded, or undertaken by a federal agency may have adverse affects on designated EFH.

Atlantic salmon is the only EFH species located in the Connecticut River. The EFH designation, however, only applies to the mixing water and brackish salinity zone and tidal freshwater salinity zone of the Connecticut River, not the Turners Falls Project and Northfield Mountain Project area. Within the meaning of the EFH statute, Atlantic salmon have been extirpated from the Connecticut River for over 100 years. The rivers where Atlantic salmon have been extirpated are not designated as EFH on the presumption that it would be extremely unlikely that these rivers will again support Atlantic salmon without artificial supplementation or stocking. Thus, there are no designated EFH species in the Turners Falls Project and Northfield Mountain Project areas.

4.5 Terrestrial Wildlife and Botanical Resources (18 C.F.R. § 5.6 (d)(3)(v))

4.5.1 Upland Botanical Resources

The region encompassing the Turners Falls Project and Northfield Mountain Project is characterized by a diversity of terrestrial botanical resources that are influenced by geological features, soil type, hydrology, climate, and historic and current land use (see Section 4.8 for land use information). A general description of the Turners Falls Project and Northfield Mountain Project area and surrounding areas is provided in Section 4.1. Located in the Connecticut River valley, with adjacent high elevations of Northfield Mountain, the Turners Falls Project and Northfield Mountain Project area has characteristics of both Northeastern Highlands and Northeastern Coastal Zone ecoregions (Swain & Kersey, 2011). The Connecticut River, during its course between Vernon and Turners Falls, regains the appearance of a river even though it serves as the reservoir for the Turners Falls Project. The wide and fertile plains on both sides of the Connecticut River are terminated by terraces rising to forest upland country to the east and west. A prominent topographic feature in the Turners Falls Project and Northfield Mountain Project area is the Northfield Mountain Range. According to the USGS mapping the Northfield Mountain Range rises some 800 feet above the river to an elevation of approximately 1100 feet within approximately two miles from the river bank. Examples of geologic and geomorphic features influencing the area's botanical communities include:

- The Northfield Mountain Range including Rose Ledge, Farley Ledge, and Briggs Brook and falls that plunge from the south side of the ridge line;
- The Connecticut River valley and remnant floodplains;
- The confluence of the Connecticut River and major tributaries (e.g., Millers River); and
- Bedrock and alluvial islands within the Connecticut River.

A detailed description of the geology of the Turners Falls Project and Northfield Mountain Project area is provided in Section 4.2.2. Recognized species and communities of concern and their habitats are identified and described in Section 4.7. The dominant vegetative assemblages within the Turners Falls Project and Northfield Mountain Project vicinity fall within several terrestrial and palustrine systems and forest physiognomic categories. Some confined areas represent other sub-dominate vegetative communities within forest physiognomic categories. The primary natural plant communities include:

- Northern hardwoods-hemlock-white pine forest
- Transition hardwoods-white pine forest
- Oak-hickory forests
- Rich mesic forests
- Successional northern hardwoods forests
- Remnant/transitional floodplain forests

Each of these community types is described in detail below.

Northern Hardwoods-Hemlock-White Pine Forest

This community type is associated with forests having a closed canopy dominated by a mix of deciduous and evergreen trees, with sparse shrub and herbaceous layers. This is the predominant hardwood forest community type throughout much of northern New England, and the cooler parts of Massachusetts (Swain & Kersey, 2011). This community type is broadly defined and is characterized by variable dominant species. The community development is on moist, well drained soils on north facing slopes.

The forest is generally dominated by a mix of sugar maple (*Acer saccharum*), beech (*Fragus grandifolia*), yellow birch (*Betula alleghaniensis*) and red oak (*Quercus rubra*) in variable proportions, mixed with eastern hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*). Beech tend to dominate on drier locations. Occurrences with large portions of white pine are usually recovering from a past disturbance where the land was open. Hemlock may dominate in ravines or cool edges of wetlands. Black cherry (*Prunus serotina*), white birch (*Betula papyrifera*), red maple (*Acer rubrum*), and other early successional tree species are often scattered, with occurrences in the subcanopy with stripped maple (*Acer pensylvanicum*), and sometimes ironwood (*Carpinus caroliniana*). The shrub layer is usually open, but may have clumps of hobblebush (*Viburnum alinifolium*) and elderberry (*Sambucus Canadensis*). Individuals of honeysuckle (*Lonicera sp*.) and currant (*Ribes sp*.) are characteristically present. The diverse but sparse shrub layer includes Christmas fern (*Polystichum acrostichoides*), Canada mayflower (*Maianthemum Canadensis*), clubmosses (*Lycopodium*), asters (*Aster sp*.), trillium (*Trillium sp*.), violet (*Viola sp*.), and bluebead lily (*Clintonia borealis*), which appear in the spring. The warmer south slopes of the Northfield Mountain Range likely support the northern hardwoods forest community including red oak and shagbark hickory (*Carya ovata*). This forest community is found at higher elevations within the Turners Falls Project and Northfield Mountain Project area and is located outside the zone of influence of the Turners Falls Project and Northfield Mountain Project operations.

Transition Hardwoods-White Pine Forest

Northern hardwood forest associations and oak-hickory forests that are typical of central hardwoods of the Connecticut River basin in southern Massachusetts and Connecticut mix in this zone (Swain & Kersey, 2011). White pine is found on abandoned fields and sandy sites, oak-hickory associations are found on dry southerly facing sites and hemlock/northern wood mixtures on lower slopes, with central hardwoods, while white birch and white pine are found at higher elevations on the hilltops. The transition hardwood zone is likely to be intermingled in between northern hardwoods and oak-hickory stands occurring in upland areas outside the influence of Turners Falls Project and Northfield Mountain Project operation.

Oak – Hickory Forests

This community type consists of hardwood forests dominated by a mixture of oaks, with hickories mixed in at a lower density, found on well drained upper slopes and ridge tops, usually on west and south facing aspects. A broadly defined, variable forest type (Swain & Kersey, 2011), the canopy is dominated by one or several oaks (*Quercus rubra, Q. alba, and Q velutina*). Mixed in are lower densities of one or several hickories (*Carya ovate, C. tomentosa, C. glabra, and C. ovalis*). Other trees include ash, birch, sassafras (*Sassafras albidum*), and red maple. A subcanopy commonly includes ironwood, flowering dogwood (*Cornus florida*), shadbush (*Amelanchier arborea*), chestnut (*Castanea dentate*), and witch-hazel (*Hamamelis virginiana*). Low shrubs are common and often diverse; blueberries (*Vaccinium sp*.), dogwoods, and viburnums are characteristically present. The herbaceous layer is also richer than in many oak forests. Plants typical of the herbaceous layer include Hepatica (*Hepatica nobilis*), goldenrod (*Solidago sp*.), tick-trefoil (*Desmondium glutinosum*), wild sarsaparilla (*Aralia nudicaulis*), and false Solomon's seal (*Maianthemum racemosa*). This variable forest community is likely to be found at higher elevations on the Northfield Mountain Range within the Turners Falls Project and Northfield Mountain Project area but is likely to be outside the influence of Turners Falls Project and Northfield Mountain Project operations.

Rich Mesic Forests

These are a variant of the northern hardwood forests where sugar maple is usually dominant and there is a diverse herbaceous layer with abundant spring ephemerals in a moist, nutrient rich environment. Rich, mesic forests are usually found on slopes or talus below bedrock or on level areas where calcareous or circumneutral bedrock is near the surface. In Massachusetts, rich mesic forests are restricted to low to moderate elevations below 2,400 feet and usually on north or east-facing, concave, middle to lower slopes that experience down slope movement of nutrients and organic matter (NHESP, 1997). Rich refers to rich in nutrients, although they are also rich in species; and mesic refers to the moderate moisture regime. Soils are usually deep, with rapid decomposition of leaves and other plant litter quickly incorporated into the soil, so that there is rarely more than one year's accumulation of leaves on the forest floor. Rich mesic forests are dominated by sugar maple, with ash (*Fraxinus sp*.), basswood (*Tilia americana*), yellow birch, beech, and red oak, with canopies typically 60 feet high or more. Ironwood, dogwood (*Cornus sp*.), and elderberry (*Sambucus racemosa*) often grow under the canopy species. Rich mesic forest communities are likely to occur in ravines and on the northerly to easterly facing cool slopes of lower elevations on the Northfield Mountain Range. These communities and associated habitat are likely to occur in higher elevations outside the area influenced by Turners Falls Project and Northfield Mountain Project operations.

Successional Forests

Successional forests are a broadly defined time sequence of forest communities, from thick, young sprouts with little diversity to mature, diversified forests with undergrowth of more shade tolerant trees (Swain & Kersey, 2011). The canopy is seldom completely closed and undergrowth may be dense or open. These transitional early pioneer forest communities occur in areas of previous disturbance within the northern hardwood forests. Soil is typically a thin layer of organic matter over sand and gravel. Red maple, black cherry and aspen (*Populus sp*.) trees and saplings dominate this community. Gray birch (*Betula populifolia*) tends to be more common on very well-drained soils. Pin cherry (*Prunus pensylvanica*) is a common associate. Other species likely to be included are red oak and white pine. As the forest matures, the understory is comprised of young trees of more shade tolerant species. Shrubs and herbaceous species are variable, and depend on surrounding seed sources and the types of disturbance that established the early successional community. Common understory species include blackberry (*Rubus sp*.), buckthorn (*Rhamnus sp*.), black huckleberry (*Gaylussacia baccata*), steeplebush (*Spirea sp.)*, and willow (*Salix sp*.). Pennsylvania sedge (*Carex pensylvanica*), dewberry (*Rubus flagellaris*), moss and other graminoids are common ground cover. These young forest communities are likely to be present within wooded areas in the vicinity of Turners Falls Project and Northfield Mountain Project structures and developed areas, but are anticipated to be outside the zone of influence of Turners Falls Project and Northfield Mountain Project operations.

Remnant/Transitional Floodplain Forests

Soils in this zone generally experience annual flooding and are either silt loams or very fine sandy loams, and soil mottling is generally preset within two feet of the soil surface. A surface organic layer is typically absent. Silver maple (*Acer saccharinum*), sycamore (*Plantanus occidentalis*), cottonwood (*Populus deltoides*), red maple, ash (*fraxinus sp*.), American elm (*Ulmus americana*), and willow are the dominate tree species. A shrub layer is generally lacking; however, saplings of overstory trees are common. Vines are abundant with hog peanut (*Amphicarpaea bracteata*) most common. The herbaceous layer is typically an even mixture of wood-nettle (*Laportea Canadensis*), ostrich fern (*Metteccia struthiopteris*), sensitive fern (*Onoclea sensibilis*) and false nettle (*Boehmeria cylindrical*) (Marks et al., 2011). Limited floodplain forests are present along the main stem of the Connecticut River and its major tributaries.

4.5.2 Terrestrial Wildlife

The physiographic settings of the Turners Falls Project and Northfield Mountain Project, with its relatively large tracts of undisturbed terrestrial habitats, provide a wide variety of habitats for terrestrial wildlife. There are a considerable number of parks and conservation lands in and around the Turners Falls Project and Northfield Mountain Project area. Notable areas include (but are not limited to)

Connecticut River Greenway State Park, Westwood Wildlife Sanctuary, Rocky Mt. Park, King Phillips Hill, Brush Mt. Conservation Area, Pauchaug Wildlife Management Area, Bennett Meadow Wildlife Management Area, Cabot Woods, Warwick State Forest, Mt. Grace State Forest, Erving State Forest, and Northfield State Forest.

Wildlife associated with habitats within the Turners Falls Project and Northfield Mountain Project includes a combination of species ranging from those "generalists" species adapted to a broad habitat range to those more specialized species that adapt to narrower habitats (specifically, open/agricultural habitats, wooded riparian habitats, wetland and riverine habitats) (DeGraaf, 2001). These include over-wintering and breeding habitats for migratory and resident bird species. Terrestrial wildlife includes predatory birds, songbirds, large and small mammals, and herptiles (reptiles and amphibians) (DeGraaf, 2001). Typical species found in open/agricultural lands include killdeer, pheasant, meadow lark, field sparrow, cottontail rabbit, and red fox. Species commonly inhabiting wooded habitats include tanager, grosbeak, nuthatch, woodcock, thrasher, woodpecker, gray squirrel, gray fox, raccoon, and white tailed deer. Wetland and riverine habitats attract ducks, geese, herons, kingfisher, beaver, muskrat, mink, and river otter (Holyoke Water Power Company, 1997). Mammal species that may or are known to occur in or near the Turners Falls Project and Northfield Mountain Project, and birds residing in, near, or migrating through the Turners Falls Project and Northfield Mountain Project, are described below. Herptile species are discussed in Section 4.6.5 as wetland, littoral, or riparian species.

4.5.2.1 *Mammals*

Forested areas provide habitats for commonly occurring species typical of western Massachusetts and the Connecticut River valley. The majority of the species are habitat generalists with a known tolerance for habitat modifications and adaptations. Mammals found in the Turners Falls Project and Northfield Mountain Project area are likely similar to species found throughout southern New England. A list of mammals likely to occur, from (DeGraaf, 2001), is presented in Appendix F.

4.5.2.1 *Amphibians and Reptiles*

According to the MADFW there are 45 inland native species of amphibians and reptiles that occur in Massachusetts (MADFW, 2012). Included are ten frogs, eleven salamanders, ten turtles and fourteen snakes. These inland native species include terrestrial and semi-aquatic amphibians and reptiles. Amphibians and reptiles geographic distributions are related to soil type, climate, and presence of water and forest or vegetation type. Some species may be common, yet rarely encountered due to their fossorial habits, nocturnal activities, or limited movements. Within the geographic area of New England there are species that are rare or uncommon in one area that are fairly common in another. Some species are at or near their geographic range. "Limiting factors" may include such climatic considerations as the amount of rainfall, maximum and minimum temperature ranges, or depth of frost, and such physical factors as soil type, plant community, and topography.

Most New England amphibians require water for breeding. Indirect relationships for both amphibians and reptiles within forest communities occur when vegetation cover in riparian zones influences water temperature, pH, or the presence and type of bottom litter. Some species may be found in a wide range of forest community types if the required aquatic habitat component is present within those types. In addition to wooded areas, streams and other aquatic locations (including bogs, marshes, wet meadows, and swamps), upland grassy communities, and non-vegetated areas (talus slopes, banks, beaches, and man-made structures) provide habitats for many species.

Some amphibians and reptiles are restricted to a narrow range of habitat conditions for breeding, feeding, or both; the bog turtle requires wetlands with high humidity and an open canopy, and the spadefoot toad is associated with the sandy soils of flood plains (DeGraaf, 1983). Other species are more generalists in their habitat requirements: wood frogs, American toads, and wood turtles are found in a number of forest types, and the red back salamander is common in a variety of habitats (DeGraaf, 1983).

4.5.2.2 *Birds*

The Connecticut River Valley has long been recognized as an important corridor for migrating birds, including numerous waterfowl. Forests, grasslands, and marshes along the river also provide habitat for breeding birds (Hunt, 2009). Many forest interior birds are summer breeding residents in this area. Woodcock, mourning dove, ruffed grouse and pheasant occur in limited numbers in the wooded sections of the Northfield Mountain Project and Turners Falls Project area. There are a number of birds, which also overwinter in the area. Raptors include (among others) the state listed endangered bald eagle, which has been known to perch in trees along the river in the Turners Falls Project and Northfield Mountain Project area and vicinity. Large flocks of waterfowl, including common goldeneye, Canada geese, and common mergansers utilize the River during the winter. In the urbanized portions of the Turners Falls Project and Northfield Mountain Project area, many of the same waterfowl species are likely to be found utilizing the river. Cormorants are seen in greater concentrations in the vicinity of developed areas than in other portions of the Turners Falls Project and Northfield Mountain Project area. Herring gulls are also common throughout developed area of the Turners Falls Project and Northfield Mountain Project. A 1996 survey, prepared for the Holyoke Hydroelectric Project (FERC No. 2004), found that 161 birds are known or expected to occur in the Turners Falls Project and Northfield Mountain Project area. A list of likely occurring birds from the 1996 Holyoke survey data and information, as provided in DeGraaf, 2001, is presented in Appendix F.

4.6 Wetlands, Riparian, and Littoral Habitat (18 C.F.R. § 5.6 (d)(3)(vi))

The Turners Falls Project and Northfield Mountain Project area encompasses a variety of water-dependent habitats that can be variously defined by frequency of inundation, water depth, and geomorphic position in the landscape adjacent to an open body of water. These habitats are characterized by a variety of vegetation types and wildlife species. Wetlands, the riparian zone, and the littoral zone are three broad habitat types that are present in the Turners Falls Project and Northfield Mountain Project area. In general, the bed of the Connecticut River and the parts of tributary systems are classified as wetland, including much of the Turners Falls Impoundment. These areas are largely unvegetated, with bottom sediments of fine sands and silts. Several areas, however, are vegetated with submerged aquatic vegetation, or emergent wetland vegetation. In addition, there is typically a very narrow fringe of Bordering Vegetated Wetland along this reach of the Connecticut River due to the relatively high and steep river banks. The Bordering Vegetated Wetland classification is more commonly associated with the tributaries (e.g., Pine Meadow Brook, Otter Run Brook, etc.) than with the main channel of the Connecticut River.

The occurrence, distribution, and characterization of wetland, littoral, and riparian habitats at the Turners Falls Project and Northfield Mountain Project are described below in Sections 4.6.1, 4.6.2, and 4.6.3 respectively. National Wetlands Inventory (NWI) maps were reviewed to identify the locations of wetlands within the boundary of the Turners Falls Project and Northfield Mountain Project area. The NWI maps identify wetlands in accordance with the Cowardin classification which includes littoral and some open water habitats as wetlands (Cowardin, 1979). NWI maps for the Turners Falls Project and Northfield Mountain Project boundary are illustrated in Figures 4.6-1 through 4.6-10. NWI wetlands within the Turners Falls Project and Northfield Mountain Project boundary, which are not littoral or open water habitats are limited to seasonally flooded deciduous broad-leaved forested and scrub-shrub wetlands, and narrow-leaved persistent emergent wetlands. Additional discussions of vegetation and wildlife are provided in Sections 4.6.4 and 4.6.5. Rare, threatened, and endangered (RTE) species, and critical habitats are discussed in Section 4.7.

4.6.1 Wetland Habitat

The Connecticut River represents the largest riverine system in New England, encompassing over 7.2 million acres in Vermont, New Hampshire, Massachusetts, and Connecticut with over 20,000 miles of streams (Holyoke Water Power Company, 1997). According to information provided by the NWI, there are mosaics of relatively small, scattered freshwater, forested wetlands on Northfield Mountain, down to Turners Falls Dam and along high terraces of the Connecticut River. To a lesser degree there are also small inclusions of freshwater scrub-shrub wetlands intermingled throughout the landscape. Patches of riverbank freshwater emergent wetlands are confined to the Connecticut River and other major tributaries. Vegetation along the shoreline is typically oriented approximately perpendicular to the slope, suggesting that vegetation patterns may be controlled by duration and frequency of flooding.

It is anticipated that narrow bands of emergent vegetation occur along the shallow shoreline and in backwater coves. Broadleaf cattail (*Typa latifolia*) is the dominant wetland emergent species forming monoculture stands along the shoreline. Other wetland vegetation likely to be observed to a lesser degree includes relatively small areas of willow (*Salix sp*.), palustrine scrub-shrub wetlands, and narrow silver maple dominated floodplain / stream side terraces. Also likely, but limited, are a few instances of invasive species ranging from a few occurrences of Phragmities to larger local stands of Phragmities and Japanese knotweed (*Fallopia japonica*). Generally, invasive species are likely to show an increasing trend of occurrences from the rural parts of the Turners Falls Impoundment to the more developed sections.

4.6.2 Littoral Zone Habitat

The shoreline along the Connecticut River is characterized by sharp, abrupt slopes with narrow deposits at the water's edge. This includes sediments deposited at the mouths of major and minor tributaries entering the Connecticut River, sediments associated with stormwater runoff that drain riparian areas, and sediments deposited by receding waters. The littoral zone is the near-shore area, extending from the seasonal high water level to the furthest extent of rooted aquatic vegetation. Typically, rooted aquatic vegetation is distributed as an upper zone of emergent rooted vegetation, a middle zone of floating-leaved rooted vegetation, and a lower zone of submerged rooted vegetation. Often, the study of the littoral zone habitat is further broken down to distinguish between a shallow littoral zone (0 to 5 feet) and deep littoral zone (5 to 10 feet) (Cowardin, 1979).

Most littoral habitat along the Connecticut River is situated on alluvium. Large expanses of alluvium are deposited as accretionary features at or near the downstream ends of islands and at or near tributary mouths, coves, and backwaters (see Section 4.2, Geology and Soils). Accretionary features are stabilized by vegetation when optimal conditions of inundation and sediment stability are reached. Once established, the vegetation initiates a cycle of sediment trapping, stabilization and accretion. Submerged aquatic vegetation (SAV) may occur in the main stem of the Connecticut River, backwater sloughs, and major tributaries.

Littoral zones provide habitat for fish and benthic invertebrates, where suitability of substrate types influence abundance and diversity of benthic organisms. Historic benthic sampling at the Turners Falls Project described in the Turners Falls Exhibit W (WMECO, 1973) found cyclic fluctuations in abundance of most organisms. Benthic insects included representatives of the groups Trichoptera, Odonata, Ephemeroptera, Diptera, Coleoptera and Megaloptera. Trendepid (Midge) larvae were the dominate organisms at all sample stations. Other types of organisms found in abundance included oligochaetes (aquatic earthworms), gastropods (snails), and pelecypods (clams and mussels) (WMECO, 1973).

4.6.3 Riparian Zone Habitat

Riparian zones boarder waterways landward of the littoral zone. In Fischer et al. (2000), the USACE defines riparian zones as long strips of vegetation adjacent to inland aquatic systems that affect or are affected by the presence of water. Riparian habitat can be a wetland or non-wetland (upland). The width of the riparian zone is a function of slope. Where the upland topography is very steep, the riparian zone is very narrow to absent.

Riparian zones along the Connecticut River are primarily limited to narrow strips due to steeply sloped banks along the shoreline, particularly within the Turners Falls Project and Northfield Mountain Project area. There may be a few, limited, silver maple dominant floodplains within the Turners Falls Project and Northfield Mountain Project area that function as an ecotone, connecting the riparian environment with the upland terrestrial habitat.

4.6.4 Wetland, Littoral, and Riparian Vegetation

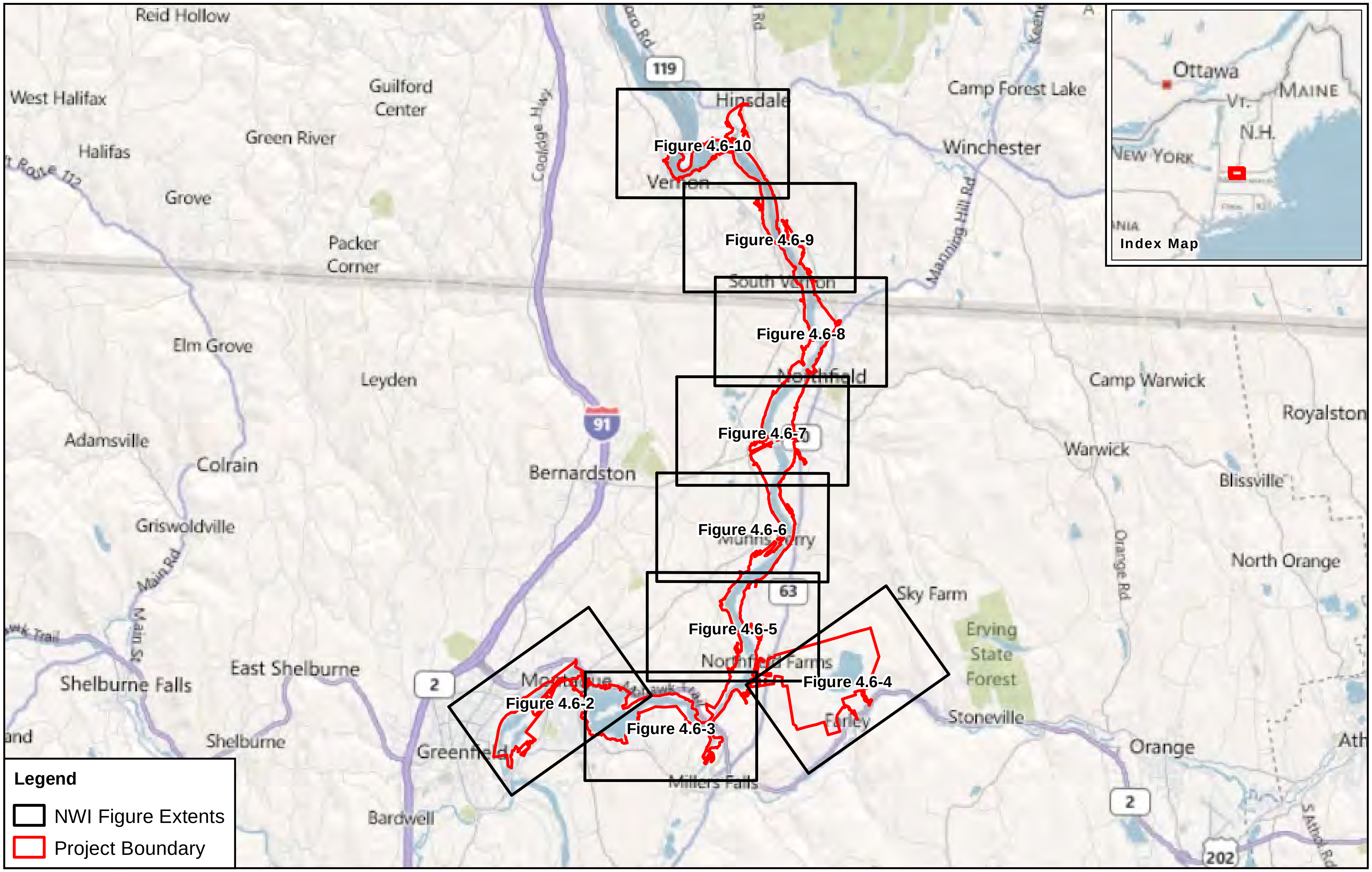
Based on available NWI mapping, aerial photography, and information provided in the National Cooperative Soil Survey, wetland vegetation in the Turners Falls Project and Northfield Mountain Project area is likely typical of that commonly found throughout southern New England. The most likely commonly occurring wetlands are forested red maple swamps. These palustrine, broad-leaved forested, Red Maple-dominated, seasonally-flooded wetlands are found in acidic soil conditions that are typically inundated for two to three months per year (Golet, 1974). Red maple is the dominant tree species, with ash, elm, and birch as common subordinates. Understory vegetation typically includes winterberry (*Ilex verticillata*), highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), spicebush (*Lindera benzoin*), cinnamon fern (*Osmunda cinnamomea*), sedges (*Carex sp*.), skunk cabbage (*Symplocarpus foetidus*), and sphagnum moss (Marks et al., 2011).

The littoral habitat of the Turners Falls Project and Northfield Mountain Project area is likely characterized as narrow bands of emergent and aquatic fringe vegetation occurring along the shoreline, commonly consisting of cattail (*Typha latifolia*), wild rice (*Zizania aquatic*), pickerel weed (*Pontederia cordata*), arrowhead (*Sagittaria latifolia*), reed canary grass (*Phalaris arundinacea*) and bulrush (*Scirpus sp*.) (Swain & Kersey, 2011).

The riparian zone in the Turners Falls Project and Northfield Mountain Project area, and down to the Pioneer Valley section of the Connecticut River, contains some of the largest remnant floodplain patches in the Connecticut River watershed (Zimmerman, 2006). The riparian zone contains a unique forest type that is adapted to the seasonal spill of water over the river's banks, the northern floodplain forest. Zimmerman (2006) describes the floodplain forest composition in waves of vegetation outward from the river's banks. The Connecticut River riparian zone and floodplain vegetation is typical of large river floodplains. The low floodplain is dominated by silver maple with co-dominate species including ash and cottonwood. Farther out, on the low ridges of heavy coarse sediment created by river flooding, commonly grows the eastern cottonwood. An intermediate layer of vegetation is observed beneath the sheltering canopy of the cottonwood, due in large part to both the shade of the overstory and the scrubbing effect of the river flooding. Seedlings of silver maple, elms, box elder and white birch are found here, as well as willow, sycamore, river birch, and red maple. Depending on the light levels in a given area of the forest floor, ostrich fern (*Matteuccia struthiopteris*), cinnamon fern, grasses (*Graminaea*) and sedges are commonly observed in the herbaceous layer (Marks et al., 2011). Grapevines (*Vitus sp.)* and American black currant (*Ribes americanum*) are abundant understory plants in this section of the floodplain. Still farther back from the river, on the rich higher terraces of the remnant floodplain, tree species such as American basswood (*Tilia Americana*), black gum (*Nyssa sylvatica*), tulip poplar (*Lirodendron tulipifera*), red maple and American beech comprise the overstory. These species grow close enough to the river to be rooted in moist floodplain soils, yet far enough away to be protected from serious flooding.

4.6.5 Wetland, Littoral, and Riparian Wildlife

Wildlife species utilize wetlands and littoral habitat in a variety of ways, with some species spending their entire life cycle in these habitats, while others use them primarily for reproduction and nursery grounds. Many wildlife species, as well as fish, frequent wetland and littoral habitats for forage, feeding on organisms produced in these ecosystems. These habitats are also essential for survival of numerous endangered animal and plant species (Metzler 1992). A discussion of littoral zone habitat is provided in Section 4.6.2. Wetlands and the riparian zone also provide habitats for many forms of wildlife. Fish and aquatic species, which may use these habitats are described in Section 4.4. Terrestrial wildlife is described in Section 4.5. Rare species are described in Section 4.7.



FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

Figure 4.6-1 NWI Index Map

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FIRSTLIGHT POWER RESOURCES

PRE-APPLICATION DOCUMENT

Figure 4.6-2 NWI Map 1

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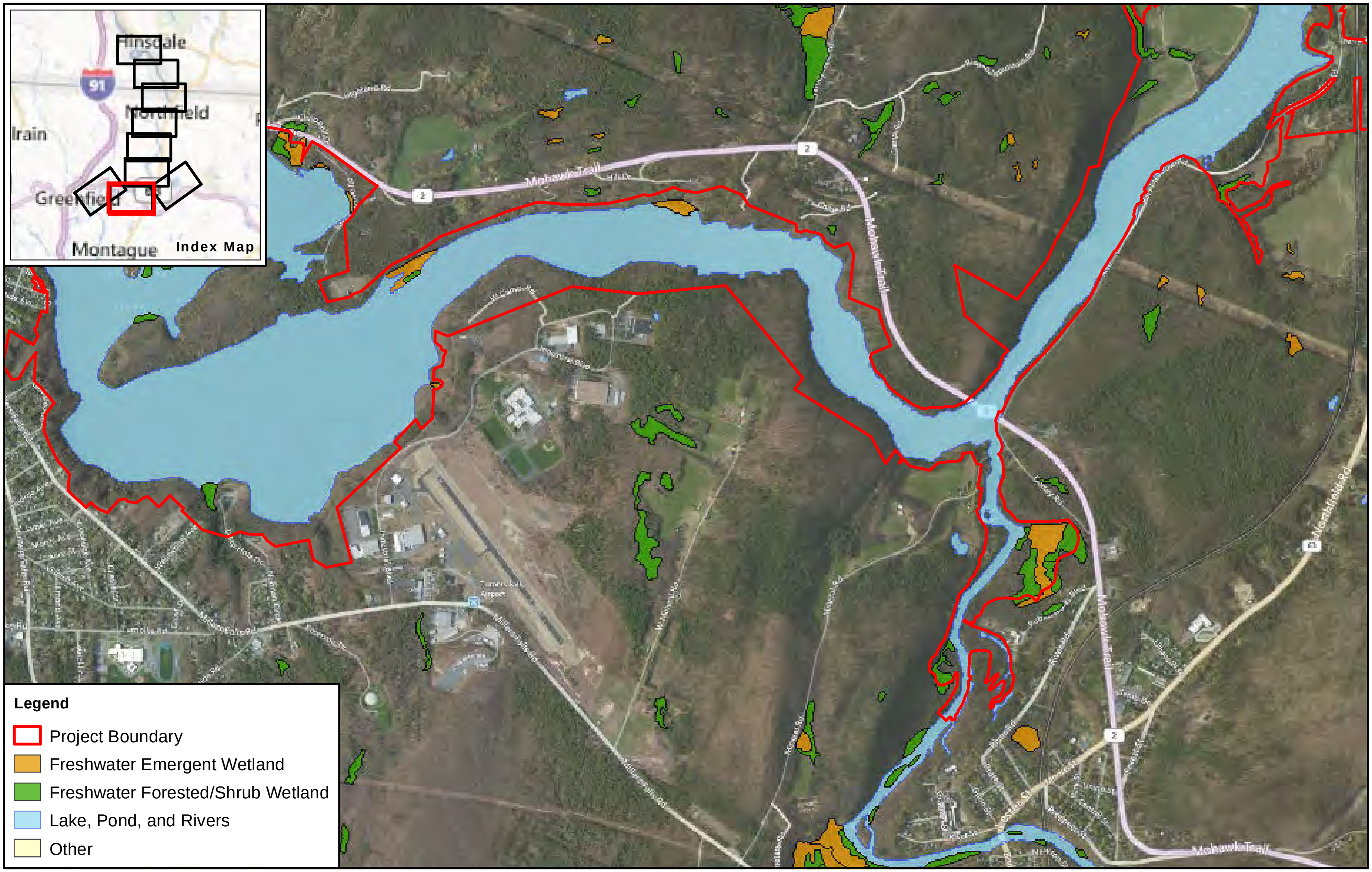

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Figure 4.6-3 NWI Map 2

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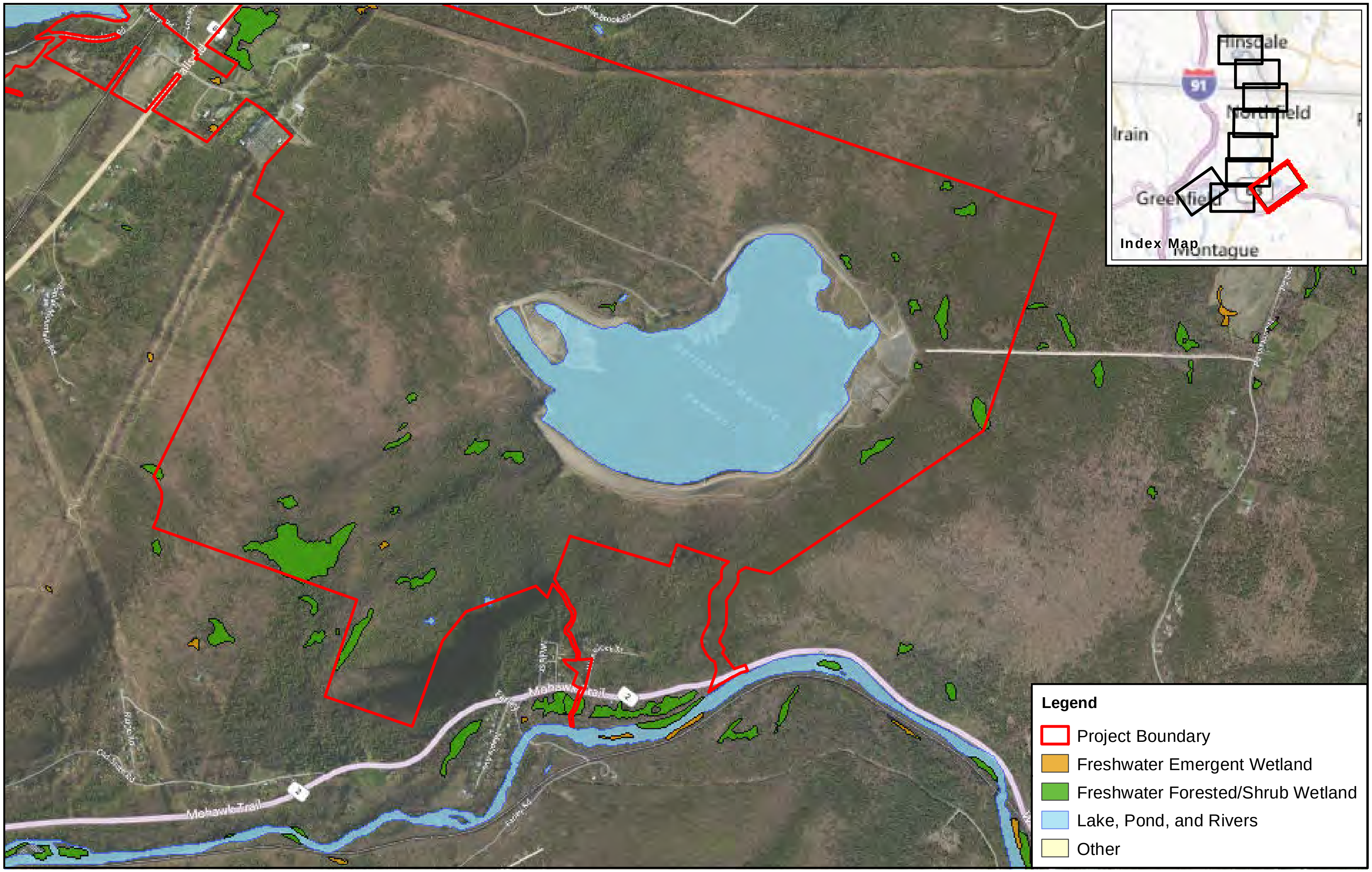

Legend
- Project Boundary
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Lake, Pond, and Rivers
- Other

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FIRSTLIGHT POWER RESOURCES

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Figure 4.6-4 NWI Map 3

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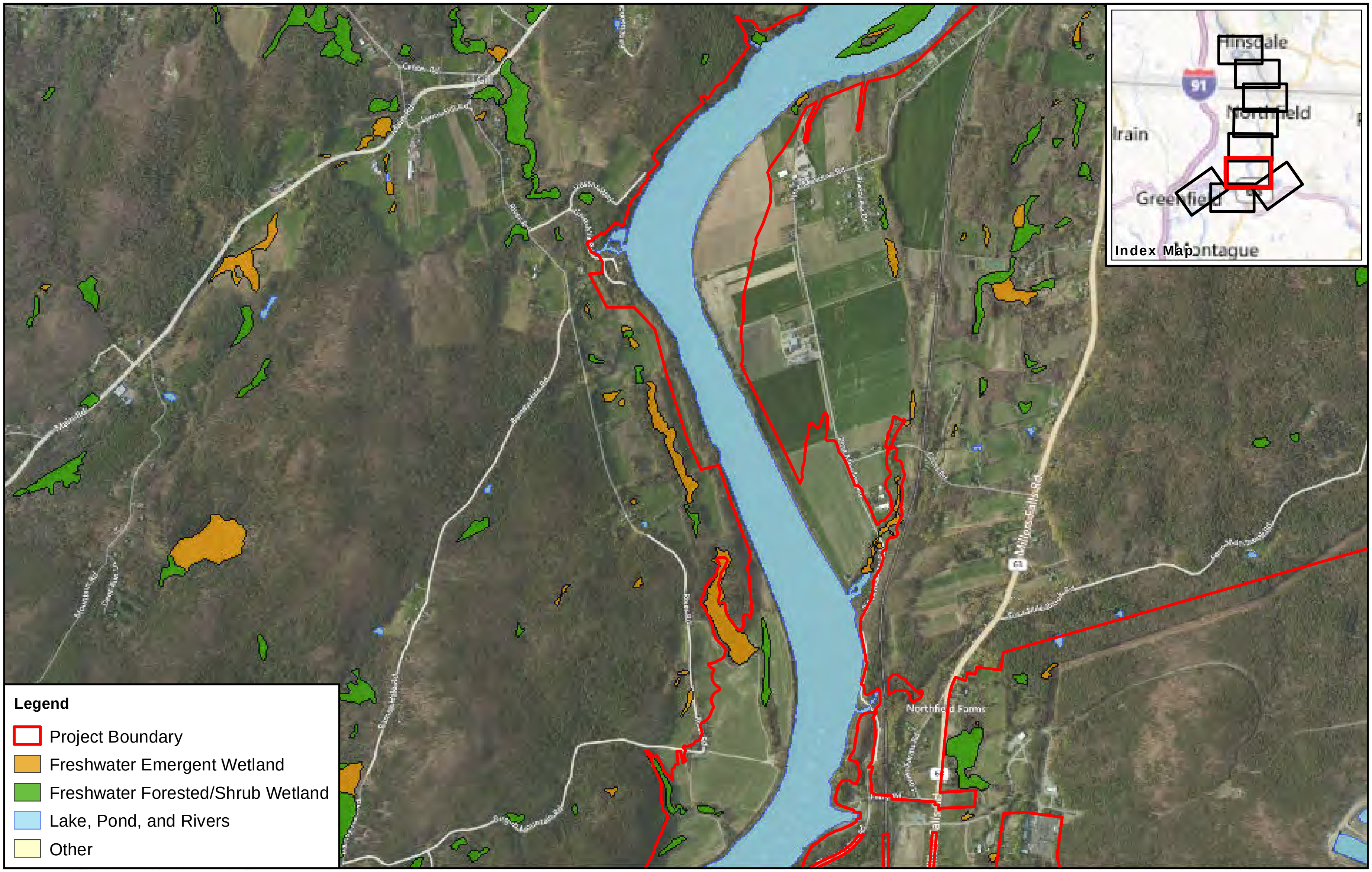

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Figure 4.6-5 NWI Map 4

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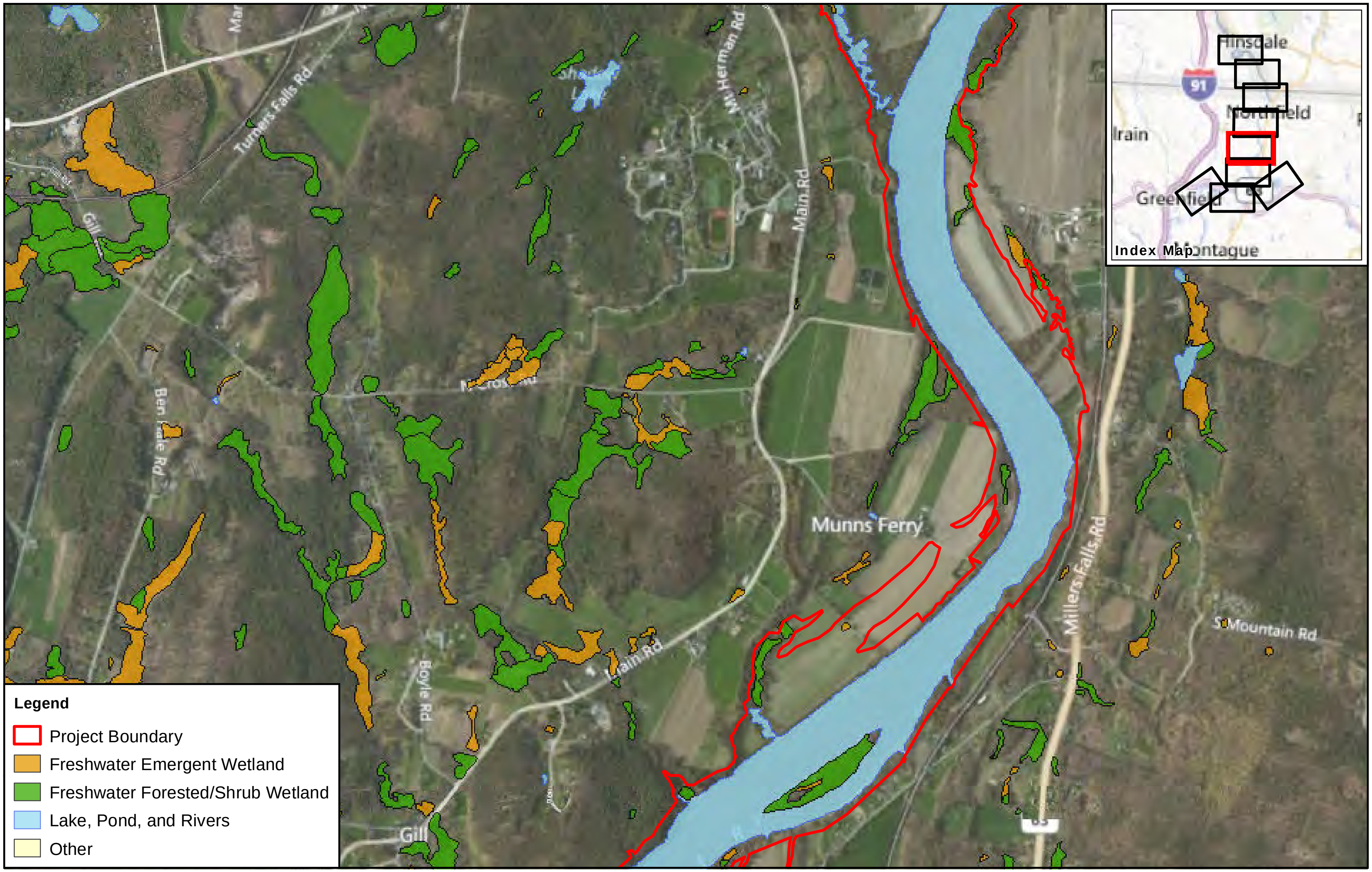

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Figure 4.6-6 NWI Map 5

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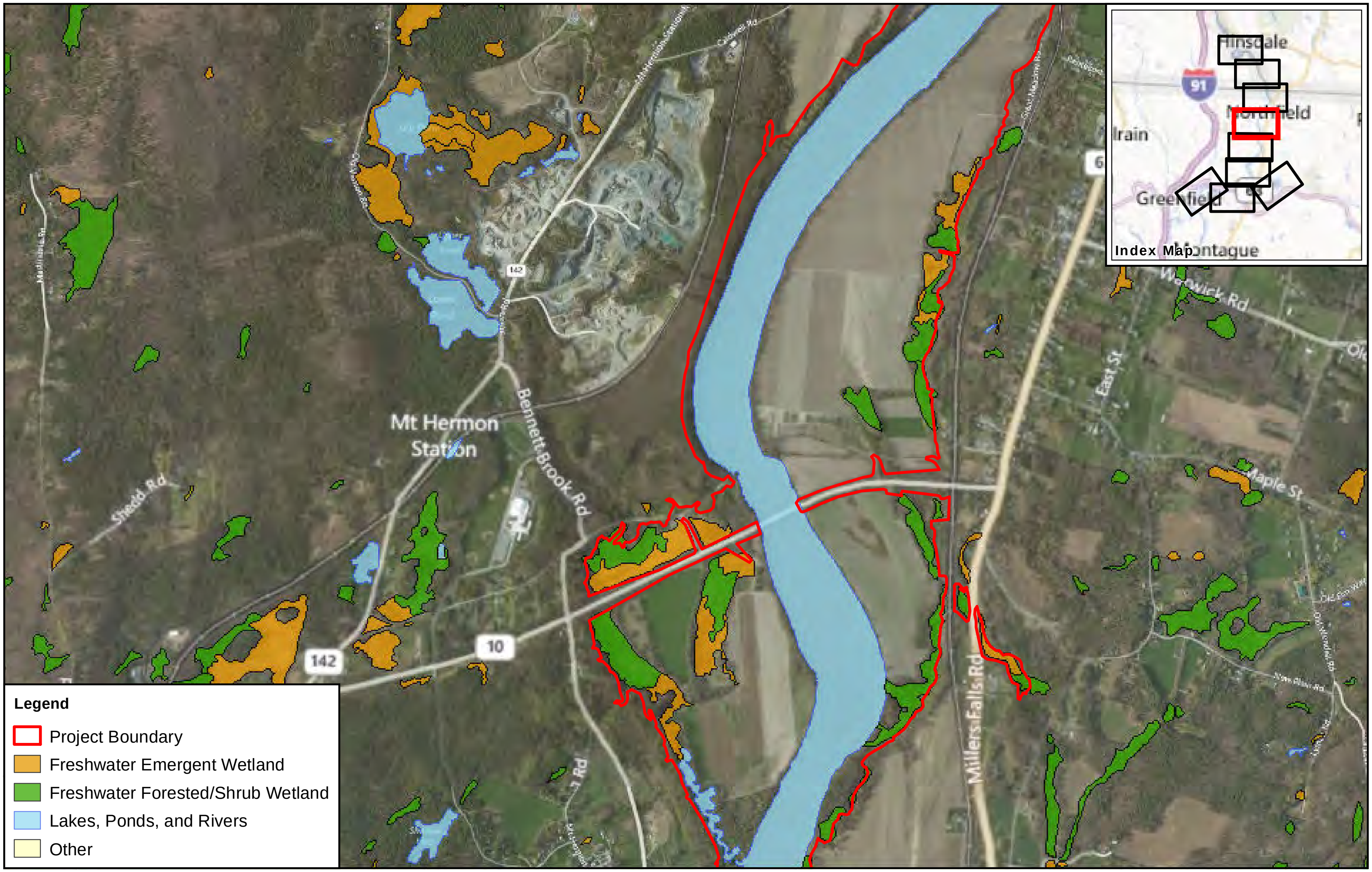

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Figure 4.6-7 NWI Map 6

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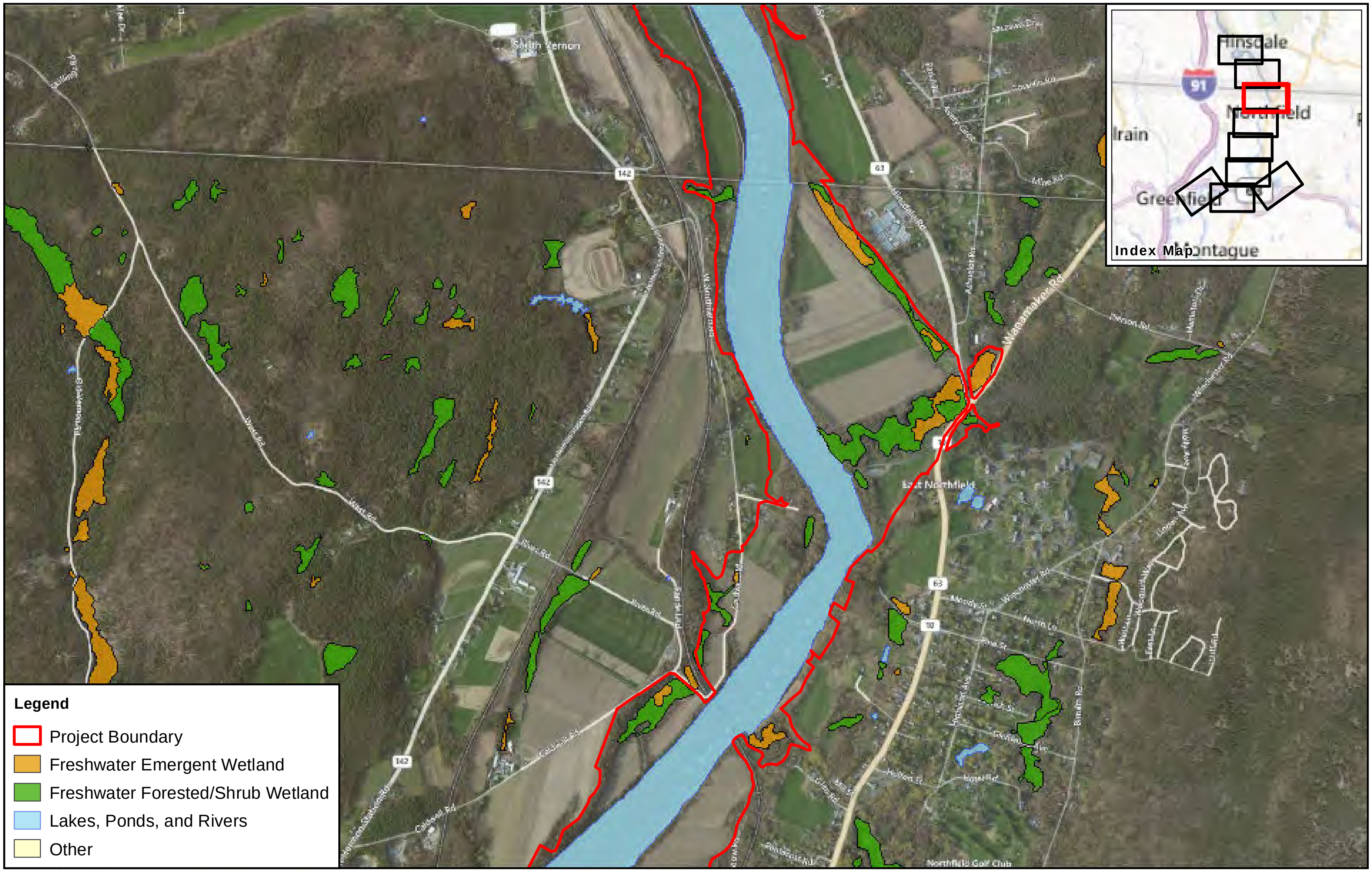

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Figure 4.6-8 NWI Map 7

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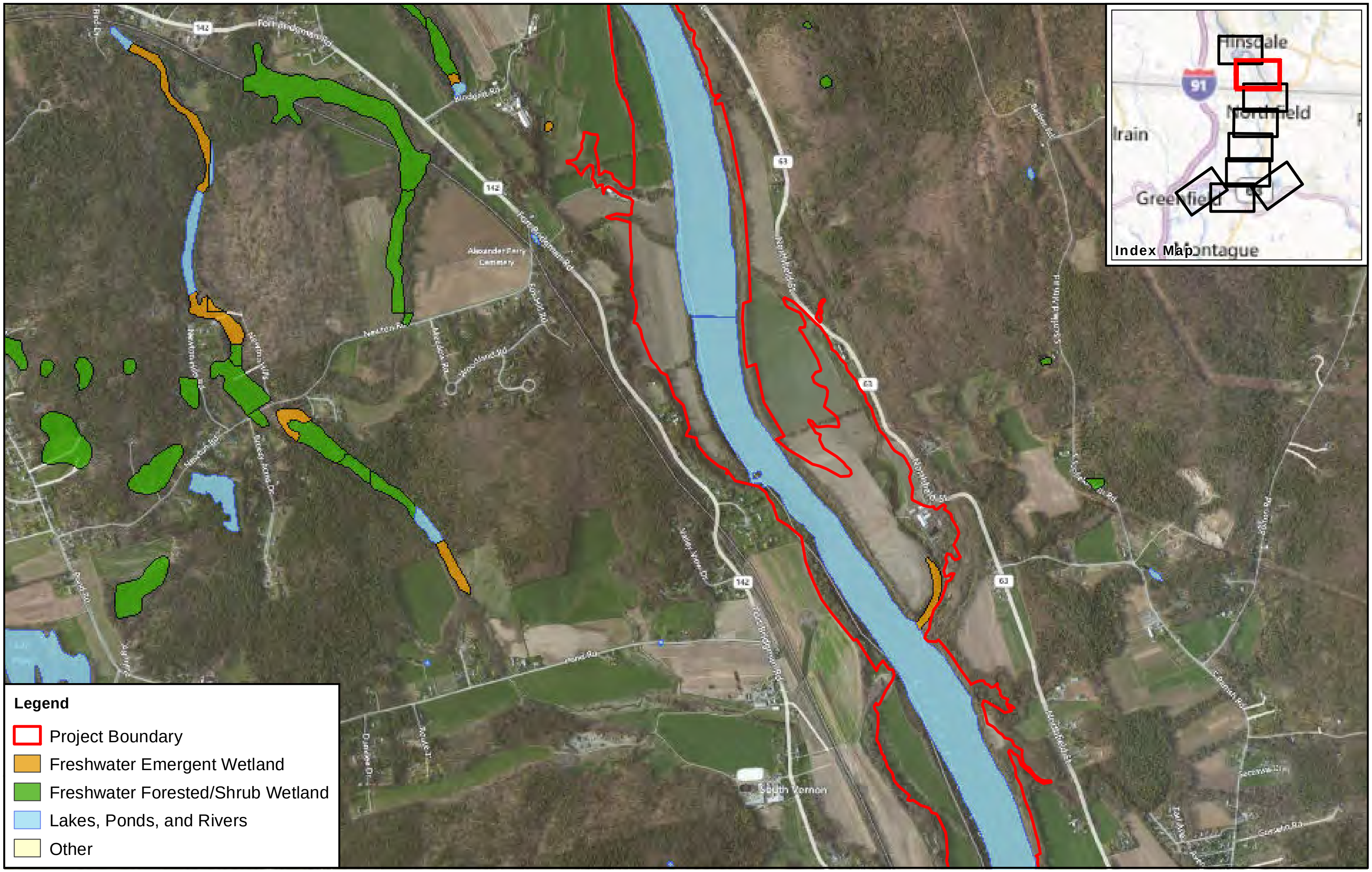

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Figure 4.6-9 NWI Map 8

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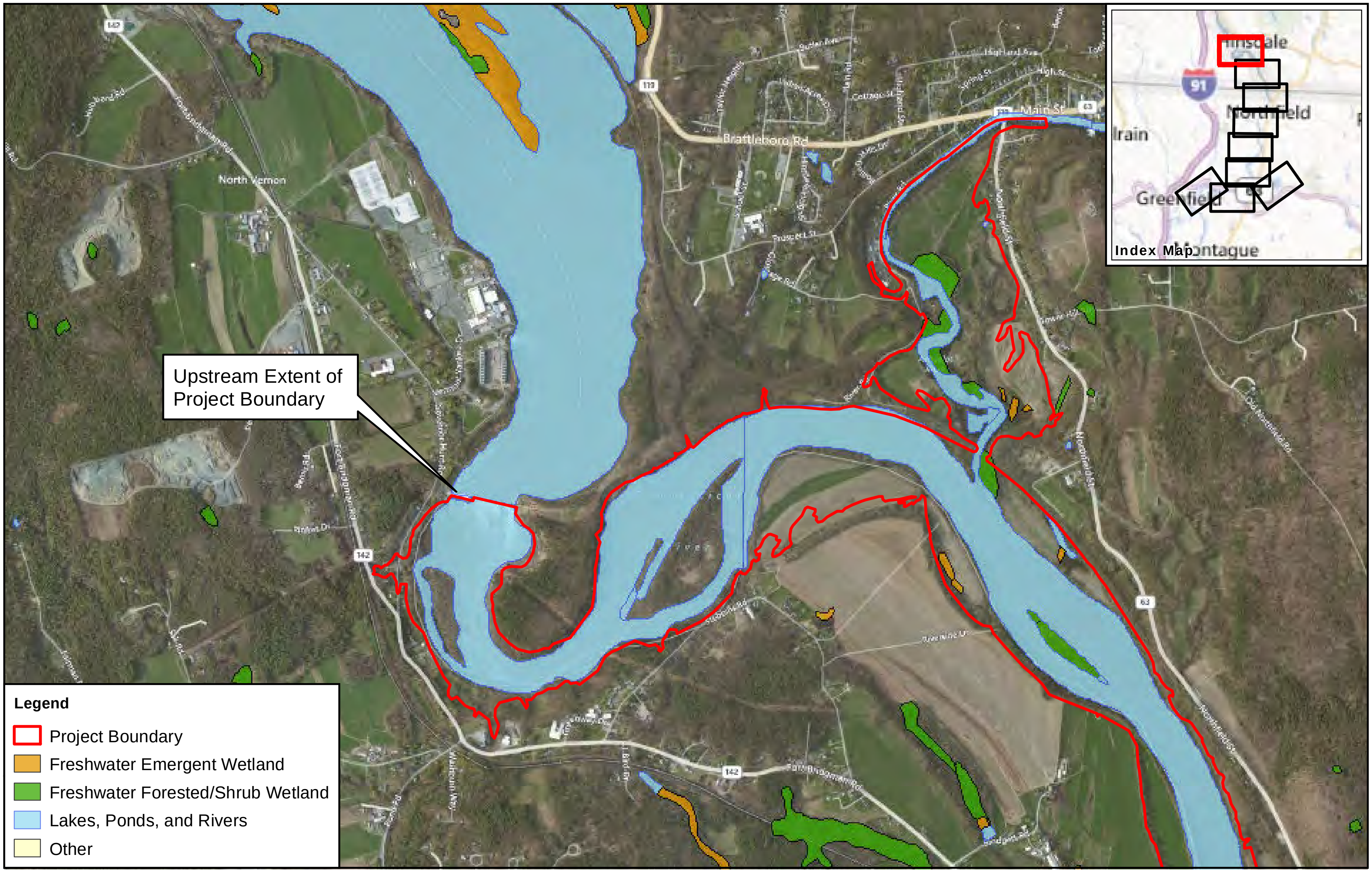

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PRE-APPLICATION DOCUMENT

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Figure 4.6-10 NWI Map 9

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4.7 Critical Habitat and Threatened and Endangered Species (18 C.F.R. § 5.6 (d)(3)(vii))

Knowledge of rare, threatened, and endangered (RTE) species use of habitats within the Turners Falls Project and Northfield Mountain Project area is based on historical and current documented occurrences on record with resource agencies and observations by the public. This section summarizes the occurrence, distribution, and habitat requirements of federal and state listed RTE species identified by resource agencies and others reported to be in the vicinity of the Turners Falls Project and Northfield Mountain Project. The exact locations of RTEs documented in these noted areas have not been disclosed by resource agencies and, therefore, the actual recorded occurrences of RTEs are uncertain for those areas within the Turners Falls Project and Northfield Mountain Project boundaries.

The following Federal and state agencies were contacted regarding the potential presence of RTE species and critical habitats within the Turners Falls Project and Northfield Mountain Project boundaries:

- USFWS
- NMFS
- Commonwealth of Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)
- Vermont Fish and Wildlife Department (VTFWD)
- New Hampshire Fish and Game Department (NHFGD)

NHESP provided a list of state listed species known or likely to occur in the vicinity of the Turners Falls Project and Northfield Mountain Project area in a letter dated October 27, 2011. The Turners Falls Project and Northfield Mountain Project area is located within or on a portion of State designated Natural Areas classified as Priority habitats and Estimated Habitats as described in Section 4.7.4 below.

4.7.1 Federally Listed Threatened and Endangered Species

USFWS maintains an online database (Environmental Conservation Online System), which is searchable by state and county that generates a tabular list of federally listed threatened and endangered species that are known or believed to occur in a given county. Federally listed species identified in this database for the counties in which the Turners Falls Project and Northfield Mountain Project are located (Franklin, MA; Windham, VT; and Cheshire, NH) are:

- Dwarf Wedgemussel *(Alasmidonta heterodon)*
- Northeastern bulrush *(Scirpus ancistrochaetus)*

In addition to the USFWS listed species, one endangered species is listed by NMFS, which is known to occur downstream of the Turners Falls dam Project area and which was also identified by NHESP as a state listed endangered species, the shortnose sturgeon (*Acipenser brevirostrum*). Detailed habitat and life history information for shortnose sturgeon is provided in Section 4.4.8. American eel (Section 4.4.5.3) and blueback herring (Section 4.4.5.2) are currently under status review to evaluate whether protection of these species under the ESA is warranted.

Dwarf Wedgemussel (*Alasmidonta heterodon)*

The dwarf wedgemussel was listed as an endangered species by the USFWS in 1990. The largest of the dwarf wedgemussel populations in the Connecticut River watershed, which numbers in the tens of thousands, can be found in two stretches of the Upper Connecticut River, identified by USFWS in its 2007 5-Year Review to be located in Coos, Grafton, Sullivan, and Cheshire counties, New Hampshire and Essex, Orange, Windsor, and Windham counties, Vermont. The dwarf wedgemussel is an oval-shaped bivalve with a smooth, thin shell. It lives in rivers and creeks of varying sizes, settling on sand and gravel bottoms. It can be found in water depths ranging from a few inches to over 20 feet. This species is generally found in a firm substrate. In recent decades, both yellow lampmussels and dwarf wedgemussels have been recorded in the Massachusetts section of the Connecticut River (Holyoke Water Power Company, 1997), downstream of the Turners Falls Project and Northfield Mountain Project. No known populations of these mussels have been documented in the Turners Falls Project and Northfield Mountain Project area. In addition, no dwarf wedgemussels or yellow lampmussels were found in a recent survey of the Northfield Mountain Project and Turners Fall Project area (Biodrawversity, 2012).

Northeastern bulrush (*Scirpus ancistrochaetus*)

The northeastern bulrush (*Scirpus ancistrochaetus*) is a leafy bulrush in the sedge family currently known only from populations scattered from New Hampshire and Massachusetts, south to West Virginia. In New England, the species is primarily found along the Connecticut River valley in New Hampshire and Vermont, and north-central Massachusetts. The species is described from a variety of wetlands along its extensive range. In the northern extent of its range, the bulrush is found most commonly on the edge of shallow beaver ponds, usually in full sun or similar habitats where water levels may vary.

Based on the 1993 recovery plan for the species at the time of publishing, 33 populations of the species were known to occur. Of the total number of known populations four occurred within north-central Massachusetts and Southern Vermont/New Hampshire. In these states the bulrush was known to occur in Franklin County, Massachusetts (1 population), Cheshire County, New Hampshire (1 population), and Windham County, Vermont (2 known populations) (USFWS, 1993). USFWS occurance data does not identify specific locations that have been documented within these counties.

4.7.2 State Listed Rare, Threatened, and Endangered Species

In response to requests for information as noted above, NHESP identified state listed threatened or endangered species and non-listed rare species that occur or may be present within the Turners Falls Project and Northfield Mountain Project area. State listed species are discussed in this section and state listed species of special concern are discussed in Section 4.7.3.

4.7.2.1 *Birds*

Five bird species were identified by NHESP as state listed endangered and/or threatened. These species are:

- American Bittern *(Botaurus lentiginosus)*
- Peregrine Falcon (*Falco peregrines)*
- Bald Eagle (*Haliaeetus leucocephalus)* – (federally delisted but protected under the Bald and Golden Eagle Protection Act)
- Grasshopper Sparrow (*Ammodramus savannarum)*

- Vesper Sparrow (*Pooecetes gramineus)*

Of these species, the Bald Eagle and Grasshopper Sparrow are also state listed endangered and/or threatened by New Hampshire and Vermont. The Peregrine Falcon is also a state listed species in New Hampshire.

One state listed endangered bird species, the Golden-Winged Warbler, was identified by New England Environmental, Inc. (NEE) in 2000 during work associated with slope stabilization measures within the Turners Falls Impoundment.

American Bittern (*Botaurus lentiginosus)*

The American bittern is listed as endangered under the Massachusetts Endangered Species Act. The population trends of American bitterns within Massachusetts are currently unknown; however the worldwide population is thought to be in decline (NHESP, 2007a). The American bittern is a medium-sized, ground dwelling heron that is known to inhabit the Connecticut River valley in Massachusetts in the spring, summer and fall. Its preferred habitat includes freshwater marshes, bogs, fens and wet meadows, though it can be found in brackish estuaries and wetlands. The American bittern spends much of its time amongst marshland vegetation, which it uses for camouflage. Its diet consists of frogs, small snakes, salamanders, crayfish, fish (including eel) and occasionally mice and grasshoppers. Breeding occurs in the spring when the female builds a nest which is often located about one foot above the water, suspended in emergent vegetation. The close proximity of the nest to the water surface makes it susceptible to fluctuating water levels. The American bittern may also occasionally nest in upland meadows adjacent to wetlands. The female will lay three to five eggs which will gestate over approximately 24 days. The male is territorial during the breeding season and will stay close to the nest. The American bittern has a large breeding range extending from Newfoundland west to Manitoba and British Columbia, south to Maryland, west through Oklahoma and Kansas to southern California. It overwinters in the south, from the Carolinas to Panama, Cuba and the Bahamas.

Specific to the Turners Falls Project and Northfield Mountain Project area, habitat preferred by the American bittern would likely be found along the mainstem of the Connecticut River and adjacent wetlands areas. As noted in Section 4.6, significant wetland, littoral, and riparian habitat is limited within the Turners Falls Project and Northfield Mountain Project area due to the abundance of steeply-sloped river banks; therefore, it is anticipated that little significant habitat is available for the American bittern.

Peregrine Falcon (*Falco peregrines)*

The peregrine falcon is a medium-sized raptor that specializes in hunting other birds in flight by ambush from above. Common prey in Massachusetts include blue jay, starling, rock dove, mourning dove, red-winged blackbird, American robin, chimney swift, finches and woodcock. The peregrine falcon is one of the most widely distributed birds in the world and can be found on every continent except Antarctica. In contemporary times they commonly nest on tall, manmade structures and artificial platforms. Historically they have nested on tall cliffs overlooking the water. There are 14 known historic cliff nesting sites in Massachusetts. Today, two known occupied nesting sites are located downstream of the Turners Falls Project and Northfield Mountain Project area at Mount Tom and Mount Sugarloaf (NHESP, 2007). Females begin breading at age two or three, whereas males may bread as early as age one. Females typically lay four eggs in early April. The eggs will incubate over 28 days; by seven weeks after hatching (in mid June), the juvenile chicks have fledged. Fledglings are fully independent of their parents by August. Peregrine falcons do not typically migrate for the winter season, with the exception of those that nest in the far north (e.g., in Labrador or Greenland).

By the mid 20th century the pesticide DDT (banned in the US in 1972) had reduced peregrine falcon populations to the point where no known nesting pairs existed east of the Mississippi River. Following the banning of DDT, restoration efforts helped the North American population to rebound. As a result of these efforts, the peregrine falcon was removed from the Federal Endangered Species List in 1999. By 2007, the peregrine falcon population in Massachusetts has rebounded to historic level, with 14 known breeding pairs. This species, however, is still listed as *Endangered* under the Massachusetts Endangered Species Act (NHESP, 2007a). Peregrine falcons are not known to nest at the Turners Falls and Northfield Mountain Projects, but are known to have historic nests down river of the Turners Falls and Northfield Mountain Projects at Mount Tom and Mount Sugarloaf and could potentially utilize the Turners Falls Project and Northfield Mountain Project area for foraging.

Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle is making a comeback and was removed from Endangered Species Act list in 2007. The enforcement of federal endangered species laws and regulations and improved controls of herbicides and pesticides on agricultural lands have aided in the recovery of this species. The bald eagle is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. It winters along the Connecticut River in the Turners Falls Project and Northfield Mountain Project area. In 2001, the USFWS documented a nesting pair of bald eagles on Barton Island in Barton Cove, approximately five miles downstream of the Northfield Mountain Project (FERC, 2001) and slightly upstream of the Turners Falls Dam. Bald eagles also nest on Kidd's Island in the impoundment. Bald eagles are known to perch in riverbank trees and forage over the Connecticut River in the Turners Falls Project and Northfield Mountain Project vicinity.

Grasshopper Sparrow (*Ammodramus savannarum)*

The grasshopper sparrow is a ground dwelling bird that eats, sleeps and nests on the ground. In Massachusetts, it inhabits sandplains grasslands, pastures, hay fields, airfields, knolls, pine barren sandplains, and costal heartlands. This species' preferred habitat includes bunch grasses (such as poverty grass, bluestem and fescue) with low stem densities and ample bare open ground. The species feeds primarily on insects (including grasshoppers) over bare ground but also eats snails, earthworms and the seeds of weeds and grasses. Its range extends from New Hampshire to California and south to Mexico, Cuba, El Salvador, the Bahamas and West Indies, where it overwinters. It returns to Massachusetts in the spring (May). Breeding occurs in the summer. Females will lay three to five eggs in a ground nest. The chicks will hatch after a 12 day incubation period. The grasshopper sparrow was once abundant particularly in eastern parts of the state. Currently there are fewer than 20 nesting sites in Massachusetts. It is known to inhabit grassy areas within the Connecticut River Valley (NHESP, 2008b).

Vesper Sparrow (*Pooecetes gramineus)*

The vesper sparrow is a migratory species that during the breeding season in Massachusetts inhabits open grasslands and taller woody vegetation interspersed with grasslands. Although considered more of a habitat generalist than some of Massachusetts' other grassland sparrows, the vesper sparrow prefers dry, well-drained habitat with a combination of short grasses, bare ground, shrubs and trees where they feed on a diet of insects and seeds. They are most commonly found in Massachusetts in hay fields, aircraft fields, croplands, abandoned gravel pits, sand plains, grasslands and coastal moors. Their range extends from Nova Scotia, west to British Columbia, and south to North Carolina and northern Mexico. Though little data is available, the vesper sparrow likely returns to Massachusetts from its overwintering grounds in April, and breeds from May through August. The nest is constructed by the female on the ground at the base of vegetation. In southern parts of its range, vesper sparrows may have as many as three broods in a year; however, in Massachusetts, they will typically have only one or two broods. A typical clutch consists of 3-5 eggs. The eggs hatch after 11 to 14 days of incubation. The chicks leave the nest after 9 to 13 days but are dependent on their parents for another three weeks. A long term study by the North American Breeding Birds Survey (1966-2006) documented a range-wide population decline of 0.9%, and as high as 3.1% in the East. There is no reliable population estimate for this species in Massachusetts (NHESP, 2010a).

Golden-Winged Warbler (*Vermivora chrysoptera*)

The golden-winged warbler is a song bird that prefer woodland edges bordering early successional clearings (such as abandoned farmland and powerline areas), heavily overgrown with patches of grass, weeds, bushes, shrubs, briars, and small trees. The summer range of the golden-winged warbler extends from southern New Hampshire west to Minnesota and south to Iowa and New Jersey. The golden-winged warbler winters in southern Mexico to South America.

4.7.2.2 *Reptiles and Amphibians*

Two state listed amphibian species were identified by NHESP. These species include:

- Marbled Salamander (*Ambystoma opacum*)
- Eastern Spadefoot (*Scaphiopus holbrookii)*

The Marbled Salamander is also state listed as endangered by New Hampshire.

Marbled Salamander (*Ambystoma opacum)*

The marbled salamander is found throughout much of southern New England, in Southern New Hampshire, Massachusetts, Connecticut and Rhode Island. It is largely terrestrial, occurring in deciduous or mixed woods of southern hardwood, dominated by oak and hickory species interspersed with white pine. They are known to inhabit a wide variety of habitats, including moist areas as well as dry sand areas; in general, they are typically found in uplands that are within the vicinity of ephemeral pools. They spend much of the time hidden under ground cover including logs, bark and stones. Marbled salamanders require vernal pools for breeding, which occurs in the autumn; typically September and October in Massachusetts. Females lay between 50 and 150 eggs under leaf litter in dry vernal pools. After seasonal rains flood the pool, eggs typically hatch within a few days. Newly-hatched larvae will remain active through the winter under the ice. If the pool doesn’t fill, the female will leave the eggs in an underground winter lair. The marbled salamander feeds on small invertebrates, including insects, crustaceans, snails, slugs and earthworms. This species has been observed in over 75 towns occurring predominantly in small numbers in the lowlands of Massachusetts, including the Connecticut River Valley. Marbled salamanders are known to occur in the Turners Falls Project and Northfield Mountain Project vicinity, in the central Connecticut River Valley. Ephemeral pool habitats, if present in the Northfield Mountain Project and Turners Falls Project vicinity, would likely be located in upland areas that are outside the zone of direct influence of Turners Falls Project and Northfield Mountain Project operations (NHESP, 2007g).

Eastern Spadefoot (*Scaphiopus holbrookii)*

The eastern spadefoot is a small, burrowing toad that requires dry-sandy or sandy-loam soils that are characteristic of pitch pine barrens and coastal oak woodlands. It can burrow as deep as eight feet into the ground to prevent desiccation or hibernate during the cold months. It is nocturnal and most active in the summer, just after sunset and just before sunrise. The eastern spadefoot’s diet consists of flies, crickets, spiders, caterpillars, earthworms, snails, moths and small vertebrates. Eastern spadefoot toads typically prefer to breed in ephemeral pools in upland sandy soils adjacent to large rivers such as the Connecticut River. Breading occurs between April and September usually after prolonged warm periods or heavy rains. The adhesive eggs are laid in massive strings (1000 -2500) over submerged twigs and grasses. The eggs hatch between day 5 and day 15 of incubation. This species ranges from New York and Massachusetts, south to eastern Florida and as far west as the southern Great Lakes region and Louisiana. This species was formerly widespread, but has declined to 32 verified populations in Massachusetts since 1982 (NHESP 2010). The eastern spadefoot is known to inhabit the central Connecticut River Valley (NHESP 2010). The ephemeral pools and upland sandy soils preferred by this species would likely be located at higher elevations that are outside of the Turners Falls Project and Northfield Mountain Project zone of influence.

4.7.2.3 *Fish*

One state listed endangered fish species was identified by the NHESP as occurring within the Northfield Mountain Project and Turners Falls Project area, the shortnose sturgeon (*Acipenser brevirostrum*), which is also a federally listed endangered species. Discussion regarding shortnose sturgeon lifecycle and potential habitat within the Northfield Mountain Project and Turners Falls Project area is included in Section 4.4.8, Fish and Aquatic Resources.

4.7.2.4 *Invertebrates*

NHESP identified nine state listed endangered and threatened species of invertebrates at the Northfield Mountain Project and Turners Falls Project. These species are:

- Spine-crowned Clubtail (*Gomphus abbreviates)* – State Endangered
- Midland Clubtail (*Gomphus fraternus)* – State Endangered
- Rapids Clubtail (*Gomphus quadricolor)* – State Threatened
- Arrow Clubtail (*Stylurus spiniceps)* – State Threatened
- Riverine Clubtail (*Stylurus amnicola)* – State Endangered
- Cobblestone Tiger Beetle (*Cicindela marginipennis)* – MA State Endangered/VT and NH State Threatened
- Yellow Lampmussel (*Lampsilis cariosa)* – State Endangered
- Dwarf Wedgemussel (*Alasmidonta heterodon)* – State Endangered/Federal Endangered
- Orange Sallow Moth (*Rhodoecia aurantiago)* – State Threatened

In 2000, two state listed threatened invertebrate species were listed by NEE during work associated with slope stabilization measures within the Turners Falls Impoundment. These species are:

- New Jersey Tea Inchworm (*Apodrepanulatrix liberaria*) – State Endangered
- Pine Barrens Zanclognatha (*Zancloganatha martha*) – State Threatened

Cobblestone Tiger Beetle is also listed as endangered in New Hampshire and threatened in Vermont.

Clubtail Dragonflies

The clubtails are large members of the dragonfly taxon *Anisotera* and the family Gomphidae. They are so named for their *club* shaped abdomen terminus. Clubtails are a semi-aquatic insect in which the juvenile nymph inhabits aquatic habitat in streams, rivers, lakes and ponds. Breeding generally occurs in the spring and summer months with females depositing the fertilized eggs into the water. Little is known about the aquatic nymph life stage but it is generally thought to last a year or more (NHESP, 2007b and 2007c). Nymphs emerge from the water on exposed rocks, woody debris, and emergent vegetation in the spring and undergo a metamorphosis into the adult, flighted stage, a process called eclosion. Clubtail dragonflies are particularly vulnerable during eclosion, and are susceptible to water level fluctuation and bank destabilization.

Cobblestone Tiger Beetle (*Cicindela marginipennis)*

Habitat for the cobblestone tiger beetle is primarily cobble and sand beaches on the upstream side of islands (NHFGD, 2005). Habitat for the cobblestone tiger beetle is flooded regularly, with floods and ice scour maintaining substrate texture on beaches and removing encroaching vegetation. This species is listed as endangered in Massachusetts and threatened in Vermont and New Hampshire.

Yellow Lampmussel (*Lampsilis cariosa*) & Dwarf Wedgemussel (*Alasmidonta heterodon)*

Thought to be eliminated from the mainstem of the Connecticut River, the yellow lampmussel was not observed in Connecticut for more than 75 years (NHESP, 2009). The yellow lampmussel is a freshwater mollusk with a bivalve shell. The yellow lampmussel has no federal listing status. Historically, records of the yellow lampmussel from the Connecticut River have been few, arising from observations made below the Turners Falls rapids (NHESP, 2009). Currently, this species is listed as endangered in Massachusetts. Little is known about the biology and ecology of this mussel. The reasons for the declining numbers of this species are not clear, but degraded habitat and loss of suitable habitat and urban population are considered contributing factors (NHESP, 2009). No yellow lampmussels were found in a recent survey of the Turners Falls Project and Northfield Mountain Project area (Biodrawversity, 2012).

NHESP identified the dwarf wedgemussel as a state listed endangered species and it is also a federally listed endangered species. However, Biodrawversity (2012) did not find any dwarf wedgemussel during recent survey of the Turners Falls Project and Northfield Mountain Project area. Habitat and life history information for this species in provided in Section 4.7.1.

Orange Sallow Moth (*Rhodoecia aurantiago)*

The orange sallow moth is a noctuid moth. Its preferred habitat includes: xeric or dry open oak woodland on rocky uplands; and the margins of old fields and other open spaces, with such habitat including utility rights of way. In Massachusetts, the winged adults are active in August. The eggs hatch soon after laid and the larvae feed on the flowers, seeds and foliage of the false foxgloves (*Aureolaria*). By late October, the orange sallow moth pupae go into a state of suspended development called the diapauses stage. They remain in the diapauses stage until August of the following year, when they emerge as adults. Their range extends from southern New England to Florida and west to Wisconsin and Missouri. In Massachusetts, the population is spotty, extending from Boston to the Berkshire Mountains in the northwest corner of the state. This species is absent from the southeast coastal plain. The orange sallow moth is known to inhabit the uplands in and adjacent to the Connecticut River valley in the vicinity of the Turners Falls Project and the Northfield Mountain Project (NHESP, 2007f).

New Jersey Tea Inchworm (*Apodrepanulatrix liberaria*)

The New Jersey tea inchworm (*Apodrepanulatrix liberaria*) is a fairly unique moth with high variability of both patterns and color. The New Jersey tea inchworm is associated with xeric, open habitats on sandy or rocky soil with New Jersey tea, including pitch pine-scrub oak, black oak barrens associated sandplain communities and rocky outcrops and ridges (Swain & Kersey, 2011). *Ceanothus americanus* is the larval host plant in southern New England. The New Jersey tea inchworm was identified within the Turners Fall Impoundment by NEE in 2000 during stabilization measures.

Pine Barrens Zanclognatha (*Zancloganatha martha*)

The Pine Barrens Zancloganatha is a nondescript noctuid moth. It inhabits sandplain pitch pine-scrub oak barrens, including successional barrens (Swain & Kersey, 2011). Adults fly in July (NHESP, 2009). Eggs hatch shortly after they are laid, and larvae feed on plant detritus such as dead pine needles and oak leaves; early-instar larvae overwinter and resume feeding in the spring, pupating by June (NHESP, 2009). The Pine Barrens Zancloganatha was identified within the Turners Fall Impoundment by NEE in 2000 during stabilization measures.

4.7.2.5 *Plants*

NHESP identified 36 listed plant species known to have historically occurred in the vicinity of the Project. Generally, listed species are likely to occur in unique habitats associated with the Connecticut River, major tributaries, wetland and riparian zones, and the high rocky elevations of Northfield Mountain. The majority of these unique habitat types are likely to occur in upland areas above the elevation at which these habitats may be influenced by Project operations. Listed plant species that were identified by the NHESP are presented in Table 4.7.2.5-1.

Note that in Table 4.7.2.5-1, “Section A” refers to the section of river north of Turners Falls Dam (i.e. the Turners Falls Impoundment), “Section B” refers to the section of river south of Turners Falls Dam to the Holyoke Dam.

Table 4.7.2.5-2 presents four state listed rare, threatened and endangered plant species listed by New England Environmental, Inc (NEE) in 2000 during work associated with slope stabilization measures within the Turners Falls Impoundment.

Table 4.7.2.5-1: NHESP State Listed RTE Plants

Scientific Name	Common Name	State (MA) Status	Preferred Habitat	Section A=north of Turners Falls Dam B=south of Turners Falls Dam
Agrimonia pubescens	Hairy agrimony	Threatened	Occurs in edges and openings within rich, rocky woodlands on steep slopes or ledges, often over circumneutral or calcareous bedrock.	B
Alnus viridis ssp. crispa	Mountain alder	Threatened	Occurs in several habitat types, which combine open, exposed areas and cool local temperatures. The most common habitat is exposed ledges, boulders, and cobble bars on the edges of the Connecticut and Deerfield Rivers.	A,B
Aplectrum hyemale	Putty-root	Endangered	Occurs in rich deciduous forests of mesic hardwood subject to occasional flooding by nearby waterways.	B
Arisaema dracontium	Green dragon	Threatened	Occurs in floodplain woodlands, with open to filtered light, typically in moist alluvial sites with annual flooding in lowlands areas along large rivers.	B
Asclepias verticillata	Linear-leaved milkweed	Threatened	Occurs on sunny ledges, ridgetop grasslands and rocky slopes and is commonly found in conjunction with ferns, mosses, lichens, various grasses and red cedars.	B
Boechera missouriensis	Green rock-cress	Threatened	Occurs on non-acidic ledges in rocky woods and hills with full to filtered light exposure, and mesic to dry soils.	A,B
Calystegia spithamaea	Low bindweed	Endangered	Occurs in dry, open, sandy, and rocky areas including sandy hillsides, sandy fields, steep slopes, gravel pits, power line corridors, railroad embankments, thickets, and young forests.	A
Carex grayi	Gray's sedge	Threatened	Occurs in moist alluvial soils of floodplain forests and riverside meadows. Tends to favor the lower slopes of swales and depressions.	A,B

Table 4.7.2.5-1: NHESP State Listed RTE Plants

Scientific Name	Common Name	State (MA) Status	Preferred Habitat	Section A=north of Turners Falls Dam B=south of Turners Falls Dam
Carex lenticularis	Shore sedge	Threatened	Generally restricted to wet, sandy or gravely beaches of cold ponds and lakes; or seasonally exposed rock cobble bars of large rivers.	A,B
Carex tuckermanii	Tuckerman's sedge	Endangered	Occurs in rich soils of lowland river floodplains including oxbows, lowland depressions, swales, forests, meadows, and vernal pools.	B
Carex typhina	Cat-tail sedge	Threatened	Occurs in seasonal forested floodplains and immediate proximity.	B
Cerastium nutans	Nodding chickweed	Endangered	Occurs in rock outcrops, talus slopes and rocky woods.	A
Cryptogramma stelleri	Fragile rock-brake	Endangered	Occurs in the wet, shady crevices of vertical ledges and talus slopes composed primarily of calcareous sedimentary rocks.	B
Deschampsia cespitosa ssp. glauca	Tufted hairgrass	Endangered		A,B
Elatine americana	American waterwort	Endangered	Occurs in the open muddy shores of ponds, tidal rivers and tributaries.	B
Eleocharis diandra	Wright's spike-rush	Endangered		A,B
Eleocharis intermedia	Intermediate spike-sedge	Threatened	Occurs in marshes, freshwater mudflats and other wet areas containing muddy substrates. Often found in exposed mud during periods of low water on alkaline river banks and pond shores.	A,B
Eleocharis ovata	Ovate spike-sedge	Endangered	Occurs in the sandy margins of lakes, ponds and rivers.	A,B
Ludwigia polycarpa	Many-fruited false-loosestrife	Endangered	Occurs almost exclusively in seasonal river floodplains with wet exposed mud including oxbows and lowland depressions.	B

Table 4.7.2.5-1: NHESP State Listed RTE Plants

Scientific Name	Common Name	State (MA) Status	Preferred Habitat	Section A=north of Turners Falls Dam B=south of Turners Falls Dam
Malaxis monophyllos var. brachypoda	White adder's-mouth	Endangered	Occurs in small shaded calcareous wetlands. Often found in hillside seeps and mossy depressions.	A
Mimulus alatus	Winged monkey-flower	Endangered	Occurs in seasonal floodplains on the banks of stream tributaries to rivers.	A,B
Minuartia michauxii	Michaux's sandwort	Threatened	Occurs in thin, dry, rocky or gravelly soils with significant sun exposure. Commonly found on limestone, traprock and sandstone ledges.	A,B
Morus rubra	Red mulberry	Endangered	Typically occurs on steep ledges or rocky slopes but can also be found in floodplains and other rich woodlands.	A
Nuphar microphylla	Tiny cow-lily	Endangered	Occurs in shallow, still or slow-moving waters that are not acidic. Typically found in oxbows, coves and backwaters.	B
Prunus pumila var. depressa	Sandbar cherry	Threatened	Occurs at the edge of floodplain forests, traprock ledges in river channels, sand flats, and riverbed cobbles and gravels near the floodline.	A,B
Rumex verticillatus	Swamp dock	Threatened	Occurs in light shade to full sun in wet and mucky soils.	B
Salix exigua ssp. interior	Sandbar willow	Threatened	Occurs on islands, sandbars and beaches in the seasonal floodplain of rivers where it is typically found in sandy, gravelly and rocky substrates.	A,B
Solidago ptarmicoides	Upland white aster	Endangered	Inhabits open or partially shaded dry rock outcrops of sandstone, shale or limestone. It prefers calcareous or circumneutral substrate.	A,B
Symphoricarpos albus var. albus	Snowberry	Endangered	Inhabits dry, open, grassy, very steep slopes of loose, somewhat calcareous sandstone.	B

Table 4.7.2.5-1: NHESP State Listed RTE Plants

Scientific Name	Common Name	State (MA) Status	Preferred Habitat	Section A=north of Turners Falls Dam B=south of Turners Falls Dam
Symphyotrichum tradescantii	Tradescant's aster	Threatened	Fissures and cracks of rocky stream or river banks, adjacent to exposed ledges at or below the high water mark, subject to flooding.	A,B
Tillaea aquatica	Pygmyweed	Threatened	Margins of ponds and rivers, in sandy and/or muddy wet soils.	B
Trichostema brachiatum	False pennyroyal	Endangered	Open sunny exposures on dry sandy soil, sandstone, or limestones. Known to occur along stream banks and railroad beds.	B

Source: NHESP, 2012; USDA, 2012

Table 4.7.2.5-2: NEE Identified State Listed RTE Plants

Scientific Name	Common Name	State Status	Preferred Habitat	Project Location
Aplectrum hyemale	Putty-Root	Endangered	Rich mesic deciduous hardwood forest with rocky outcrops subject to occasional flooding from streams	Turners Falls Impoundment
Arabis missouriensis	Green Rock-Cress	Threatened	Inhabits non-acidic ledges in rocky woods and hills with full to filtered light exposure and dry soil	Turners Falls Impoundment
Crassula aquatica	Pygmyweed	Threatened	Grows along shores in mats on mud flats or partially submerged in water	Turners Falls Impoundment
Mimulus moschatus	Musk Flower	Threatened	Is an indicator species of riverside seep communities, growing at the base of river banks in pockets of sand, gravel and mud	Turners Fall Impoundment

Source: NHESP, 2012

4.7.3 Massachusetts Species of Special Concern

NHESP identified several species that are considered species of special concern that are not state listed threatened or endangered. Special concern is defined by the state as "native species which have been documented by biological research or inventory to have suffered a decline that could threaten the species if allowed to continue unchecked, or which occur in such small numbers or with such restricted distribution or specialized habitat requirements that they could easily become threatened within Massachusetts". Among these are: three reptile and amphibian species; two fish species; ten invertebrate species; and four plant species. Each of the species identified are discussed in detail, within their respective groups, below.

4.7.3.1 *Reptiles and Amphibians*

Three state listed amphibian species of special concern were identified by NHESP relative to the Turners Falls Project and Northfield Mountain Project area. These species include:

- Wood Turtle *(Glyptemys insculpta)*
- Eastern Box Turtle *(Terrapene Carolina)*
- Jefferson Salamander *(Ambystoma jeffersonianum)*

Wood Turtle (*Glyptemys insculpta)*

The wood turtle is a medium-sized turtle, typically measuring 14 - 20 cm in length. It is easily identified by its distinctive brown carapace with irregular pyramid-shaped scutes and orange feet and legs. The wood turtle's preferred habitat includes riparian areas of slower moving mid-sized streams and small rivers with adjacent mixed or deciduous forests, fields, riparian wetlands including wet meadows, bogs, and beaver ponds. Wood turtles are opportunistic omnivores; their diet consists of both plant and animal matter that is consumed on land and in the water. They are active in the warmer months from late March to October. Wood turtles hibernate during the winter in burrows in muddy banks, stream bottoms, deep pools, instream woody debris, and abandoned muskrat burrows in larger free-flowing rivers. Breeding typically occurs in the spring, but can occur opportunistically throughout their active season. Female wood turtles will often build several nests before selecting one in which to lay eggs. Each year, a female wood turtle will lay one clutch of approximately seven eggs. Wood turtle eggs hatch in August and September. The wood turtle's range extends throughout New England, north to Nova Scotia, west to eastern Minnesota, and south to northern Virginia. In Massachusetts, the wood turtle is distributed over much of the state. Little is known about the local population, and though widespread throughout the state, few occurrences are known (NHESP, 2007d). Although wood turtle habitat is varied, occurring in a wide range of habitats, preferred riparian habitat (described in Section 4.6) is limited within the Project area due to the naturally occurring steep river banks.

Eastern Box Turtle (*Terrapene Carolina)*

The eastern box turtle is small, typically measuring 11.4 - 16.5 cm in length. Its carapace is oval shaped and is generally dark in color with orange mottling. The head, feet and legs exhibit a similar coloration. It is a terrestrial turtle and inhabits a wide range of habitats including dry and wet woodlands, brushy fields, thickets, marsh edges, bogs, swales, fens, stream banks, and well-drained bottomland. The eastern box turtle is omnivorous, feeding on slugs, insects, earthworms, snails, carrion, mushrooms, berries, fruits, leafy vegetables, roots, leaves, and seeds. Females become sexually mature around age 13 and breed opportunistically anytime between April and October. In Massachusetts, nesting occurs in June and July. Female eastern box turtles may travel as far as one mile in search of preferred nesting habitats, which include successional fields, meadows, utility rights of way, woodland openings, roadsides, cultivated gardens, residential lawns, mulch piles, beach dunes, and abandoned gravel pits. Females will lay four to five eggs which typically hatch in September after an incubation period of 87-89 days. Their range extends from southeastern Maine; south to northern Florida; and west to Michigan, Illinois, and Tennessee. The eastern box turtle can be found in many parts of the state, but is most common in southeast Massachusetts and within the Connecticut River valley. No long term population trends are currently available (NHESP, 2007e). As a terrestrial turtle, eastern box turtle is likely found at higher elevations within the Turners Falls Project and Northfield Mountain Project area that would likely be outside the extent of any effects of Project operations.

Jefferson Salamander (*Ambystoma jeffersonianum)*

The Jefferson salamander is a mole salamander that is native to the northeast. Jefferson salamanders are long and slender, with elongated limbs and toes. They are grayish brown to dark brown in color with a lighter underside, often with silvery flecks on the limbs and lower sides of the body. Jefferson salamanders have a strong affinity for upland forests; they prefer to reside most of the year in well drained deciduous or mixed forest areas that are within 250 to 1,600 meters of small vernal pools or ponds. Jefferson salamanders hibernate underground in the winter months, usually near breeding sites. In March and April, they begin to migrate to breeding ponds. Jefferson salamanders have been found to migrate to and from breeding pools that are within an average of 100 to 900 feet from their terrestrial habitat. Adult Jefferson salamanders are rarely seen outside of the breeding season. Jefferson salamanders are known to interbreed with blue-spotted salamanders, producing hybrid populations. There are 47 towns in Massachusetts where Jefferson salamanders have been observed, predominantly in the western half of the state. The major threat to this species is loss, degradation and fragmentation of aquatic breeding habitat and terrestrial habitat due to human development and urbanization (NHESP, 2010b). Jefferson salamanders may potentially be found in close proximity to isolated ephemeral pools at higher elevations within the glacial till landscape of Northfield Mountain. Potential ephemeral pool habitats would likely occur outside of the area that may be directly affected by the Turners Falls Project and Northfield Mountain Project operations.

4.7.3.2 *Fish*

NHESP identified two fish species that are state listed species of special concern that occur within the Project area. These species are:

- Burbot *(Lota lota)*
- Eastern Silvery Minnow *(Hybognathus regius)*

Burbot (*Lota lota)*

The burbot is a cold water species and the only member of its family (cod) to inhabit inland freshwaters. Its appearance is distinct from other freshwater species in Massachusetts: the body is elongate; the rear dorsal and anal fins are long, extending to the caudal peduncle; the caudal fin is rounded; and a single large chin barbell is present. The upper body is mottled brown and grey with a light underside (Hartel et al., 2002). The burbot is a coldwater species that inhabits cold (and often deep) streams, rivers and lakes. Burbot can grow very large in deep lakes (up to one meter), but more commonly reach a length of approximately 30 cm in streams and rivers. Spawning occurs over rocky substrate, at night in the cold months from November to March in Massachusetts. Eggs incubate for approximately 30 days. Young burbot grow quickly until year three or four, when growth slows. Burbot are rare in Massachusetts, with only a few records from the Connecticut and Housatonic Rivers (Hartel et al., 2002 and NHESP, 2008). Habitat for the burbot may exist in deeper sections of the main channel of the Connecticut River.

Eastern Silvery Minnow (*Hybognathus regius)*

The eastern silvery minnow is a stout, round-bodied shiner typically ranging in length between 76 and 127 mm (NHESP, 2008a). It is distinguished from other minnows in Massachusetts by a combination of characteristics including medium-sized eyes, a small slightly subterminal mouth, fleshy barbs at the tip of the lower jaw and 38-40 lateral line scales (Hartel et al., 2002). This species inhabits slow-moving, wide rivers. In Massachusetts, the eastern silvery minnow is only known to occur within the Connecticut River mainstem, north of the Holyoke Hydroelectric Project (FERC No. 2004), and in lower portions of the Deerfield River, a main tributary entering to the Connecticut River south of Cabot Station. Spawning occurs diurnally, in late spring. Females lay eggs in substrate amongst emergent grasses and reeds for cover. The eggs are non-adhesive, unlike most cyprinid species in the Northeast. Their diet consists predominantly of filamentous algae and other filtered organics. The population status is not well understood in Massachusetts, but is generally thought to be in decline (Hartel et al., 2002).

4.7.3.3 *Invertebrates*

NHESP identified nine invertebrate species that are state listed species of special concern and that may occur within the Project area. These species include:

- Eastern Pondmussel (*Ligumia nasuta)*
- Creeper (*Strophitus undulates)*
- Twelve-spotted Tiger Beetle (*Cicindela duodecimguttata)*
- Skillet Clubtail (*Gomphus ventricosus)*
- Cobra Clubtail (*Gomphus vastus)*
- Zebra Clubtail (*Stylurus scudderi)*
- Tule Bluet (*Enallagma carunculatum)*
- Stygian Shadowdragon (*Neurocordulia yamaskanensis)*
- Rook Snaketail (*Ophiogomphus asperses)*

In 2000, threatened invertebrate species that are state listed species of special concern were identified by New England Environmental, Inc. (NEE) during work associated with slope stabilization measures within the Turners Falls Impoundment. These species are:

- Intricate Fairy Shrimp (*Eubranchipus intricatus*)
- Pine Barrens Zale *(Zale lunifera*)
- Barrens Buckmoth *(Hamileuca maia*)

Eastern Pondmussel (*Ligumia nasuta)*

The eastern pondmussel is medium to large in size, reaching lengths over 150 mm. It is a bivalve with a distinctly elongate shell and a blunt posterior end. The shell is dark brown or black in color, latterly compressed and thin, but also quite strong. It inhabits streams, rivers, lakes and ponds. This species has shown no distinct preference for substrate, depth or flow conditions. In the Connecticut River watershed, most populations occur in streams and rivers, rather than in ponds and lakes. The eastern pondmussel is a filter feeder, spending most of its time partially submerged in substrate. Their larvae, called glochidia, attach themselves to the gills of host fish where they live as parasites and develop into juveniles. Their range includes the Atlantic coastal drainage from New Hampshire to Virginia and the eastern great lakes region. In Massachusetts, the eastern pondmussel is most abundant in the southeastern portion of the state; however, populations also occur in the central Connecticut River Valley (NHESP, 2009). The eastern pondmussels' habitat is fairly ubiquitous in deep water habitats and may occur at locations within the Connecticut River within the Northfield Mountain Project and Turners Falls Project area. No eastern pondmussels were found in a recent survey of the project area (Biodrawversity, 2012).

Creeper (*Strophitus undulates)*

The creeper is a small freshwater mussel that rarely exceeds three inches in length. The shape is subovate to subtrapezoidal and usually has a blunt posterior end. The nacre is white and dull-yellow or greenish toward the beak cavity. Shells (dead animals) are easy to distinguish because they lack hinge teeth. In the northeast, the creeper inhabits small to large rivers. Preferred habitats include low-gradient river reaches with sand and gravel substrates and low to moderate water velocities, although they can occur within a broader range of habitat conditions (Nedeau, McCollough, & Swartz, 2000). While the creeper has not been reported from lakes in the northeast, they often inhabit small impoundments of run-of-river dams that retain some amount of flow (NHESP, 2007). No creeper mussels were found in a recent survey of the Northfield Mountain Project and Turners Falls Project area (Biodrawversity, 2012).

Twelve-spotted Tiger Beetle (*Cicindela duodecimguttata)*

The twelve-spotted tiger beetle is one of 84 in its genus. It measures 12-15 mm in length. It is black in color with white banding that is often broken into spots. It inhabits the margins of streams, rivers and ponds, and is known to occur along the shores of the Connecticut River in New England. It has a two year life cycle and overwinters the first year as an instar larvae and the second winter as an adult. It feeds primarily on other insects. Its range includes southern Canada and the United States, east of the Rocky Mountains. The twelve-spotted tiger beetle can be susceptible to water level fluctuation, particularly in the winter months when it overwinters along the shoreline in burrows (Cresswell, 2004). Preferred habitat characteristics include cobble and sand beaches, which may occur on the upstream side of islands, and along shorelines of the Connecticut River within the Northfield Mountain Project and Turners Falls Project area.

Dragonflies

Members of the dragonfly taxon *Anisotera* and damselflies *Zygoptera* are semi-aquatic insects in which the juvenile nymphs inhabit aquatic habitat in streams, rivers, lakes and ponds. Breeding generally occurs in the spring and summer months, with females depositing fertilized eggs into the water. Little is known about the aquatic nymph life stage but it is generally thought to last a year or more (NHESP, 2007b and 2007c). Nymphs typically emerge from the water on exposed rocks, woody debris and emergent vegetation in the spring; they then undergo a metamorphosis into the adult flighted stage in a process called eclosion. They are particularly vulnerable during eclosion, and are susceptible to water level fluctuation and bank destabilization.

Intricate Fairy Shrimp (*Eubranchipus intricatus*)

The intricate fairy shrimp is a small, elongated reddish-yellow to orange colored crustacean. In Massachusetts, this species is known as an inhabitant of ephemeral (vernal) ponds (NHESP, 2009). The intricate fairy shrimp is typically found in deeper, less temporary, and more bowl-shaped pools than the often encountered springtime fairy shrimp. Little is known regarding the status of the intricate fairy shrimp in Massachusetts. Prior to 1977 there were only two records for intricate fairy shrimp in Massachusetts (NHESP, 2009). The intricate fairy shrimp was identified within the Turners Fall Impoundment by NEE in 2000 during stabilization measures.

Pine Barrens Zale (*Zale lunifera*)

The pine barren zale is a noctuid moth. Adult moths fly in late May and early June. Eggs hatch soon after laying and larvae feed on scrub oak. Larvae pupate in late July or early August, and pupae overwinter. In Masachusetts, the pine barren zale inhabits sandplain pitch pine-scrub oak barrens, especially oak thickets (NHESP, 2009). The pine barren zale was identified within the Turners Fall Impoundment by NEE in 2000 during stabilization measures.

Barrens Buckmoth (*Hemileuca maia*)

The barrens buckmoth is a day-flying saturniid moth with wings that are black proximally with a white band; the reniform and discal spots are yellow and elongated. Adult moths fly on sunny days from late September through October. Females lay eggs in clustered rings around twigs of scrub oak, occasionally on other species of shrubby oaks. Eggs overwinter and hatch in May. In Massachusetts the buckmoth inhabits xeric, open habitats with extensive scrub oak thickets, especially sandplain pitch pine-scrub oak barrens. In Massachusetts the buckmoth is restricted to the southeast coastal plain, with one inland population in the Connecticut River Valley (NHESP, 2009).

4.7.3.4 *Plants*

NHESP identified four state listed plant species of special concern, which may occur within the Northfield Mountain Project and Turners Falls Project area. These species include:

- Autumn Coralroot *(Corallorhiza odontorhiza)*
- Frank’s Lovegrass *(Eragrostis frankii)*
- Roundleaf Shadbush *(Amelanchier sanguine)*
- Sand Violet *(Viola adunca)*

Autumn Coralroot (*Corallorhiza odontorhiza)*

Autumn coralroot is a member of the orchid family. It is a saprophyte – a type of plant that obtains its nourishment from dead organic matter present in the soil, rather than from photosynthesis. The flower stalk is 2 to 8 inches high; the raceme has from 5 to 15 small blossoms, each borne on a very long drooping stalk. The petals are dark purple or purplish green. Autumn coralroot blooms late in the year, from September to October. In general, autumn coralroot grows in either light soil or rich humus in open deciduous or mixed forests. In Massachusetts, it has been found in the wooded border of brooks, trails in open woodlands, rich limey forests, mesic woods at the base of talus slopes, and in open medium-dry woods (NHESP, 2010).

Frank’s Lovegrass (*Eragrostis frankii)*

Frank’s lovegrass is an annual with repeatedly branched, erect clumps. It has narrow blades that are 5-13 cm long and 1-3 mm wide. The spikelets are ovate and typically 3-5 flowered. The flowering season is from August through September. Frank’s lovegrass prefers sandy riverbanks and sandbars. In Massachusetts, it is only found along the Housatonic and Connecticut Rivers. According to the NHESP, in Massachusetts, eighteen current (1984 to present) occurrences have been verified, and three additional historical occurrences are reported (NHESP, 2009), but not specifically identified in the Turners Falls Project and Northfield Mountain Project area.

Roundleaf Shadbush (*Amelanchier sanguine)*

Roundleaf shadbush is a deciduous, straggling shrub which usually grows singly or few-together in a clump on calcareous or sub-acid rocky ledges, outcrops and summits. It has racemes of white flowers that bloom in late April and early May. Roundleafed shadbush inhabits open to partly-shaded sites in Massachusetts on riverside outcrops and rocky summits. Threats to roundleaf shadbush include changes or alterations to flood regimes along rivers. Competition from non-native species along river shores is also a concern (NHESP, 2007). Preferred habitat is anticipated to be limited within the Northfield Mountain Project and Turners Falls Project area due to the limited presence of outcrops and rocky summits.

Sand Violet (*Viola adunca)*

Sand violet is a low-growing perennial herb with dense rosettes of egg-shaped leaves and a showy purple-violet flower that blooms from mid April through mid June. It grows in disturbed habitats, usually in full sun on moist to very dry soils. Sand violet is one of only three New England “stemmed violets” with purple flowers. Typical habitats include log landings, skid trails, power line rights-of-way, and lawns (NHESP, 2009). It is not anticipated that any existing populations of this species would occur within areas that would be affected by Northfield Mountain Project and Turners Falls Project operations.

4.7.4 Designated Habitat

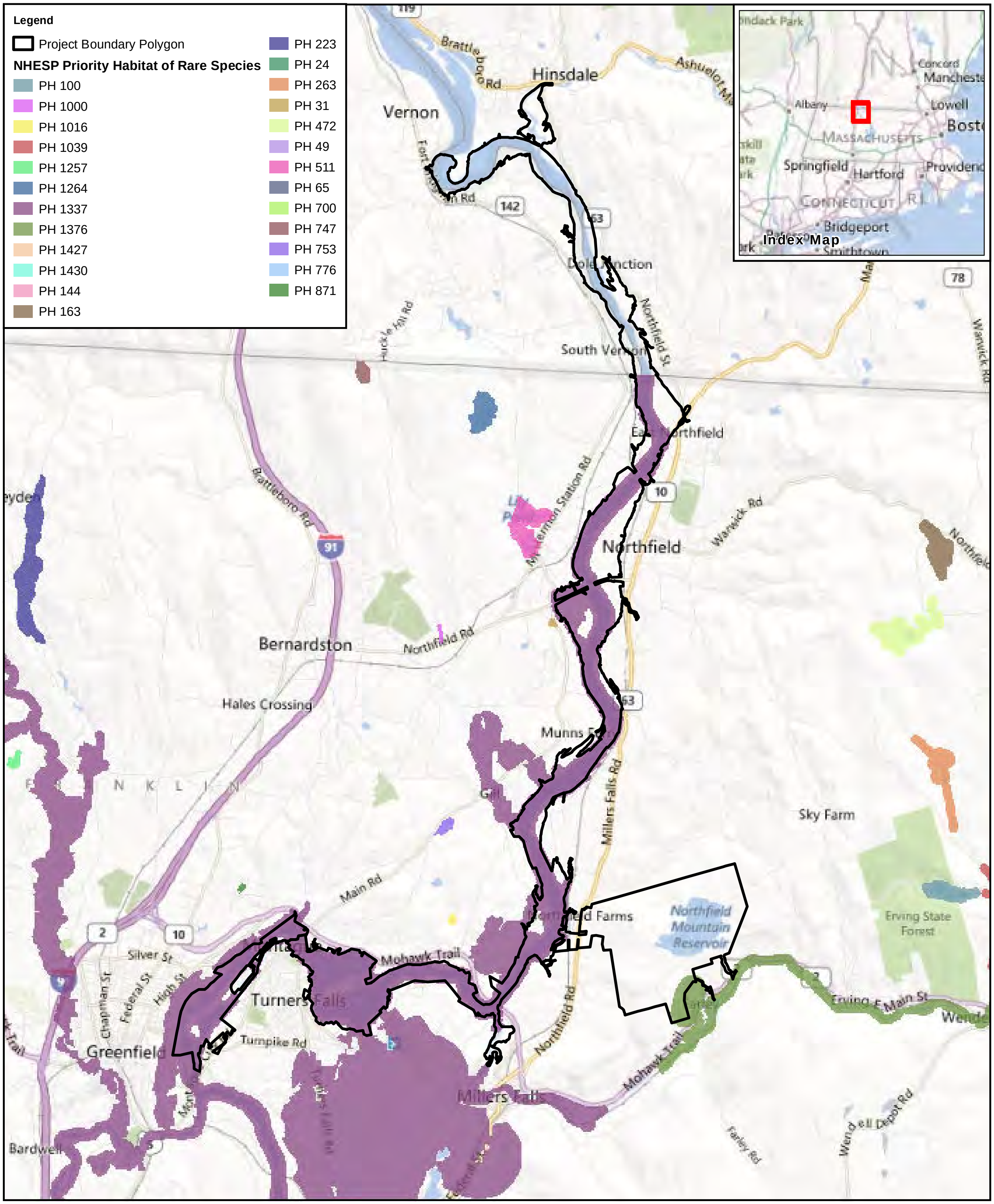
4.7.4.1 *Federally Designated Critical Habitat*

USFWS maintains an online database (Environmental Conservation Online System) which is searchable by state and county that generates a tabular list of federally designated critical habitat. Similarly, NMFS provides online mapping of critical habitat areas for each federally listed species under its jurisdiction. No federally designated critical habitat areas are identified for the Turners Falls Project and Northfield Mountain Project area.

4.7.4.2 *Natural Areas*

Natural areas with habitats that support, or may support, state listed species are identified by NHESP as Priority habitats 32, 1336, 1337, &1401 (PH 32, PH 1336, PH 1337, PH 1401) and Estimated Habitats 76, 486, 252 & 996 (EH 76, EH 486, EH 252, EH 996). The priority habitats and estimated habitats are mapped and identified in the Massachusetts Natural Heritage Atlas 13th Edition (MADFW 2008, pg. 189). Figure 4.7.4.2-1 illustrates locations of these habitat areas at locations surrounding the Turners Falls and Northfield Mountain Projects.

The NHESP tracks examples of communities that are state ranked (SRank) to reflect the community’s rarity and threat within the region and in Massachusetts. NHFGD and VTFWD also maintain similar listings of state ranked rare communities for their respective states. NHESP review yielded no site specific examples of known natural communities that demonstrate regional rarity and are threatened. Generally, the natural communities that were identified as being located in the Turners Falls Project and Northfield Mountain Project area had a SRank value of S4 and S5, which are defined and categorized by NHESP as apparently (S4) to demonstrably (S5) secure in Massachusetts. No unique natural communities have been documented by NHESP within the Turners Falls Project and Northfield Mountain Project area.



FIRSTLIGHT POWER RESOURCES

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Figure 4.7.4.2-1
State (MA) Designated
Priority Habitat Areas

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4.8 Recreation and Land Use (18 C.F.R. § 5.6 (d)(3)(viii))

Recreation use at the Turners Falls Project and Northfield Mountain Project occurs in all seasons and includes boating, fishing, camping, canoeing, sightseeing, hunting, skiing, hiking, walking, biking, horseback riding, and picnicking. There are multiple recreation facilities within the Projects' boundary that offer a variety of recreation opportunities. Existing facilities are described on Section 4.8.1 below. These include facilities that are located within the Turners Falls Project and Northfield Mountain Project area; other facilities that are near, but not within the Turners Falls Project and Northfield Mountain Project area; and State parks. For a general description of the Turners Falls Project and Northfield Mountain Project facilities and area, please refer to Section 3.1.

The Massachusetts Outdoors 2006 Report is the Statewide Comprehensive Outdoor Recreation Plan (SCORP) for the state and covers the time period of 2006-2011. The SCORP notes that the greatest statewide need is for trail-based activities, with walking and road biking indicated as the individual activities in greatest demand. Field-based activities ranked second with playground activity being near the top of the list. There was also a strong need for water-based activities (MAEOEEA, 2012).

The New Hampshire Outdoors 2008-2013 Statewide Comprehensive Outdoor Recreation Plan is the current plan for New Hampshire. The plan identifies six issues of statewide importance, each with defined goals, objectives, and strategies. In 1997, the most popular recreational activities in the state included walking, wildlife watching, and hiking. The plan also says that New Hampshire needs local, close-to home recreational opportunities. One of the goals stated in the SCORP was to ensure that a variety of recreational opportunities are provided, even as pressures and potential conflicts arise, including a goal to support, protect, and maintain existing outdoor recreation opportunities, focusing on boat ramps and playgrounds (New Hampshire Office of Energy and Planning, 2012).

The Vermont Outdoor Recreation Plan 2005-2009 is the current SCORP for the state. The SCORP states that each of the state's regional planning commissions in 2003 revealed the need for more access to all types of outdoor recreational resources (Vermont, 2012).

4.8.1 Existing Recreational Facilities and Opportunities

4.8.1.1 *Facilities within the Turners Falls Project and Northfield Mountain Project Area*

In general, areas associated with the Turners Falls Project and the Northfield Mountain Project are open to the public for recreation use. There is no public access to the Northfield Mountain upper reservoir, and the reservoir is surrounded by a security fence. It can be viewed, however, from a platform on a nearby trail.

There are no Project lands or lands adjacent to the Turners Falls and Northfield Mountain Projects that are currently being considered for inclusion in the National Wilderness Areas (Wilderness.net, 2011). There is currently no designated Wild or Scenic River located within the Turners Falls and Northfield Mountain Projects' boundary (USFWS, 2011). There is one National Scenic Trail partially located within the Northfield Mountain Project boundary (NPS, 2011). The New England National Scenic Trail is a 220-mile hiking trail that travels through 39 communities in Connecticut and Massachusetts. The trail passes through the Northfield Mountain Project along the southern edge of the Northfield Mountain Project's upper reservoir. The Northfield Mountain National Recreational Trail (a component of the National Trail System) is also partially located within the Northfield Mountain Project boundary. This system of trails can be accessed from the Northfield Mountain Tour and Trail Center (also known as the Visitor Center).

There are portions of two trails (one state and one locally managed) that cross the Turners Falls and Northfield Mountain Project boundaries. The first is the Fort Hill Rail Trail in Hinsdale, New Hampshire.

The multiple use trail is nine miles long and travels from Route 63 along the Connecticut River to the old bridge on Route 119. Permitted uses include hiking, biking, horseback riding, snowshoeing, Nordic skiing, snowmobiling, and mushing. The trail is currently maintained by the State of New Hampshire (New Hampshire State Parks, 2012). The second is the Northfield Connector Bike Path, an 11-mile shared roadway route that connects the Canalside Trail Bike Path with the Northfield Mountain Trail System (FRCOG, 2012). The Northfield Connector Bike Path is maintained by the Franklin Regional Council of Governments.

There are 20 formal recreation facilities located within the Turners Falls and Northfield Mountain Projects' boundary (Figure 4.8.1-1 and Figure 4.8.1-2). These facilities provide a variety of amenities, including but not limited to boat ramps, camp sites, picnic tables, benches, trails, and interpretive displays. Below is a brief description of each of the recreation facilities located within the Turners Falls and Northfield Mountain Projects' boundary.

Cabot Woods Fishing Access: This site is located within the Turners Falls Project on Migratory Way in Montague, MA. This site is owned and managed by the Licensee and is open to the public for day use activities such as fishing, hiking, and picnicking. There are picnic tables, three ADA parking spaces, and 17 parking spaces available at the site.

Turners Falls Branch Canal Area: This site is located within the Turners Falls Project, off of Power Street in Montague, MA. This site is owned and managed by the Licensee and is open for fishing. Parking and benches are available at this site.

Turners Falls No. 1 Station Fishing Access: This site is located within the Turners Falls Project, off of Power Street in Montague, MA. This site is owned and managed by the Licensee and is open for fishing. Parking is available.

Unity Park: This park is located within the Turners Falls and Northfield Mountain Projects, on either side of First Street in Montague, MA. This site is owned by the town of Montague, with a portion on the east side that is owned by the Licensee. The park facilities located on the south side of the road are managed by the town of Montague, while the portion of the park located between the river and the road is managed by the Licensee. The park offers day use activities including walking, fishing, sightseeing, picnicking, and biking. Amenities at the park include restrooms, a playground, parking, ballfields, a basketball court, a paved trail, benches, and picnic tables.

Canalside Trail Bike Path: This bike trail is located within the Turners Falls Project along the Turners Falls Power Canal in Montague, MA. The trail property is leased to and managed by the MA Department of Environmental Management (now MA Department of Conservation and Recreation) and is open for non-motorized public use.

Turners Falls Fishway Viewing Area: This site is located within the Turners Falls and Northfield Mountain Projects, off of First Street in Montague, MA. The fishway is managed by the Licensee and is located at the southern end of Unity Park. The facility is open to the public in the spring to watch migrating fish.

Barton Cove Nature Area and Campground: This Nature Area is located within the Turners Falls and Northfield Mountain Projects, on Barton Cove Road in Gill, MA. The Nature Area is owned and managed by the Licensee and is open to the public for camping, picnicking, and bank fishing. Campsites have a picnic table, fire ring and garbage can. There are two vault toilets and additional portable restrooms located within the campground. There is water access from some of the sites and bank fishing is permitted.

MA State Boat Launch: This launch is located within the Turners Falls and Northfield Mountain Projects, off of Route 2 in Gill, MA. This site is owned and managed by the state of Massachusetts, and is open to the public. The site offers boat launching and bank fishing opportunities. There is a parking lot, boat ramp, dock, and portable sanitation facility.

Barton Cove Canoe and Kayak Rental Area: This site is located within the Turners Falls and Northfield Mountain Projects, off of Route 2 in Gill, MA. This site is owned and managed by the Licensee and offers day use opportunities. There is a canoe/kayak launch, a rental office, picnic tables, parking, and a portable sanitation facility.

Cabot Camp: This camp is located within the Turners Falls and Northfield Mountain Projects, at the end of Mineral Road in Montague, MA. The site is owned and managed by the Licensee and is open to the public as an informal bank fishing area. There is a large parking area and access to a local bike trail from the site.

Northfield Mountain Boat Tour and Riverview Picnic Area: This picnic area is located within the Northfield Mountain Project, off Pine Meadow Road in Northfield, MA. This site is owned and managed by the Licensee, and is available for day use activities including interpretive riverboat cruises, picnicking, and bank fishing. The site is accessible from the water and via a paved road. There is a formal parking lot available for those using the site and those who are boarding the riverboat. There are picnic tables, grills, sanitation facilities, and a boat dock at the site.

Northfield Mountain Tour and Trail Center: This site, which is also known as the Visitor Center, is located within the Northfield Mountain Project, off Millers Falls Road (Rt. 63) in Northfield, MA. The Center is owned and managed by the Licensee and is available for day use activities. Available opportunities include viewing interpretive displays, picnicking, and educational programs. The Center has restrooms, cross-country ski rental equipment, and parking. It is open for year-round recreational and educational use.

Northfield Mountain Trail System: The trail system is located at the Northfield Mountain Project, off Millers Falls Road (Rt. 63) in Northfield, MA. Over twenty-six miles of trail are available for hiking, biking, horseback riding, snowshoeing, and cross-country skiing.

Northfield Mountain Mountaintop Observation Area: This site is located adjacent to the Northfield Mountain Project upper reservoir. The Observation Deck is owned and managed by the Licensee and is accessible by hiking the trail system.

Munn’s Ferry Boat Camping Recreation Area: This site is a water access site located on the east side of the river in Northfield, MA. The camping area is located within the Turners Falls and Northfield Mountain Projects. This area is owned and managed by the Licensee and is available for overnight use. There are tent campsites each with a trash can, tent platform, picnic table, fire ring and grill. There is also a lean-to site with a trash can, tent platform, picnic table, fire ring and grill. There are pit toilets available at the site. Bank fishing opportunities are also available at this site.

Bennett Meadow Wildlife Management Area (WMA): The Bennett Meadow WMA is managed by the state of Massachusetts, Division of Fisheries and Wildlife. The site is located within the Turners Falls and Northfield Mountain Projects. This site offers day use opportunities; it is open for hunting, and is also used for walking and hiking.

Pauchaug Boat Launch: This site is owned and managed by the state of Massachusetts. The site is located within the Turners Falls Project and Northfield Mountain Project. There is a boat launch, parking and portable sanitation available at this site.

Pauchaug WMA: This WMA is owned and managed by the state of Massachusetts, Division of Fisheries and Wildlife. This site is similar to the Bennett Meadow WMA and is located within the Turners Falls Project and Northfield Mountain Project. The site is open for hunting and is used for walking/hiking and bank fishing.

Governor Hunt Boat Launch/Picnic Area: This site is owned and managed by TransCanada, which owns the Vernon Project. While this area is within the Vernon Project boundary, the area is also located in the area where the Turners Falls Project and Northfield Mountain Project boundaries and the Vernon Project boundary overlap. The area is open for day use opportunities and has a picnic area and boat launch. Recreation opportunities at the site include bank fishing, picnicking, boat launching, and sightseeing.

Turners Falls Canoe Portage: Portages around the Turners Falls Dam are available seven days per week for canoes and kayaks. The portage take-out is at the Barton Cove Canoe & Kayak Rental Area. Boaters wishing to proceed downriver of Barton Cove are picked up by the Licensee and driven to just downstream of the Project on Poplar Street in Montague City, where they can continue their trip.

4.8.1.2 *Recreational Facilities Near the Northfield Mountain and Turners Falls Projects*

There are two recreational facilities adjacent to the Northfield Mountain and Turners Falls Projects' boundary. The first is the King Philip's Hill Trail. This is a short trail that is located just outside of the Projects' boundary in the town of Gill, MA. The second is the French Kings Bridge, which crosses over the Projects and offers views of the Projects. In addition, there are several areas near the Turners Falls and Northfield Mountain Projects, which offer recreation opportunities. The Mount Grace Land Trust owns the Brush Mountain Conservation Area which includes a hiking trail. The Nature Conservancy owns the 169 acre Stacy Mountain Preserve, in Gill MA. The site offers hiking opportunities (TNC, 2012).

4.8.1.3 *State Parks*

There is one State Park located within the Turners Falls and Northfield Mountain Projects' boundary. A portion of the Connecticut River Greenway State Park, which encompasses the Connecticut River Water Trail, is located within the Turners Falls Project and Northfield Mountain Project and incorporates Project recreation facilities. There are numerous State Forests and Wildlife Management Areas located in close proximity to the Turners Falls and Northfield Mountain Projects. These state lands include: Pisgah State Park, Satan's Kingdom WMA, Erving State Forest, Warwick State Forest, Mt. Grace State Forest, and the Northfield State Forest. There is also the Fort Hill Recreation Rail Trail in Hinsdale, NH that offers hiking, biking, horseback riding, snowshoeing, snowmobiling, and mushing. The trail crosses the Project boundary over the Ashuelot River.

4.8.2 Recreational Use

Recreation use at the Turners Falls Project and Northfield Mountain Project was most recently reported for 2008, as submitted to FERC on March 4, 2009 in the 2009 FERC Form 80. Project use was recorded in the annual number of recreation days that occurred within the Projects' area. A "recreation day" is defined by FERC as each visit by a person to a development for recreational purposes during any portion of a 24-hour period.

The 2009 Form 80 for the Turners Falls Project reported that the total annual daytime use was 36,694 recreation days, and the total annual nighttime use was 4,584 recreation days. The peak weekend daytime average use was 339 recreation days, and the nighttime average was 27 recreation days. The interpretive displays were used at 80% of facility capacity, while the trails were used at 5% of their capacity. Parks and picnic areas in the Project were used at 35% of the facility capacities. The canoe portage and tailwater fishing facilities were used at 10% of their capacities.

The 2009 Form 80 for the Northfield Mountain Project reported that the total annual daytime use was 71,672 recreation days, and the total annual nighttime use was 4,564 recreation days. The peak weekend daytime average was 2,360 recreation days, and the nighttime average was 207 recreation days. The tent/trailer/RV sites and group camps were used at 80% of the facilities' capacities, while the interpretive displays were used at 20% of their capacity. The parks were used at 28% capacity, trails were used at 25% capacity, picnic areas were used at 24% capacity, and the Tour and Trail Center was used at 50% capacity.

4.8.3 Land Use

The Turners Falls and Northfield Mountain Projects are located in the states of Massachusetts, New Hampshire and Vermont. Specifically, the Projects are located in the following towns and counties:

Massachusetts

- Erving, Franklin County
- Gill, Franklin County
- Greenfield, Franklin County
- Montague, Franklin County
- Northfield, Franklin County

New Hampshire

- Hinsdale, Cheshire County

Vermont

- Vernon, Windham County

The area surrounding the Turners Falls and Northfield Mountain Projects, from the Northfield Mountain Project north to the Vernon Project, is largely rural with a mix of agriculture lands and some forested areas. The lands south of the Northfield Mountain Project, near the Turners Falls Dam, are largely developed with a mix of residential and industrial uses.

Lands that are privately owned in the Turners Falls and Northfield Mountain Projects' vicinity are regulated by the respective town's zoning as well as municipal regulations and ordinances. The majority of the lands abutting the Projects in Erving and Greenfield, MA are currently zoned as rural residential. Gill, MA currently zones the majority of the lands abutting the Projects as residential agriculture, and remaining portions of abutting lands are zoned as village residential and village commercial. The lands abutting the Projects located within the town of Montague, MA are a mix of agriculture, unrestricted, recreation, central business, and neighborhood business zones. Rural agricultural uses make up most of the abutting land area in Hinsdale, NH, and Vernon, VT does not have local zoning in place at this time.

4.8.3.1 *Currently Designated Natural Areas*

There are no Vermont, Massachusetts, or New Hampshire designated natural areas within the Turners Falls and Northfield Mountain Projects' boundary.

4.8.3.2 *Project Boundary*

The lands within Project boundary that are associated with the Northfield Mountain Project are used primarily for Project operations and recreation. There are, however, large areas of agricultural and forested lands, as well as wetland areas located within the Northfield Mountain Project boundary that are not used for Project operations. Other land types located within this area include open land and low to very low density residential development. Associated land use activities may include but are not limited to land maintenance, road and trail maintenance, tree removal, and vegetation clearing.

The lands within Project boundary that are associated with the Turners Falls Project are classified as forest, wetlands, open land, powerline/utility, urban public/institutional, industrial, and very low to medium density residential. Associated land use activities may include but are not limited to land maintenance, road and trail maintenance, tree removal, and vegetation clearing.

4.8.3.3 *Shoreline Management*

Lands adjacent to the Turners Falls Project and Northfield Mountain Project boundaries are regulated by respective town zoning and municipal regulations and ordinances. The Connecticut River Corridor Management Plan (1997) was developed by the Connecticut River Joint Commissions and is considered during decision-making for those areas in the vicinity of the Projects that are located in Vermont and New Hampshire.

The Licensee has granted permission to others for non-Project uses of Project lands in accordance with the provisions of the Turners Falls and Northfield Projects' licenses. These non-Project uses include uses of Project lands for a parking area, the Conte Fish Lab, a fire pond, a privately owned boat club, private camps, landscaping activities, agricultural uses, communications antennas, docks, a NPDES discharge, and water withdrawals.

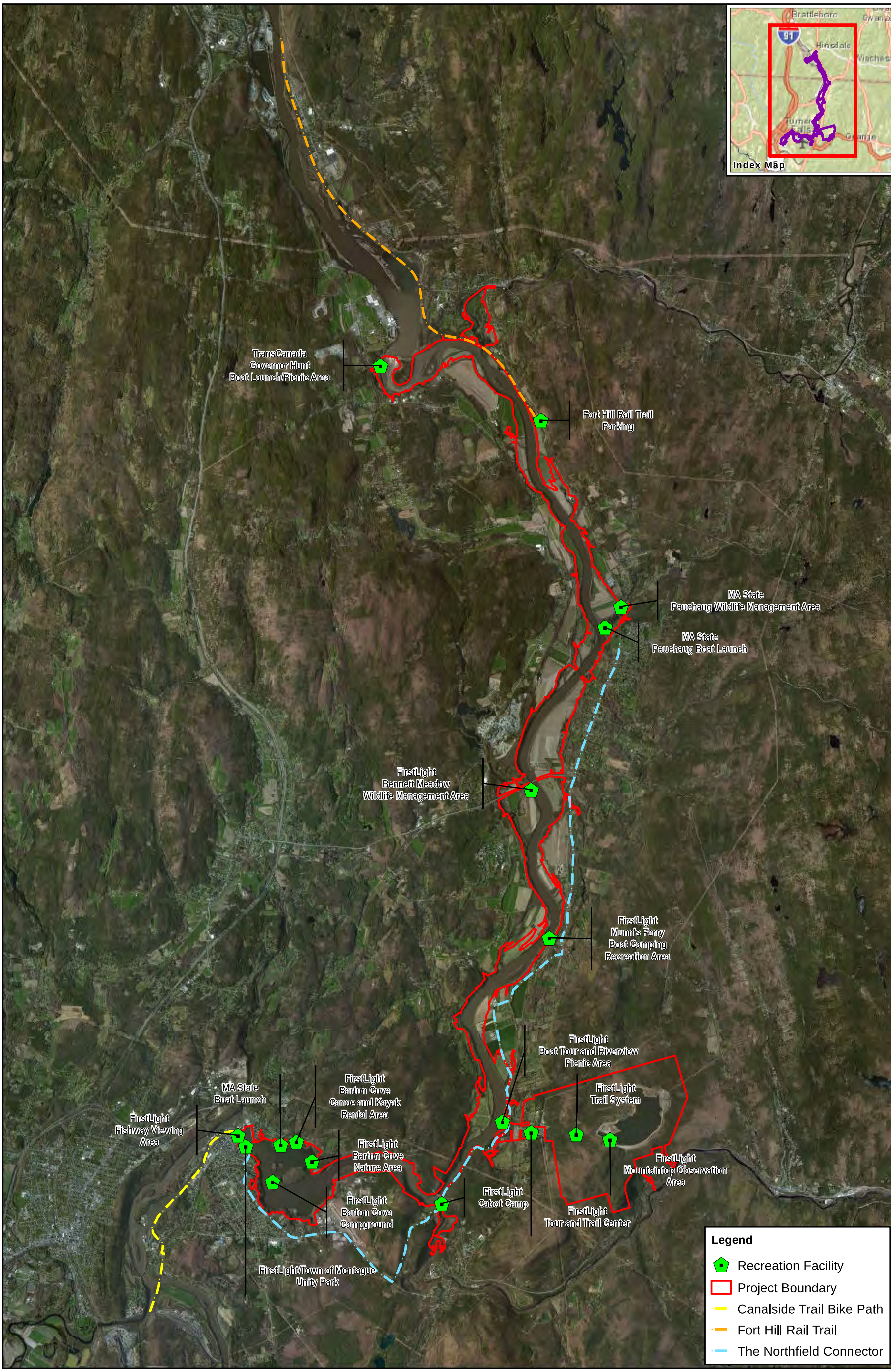

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Figure 4.8.1-1:
Northfield Mountain Recreation Facilities

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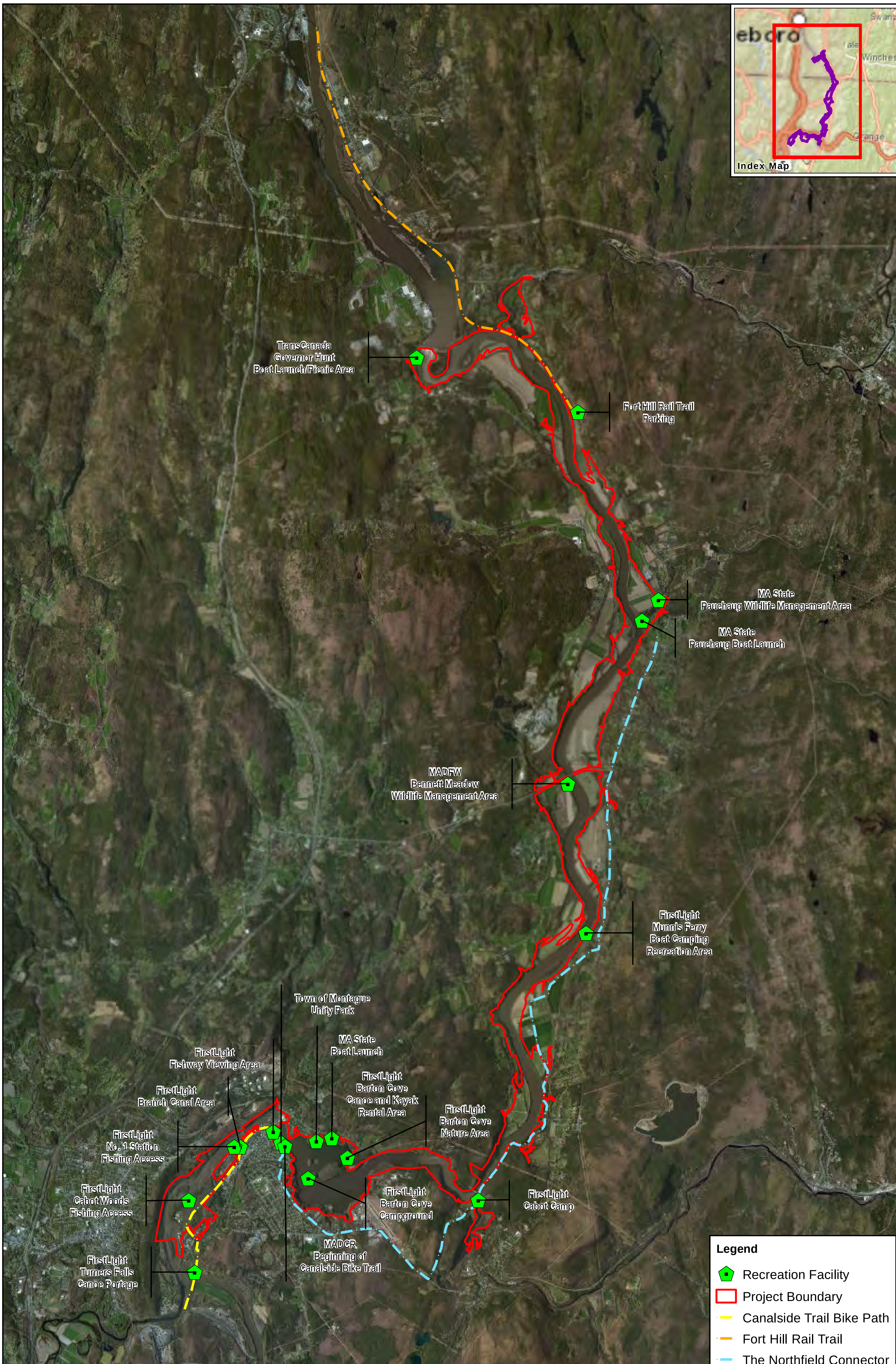

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Figure 4.8.1-2:
Turners Falls Recreation Facilities

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4.9 Aesthetic Resources (18 C.F.R. § 5.6 (d)(3)(ix))

4.9.1 Landscape Description

The Connecticut River valley's landscape has distinct natural beauty and classic New England farm village patterns. In the Turners Falls Project and Northfield Mountain Project vicinity, historic villages and working landscapes combine with natural riverine beauty to create a scenic corridor. The region is comprised of riverside farmlands, woodlands, historic village centers founded in the late 1600s, working landscapes laid out during Colonial times, and vistas of the Connecticut River and mountain ranges. Step-like terraces and floodplains slope up to the bordering hills. The valley is framed by the Berkshire Mountains on the west and by the central uplands on the east. In autumn, the trees blaze with color (PVPC, 2012).

The corridor along Turners Falls Impoundment was designated as a scenic landscape in 1981 by the Massachusetts Department of Conservation and Recreation (then Department of Environmental Management). Below Cabot Station, most of the river corridor down to South Hadley is also considered a scenic landscape. Figure 4.9.1-1 depicts these scenic landscape designations as well as other aesthetic elements and scenic byways in the Turners Falls Project and Northfield Mountain Project vicinity.

4.9.2 Scenic Byways and Viewscapes

Connecticut River National Scenic Byway

The roadways along the Connecticut River in New Hampshire, Vermont, and Massachusetts were designated as state scenic byways in 1994, 1999, and 2000, respectively. In 2005, the Vermont and New Hampshire sections were designated as a National Scenic Byway. The Massachusetts section, which extends from the state border in Northfield down to South Hadley, was added to the Connecticut River National Scenic Byway in 2009. Scenic byway routes in the Turners Falls Project and Northfield Mountain Project vicinity include Route 142 through Vernon, VT, Route 63 through Hinsdale, NH and Northfield, Erving, and Montague, MA, and Route 47 through Sunderland, Hadley, and South Hadley, MA. Designated waypoints along the byway include Northfield Mountain Tour and Trail Center and the Great Falls Discovery Center in Turners Falls. Figure 4.9.1-1 shows the route of the Connecticut River Scenic Byway in the Turners Falls Project and Northfield Mountain Project vicinity (USDOT, 2012).

Mohawk Trail Scenic Byway

The Mohawk Trail Scenic Byway was one of the earliest scenic byways in New England, receiving its designation in 1953. It follows an east-west corridor along Route 2 from Athol to Williamstown, MA. In Erving, the Byway passes through forested areas along the Millers River with views of the Erving Cliffs (Farley Ledges) as well as of mountains in Wendell and Gill. At the Erving-Gill town line, the Byway crosses the Connecticut River on the French King Bridge with spectacular views up and down the river (see below). In Gill, the Byway has a more rural feel with views of Barton Cove, some views of the river through trees to Montague and farmsteads, and a gently rolling landscape. Near the eastern town line, a panoramic view of the Village of Turners Falls and its historic industrial landscape is visible across the Connecticut River and the power canal. The Byway then turns onto Route 2A and passes through historic downtown Greenfield (FRCOG, 2009).

Connecticut River Water Trail

The Connecticut River Water Trail is a 12-mile-long paddling trail that runs from the Turners Falls Dam to a boat access point one mile north of Hatfield Center (see Figure 4.9.1-1). It features a nearly unbroken vegetated shoreline, wetlands, high bluffs, long views, and floodplain forests. The water trail is part of the longer Connecticut River Greenway State Park, which encompasses the length of the river in Massachusetts (MADCR, 2012).

Metacomet-Monadnock Trail/New England National Scenic Trail

The Metacomet-Monadnock Trail (M-M Trail) is a long distance hiking footpath that extends from the Connecticut state line to Mt. Monadnock in New Hampshire (see Figure 4.9.1-1). In 2001, the National Park Service certified sections of the trail, including those near Northfield Mountain, as a National Recreational Trail. In 2009, the trail was designated as part of the New England National Scenic Trail (NET), which also includes the Mattabesett Trail in Connecticut (collectively known as the M-M-M Trails). In Northfield, the M-M Trail traverses the open ledges of Crag Mountain, from which views of Northfield Mountain Reservoir can be seen to the southwest (see Figure 4.9.2-1) (AMC, 2010).

Connecticut River National Blueway

The Connecticut River was designated the first National Blueway on May 24, 2012 by the US Department of Interior. The federal designation will comprise the entire river, as well as its watershed. The Blueway designation is intended to provide for better coordination of local, state and federal groups to promote best management practices, information sharing and stewardship.

Scenic Viewpoints

Located between the Northfield Mountain Project tailrace and the Turners Falls Dam, the French King Gorge, with its 250-foot-high rocky banks, is of ecological and scenic significance. The gorge was formed thousands of years ago by glacial melt waters. The Route 2 bridge that connects Gill to Erving, also known as the French King Bridge, provides scenic views to the north and south, where the Millers River empties into the Connecticut (see Figure 4.9.2-2). This is a popular tourist destination and some parking is provided on both sides of the road at the bridge (MADCR, 2012).

The Gill-Montague Bridge just below Turners Falls Dam provides scenic views of the dam and bypass reach for pedestrian and automobile traffic. Figure 4.9.2-3 is an aerial image showing the bridge, the Village of Turners Falls, and the landscape surrounding the lower Turners Falls Impoundment.

At more than 1,200 feet in height, Mt. Toby in Sunderland, just south of the Turners Falls Project and Northfield Mountain Project, looms over the middle Connecticut River valley offering outstanding panoramic views. A moderate hiking trail of about 6 miles leads to the top, and there are shorter hiking trails as well. Related geologically to Mt. Sugarloaf, Mt. Toby features cliffs, caves, waterfalls, wetlands, and open fields (MADCR, 2012).

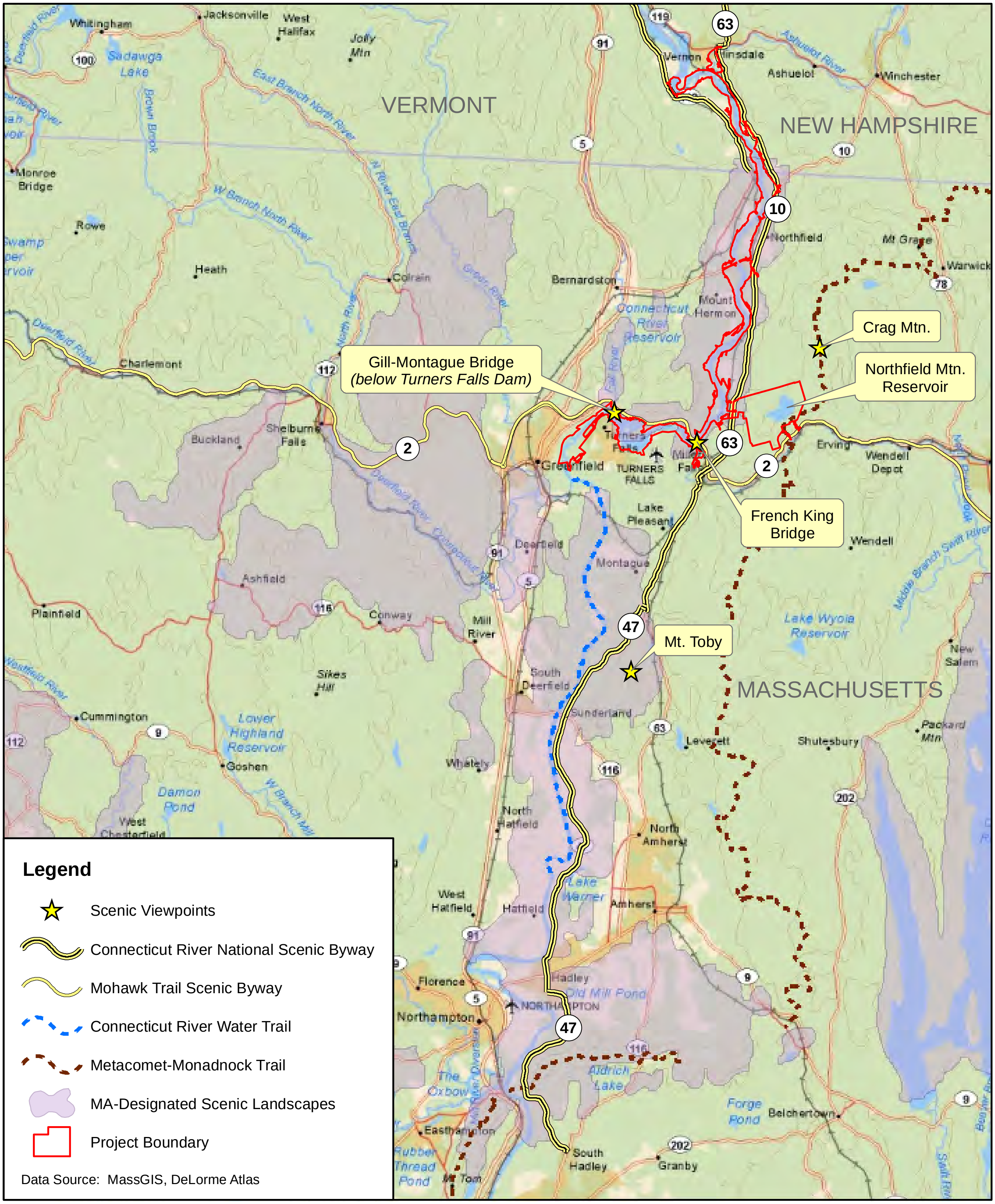

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Figure 4.9.1-1: Aesthetic Resources in the Project Vicinity

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Figure 4.9.2-1: View of Northfield Mountain Reservoir from Crag Mountain

Figure 4.9.2-2: French King Bridge over Turners Falls Impoundment

Figure 4.9.2-3: Aerial View of Turners Falls Dam Area, Looking Upstream

4.10 Cultural Resources (18 C.F.R. § 5.6 (d)(3)(x))

4.10.1 Introduction and Geographic Overview

This review of information regarding known cultural resources in the Turners Falls Project and Northfield Mountain Project area includes: a geographic overview of the area; a pre-historic and historic (1620-1961) context for the Turners Falls Project and Northfield Mountain Project area; and the results of preliminary research on known archaeological and historic architectural resources in the Projects' area. For a general description of the Projects' facilities and area, please refer to Section 3.1.

4.10.2 Prehistoric Context

The archaeological record of New England is long and complex, dating back more than 10,000 years. The prehistory of the Northeast is generally divided into three broad periods: the Paleoindian period (before 8000 BC), the Archaic period (8000 BC – 1000 BC), and the Woodland period (1000 BC – AD 1600). Each is further divided into sub-periods representative of changes in material culture, artifact forms, and cultural adaptations. A fourth period of much shorter duration – the Contact period (AD 1500 – AD 1620) – is used to describe the time of initial Native American–European interaction, and before all native peoples were assimilated and/or removed from the region. These periods are associated with unique sets of social, political, and technological adaptations that arose, in part, in response to gradually changing environmental conditions following the end of the last ice age. Native American archaeological sites dating to these time periods, and representing all manner of local cultural adaptations, are known to exist within the Upper Connecticut River Valley area and throughout the surrounding region.

4.10.2.1 *Paleoindian Period (before 8000 BC)*

The ancestors of the first people to occupy what is today the northeastern United States entered the continent from northeastern Asia at least 15,000 years ago. By about 14,000 years ago, groups of these early Native Americans, referred to as Paleoindians, had entered the Upper Connecticut River Valley. The Paleoindians focused their settlement and migration around a mosaic of streams and wetlands formed in the basins of pro-glacial lakes (Bunker, 1994, p.21; Nicholas, 1983). Paleoindians who lived in the region are characterized as hunters and gatherers, small groups reliant on a highly mobile lifestyle as a strategy for food resource and lithic raw material acquisition for subsistence and stone tool-making (Tankersley, 1998; Spiess, Wilson, & Bradley, 1998). These groups hunted migratory, large, cold-adapted game animals – mastodon, caribou, and woodlands bison, along with horse, deer, giant beaver, moose, elk, and mammoth – that inhabited the grasslands and forests south of the Laurentide Ice Sheet (Fagan, 2000). The locations of high-quality lithic materials that could be used for tool making and hunting were widely dispersed (Tankersley, 1998).

The fluted point is the most distinctive artifact in the Paleoindian toolkit, but is also accompanied by spurred end scrapers, side scrapers, and spokeshave gravers, which would have been used to process big game (McBride, 1984; Ritchie, 1980). Most Paleoindian sites in the Connecticut River drainage are isolated finds found within lake margins in riverine or marsh habitats (McMillan, 1982). Diagnostic artifacts have been recovered from sites such as the Hadley site in central Massachusetts (Curran & Dincauze, 1977), site 6LF21 in Connecticut (Moeller, 1980), and the Whipple site in New Hampshire (Curran, 1984; 1994).

4.10.2.2 *Archaic Period (8000 BC – 1000 BC)*

The Archaic period developed from the preceding Paleoindian period. It represented a time of marked cultural change as modern environmental conditions slowly emerged. The Archaic period is generally divided into three sub-periods: Early Archaic (8000 BC – 6000 BC), Middle Archaic (6000 BC – 4000 BC), and Late Archaic (4000 BC – 1000 BC) (Gardner, 1980; Griffin, 1967). The specific cultural differences among these sub-periods is primarily in the diversity of tool types found within sites, and the organization of a more sedentary way of life (evidenced by gradual increases in site size, duration of occupation, and frequency across the landscape). The transition from the early to the late sub-period is also characterized by an increasing reliance on the exploitation of aquatic and plant food resources, and a continued expansion of regional population density (Funk, 1978).

The transition from the Paleoindian to the Early Archaic period is characterized by the introduction of chipped-stone and groundstone unifacial implements in toolkits (Funk & Wellman, 1984). Tools were typically produced from local stone, often collected in cobble form. By the Middle Archaic period, cultural innovations become more abundant; the frequency of chipped-stone spear points increased and the first cemetery sites occurred (McBride, 1984). These cemetery sites reveal mortuary practices that included sprinkling of graves with red ocher, and offering of grave goods (Dincauze, 1975; Moorehead, 1922; Robinson, 1992; Willoughby, 1898). By this period, Native peoples had a clear riverine focus and numerous sites exist along inland waterways. Shell middens and large habitation sites located near falls or other confluences exhibit the shift toward harvesting marine resources. Biface tools dominate the tool assemblages associated with this time period, and include scrapers, unhafted flake knives, and perforators, as well as ground-stone atlatl weights, full grooved axes, gouges, ulus, and plummets (Dincauze, 1976). The Early Archaic John's Bridge site on the Missisquoi River in Vermont (Thomas & Robinson, 1980) and the Middle Archaic Neville site on the Merrimack River in New Hampshire (Dincauze, 1976) are important examples of Archaic-period sites.

There is a higher frequency of Late Archaic sites throughout the region (Ritchie, 1985). This period is characterized by the existence of high-density sites and a broader toolkit than in previous periods. Diagnostic artifact types include a diverse array of side- and corner-notched projectile points, primarily made from locally available lithic materials. By the Late Archaic period, toolkits had been expanded to include a variety of ground-stone artifacts, steatite and sandstone containers, atlatl weights, mortars, pestles, and full-grooved axes (Justice, 1987; Truncer, 2004). Late Archaic populations established territories and large trade networks developed; increased specialization is also evident in the toolkits of the period (Dincauze, 1975; Mulholland, 1979; Snow, 1995).

4.10.2.3 *Woodland Period (1000 BC – AD 1600)*

The Woodland period emerged out of a series of cultural adaptations that began in the terminal portion of the Late Archaic. The overall cultural tendency at this time was toward a more sedentary lifestyle associated with a growing reliance on exploitation of imported domesticated plant species (Raber, 1985). Technological advances that accompanied this social change included the development of ceramic containers and food storage capabilities, the introduction of domesticated plants, and the bow and arrow (McBride, 1984; Peterson & Sanger, 1991). The ability to grow, cook, and store food helped to establish a more stable way of life and allowed, among other innovations, the establishment of regionally distinct tribal networks, the elaboration of sociopolitical systems (including the emergence of ranked, stratified societies), and increased burial ceremonialism (Braun, 1974; Snow, 1995).

By the Late Woodland period (AD 1000 – AD 1500), maize-focused horticulture became well-established in more southerly areas, while in the Connecticut River drainage basin, adoption of maize horticulture appears to have taken place later (MHC, 1984; Trigger, 1978). Instead, Prehistoric inhabitants continued practices carried over from the Middle Woodland until the Late Woodland period (AD 1500 – AD 1600), when sedentary village life became a major component of the regional adaptation and evidence of tropical cultigens became abundant (Haviland & Power, 1981). In addition to the cultivation of plants such as maize, beans, and squash, Late Woodland peoples continued to hunt, fish, and gather wild plant foods (Bumstead, 1980; Raber, 1985; Custer, 1996). The Woodland period terminated during the first contacts with Europeans, as foreign goods were introduced to the Native peoples.

4.10.2.4 *Contact Period (AD 1500 – AD 1620)*

Overlapping with the Woodland period, the Contact period (AD 1500 – AD 1620), as indicated, is marked by early interaction of Europeans with local Native American groups (MHC, 1984). Although direct contact between the groups was rather limited, indirect contact via trade of material goods and the spread of disease played a key role in the termination of preceding Woodland period cultures. During this time, the Upper Connecticut River Valley contained two core Native groups, the Pocumtuck and the Squakheag (Grumet, 1995; MHC, 1984). The Pocumtuck encompassed the modern Massachusetts towns of Whatley, Sunderland, Deerfield, Montague, Greenfield, and Gill. Turners Falls, located within present-day Montague is also the site of the Pocumtuck village known as Peskeomskut (MHC, 1982a, and 1984). The Squakheag encompassed the modern towns of Northfield, South Vernon, and Hinsdale. Present-day Northfield is the site of Squakheag villages, Squenatock on the east side of the Connecticut River, and Natanis on the west side (MHC, 1982b and 1984). Culturally similar groups also occupied the Lower Connecticut River Valley and surrounding upland areas in the region.

By this time, large Native American settlements were situated on floodplains while smaller villages were established along nearby subsidiaries and lakes (MHC, 1984). The Pocumtuck-Squakheag cultivated maize, beans, and squash. They supplemented their diet by fishing and hunting game such as bear, deer, and moose. However, little is known about the cultural practices of these peoples, as warfare and disease decimated their population prior to European settlement in the area. The Pocumtuck had been engaged in combat with its rival, the Mohawk. Meanwhile, smallpox, a European disease for which Native Americans had no immunity, swept across the region by means of local trade (Grumet, 1995; MHC, 1984; Trigger, 1978).

4.10.3 Historic Context

The following historic context examines the history of Euro-American settlement of the Northfield Turners Falls Project and Northfield Mountain Project area in Massachusetts, Vermont, and New Hampshire between the Colonial period and the mid-twentieth century (1961). Time periods for the historic context are those developed by the Massachusetts Historical Commission (MHC) in *Historic and Archaeological Resources of the Connecticut River Valley—A Framework for Preservation Decisions* (Zimmerman et al., 1984).

4.10.3.1 *Plantation and Colonial Periods (1620-1775)*

In May 1672, the Massachusetts General Court authorized the laying out of what later became Northfield Township provided that “not less than twenty families should be settled within eighteen months from the date of the grant; that the petitioners took good care to provide and maintain the preaching of the Word and ordinances of God among them; and that a farm of 300 acres be reserved for the use of the country” (Temple & Sheldon, 1875, p. 103). After the first settlers arrived in the spring of 1673, they built “small huts surrounded by a stockade and fort. In the center of their collection of huts they built one for public worship, and employed Elder William Janes as their preacher" (Everts, 1879, p. 104). Due to conflicts with Native Americans, however, the settlement was abandoned and the residents fled to Hadley in late 1675.

The town of Gill, Massachusetts was part of the original 1672 grant extending east to the Connecticut River and including Squakheag (Northfield) and Swampfield (Montague). As with Northfield, colonial settlement in Gill was scattered and short-term due to fear of Indian uprisings. At least two homes were established in Gill a short time prior to the outbreak of King Phillip’s War in 1675. They were reputedly erected on two separate lowland locations situated on the Mohawk Trail in Riverside village and near the southern terminus of River Road, but were abandoned during that conflict (MHC, 1982, p. 3). The first permanent colonial settlements in Gill did not occur until nearly 1776.

No new attempts to settle in Northfield occurred until 1685, when John Woodward, Wm. Clarke, Jr., and Richard Lyman were granted the privilege of building a saw mill, and given 20 acres of land as encouragement. In response to the petition of Clarke, "in behalfe of those that are preparing to resettle the village," the General Court extended the southerly town boundary along the east side of the river two and a half miles, to Four-Mile Brook (Temple & Sheldon, 1875, p. 89). About twenty families entered upon the settlement during that year, a fort was built, and John Clary, Jr., also having received an offer of 20 acres of land, set up a grist-mill on Mill Brook (Everts, 1879, p. 105).

The Northfield settlement was abandoned again as a result of King William's War in 1689 and Queen Anne's War in 1702-1713, with settlers returning to Hadley. In 1716, Steven Belding, of Swampfield, built a grist-mill on the site of John Clary's old mill (Stone, 1930, p. 121). A grist mill was built soon after and a pound was built in 1718. Ebenezer Field, of Deerfield, settled in Northfield in 1720, and set up the first blacksmith shop there, along with Stephen Crowfoot who opened a carpenter shop (Temple & Sheldon, 1875, p. 100).

The earliest land grant in what is now Montague, Massachusetts is dated March 23, 1716, when Samuel Partridge and John Pynchon granted to Benjamin Munn and others milling privileges on Sawmill Brook, where they erected a saw mill (Pressey, 1910, p. 147 and Everts, 1879, p. 290). Montague was established as a part of Sunderland in December, 1753, with its boundary with Shutesbury set in 1761. The name is said to have been chosen in honor of Capt. William Montague, who commanded "The Mermaid" at the taking of Cape Breton. The northern part of the district to Millers River and Turners Falls was included as part of the Two Mile Addition in 1770. The northeast section along Lyon's Brook was annexed to Wendell in 1803 (MHC 1982a, p. 1).

The incorporation of Northfield as a town dates from June 15, 1723, and the first town-meeting for the election of officers was held July 22 in that year. At this time, the town of Northfield included within its limits what are now portions of Vernon, VT and Hinsdale and Winchester, NH; the north portion of Northfield, which assisted in making these towns, was cut off in 1740, when a new province line was run. The original grant in 1672 made the town equal to six miles square, or eight miles long by four and one-half miles wide, and to this, in 1685, there was an addition of two and one-half miles to the south end, east of the Connecticut River (Everts, 1879, p. 108).

Throughout the 1720s, the Massachusetts colonial government authorized the building of several forts along its northern and northwestern frontier as a defense against the French and their Indian allies. Fort Dummer, built by the colonial militia under Lieutenant Timothy Dwight and named for Lieutenant Governor William Dummer, was located in what is now Brattleboro, Vermont and was the first permanent colonial settlement in that state. The fort was initially the gateway to the early settlements along the banks of the Connecticut River. Forty-three English soldiers and twelve Mohawk Indians manned the fort in 1724 and 1725 (Fort Dummer State Park, Vermont Department of Forests, Parks, and Recreation).

On October 11, 1724 the French attacked the fort and killed some soldiers, but left before reinforcements could arrive. In 1725, the so-called Dummer's War ended, and in 1728 the fort was converted into a trading post for lucrative commerce with the remaining Indians. During and after the conflict known as King George's War (1744-1748), Massachusetts kept a small body of troops at the fort until 1750, after which it was considered unnecessary. The township became one of the New Hampshire grants, chartered on December 26, 1753 by Governor Benning Wentworth and named Brattleborough after Colonel William Brattle, Jr. of Boston, a principal proprietor. Settlement in southern Vermont was tentative until after the 1763 Treaty of Paris, when France abandoned its claims to New France. The site of Fort Dummer was flooded when the Vernon Dam was built on the Connecticut River in 1908 (Fort Dummer State Park, Vermont Department of Forests, Parks, and Recreation).

Fort Bridgman, built by Orlando Bridgman in 1737 in present-day Vernon, Windham County, Vermont, was constructed of squared yellow pine logs laid lengthwise, crossed at the corners and fastened with wooden pins. The two-story compound was surrounded by a twenty-foot-high picket fence. It was one of 16 forts established in a line from Fort Dummer to Fort Massachusetts to protect settlers during King George's War. On June 24, 1746 the fort was burned by the French and Indians. Quickly rebuilt, the fort was again attacked and burned on October 22, 1747. The fort was again rebuilt and survived through the end of the war. Burned again during the French and Indian War (1754-1763), Fort Bridgman was rebuilt for a fourth time and remained standing until 1838 (Roberts, 1988, p. 797).

Hinsdale, in Cheshire County, New Hampshire is named for Col. Ebenezer Hinsdale, an early settler who built a small stockade and gristmill here in 1742. Hinsdale township originally contained the township of Vernon, Vermont on the opposite side of the Connecticut River. Colonel Hinsdale was from a prominent family in Deerfield, and was once chaplain of Fort Dummer (Child, 1885, p. 181).

The town of Erving, Massachusetts traces its roots to the tract comprising portions of several surrounding towns, measuring twelve miles long and two miles in width, that was bought by a company of Proprietors in 1751, who sold it shortly thereafter to John Erving, of Boston, whose grant was confirmed by the General Court in January 1752 (Everts, 1879, p. 301).

By the mid-eighteenth century, Montague was experiencing the most sustained growth of the several townships in the area. Establishment of the Congregational meetinghouse on Leverett Street in Montague Center was followed by construction of a bridge across the Sawmill River in 1756, the settlement's first schoolhouse in 1757, and a pound in 1766 (MHC, 1982a, p. 3). In 1765, Montague consisted of 49 houses, 64 families, and 392 individuals. By 1776, the town population had reached 575 (MHC 1982a, p. 6). Development of a rudimentary transportation network was the key to the town's early growth. The primary north-south highway in Montague was improved as Federal Street (present Route 63) to Lake Pleasant with connections across Montague Plain to East Mineral Hill Road and a bridge at Millers River ford by 1774.

The province of New Hampshire was divided into five counties in 1771. Cheshire County was named for Cheshire County in England. Keene and Charlestown were made the county "shire-towns." The early settlers of Cheshire County came from Massachusetts north along the Connecticut River. In 1827, the county was divided, the northern portion taking the name of Sullivan County (Childs 1885, pp. 23-25).

4.10.3.2 *Federal and Early Industrial Periods (1776-1870)*

Transportation improvements in Montague begun after the Revolution include the Upper Locks and Canal (1792-98) from Turners Falls to Montague City. The canal, designed by Benjamin Prescott of Northampton, was first completed in 1798 by the Proprietors of the Upper Locks and Canals on the Connecticut River under a charter granted on February 23, 1792, by the Massachusetts legislature. After completing the South Hadley Canal, many of the earlier Proprietors turned their attention to extending navigation to regions above Turners Falls (Bacon, 1906, p. 814; MHC, 1982, p. 8).

Construction work included a log-crib dam extending across the Connecticut River at a place called "Great Falls" (now Turners Falls), a canal 2.5 miles long and 20 feet wide from there to a point downstream near the Deerfield River, and a towpath on its east shore. The canal had ten locks as finally completed. Upstream, a dam and single-lock canal near the confluence of the Connecticut and Millers Rivers allowed barges to bypass the French King rapids. The canals were opened for business in 1798 and by 1802 supported regular freight traffic by boat from Long Island Sound to Bellows Falls, Vermont.

The canal's principal investors were Dutch capitalists, who, in their enthusiasm for the project planned a manufacturing and commercial city at the outlet of the canal at Montague City (MHC, 1982a, p. 8).

Related transportation improvements included the east-west road from Montague City via the Fifth Massachusetts Turnpike (completed by 1799) to Millers Falls and the opening of the Connecticut River Bridge to Greenfield in 1802.

The Montague Canal was profitable for 30 years, returning a 4% dividend to its investors, and even in 1826 was briefly considered as part of a larger system from Boston to the Hudson River. Within a few decades, however, railroads had become the favored means of transport, and the canal eventually closed to navigation in 1856 (Bacon, 1906, p. 820).

Established as a town from Greenfield in 1793, Gill has its western boundary along the Fall River. Location of the meetinghouse at Gill Center in 1794 established it as the center of the town's population. A secondary settlement was maintained at Turners Falls (Riverside) and along Country Road to West Gill and the farming area in the Fall River Valley. The northeast section of the town (Mount Hermon) was annexed from Northfield in 1795 and Great Island was annexed from Montague in 1801 (MHC, 1982, p.2).

The first settlement within the limits of the town of Erving was probably not made until 1801, when Col. Asaph White of Heath located there (Everts, 1879, p. 308). In 1803, White erected a dam across Millers River, built a saw-mill, and later kept a public-house. Before moving to Erving, in 1797, he was one of the incorporators of the Second Massachusetts Turnpike Corporation, and later, in 1799, one of the incorporators of the Fifth Massachusetts Turnpike Corporation. The road laid out by the Fifth Massachusetts Turnpike Corporation in 1799 passed from Greenfield to Athol by way of Erving.

The four Franklin County townships experienced healthy population growth during the first few decades of the nineteenth century, with Gill being typical. Between 1800 when it stood at 700 and 1830, Gill's population grew by 23 percent, reaching 864 in the latter year (MHC, 1982, p. 4). Not until the 1880s would Gill again report as many residents. The town's economy during this period was almost entirely agricultural, with a few small saw- and gristmills established on Fall River and Dry Brook. The town was noted for "rich grazing and tillage soils and developed a reputation for producing abundant corn and rye crops" (MHC, 1982, p. 6). Excess agricultural produce was sent overland to Boston or to river towns to the south. One writer noted: "As an agricultural town, Gill is more than ordinarily fruitful, and the chief support of her inhabitants is gained from the soil. The soil is deep and strong, and in the Connecticut Valley is especially valuable for the production of tobacco, of which, however, the cultivation has latterly materially diminished" (Everts, 1879, p. 204).

Tobacco was also extensively grown in Northfield in the years before the Civil War, although it declined sharply in importance after the war. Noted one writer: "Tobacco-growing upon the river bottomlands, which extend north and south through the town, was pursued to a great extent, and previously it was a highly profitable industry but it has latterly much declined, and during 1878 but about 100 acres of tobacco were grown, or less than one-fourth of the amount planted in 1868" (Everts, 1879, p.304).

The railroad proved to be a much more reliable form of regional transportation than the Upper Locks and Canal and its construction in the 1840s and 1850s greatly aided in the development of Montague and Gill. The primary east-west railroad route through Montague was constructed in 1848 as the Fitchburg line of the Boston & Maine Railroad. It ran along the south bank of Millers River gorge to Millers Falls, with an extension to Greenfield built in 1851 by the Massachusetts & Vermont (Pressey, 1910, p. 186). An additional route looped south to the Sawmill River and Montague depot along Hannegan Brook and Lake Pleasant including a bridge across the Connecticut River to East Deerfield. In 1855, a north-south route from Amherst to Millers Falls was built by the New London & Northern Railroad. Development of Turners Falls by the Fitchburg Railroad required a branch line from Greenfield across Connecticut River to Montague City and Turners Falls, completed in 1868 (Everts, 1879, p. 208).

The Fitchburg paper and railroad magnate John Alvah Crocker was responsible for the development of Turners Falls and of the Fitchburg Railroad. The main line of the road, completed in1848, ran west only as far as Millers Falls, before turning north toward Vermont. According to Crocker's plan, Millers Falls, not Turners Falls, would have been the center of manufacturing for an area including Northfield Farms, Factory Village (Greenfield), Montague City, Montague Center, and Farley (in Wendell and Erving) (Pressey, 1910, p. 198).

Agriculture was in decline in Erving by the Civil War. Tobacco and small grains were grown to only a limited extent. Manufacturing was the chief source of revenue in Erving during the last half of the nineteenth century, with the most important enterprise being carried on at Millers Falls by the Millers Falls Company, controlled principally by Greenfield industrialists. The company's extensive works were built on Millers River, opposite Millers Falls village in Montague, and at one time employed about 150 in the manufacture of saws and small hardware. The company was organized in 1868, and the location of the manufactory at Millers Falls in that year gave that locality its first substantial growth. The water-power gained at this point from Millers Falls was controlled by the Miller's Falls Company, whose dam and canal were constructed in 1868 (Stone, 1930, pp. 48, 52).

4.10.3.3 *Late Industrial and Modern Periods (1871-1960)*

As a result of the development of Riverside and Turners Falls across the river, and the founding of the Mount Hermon School, Gill experienced a rising population during the Late Industrial period, recording a growth rate of 45.6 percent (MHC, 1982, p. 8). Between 1870 and 1895, the town grew by 65.7 percent, reaching a high of 1,082 persons in the latter year. After 1895, however, this advance stopped, and by 1915 the number of residents stood at only 951.

Several factors gave Gill an economic boost during the industrial period. In the 1860s, with the re-establishment of the Connecticut River log drives, Holmes, Wood & Co. began the extensive sawmills at Riverside which five years later were incorporated as the Turners Falls Lumber Company (MHC, 1982, p. 8). In 1875, the lumber company reported an annual product value of $17,000 - a figure which also represented the total value of Gill's manufactured product that year (MHC, 1982, p. 9). In 1879, it was reported: "Running to its full capacity, the company's mill employs the services of forty men, and produces from 30,000 to 40,000 feet of lumber daily" (Everts, 1879, p. 204).

A second factor in the development of Gill was the establishment of the Turners Falls Company, and the laying out of what was hoped would be an extensive manufacturing city in the early 1870s. With the completion of a suspension bridge connecting Turners Falls and Riverside in 1878, Riverside rapidly grew in favor among the businessmen of Turners Falls as a place of suburban residences. The founding of the Mt. Hermon School in 1881 both increased the town's population and opened up a new market for farm and dairy products (MHC, 1982, p. 8).

In the Late Industrial period, Montague's population had the highest growth rate, 256.3%, of any town in Franklin County, although most of this growth occurred during the boom period of Turners Falls between 1870 and 1890, when the town grew on average by over 200 persons a year. By 1915, with the population at 7,925, Montague was the second largest town in the county, after Greenfield (MHC, 1982a, p. 10).

In 1866, Crocker's Turners Falls Company purchased land in Montague, lying on the river-front and adjacent to the falls. They then built a bulkhead at a cost of $24,000, and on March 20, 1867, a dam, costing $105,000, was completed (Fogg, 1912, p. 291). The width from shore to shore was upward of 500 feet, with Great Island located about midway between the banks. The fall over the dam was nearly thirty feet, with the entire fall controlled by the company about eighty vertical feet. The company's power canal occupied a portion of the bed of the old canal. In 1879, the company's assets included, besides the dam and canal, upward of 1,300 acres of land, covering a long stretch of mill-sites on the river-front, and building-sites and other real estate in the village, as well as the water-right at Factory Village, in Greenfield, on Fall River, just above Turners Falls (Everts, 1879, p. 310).

Among the earliest new industries at Turners Falls was the cutlery factory of the John Russell Manufacturing Company, which relocated from Greenfield with a dramatic expansion of its plant in 1868-70. Despite a reorganization of the company, by 1880 it still only employed half of the plant's designed capacity (MHC, 1982b, pp. 13-14). The company's 600 cutlery employees made up almost half the manufacturing work force of Montague that year. Three paper companies: Montague Paper (1871), Keith Paper (1874), and Turners Falls Paper (1879) employed another 485 workers. All three were part of an interlocking directorate including directors of the Turners Falls Company itself. For the paper mills, the Turners Falls Company purchased the water and water rights of the Falls River between Greenfield and Gill. The Turner Falls Company also attracted one cotton manufacturer, Joseph Griswold, who built a cotton mill at Turners Falls in 1879 (MHC, 1982a, p. 10).

Each of these new companies built impressive manufacturing plants, with the factory and mill of the Montague Paper Company being typical. In 1871, a three-story brick mill, 128 by 55 feet, was erected just west of the Russell Company's works, and the work of manufacturing news-printing paper began (MHC, 1984, p. 187). In 1872 the manufacture of book-paper was inaugurated. In 1874, the works were enlarged by the addition of a three-story wing, 100 by 55 feet; in 1875, the company purchased the works of the Turners Falls Pulp Company, directly east, and consisting of a two-story brick building, 200 by 55 feet. The latter was soon enlarged, and by 1879 the company had a front on the river of 560 feet (Fogg, 1912, p. 292; Everts, 1879, pp. 308-310).

In the 1890s, Turners Falls continued to expand with a new paper mill (Marshall Paper), shoe factory (G.F. Littlefield), and leather manufacturer (Shawmut Mfg. Co.). The Turners Falls Company capitalized on the hydroelectric potential of the canal and in 1904 the firm extended the original canal by 1,000 feet to a hydroelectric plant on the Connecticut River shore (Fogg, 1912, p. 292). In 1914-15 a new dam was constructed, and the canal was widened from 50 to 130 feet, extending it two miles along the Connecticut River. Completion of the new Cabot Station, ca. 1915, gave the company the largest hydroelectric production capability in the Connecticut River Valley (MHC, 1982a, p. 10).

In 1905, the wooden crib dam at Turners Falls was replaced with a concrete dam with the same elevation. By 1907, electricity generated in Turners Falls was being transmitted to Amherst. The elevation of the dam was raised to 172 feet in 1913 which extended the impoundment upstream to the French King Gorge (Fogg 1912, p. 292). By 1915, flashboards had been added to the dam raising the water level to 179 feet and extending the impoundment to the confluence of the Ashuelot River in Hinsdale, New Hampshire. Power generated in Turners Falls could now be used in the greater Springfield, Massachusetts area. Just ten years later, due to the expansion of transmission facilities and increases in generation efficiency, the Connecticut River at Turners Falls supplied electricity to homes and businesses as far south as Hartford, Connecticut and as far west as Pittsfield, Massachusetts.

Turners Falls and Montague essentially reached the peak of their industrial development in the pre-World War I period; with the exception of several new industrial plants along the lower end of the canal in Turners Falls, relatively little new industrial development occurred after the war (MHC, 1982, p. 12).

The 1920s saw an increased demand for electricity, so the Turners Falls Company expanded its transmission system southward and by 1923 had reached the Springfield area. Another line went westward across the Berkshires to Pittsfield. In 1925 the company interconnected with other utilities by means of a line going south from Agawam. This was their first interconnection with a neighboring major utility. Also in 1925, the Turners Falls group became one of the originators of the Connecticut Valley

Power Exchange for the purpose of coordinating hydro generation in Massachusetts with thermal generation at Springfield and Hartford (Northeast Utilities, 1991).

Significant improvements of the east-west highway corridor from Greenfield to Boston occurred during the 1920s and 1930s, with Route 2 and the Mohawk Trail bypass around Turners Falls completed by 1931, including the monumental Art Deco-style concrete bridges over the Connecticut River at French King Rock and at Turners Falls Dam with a short span over the Fall River. The Riverdale suspension bridge was destroyed in the 1936 flood although the piers remain intact at Bridge Street (MHC, 1982, p. 12).

In 1942, Western Massachusetts Electric Company (WMECO) was formed following the consolidation of several electric companies. The Federal Power Commission then issued WMECO a license to operate the Turners Falls power generating facility. In 1965, three Connecticut River valley power companies, including WMECO, merged to form Northeast Utilities Service Company (NU). Projected energy deficits and the 1965 power blackout led NU to develop plans to increase generating capacity. One of the projects proposed by NU was the Northfield Mountain Pumped Storage Project (Northeast Utilities, 1991).

4.10.4 Archeological Resources

Staff of the Massachusetts Historical Commission (MHC) reviewed FirstLight's request for information, submitted on September 30, 2011, relevant to the relicensing of the Northfield Mountain and Turners Fall Projects. By letter dated October 7, 2011, the MHC recommended that a qualified cultural resource consultant research and compile the information required by FERC relicensing application for identified historic and archaeological resources and archaeologically sensitive areas. As per the MHC, the cultural resources consultant will evaluate the potential effects on historic and archaeological resources of the Projects' operations, and any new construction, demolition or rehabilitation, which may be required for the facilities. Given the sensitivity for archaeological resources within the general region, it is likely that a Phase 1A study would be required. A Phase IA study would include a literature review and archaeological site file search at the Massachusetts, Vermont, and New Hampshire State Historic Preservation Offices (SHPOs), in addition to further consultation with those agencies.

4.10.5 Historic Structures

Online research on the National Park Service-National Register of Historic Places (NRHP) website indicates that there are no NRHP-listed architectural resources located within the Project boundaries. To date, there have been no architectural surveys following current MA-SHPO, VT-SHPO or NH-SHPO guidelines conducted within the Northfield Mountain and Turners Falls Project boundaries sufficient to render determinations of NRHP-eligibility for buildings or structures 50 years or older. Information from any architectural studies conducted in connection with the issuance of a license in 1980 for the Turners Falls Project is considered out-of-date according to current guidelines and not sufficient to determine NRHP-eligibility.

Preliminary online research (the online Massachusetts Cultural Resources Information System (MACRIS) database) indicates that an architectural survey has been conducted with respect to the Turners Falls Project including the Power Canal and buildings associated with the Turners Falls Power Company in the NRHP-listed Turners Falls Historic District, but the survey forms for these buildings and structures have not been digitized and are not available online. Most of this information dates from the district's listing in the NRHP in 1982 and is considered out-of-date and incomplete by the MHC.

Similarly, survey forms for architectural resources located within the vicinity of the Turners Falls Project in Vermont (such as the Vernon Dam and Powerhouse) and in Hinsdale, New Hampshire are not available online and there is no database in either state corresponding to MACRIS.

4.11 Socio-Economic Resources (18 C.F.R. § 5.6 (d)(3)(xi))

4.11.1 Population Patterns

The Pioneer Valley region encompasses 43 cities and towns in the Connecticut River Valley in western Massachusetts. An estimated 608,000 people live in the nearly 1,200-square-mile region, which includes the fourth largest metropolitan area in New England (Springfield). The Pioneer Valley's diverse economic base, its renowned academic institutions, and its wealth of natural resources make it a unique place to live and work. Residents live in downtown areas, suburban neighborhoods, quiet villages, historic areas, and rural homesteads. People work in downtown offices in Springfield, the region's cultural and economic center; in plants and factories in Holyoke and Chicopee, the first planned industrial communities in the nation; in academic halls in Amherst, Northampton, and South Hadley, home to venerable colleges and a flagship university; in tobacco fields in Hadley, where families have worked the land for generations; in distribution centers in Westfield, near the crossroads of two interstate highways; and in offices scattered throughout the region (PVPC, 2012).

The area immediately surrounding the Turners Falls Project and Northfield Mountain Project is relatively rural in nature. Franklin County is the most rural in Massachusetts, and Greenfield is its largest municipality. Based on the results of the 2010 census (presented in Table 4.11.1-1), the estimated populations of the three counties within the Turners Falls Project and Northfield Mountain Project boundary—Franklin County, MA, Cheshire County, NH, and Windham County, VT—are 71,444, 77,274, and 44,453, respectively. This translates to population densities of 99 people per square mile in Franklin County, 106 people per square mile in Cheshire County, and 56 people per square mile in Windham County. Housing densities are roughly 46, 48, and 37 units per square mile, respectively (US Census Bureau, 2010).

Table 4.11.1-2 shows that over the last decade, populations have remained relatively stable in the Turners Falls Project and Northfield Mountain Project vicinity—ranging from a decline of 0.1 percent in Franklin County to an increase of 4.7 percent in Cheshire County (US Census Bureau, 2010).

The nearest major town is Greenfield, MA, which has a population of 17,610 (2010) and a town center located about 4 miles southwest of the Turners Falls dam. Other significant population centers near the Turners Falls Project and Northfield Mountain Project are shown in Table 4.11.1-3 and include Northampton (28,709 residents, 28 miles south of the Turners Falls Project and Northfield Mountain Project), Amherst (37,819 residents, 17 miles south of the facilities), Holyoke (39,885 residents, 38 miles south), Springfield (152,906 residents, 48 miles south), and Hartford, CT (124,775 residents, 70 miles south). For reference, Boston is approximately 106 miles east of the Turners Falls Project and Northfield Mountain Project and has about 602,609 residents (US Census Bureau, 2010).

Table 4.11.1-1: Population and Housing Data in the Turners Falls Project and Northfield Mountain Project Vicinity

County	Population (2010)	Housing Units (2010)	Land Area (sq. mi.)	Population Density (people/sq. mi.)	Housing Density (units/sq. mi.)
Franklin Co., MA	71,444	33,695	725	99	46
Cheshire Co., NH	77,274	34,682	729	106	48
Windham Co., VT	44,453	29,601	798	56	37

Source: US Census Bureau, 2010

Table 4.11.1-2: Population Trends in the Turners Falls Project and Northfield Mountain Project Vicinity

County	Population (2000)	Population (2010)	Percent Change
Franklin Co., MA	71,535	71,444	-0.13%
Cheshire Co., NH	73,825	77,274	4.67%
Windham Co., VT	44,216	44,453	0.54%

Source: US Census Bureau, 2010

Table 4.11.1-3: Major Population Centers near the Turners Falls Project and Northfield Mountain Project

Town or City	Population (2010)	Approximate Distance from Turners Falls Dam (mi)
Greenfield, MA	17,610	4
Amherst, MA	37,819	17
Brattleboro, VT	7,136	22
Northampton, MA	28,709	28
Keene, NH	23,547	36
Holyoke, MA	39,885	38
Springfield, MA	152,906	48
Hartford, CT	124,775	70
Boston, MA	602,609	106

Source: US Census Bureau, 2010

4.11.2 Economic Patterns

Income distributions of the counties in the Turners Falls Project and Northfield Mountain Project vicinity are shown in Table 4.11.2-1. Median household income in the region was lower than that for Massachusetts overall ($62,072), ranging from $47,386 in Windham County to $52,644 in Cheshire County. In 2010, 12.7 percent of households throughout the state earned less than $15,000; this figure was identical for Franklin County and was bracketed by Cheshire and Windham counties at 9.7 percent and 13.3 percent, respectively. Additionally, while over 29 percent of Massachusetts households earned more than $100,000 in 2010, only 17.2 percent of households in Franklin County, 17.7 percent in Cheshire County, and 14.5 percent in Windham County surpassed that amount (US Census Bureau, 2010).

Table 4.11.2-2 displays the distribution of the civilian employed population (age 16 or over) for each county and the Commonwealth of Massachusetts. In general, counties in the Turners Falls Project and Northfield Mountain Project vicinity have a higher percentage of people employed in the natural resources, construction and maintenance sector and the production, transportation, and material moving sector than in Massachusetts overall, while less people are employed in the management, business, science, and arts sector. Additionally, unemployment rates are lower in the Turners Falls Project and Northfield Mountain Project vicinity—ranging from 6.5 percent in Windham County to 9.7 percent in Cheshire County, compared to 10.2 percent for Massachusetts (US Census Bureau, 2010).

Some of the larger employers in the Turners Falls Project and Northfield Mountain Project vicinity include the Greenfield Community College (300 employees in 2010), Yankee Candle in Whately (1,500 employees), Cooley Dickinson Hospital and Smith College in Northampton (1,800 and 1,000 employees, respectively), and the University of Massachusetts in Amherst (7,900 employees) (Clarke, 2011).

FirstLight employs approximately 53 full-time employees at the Northfield Mountain Project and 12 full-time employees at the Turners Falls Project.

Table 4.11.2-1: Income Distribution for Households in the Turners Falls Project and Northfield Mountain Project Vicinity

County or State	Median Household Income (2010)	Percent of Households with Incomes More than $100,000	Percent of Households with Incomes Less than $15,000
Franklin Co., MA	$50,514	17.2%	12.7%
Cheshire Co., NH	$52,644	17.7%	9.7%
Windham Co., VT	$47,386	14.5%	13.3%
Massachusetts	$62,072	29.2%	12.7%

Source: US Census Bureau, 2010

Table 4.11.2-2: Occupation Distribution in the Turners Falls Project and Northfield Mountain Project Vicinity

County or State	Occupation*					Percent Unemployed
	Management, business, science, and arts	Service	Sales and office	Natural resources, construction, and maintenance	Production, transportation, and material moving	
Franklin Co., MA	37.5%	15.6%	23.3%	10.1%	13.5%	7.8%
Cheshire Co., NH	34.5%	17.3%	23.0%	9.0%	16.1%	9.7%
Windham Co., VT	39.0%	18.1%	20.2%	11.2%	11.5%	6.5%
Massachusetts	43.5%	17.4%	23.5%	6.8%	8.9%	10.2%

4.11.3 Transportation Infrastructure and Access

Figure 4.9.1-1 depicts the major transportation routes that provide access to the Turners Falls Project and Northfield Mountain Project area. Interstate 91 is the major north-south transportation corridor that parallels the Connecticut River from its confluence with the Passumpsic River in Barnet, VT and Monroe, NH south to Hartford, CT. US Highway 5 follows a similar route to the west of the Turners Falls Project and Northfield Mountain Project vicinity through Greenfield. State Route 2 travels east-west through the state from the Boston area, connecting Millers Falls and Turners Falls via the French King Bridge. Several smaller roads provide access along the Turners Falls Impoundment, including Route 63 on the east side and Route 142 and Main Road in Gill on the west side. Other Connecticut River road crossings in the Turners Falls Project and Northfield Mountain Project vicinity include the Route 10 Bridge in Northfield, the Gill-Montague Bridge directly below Turners Falls Dam, the Turners Falls Road Bridge in the bypass reach, and Montague City Road Bridge just above the confluence with the Deerfield River, as well as crossings of Power Street and 11th Street over the power canal.

The New England Central Railroad (NECR) connects the Vermont and Quebec border just south of Montreal to the port of the Thames River in New London, CT. This railroad traverses the Turners Falls Project and Northfield Mountain Project area on the east side of Turners Falls Impoundment from Millers

Falls up to Northfield, where it crosses to the west side just below the state border. South of the Turners Falls Project and Northfield Mountain Project, the NECR parallels the Connecticut River down to Amherst, where it then veers southeast. In Millers Falls, the NECR interchanges with the Norfolk Southern and Pan Am Southern (NS/PAS) railroad, which travels east-west through the state, connecting Maine and New York. The NS/PAS crosses the Connecticut River near McLellan Farm Road in East Deerfield. An abandoned branch of this railroad crosses the river upstream, just below the mouth of the Deerfield River. The Pan Am Southern (PAS) continues south along the Connecticut River to Northampton, Springfield, and beyond, following the route of the original Connecticut River Railroad.

Turners Falls Airport, a small public airport in Montague, also provides access to the Turners Falls Project and Northfield Mountain Project area.

4.12 Tribal Resources (18 C.F.R. § 5.6 (d)(3)(xii))

There are no Native American reservations within the Turners Falls Project and Northfield Mountain Project area. There are no federally recognized tribes in Vermont or New Hampshire, but there are two federally recognized tribes in Massachusetts as listed below.

Wampanoag Tribe of Gay Head (Aquinnah)
20 Black Brook Road
Aquinnah, MA 02535-1546

Mashpee Wampanoag Indian Tribe Council
P.O. Box 1048
Mashpee, MA 02649

There are no state recognized tribes in Massachusetts or New Hampshire. There are two tribes in Vermont that may have a potential interest in the Projects:

Nulhegan Abenaki Tribe
158 Whiting Lane
Browningtion, VT 05860

Elnu Abenaki Tribe
Robert Longtoe Sheehan
Tribal Headquarters
5243 VT Route 30
Jamaica, VT 05343

Other potentially interested Native American tribes include:

Stockbridge-Munsee Community
N8476 Moh He Con Nuck Road
P.O. Box 70
Bowler, WI 54416

Narragansett Indian Tribe
P.O. Box 268
Charlestown, RI 02813

5 PRELIMINARY ISSUES AND STUDIES LIST (18 C.F.R. § 5.6 (d)(4))

5.1 Issues Pertaining to the Identified Resources

This section identifies preliminary issues potentially pertaining to FirstLight's continued operation of the Turners Falls and Northfield Mountain Projects based upon existing resource information summarized in Section 4 and consultation with state and federal agencies.

5.1.1 Geology and Soils

- Effects of the Turners Falls Project and Northfield Mountain Project operations, if any, on streambank erosion.

5.1.2 Water Resources

- Effects of potential alternative modes of operating the Turners Falls Project and Northfield Mountain Project on hydropower generation.

5.1.3 Water Quality

- Effects of the Turners Falls Project and Northfield Mountain Project operations, if any, on dissolved oxygen and temperature [given the potentially controlling effects of the upstream Vermont Yankee Nuclear Power Station].

5.1.4 Fish and Aquatic Resources

- Effectiveness of upstream passage for American shad at all three fish passage facilities.
- Effectiveness of existing upstream passage for American eels.
- Effectiveness of downstream passage for juvenile and post-spawned adult American shad, river herring, and out-migrating adult silver eels.
- Effects of the Turners Falls Project, if any, on the upstream passage of shortnose sturgeon at Turners Falls Dam (historic upstream limit of range).
- Effects of Project operations (Cabot, Station No. 1), if any, on shortnose sturgeon spawning habitat.
- Effects of changes in water levels and flows from the Turners Falls Project operation, if any, on zone of passage and fish habitat.

5.1.5 Terrestrial Wildlife and Botanical Resources

- Effects of changes in water levels and flows from the Turners Falls Project and Northfield Mountain Project operations, if any, on wildlife and botanical habitat and species within the Projects' boundaries.

5.1.6 Wetlands, Riparian, and Littoral Habitat

- Effects of Turners Falls Project and Northfield Mountain Project operations, if any, on wetland, riparian and littoral zone habitat within and adjacent to the Projects' boundary.

5.1.7 Critical Habitat and Threatened and Endangered Species

- Effects of Turners Falls Project and Northfield Mountain Project operations, if any, on habitat for several federal and state listed rare, threatened, and endangered species.

5.1.8 Recreation and Land Use

- Effects of Turners Falls Project and Northfield Mountain Project operations, if any, on existing recreational facilities, such as boat ramps.

- Projected future use of recreation facilities.

5.1.9 Aesthetic Resources

- No specific issues identified at this time. Information from other studies proposed herein can be utilized to assess effect, if any, of the Turners Falls and Northfield Mountain Projects on these resources.

5.1.10 Cultural Resources

- Effects of Turners Falls Project and Northfield Mountain Project operations, if any, on historic properties, including pre-contact and post-contact archaeological resources and above-ground structures.

5.1.11 Socio-Economic Resources

- No specific issues identified at this time. Information from other studies proposed herein can be utilized to assess effect, if any, of the Turners Falls and Northfield Mountain Projects on these resources.

5.1.12 Tribal Resources

- No specific issues identified at this time. Information from other studies proposed herein can be utilized to assess effect, if any, of the Turners Falls and Northfield Mountain Projects on these resources.

5.2 Potential Studies or Information Gathering

This section preliminarily identifies potential studies or information gathering that may be needed to analyze the preliminary resource issues identified in Section 5.1. FirstLight considered these issues along with feedback received from stakeholders during the PAD development to identify the following potential studies or information gathering needs by resource area. Because the list of proposed studies and information is preliminary, it may be modified during development of FirstLight's Proposed Study Plan. FirstLight will consult with stakeholders to develop any necessary study plans for the Turners Falls and Northfield Mountain Projects as described in the schedule presented in Section 2 of this PAD.

5.2.1 Geology and Soils

Information from previously conducted studies and ongoing studies, all of which are discussed in Section 4.2, will be utilized to assess the effects, if any, of the Turners Falls and Northfield Mountain Projects on streambank erosion.

5.2.2 Water Resources

5.2.2.1 *Assess Turners Falls Project and Northfield Mountain Project operations on hydropower generation.*

Study Objectives:

- To develop a calibrated operations model that reasonably simulates the current operation of the Turners Falls Project and Northfield Mountain Project including the timing, magnitude and duration of flow, reservoir elevations and hydropower generation.

Project Nexus:

During the relicensing process, FirstLight intends to evaluate potential modifications to the existing Turners Falls Project and Northfield Mountain Project as described in Section 3.4.4. In addition, as the relicensing process proceeds, alternative operations may be evaluated. It is important to understand how any alternative mode of operation could result in gains or losses in generation at the Turners Falls Project and Northfield Mountain Project.

Methodology/Level of Effort:

The USACE, in working for the Nature Conservancy, developed a simulation model of the entire Connecticut River Basin. The specific simulation model is a program developed by the USACE called Hydrologic Engineering Center- Reservoir Simulation (or HEC-ResSim). FirstLight will use this model, but update it to reflect an hourly time step.

5.2.3 Water Quality

5.2.3.1 *Assess the effects of Turners Falls Project and Northfield Mountain Project operations on dissolved oxygen and temperature.*

Study Objectives:

- Collect dissolved oxygen and temperature data during the summer period and under various hydropower operating conditions at the Vernon Hydroelectric Project, Turners Falls Project, and Northfield Mountain Project.

Project Nexus:

Operation of upstream hydroelectric projects as well as the Turners Falls Project and Northfield Mountain Project may impact water quality through the use of water for hydropower generation.

Methodology/Level of Effort:

The water quality study will include two components: a) continuous dissolved oxygen and temperature monitoring at specific locations in the Turners Falls Project and Northfield Mountain Project area and b) monthly *in-situ* dissolved oxygen and temperature profiles within the Turners Falls Impoundment in the Northfield Mountain Upper Reservoir. It is anticipated that the study will be conducted from approximately June 15 through September 30.

5.2.4 Fish and Aquatic Resources

5.2.4.1 *Evaluate the Need for Potential Improvements to Existing Downstream Fish Passage/Protection Measures for American Shad, and American Eel*

Information from previously conducted studies and ongoing studies will be utilized to assess issues related to downstream passage for American shad and American eel at the Turners Falls Project.

5.2.4.2 *Evaluate the Need for Potential Improvements to Existing Upstream Fish Passage Facilities for American Shad, and American Eel*

Information from previously conducted studies and ongoing studies will be utilized to assess issues related to upstream passage for American shad and American eel at the Turners Falls Project.

5.2.4.3 *Assess Effects of Project Operations (Cabot, Station No. 1) on Shortnose Sturgeon*

Study Objectives:

The study objectives include:

- Assess effects of discharges from Cabot Station and Station No. 1, if any, on shortnose sturgeon spawning

Project Nexus:

Shortnose sturgeon are believed to spawn at discrete sites within rivers. Two areas (Rock Dam and below Cabot Station) near Montague, have consistently been found to provide spawning habitat for shortnose sturgeon, in the 1.4-km reach of the Connecticut River from the Rock Dam to 200 meters downstream of Cabot Station. These areas are located just downstream of the species' historical limit in the Connecticut River at Turners Falls. The Montague sites have been verified as spawning areas based on successful capture of sturgeon eggs and larvae over several years. Researchers at Conte Lab have theorized that shortnose sturgeon recruitment to the entire Connecticut River population may come from this spawning area.

Methodology/Level of Effort:

Results of the instream flow habitat assessment and operations model will be utilized to assess effects of current and proposed operation on sturgeon spawning habitat.

5.2.4.4 *Conduct Instream Flow Habitat Assessment in Bypass Reach and below Cabot Station*

Study Objectives:

The study objectives include:

- Assess effects of discharges from Cabot Station, if any, on zone of fish passage and habitat.

Project Nexus:

Discharges from Cabot Station may affect the Connecticut River downstream to the Sunderland Bridge where the Holyoke Dam (FERC No. 2004) impoundment begins. This stretch of the river has been identified as a major spawning area and overwintering area for the ESA listed shortnose sturgeon. Other diadromous species such as American shad adults and juveniles, American eels and Atlantic salmon may need to traverse this reach during their upstream and downstream migrations.

Although there are no year-round minimum flow requirements for the Turners Falls bypass reach, a 400 cfs seasonal minimum flow is currently required during the upstream passage season. Special releases also occur to protect the federally listed endangered shortnose sturgeon in the bypass reach below the Turners Falls Dam. This flow release was determined in 1992 in consultation with MADFW and NMFS to ensure that an adequate zone of passage exists in the reach during the spring and summer months when sturgeon may be present and require volitional movement.

Methodology/Level of Effort:

The proposed study methodology involves a phased approach beginning with a field survey to identify the mesohabitat present in the study area and to delineate the relative quantity and spatial distribution of each habitat type. Each mesohabitat type of interest will be assigned specific attributes to be used for field delineation. The exact classification criteria for each mesohabitat type will be developed in consultation with the state and federal agencies. The mesohabitat mapping and accompanying characterization of aquatic mesohabitat will provide essential information regarding the character and extent of aquatic habitat that may be affected by Turners Falls Project operation and to determine what level of secondary phase of study if any, may be necessary.

5.2.5 Terrestrial Wildlife and Botanical Resources

5.2.5.1 *Conduct Baseline Inventory of Botanical Resources in the Turners Falls Impoundment, the Bypass Reach, and below Cabot Station*

Study Objectives:

The study objectives include:

- To provide information pertinent to:
- existing wildlife (bird and mammal) habitats in riparian areas;
- the presence of waterfowl, wading, shore birds, and raptors;
- the presence of aquatic furbearers such as otter, beaver, and mink;
- the nature and extent of riparian and adjacent wetlands and botanical resources (including invasive and exotic species); and
- the presence of RTE species or associated habitats.

Project Nexus:

The Turners Falls and Northfield Mountain Projects provide habitat for a variety of wildlife and botanical species. Water levels fluctuations have the potential to affect littoral zone habitat for a variety of life stages of terrestrial resources. An understanding of the terrestrial resources in the project area would provide information on the type and quantity of habitat potentially affected by project operations.

Methodology/Level of Effort:

A field survey of the shoreline will be conducted within the Turners Falls Impoundment, in the Bypass Reach, and below Cabot Station to document the type and distribution of wildlife habitats and wetlands (including verification of existing NWI mapping), including vegetation communities and plant species, present in the project area. A field survey of wildlife species (e.g., birds and mammals) will be conducted concurrently with botanical and wetland surveys. The presence of any RTE species or habitats will also be noted. This field effort will document wildlife species, habitats, sightings, and signs of presence within the project area, as well as document the botanical and wetland resources of the Projects.

5.2.6 Wetlands, Riparian, and Littoral Habitat

FirstLight proposes to conduct field verification of NWI mapping and habitat mapping as identified under Section 5.2.5.

5.2.7 Critical Habitat and Threatened and Endangered Species

FirstLight proposes to conduct field survey of wildlife and botanical species and habitat as identified under Section 5.2.5, which would include terrestrial critical habitat and RTE species. As described under Section 5.2.4, FirstLight also proposes to evaluate instream flows relative to shortnose sturgeon spawning areas as well as assessing the effects of Cabot station on shortnose sturgeon.

5.2.8 Recreation and Land Use

5.2.8.1 *Recreation Use/User Contact Survey*

Study Objective:

The objectives of the study are:

- Determine the amount of recreation use at the Turners Falls and Northfield Mountain recreation site; and
- Interview the recreating public to determine user opinions and goals with regard to the recreation sites.

Project Nexus:

FERC policy requires licensees to provide reasonable public recreation opportunities consistent with the safe and effective operation of the project.

Methodology/Level of Effort:

FirstLight proposes to conduct a user count at the Turners Falls Project and Northfield Mountain Project recreation sites using both pressure tube counters and visual counts. Staff would also conduct calibration counts to support the tube counters. FirstLight proposes to develop and conduct contact surveys to determine the views of the recreating public with regard to the available recreation sites and activities within the Turners Falls Project and the Northfield Mountain Project boundary and to also request zip code information to assist with determining user distribution. FirstLight proposes to use this information in conjunction with the Recreation Facilities Inventory and Assessment to determine the sufficiency of existing recreation facilities.

5.2.8.2 *Recreation Facilities Inventory and Assessment*

Study Objective:

The objective of this study is to complete a thorough investigation of the existing recreation facilities within the Turners Falls Project and Northfield Mountain Project boundary.

Project Nexus:

FERC policy requires licensees to provide reasonable public recreation opportunities consistent with the safe and effective operation of the project.

Methodology/Level of Effort:

The bulk of this study was conducted in 2012 and a summary of the results have been included in Section 4.8.1. FirstLight used a standardized survey form to evaluate each existing recreation facility to determine its current condition. This included all structures and amenities at each facility. FirstLight proposes to use this information in conjunction with the Recreation Use/User Contact Survey and the results from the 2014 Form 80 survey to assess the sufficiency of existing recreational facilities.

5.2.8.3 *Land Use Classification/Inventory*

Study Objective:

The objective of this study is to determine the appropriate land use classifications lands within the Turners Falls Project and Northfield Mountain Project boundary.

Project Nexus:

Operation of the Turners Falls Project and the Northfield Mountain Project may have the potential to affect access to the Projects' lands and land use.

Methodology/Level of Effort:

FirstLight proposes to review the existing land use information available and determine the appropriate land use classes for the Turners Falls Project and Northfield Mountain Project. Once the classifications are determined, staff will review available aerial photography and apply the appropriate classification to the Turners Falls Project and Northfield Mountain Project lands.

5.2.8.4 *Assessment of Effects of Project Operation on Recreation and Land Use*

Study Objective:

The objective of this study is to determine if the operation of the Turners Falls Project and the Northfield Mountain Project has an effect on the recreation facilities or land use within either Project.

Project Nexus:

Operation of the Turners Falls Project and the Northfield Mountain Project may have the potential to affect recreational opportunities and access to the Projects' lands.

Methodology/Level of Effort:

FirstLight proposes to use the information derived from the studies set forth in Sections 5.2.8.1 and 5.2.8.2 to assess the potential impact of continuing operation and maintenance of the Projects' on recreation facilities (for example, the potential effect of water level fluctuations on existing boat ramps).

5.2.9 Aesthetic Resources

Adequate information exists for FirstLight to assess effects, if any, of the Turners Falls and Northfield Mountain Projects on this resource.

5.2.10 Cultural Resources

5.2.10.1 *Phase 1A Archaeological Survey and Historic Structures Survey*

Study Objective:

The objective of the survey is to identify historic properties listed in or eligible for listing in the NRHP and to identify and assess any potential adverse effects to historic properties from the continuing operation and maintenance of the Turners Falls and Northfield Mountain Projects.

Project Nexus:

Section 106 of the National Historic Preservation Act and its implementing regulations require FERC, prior to issuing a new license, to take into account the effect of its licensing action on historical and cultural resources eligible for listing in the National Register of Historic Places and to establish an appropriate management plan to protect such resources.

Methodology/Level of Effort:

FirstLight proposes to examine archaeological and architectural site files, cultural resources reports, and archives located at the Massachusetts, Vermont, and New Hampshire SHPOs, examine other relevant sources that may contain historical, architectural, and archaeological information on the Turner Falls Project and Northfield Mountain Project area, develop prehistoric and historic contexts and an archaeological sensitivity model; conduct field reconnaissance of the Turners Falls Project and Northfield Mountain Project area to confirm the sensitivity models and eliminate areas from further study, and conduct a reconnaissance level architectural survey of the area from which the Turners Falls and Northfield Mountain Projects may be visible to any historic resources. FirstLight may propose to conduct a Phase 1B archaeological and an intensive level architectural level survey, depending on the results of the initial survey and after consultation with the SHPOs.

5.2.11 Socio-Economic Resources

Adequate information exists for FirstLight to assess effects, if any, of the Turners Falls and Northfield Mountain Projects on this resource.

5.2.12 Tribal Resources

FirstLight will consult with the federally recognized Mashpee Wampanoag Tribe and the Wampanoag Tribe of Gay Head (Aquinnah) of Massachusetts to identify any concerns with respect to effects of the Turners Falls and Northfield Mountain Projects on tribal resources. In addition, FirstLight will also consult with the following tribes that may be interested in the relicensing: the Nulhegan Abenaki Tribe, the Elnu Abenaki Tribe, the Stockbridge-Munsee Community, and the Narragansett Indian Tribe.

5.3 Relevant Comprehensive Waterway and Resource Management Plans

Section 10(a)(2)(A) of the Federal Power Act (FPA), 16 USC § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with Federal or state comprehensive plans for improving, developing, or conserving a waterway affected by the project.

Order No. 481-A, issued on April 27, 1988, established that the Commission will accord FPA § 10(a)(2)(A) comprehensive plan status to any Federal or state plan that:

- Is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;

- Specifies the standards, the data, and the methodology used; and
- Is filed with the Secretary of the Commission.

Under 18 C.F.R. § 5.6, the PAD must list relevant qualifying Federal and state or tribal comprehensive waterway plans, and relevant resource management plans.

Based on the Commission's December 2011 revised list of comprehensive plans for Massachusetts, New Hampshire and Vermont, the following comprehensive waterway and resource management plans may pertain to the Turners Falls Project and Northfield Mountain Project area.

5.3.1 Federal and Regional Comprehensive Waterway Development Plans

Atlantic States Marine Fisheries Commission. 1995. Interstate Fishery Management Plan for Atlantic striped bass. (Report No. 24). March 1995.

Atlantic States Marine Fisheries Commission. 1998. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*). (Report No. 31). July 1998.

Atlantic States Marine Fisheries Commission. 1998. Interstate Fishery Management Plan for Atlantic striped bass. (Report No. 34). January 1998.

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Atlantic States Marine Fisheries Commission. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000.

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Connecticut River Atlantic Salmon Commission. 1992. A management plan for American shad in the Connecticut River Basin. Sunderland, Massachusetts. February 1992.

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5.3.2 Massachusetts Comprehensive Waterway Development Plans

Massachusetts Department of Environmental Quality Engineering. 1983. Connecticut River Basin water quality management plan. Westborough, Massachusetts. June 1983. 95 pp.

Massachusetts Executive Office of Energy and Environmental Affairs. Statewide Comprehensive Outdoor Recreation Plan (SCORP): Massachusetts Outdoor 2006. Boston, Massachusetts.

5.3.3 New Hampshire Comprehensive Waterway Development Plans

Connecticut River Joint Commissions. New Hampshire Department of Environmental Services. 1997. Connecticut River corridor management plan. Charlestown, New Hampshire. Concord, New Hampshire. May 1997.

Connecticut River Joint Commissions. New Hampshire Department of Environmental Services. Connecticut River corridor management plan: 2008 Update to the Water Resources Chapter: (a) Headwaters Region; (b) Upper Valley Region; (c) Wantastiquest Region; (d) Riverbend Region; and (e) Mt. Ascutney Region. Charlestown, New Hampshire. Concord, New Hampshire.

Connecticut River Joint Commissions. New Hampshire Department of Environmental Services. Connecticut River corridor management plan: 2009 Update to the Recreation Plan: (a) Headwaters Region; (b) Upper Valley Region; (c) Wantastiquest Region; (d) Riverbend Region; and (e) Mt. Ascutney Region. Concord, New Hampshire.

New Hampshire Office of State Planning. 1977. Wild, scenic, & recreational rivers for New Hampshire. Concord, New Hampshire. June 1977. 63 pp.

New Hampshire Office of State Planning. 1989. New Hampshire wetlands priority conservation plan. Concord, New Hampshire. 95 pp.

New Hampshire Office of Energy and Planning. New Hampshire Statewide Comprehensive Outdoor Recreation Plan (SCORP): 2008-2013. Concord, New Hampshire. December 2007.

New Hampshire Office of State Planning. 1991. Public access plan for New Hampshire's lakes, ponds, and rivers. Concord, New Hampshire. November 1991. 65 pp.

State of New Hampshire. 1991. New Hampshire rivers management and protection program [as compiled from NH RSA Ch. 483, HB 1432-FN (1990) and HB 674-FN (1991)]. Concord, New Hampshire. 19 pp.

State of New Hampshire. 1992. Act designating segments of the Connecticut River for New Hampshire's rivers management and protection program. Concord, New Hampshire. May 15, 1992. 7 pp.

5.3.4 Vermont Comprehensive Waterway Development Plans

Vermont Agency of Environmental Conservation. 1986. Vermont Rivers Study. Waterbury, Vermont. 236 pp.

Vermont Agency of Natural Resources. 1988. Hydropower in Vermont: an assessment of environmental problems and opportunities. Waterbury, Vermont. May 1988.

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Vermont Department of Fish and Wildlife. 1993. The Vermont plan for brook, brown, and rainbow trout. Waterbury, Vermont. September 1993.

Vermont Department of Forests, Parks and Recreation. Vermont State Comprehensive Outdoor Recreation Plan (SCORP): 2005-2009. Waterbury, Vermont. July 2005.

Vermont Natural Heritage Program. New Hampshire Natural Heritage Inventory. 1988. Natural shores of the Connecticut River: Windham County, Vermont, and Cheshire County, New Hampshire. December 1988. 14 pp.

5.4 Relevant Qualifying Resource Management Plans

5.4.1 General Description of the River Basin

Pioneer Valley Planning Commission (PVPC). (2001). *The Connecticut River Strategic Plan*. West Springfield, MA: Author.

5.4.2 Geology and Soils

None identified.

5.4.3 Water Resources

None identified.

5.4.4 Fish and Aquatic Resources

None identified.

5.4.5 Terrestrial Wildlife and Botanical Resources

None identified.

5.4.6 Wetlands, Riparian, and Littoral Habitat

None identified.

5.4.7 Critical Habitat and Threatened and Endangered Species

None identified.

5.4.8 Recreation and Land Use

None identified.

5.4.9 Aesthetic Resources

Franklin Regional Council of Governments (FRCOG). (1998). *Connecticut River Scenic Farm Corridor Management Plan*. Greenfield, MA: Author.

Franklin Regional Council of Governments (FRCOG). (2009). *Mohawk Trail Scenic Byway Eastern Section – Athol to Greenfield: Corridor Management Plan 2009*. Greenfield, MA: Author.

Franklin Regional Council of Governments (FRCOG). (2011). *Draft 2012 Regional Transportation Plan*. Greenfield, MA: Author.

5.4.10 Cultural Resources

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Massachusetts Historical Commission. (2002). *Connecticut River Stabilization Project, Durkee Upstream and Durkee Downstream Parcels, Northfield, MHC #RC.26540.EOEA #8162*. (Letter to Pat Moriarty, Northeast Utilities Service Company, Northfield, MA, December 19, 2002.)

5.4.11 Socio-Economic Resources

Franklin Regional Council of Governments (FRCOG). (2011). *Draft 2012 Regional Transportation Plan*. Greenfield, MA: Author.

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Pioneer Valley Clean Energy Collaborative. (2008). *Pioneer Valley Clean Energy Plan*. Assistance provided by Pioneer Valley Planning Commission, Franklin Regional Council of Governments, and Massachusetts Technology Collaborative.

5.4.12 Tribal Resources

None identified.

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Stone and Webster Engineering Corp. (1972b) *Supplement to the Reservoir and River Flow Management Procedures, Northfield Mountain Pumped Storage Project, Turners Falls Development*. Hartford, CT: Author.

6.2 General Description of the River Basin

Carr, J. W. & Kennedy, L. E. (2008). *Connecticut River watershed 2003 water quality assessment report (Rep. No. 34-AC-2)*. Worcester, MA: Massachusetts Department of Environmental Protection, Division of Watershed Management.

Connecticut River Joint Commissions (CRJC). (2009). *Connecticut River management plan* – Wantastiquest region. Charlestown, NH: CRJC.

Deacon, J., Smith, T., Johnston, C., Moore, R., Weidman, R., & Blake, L. (2006). Assessment of total nitrogen in the Upper Connecticut River basin in New Hampshire, Vermont, and Massachusetts, December 2002-September 2005 (Scientific Investigations Report 2006-5144). Reston, VA: US Geological Survey.

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6.3 Geology and Soils

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FirstLight Hydro Generating Company (FirstLight). (2007). *Application for amendment of license and request for expedited processing*. Northfield, MA: Author.

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US Army Corps of Engineers (USACE). (1991). *General investigation study - Connecticut River streambank erosion*. Waltham, MA: USACE, New England Division.

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6.13 Tribal Resources

See Section 6.1.10.

APPENDIX A – Summary of Contacts and Correspondence Letter Made in Preparing the PAD 18 C.F.R. § 5.6 (d)(5)

FirstLight Power Resources
GDF SUEZ

Northfield Mountain Station
99 Millers Falls Road
Northfield, MA 01360
Ph: (413) 659-4489
Fax: (413) 659-4459
Internet: john.howard@gdfsuezna.com

John S. Howard
Plant Manager

September 29, 2011

Re: Request for Information Pertaining to the Federal Energy Regulatory Commission (FERC) Relicensing of the Turners Falls Hydroelectric Project (FERC No. 1889) and the Northfield Mountain Pumped Storage Project (FERC No. 2485) on the Connecticut River.

Dear Sir/Madam:

FirstLight Power Resources (FirstLight) is beginning the process of relicensing the Turners Falls Hydroelectric Project and the Northfield Mountain Pumped Storage Project (the Projects) with the Federal Energy Regulatory Commission (FERC). The Turners Falls Hydroelectric Project consists of the Turners Falls Dam, gatehouse, canal, three fishways[1], and two hydroelectric developments (Station No. 1 and Cabot Station) located on the canal. The Turners Falls Dam creates the Turners Falls Pool, which extends into MA, VT, and NH. The Turners Falls Pool serves as the lower reservoir for the Northfield Mountain Pumped Storage Project.

Figure 1 provides a regional map of the Projects' location, and Figure 2 depicts major Project features.

FirstLight plans to use FERC's Integrated Licensing Process (ILP) for the relicensing effort. Both Project licenses expire on April 30, 2018. FirstLight must file a license application with FERC no later than April 30, 2016 (i.e., two years prior to the expiration date). FirstLight's Notice of Intent[2] (NOI) and Pre-Application Document (PAD) must be filed no later than 5 to 5.5 years prior to the license expiration, which falls within the October 30, 2011 to April 30, 2012 timeframe.

As one of the first steps in the ILP, FirstLight will develop and file the PAD with the FERC. The PAD is a document that summarizes all existing, relevant, and reasonably available information on the Projects that has been collected by FirstLight, state and federal agencies, and non-government organizations. Below is a brief table of contents for a typical PAD.

1. Introduction
2. Process Plan and Schedule
3. Description of the Project Location, Facilities, and Operations

[1] Fishways exist at Cabot Station, the gatehouse, and the Turners Falls Dam (also known as the spillway fishway).
[2] The NOI consists of paperwork that must be filed with FERC and essentially indicates that FirstLight will be seeking a new operating license for the Projects. FirstLight will file the NOI during the filing of the PAD to state that they have opted to relicense the Projects.

4. Description of Existing Environment Resources and Impacts
   - Geology & Soils
   - Fisheries & Aquatic Resources
   - Wetlands, Riparian, Littoral Habitat
   - Recreation & Land Use
   - Cultural Resources
   - Tribal Resources
   - Water Quantity & Quality
   - Wildlife & Botanical Resources
   - Rare, Threatened, & Endangered Species
   - Aesthetic Resources
   - Socio-Economic Resources
   - General Description of Basin
5. A Preliminary list of Issues and Studies

Of particular interest to FirstLight is information related to the *Existing Environmental Resources and Impacts* sections of the PAD, including:

- Fisheries (e.g., any stocking records, regulation and management plans, population surveys, creel surveys, target fish community, diadromous fish information)
- Water Quality (e.g., any water quality data collected within the Project area);
- Wetlands (e.g., any known wetlands that occur within the Project area);
- Any historical, archeological, or cultural resources in the Project area;
- Any rare, threatened, or endangered species in the Project area; and
- Any recreational information in the Project area.

FirstLight respectfully requests any information your organization may have collected regarding the environmental, recreational, and/or cultural resources along the Connecticut River in the vicinity of the Projects. We would appreciate any pertinent information you could provide by October 30, 2011. Please send any paper or electronic files to John Howard, Plant Manager, at the address above.

FirstLight recognizes that there have been numerous previous studies, analyses, and reports on these Projects covering a range of resources. To eliminate potential duplication, we have included in Attachment 1 a list of relevant references already obtained by FirstLight. Note that the references are organized by resource area, but some reports may cover more than one area.

Finally, Attachment 2 contains a distribution list of those receiving this data request. If you are aware of any other organization or group that may be interested in this matter, please let us know.

We appreciate your assistance in providing background information so we can prepare the PAD.

Sincerely,

John Howard

Attachments:
Figures 1 and 2
Attachment 1: List of References
Attachment 2: Distribution List

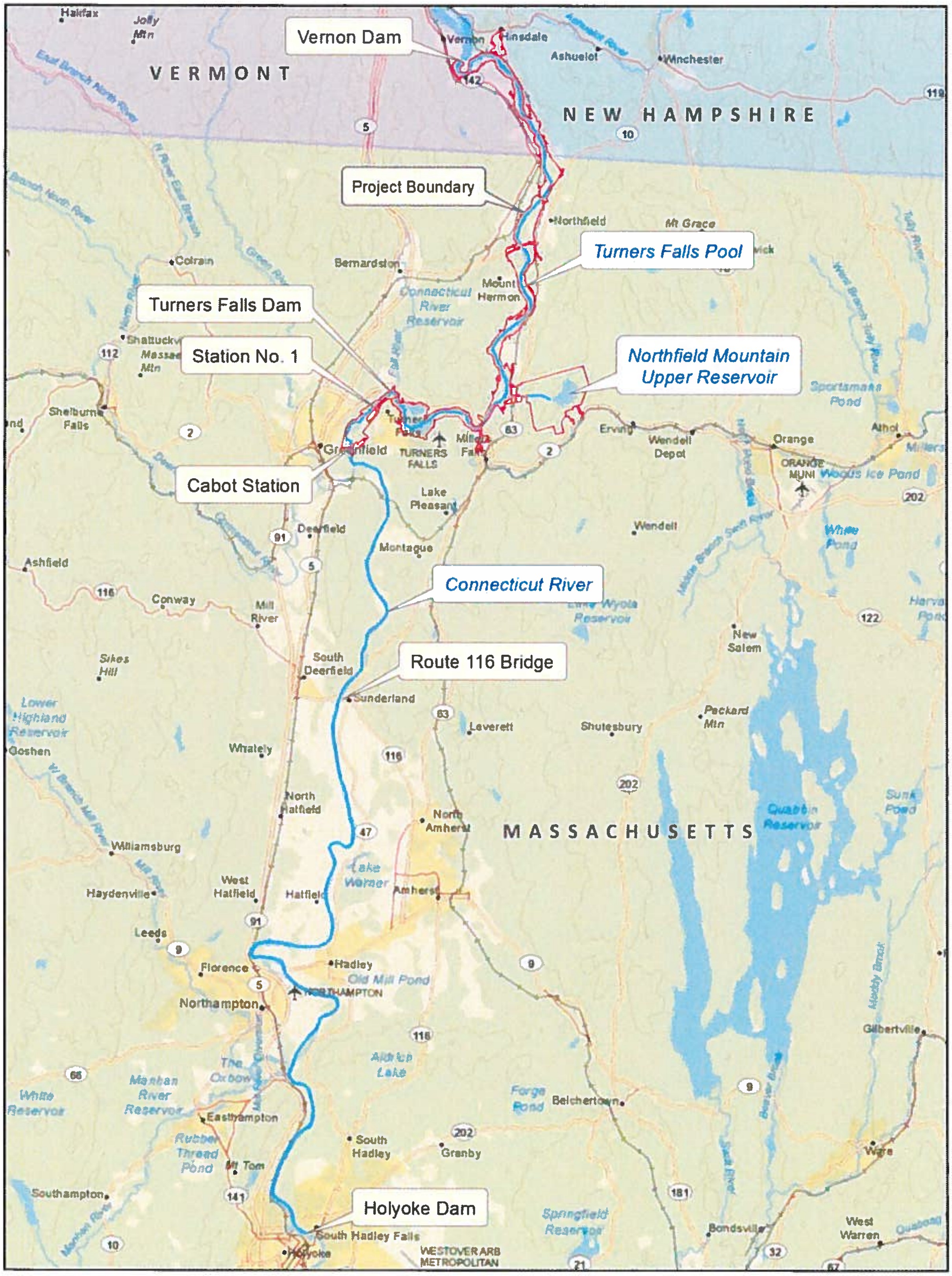

Figure 1: *Regional Map of the Northfield Mountain Pumped Storage & Turners Falls Hydroelectric Projects*

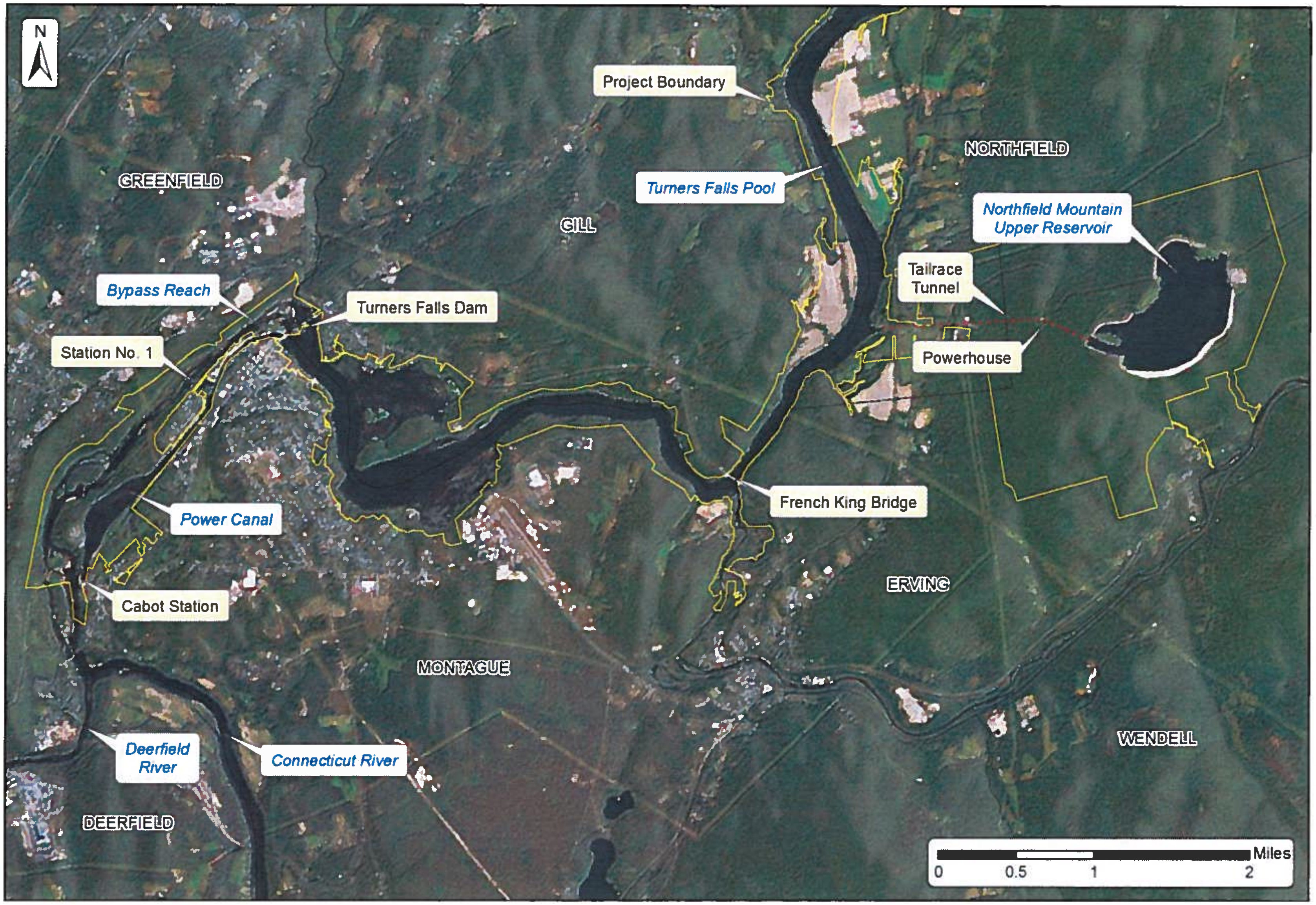

Figure 2: *Project Area Map of the Northfield Mountain Pumped Storage & Turners Falls Hydroelectric Projects*

ATTACHMENT 1: List of Relevant References by Resource Area

WATER RESOURCES

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July 6, 2012

Via E-mail and Overnight Delivery

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100 Cambridge Street, Suite 900
Boston, MA 02114

Re: Request for Advisory Opinion
FirstLight Hydro Generating Company: Northfield Mountain Pumped Storage Project and Turners Falls Hydroelectric Project

Dear Secretary Sullivan:

FirstLight Hydro Generating Company (FirstLight), an indirect subsidiary of IPR-GDF SUEZ North America, Inc., and 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), hereby submits a Request for an Advisory Opinion pursuant to 301 CMR 11.01(6)(a) and M.G.L. ch. 30, § 8. The Request pertains to whether the upcoming relicensing of the Northfield Mountain and Turners Falls Projects by the Federal Energy Regulatory Commission (FERC) subjects either Project to Massachusetts Environmental Policy Act (MEPA) jurisdiction. FirstLight requests your concurrence, based on the facts presented in this letter, that the forthcoming FERC relicensing process and the related State Actions do not require MEPA review.

Background

The Northfield Mountain Project and Turners Falls Project are located on the Connecticut River in Franklin County, in the towns of Erving, Gill, Greenfield, Montague and Northfield. Both Projects utilize water from the Connecticut River to generate hydroelectric power.

The Northfield Mountain Project consists of: (a) an upper reservoir and dam; (b) an underground powerhouse; (c) a tailrace; and (d) a lower reservoir known as the Turners Falls Impoundment (Connecticut River). The Turners Falls Project consists of: (a) two concrete gravity dams separated by an island and appurtenant facilities located on the Connecticut River in the towns of Gill and Montague, MA; (b) a gatehouse controlling flow to the main power canal; (c) the main power canal and a short branch canal; (d) two hydroelectric powerhouses, located on the power canal, known as Station No. 1 and Cabot Station; and (e) a reservoir known as the Turners Falls Impoundment.

The Turners Falls Dam is located at approximately river mile 122 (above Long Island Sound) on the Connecticut River, in the towns of Gill and Montague, MA. The tailrace of the Northfield Mountain Project is located approximately 5.2 miles upstream of Turners Falls Dam, in the town of Northfield, MA. The upper reservoir of the Northfield Mountain Project is located atop Northfield Mountain in Erving, MA.

The Turners Falls Impoundment, created by the Turners Falls Dam (which also serves as the lower reservoir for the Northfield Mountain Project), is approximately 20 miles long, extending upstream through the Connecticut River valley to the base of Vernon Dam, located in Vernon, VT.

More information about the Northfield Mountain and Turners Falls Projects can be found at http://www.NorthfieldRelicensing.com and on Attachment A.

The current FERC license for the Northfield Mountain Project was issued on May 14, 1968 and expires on April 30, 2018. The current FERC license for the Turners Falls Project was issued on May 5, 1980 and also expires on April 30, 2018. No later than April 30, 2016, two years prior to license expiration, FirstLight is required to file its final license applications with FERC for both Projects.

FERC Relicensing Process

FirstLight will apply for FERC license renewal using the Integrated Licensing Process (ILP) as set forth in Part 5 of the FERC's regulations, 18 C.F.R. Part 5. The ILP was developed to integrate the pre-filing consultation with FERC's scoping pursuant to the National Environment Policy Act (NEPA), 42 U.S.C. § 4321, *et seq*. The process is initiated with the filing of the Pre-Application Document (PAD) and Notice of Intent (NOI), which FirstLight plans to submit to FERC in the fall of 2012.

The major annual milestones in the ILP are as follows:

- 2012: Filing of the PAD and NOI with FERC in the fall.
- 2013: Formal study scoping and planning. In short, this entails developing study plans in consultation with the stakeholders.
- 2014: First field study season.
- 2015: Second field study season and, at the end of the year, file the Preliminary Licensing Proposal or Draft License Application with FERC.

- 2016: File the Final License Application with FERC and file an application for a Water Quality Certification pursuant to section 401 of the Federal Clean Water Act ("401 WQC") with the Massachusetts Department of Environmental Protection ("MADEP").

State Action

Prior to FERC issuing a new final license to FirstLight for the Projects, the MADEP must issue a 401 WQC. FirstLight believes that the issuance of a 401 WQC by MADEP could constitute an "Agency Action", specifically issuance of a "Permit" as defined in 301 CMR 11.02.

Although FirstLight expects the MADEP will consult with many other Agencies prior to issuing a 401 WQC, FirstLight has not identified other Permits or Agency Actions that are required as prerequisites for FERC to issue new licenses for the Northfield Mountain or Turners Falls Projects.

Review Thresholds and Fail-Safe

For MEPA jurisdiction to be triggered, there must be both an "Agency Action", and, except where the Secretary requires "fail-safe" review, the project must exceed the "Review Thresholds" identified in 301 CMR 11.03.

Because the proposed project is the relicensing of existing structures and operations, rather than authorization to construct new projects, FirstLight does not believe any of the Review Thresholds will be exceeded, and as a result, believes that MEPA jurisdiction would not be triggered.

Given the extensive public process associated with the FERC relicensing process itself, it does not appear that fail-safe review under 301 CMR 11.04(1) would be warranted.

Post-FERC Relicensing Construction

It is possible that the new FERC licenses issued in 2018 will require FirstLight to make physical or operational modifications to the Projects, and it is further possible that those required modifications might exceed Review Thresholds, e.g., modifications to wetlands or waterways to improve habitat functioning may exceed square footage thresholds set forth in 301 CMR 11.03(3)(a).

Because the requirements for Project modifications will not be specified until the FERC licenses have been reissued, they will need to be designed, permitted and constructed after the issuance of the FERC licenses. In FirstLight's view, the possibility that such construction may be required, and the possibility that construction may require Agency Action and exceed Review Thresholds, should not trigger the requirement for MEPA review for the original relicensing. Rather, such subsequent projects should be reviewed for MEPA applicability prior to the taking of any Agency Actions that are necessitated by requirements in the 2018 licenses.

Request for Advisory Opinion

To avoid doubt about the meaning or applicability of 301 CMR 11.00, FirstLight hereby requests the Secretary's Advisory Opinion as to MEPA applicability, including whether the relicensing of the Northfield Mountain Project or the Turners Falls Project by FERC necessitates the prior filing of an Environmental Notification Form (ENF) or an Environmental Impact Statement (EIS) with MEPA prior to the taking of any Agency Actions.

Very truly yours,

Adam P. Kahn

Enclosure: Attachment A

cc: John S. Howard, FirstLight Relicensing Project Manager
Susan M. Babcock, Esq., FirstLight Power Resources
Mark J. Wamser, P.E., Gomez and Sullivan Engineers
Robert J. McCollum, MADEP
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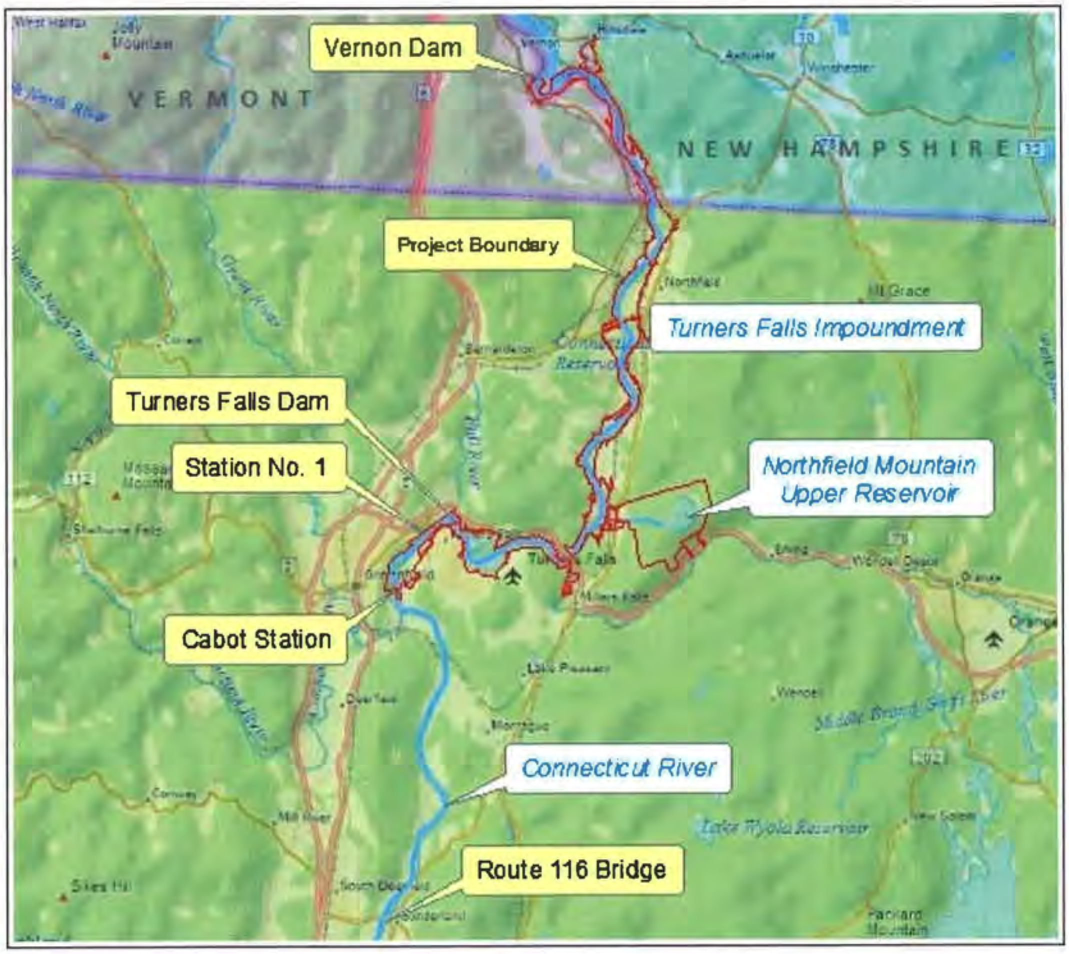
Attachment A:

Project Locations & Features

The Turners Falls Hydroelectric Project and Northfield Mountain Pumped Storage Project are located on the Connecticut River in the states of Massachusetts (MA), New Hampshire (NH) and Vermont (VT).



The greater portion of the Turners Falls Project and Northfield Mountain Project, including developed facilities and most of the lands in the Project Boundary are located in Franklin County, MA; specifically, in the towns of Erving, Gill, Greenfield, Montague and Northfield. The impoundment created by the Turners Falls Dam extends northerly into the town of Hinsdale, in Cheshire County, NH, and the town of Vernon, in Windham County, VT.

The Turners Falls Dam is located at approximately river mile 122 (above Long Island Sound) on the Connecticut River in the towns of Gill and Montague, MA. The dam creates an impoundment extending upstream approximately 20 miles to the base of TransCanada's Vernon Hydroelectric Project Dam in VT/NH. At the Turners Falls Dam is a gatehouse controlling flow into a power canal. Associated with this canal are the development's two hydroelectric generating facilities: Station No. 1 and Cabot Station. Station No. 1 is located approximately one-third of the way down the power canal, while the Cabot Station is located at the downstream terminus of the power canal. Station No. 1 discharges into the Connecticut River approximately 0.9 miles downstream of the Turners Falls Dam.

The Northfield Mountain Project is a pumped-storage facility that utilizes the Turners Falls Impoundment as its lower reservoir. The tailrace of the Northfield Mountain Project is located approximately 5.2 miles upstream of Turners Falls Dam, on the east side of the impoundment. The Northfield Mountain Project includes a man-made upper reservoir situated atop Northfield Mountain, to the east of the tailrace. Water is typically pumped from the Turners Falls Impoundment to the upper reservoir at night, while generation occurs during the day. When generating, water is passed via an underground pressure shaft to an underground powerhouse. An underground tailrace tunnel then delivers water to the Turners Falls Impoundment.

Project Facilities

Turners Falls Hydroelectric Project (FERC No. 1889)

Key features of the Turners Falls Hydroelectric Project are the Turners Falls Dam and associated impoundment, a gatehouse, a power canal, two generating stations (Station No. 1 and Cabot Station), and a bypassed reach. Each feature is described below.

Turners Falls Dam

The Turners Falls Dam consists of two individual concrete gravity dams, referred to as the Gill Dam and Montague Dam, which are connected by a natural rock island known as Great Island. The 630-foot-long Montague Dam is founded on bedrock and connects Great Island to the west bank of the Connecticut River. It includes four bascule type gates and a fixed crest section which is normally not overflowed. When fully upright, the top of the bascule gates are at elevation 185.5 feet mean sea level (msl).

The 493-foot-long Gill Dam connects Great Island to the east bank of the Connecticut River, and includes three tainter spillway gates. When closed, the elevation atop the tainter gates is at elevation 185.5 feet msl.

Turners Falls Impoundment

Turners Falls Impoundment extends upstream approximately 20 miles to the base of TransCanada's Vernon Dam in Vernon, VT. To provide storage capacity for the Northfield Mountain Pumped Storage Project, the Turners Falls Impoundment elevation may vary, per the current FERC license, from a minimum elevation of 176.0 feet msl to a maximum elevation of 185.0 feet msl; a 9 foot fluctuation as measured at the dam. The Turners Falls Impoundment is not a level pool; rather, it is sloped between Turners Falls Dam and Vernon Dam. The slope of the water surface profile steepens as the magnitude of flow increases.

Gatehouse

The gatehouse is located on the west of the Connecticut River. It forms the abutment for connecting the Montague spillway with the shoreline and is equipped with headgates controlling flow from the Turners Falls Impoundment to the power canal. The gatehouse houses 14 gates controlling flow to the power canal.

Power Canal

The power canal is approximately 2.1 miles long and ranges in width from approximately 920 feet in the Cabot forebay (downstream end of canal) to 120 feet in the canal proper. The power canal has a design capacity of approximately 18,000 cubic feet per second (cfs).

Station No. 1 and Cabot Station

FirstLight has two hydroelectric facilities located on the power canal, including Station No. 1 and Cabot Station. Station No. 1 operates under a gross head of approximately 43.7 feet, and has an approximate total electrical capacity and hydraulic capacity of 5,693 kilowatts (kW) and 2,210 cfs, respectively. Cabot Station is located at the downstream terminus of the power canal. The powerhouse houses six vertical, Francis type, single runner turbines. Cabot Station has a total station electrical capacity of 62.016 megawatts (MW) or roughly 10.336 MW/unit. The station has a total hydraulic capacity of approximately 13,728 cfs or roughly 2,288 cfs/unit.

Bypass Reach

The canal bypasses approximately 2.7 miles of the Connecticut River. Fall River, located near the head of the bypass channel, discharges into the bypass reach. Station No. 1 discharges into the bypass reach approximately 0.9 miles downstream of the Turners Falls Dam.

Fish Passage Facilities

The Turners Falls Project is equipped with three upstream fish passage facilities, including (in order from downstream to upstream): the Cabot fishway, the Spillway fishway, and the Gatehouse fishway.

Fish passing through the Cabot fishway enter the power canal; from there, they swim 2.1 miles upstream to the Gatehouse fishway. Fish bypassing the Cabot fishway move upstream via the bypassed reach where they will ultimately encounter the Turners Falls Dam. Fish arriving there are passed upstream via the Spillway fishway into the upper terminus of the power canal, below the gatehouse. Here, they rejoin fish that have passed to this point via the Cabot Ladder. From the upstream end of the power canal, all fish are passed above the gatehouse via the Gatehouse fishway. The Gatehouse fishway delivers fish into the Turners Falls Impoundment to continue their journey up the Connecticut River.

The Connecticut River Atlantic Salmon Commission (CRASC) establishes an annual schedule for the operation of upstream fish passage facilities at the Connecticut River dams. The schedules are based on the projected movement of migratory fish and may be adjusted in season to address actual observations.

Downstream Fish Passage Facilities

The downstream fish passage facilities are located at Cabot Station, at the downstream terminus of the power canal. Assuming no spill is occurring at Turners Falls Dam, fish moving downstream pass through the gatehouse (which has no racks) and into the power canal. Downstream fish passage facilities at Cabot Station consist of: reduced bar-spacing in the upper section of the intake racks; a broad-crested weir developed specifically to enhance fish passage at the log sluice; the log sluice itself, which has been resurfaced to provide a safe passage route; above-water lighting; and a sampling facility in the sluices.

In addition to downstream passage facilities at Cabot Station, a guide net is installed below the Northfield Mountain Pumped Storage Project tailrace to reduce entrainment of emigrating salmon smolt into the Northfield intakes during pumping operation. The CRASC also establishes an annual schedule for the operation of downstream fish passage facilities at the Connecticut River dams.

Northfield Mountain Pumped Storage Project (FERC No. 2485)

Key features of the Northfield Mountain Pumped Storage Project are the upper reservoir dam, intake channel, powerhouse, and tailrace tunnel.

Upper Reservoir Dam

The crest of the upper reservoir's Main Dam is at elevation 1010 feet msl. There are three dikes known as the North, Northwest, and West Dikes, and are constructed in a similar manner and to the same crest elevation as the Main Dam.

Upper Reservoir Storage Capacity

Per the current FERC license for the Northfield Mountain Pumped Storage Project, the upper reservoir may operate between 1000.5 feet msl and 938 feet msl, which equates to a useable storage capacity of approximately 12,318 acre-feet. The upper reservoir was constructed to accommodate an elevation of 1004.5 feet msl as approved by FERC in 1976. In addition, the reservoir retains useable storage capacity down to elevation 920 feet msl. Located southwest of the upper reservoir is the intake channel that conveys water to the powerhouse.

Powerhouse

The underground powerhouse contains four reversible pump/turbines operating at gross heads ranging from 753 to 824.5 feet. The electrical capacities of the units are as follows: Unit 1: 267.9 MW, Unit 2: 291.7 MW, Unit 3: 291.7 MW and Unit 4: 267.9 MW, for a total station nameplate capacity of 1,119.2 MW. Historically, the total station capacity was 1,080 MW (270 MW/unit); however, Units 2 and 3 recently underwent efficiency improvements with the replacement of the turbine runner, and rewind of the motor-generator.

When operating in a pumping mode, the approximate hydraulic capacity is 15,200 cfs (3,800 cfs/pump). Alternatively, when operating in a generation mode, the approximate hydraulic capacity is 20,000 cfs (5,000 cfs/turbine).

Water flows between the Powerhouse and the Turners Falls Impoundment via the Tailrace Tunnel.

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July 12, 2012

Adam Kahn
Foley Hoag LLP
155 Seaport Boulevard
Boston, MA 02210-2600

Re: Request for Advisory Opinion
FirstLight Hydro Generating Company: Northfield Mountain Pumped Storage Project and Turners Fall Hydroelectric Project – Erving, Gill, Greenfield, Montague and Northfield

Dear Mr. Kahn:

I am writing in response to your letter of July 6, 2012, in which you requested an advisory opinion as to whether review under the Massachusetts Environmental Policy Act (MEPA) would be required for the relicensing by the Federal Energy Regulatory Commission (FERC) for the facilities referenced above.

The facilities utilize water from the Connecticut River to generate hydroelectric power and were first licensed by FERC in 1968. The current FERC license expires in 2018 and the Proponent is now embarking on relicensing both facilities. Prior to relicensing, the Massachusetts Department of Environmental Protection (MassDEP) must issue a 401 Water Quality Certification for both facilities. However, while the facilities require a State Agency Action, no new work or activity is proposed in conjunction with the relicensing. On this basis, you assert that the relicensing does not meet or exceed any MEPA review thresholds, and thus, the facilities would not be subject to any review under MEPA.

Based on the information contained in your letter, I concur that the relicensing of these facilities does not constitute a Project, as it is defined in the MEPA regulations. Because no new work or activity is proposed, no MEPA review thresholds would be met or exceeded. Therefore, the facilities are not subject to MEPA review and the submission of an Environmental Notification Form (ENF) is not required.

Please contact Rick Bourré, Assistant Director of the MEPA Office, at (617) 626-1130 if you have any questions concerning this matter.

Sincerely,

Maeve Vallely-Bartlett
Assistant Secretary

Pre-FERC Process Stakeholder Meetings

Stakeholders	Meeting Date
United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Massachusetts Division of Fisheries and Wildlife (MADFW)	12/08/2011
Massachusetts Department of Environmental Protection (MDEP)	02/02/2012
FERC	02/15/2012
The Nature Conservancy (TNC)	02/22/2012
Connecticut River Watershed Association (CRWC)	02/26/2012
United States Environmental Protection Agency (USEPA)	03/29/2012
Joint meeting of the Connecticut River Streambank Erosion Committee (CRSEC) and the Franklin Regional Council of Governments (FRCOG)	04/04/2012
Massachusetts Executive Office of Energy and Environmental Affairs (MEOEEA)	04/27/2012
Joint meeting of the Gill, Northfield, Montague, Erving and Gill Conservation Commissions	09/12/2012

APPENDIX B – PAD Content Cross-Reference Table

Pre-Application Document Content Cross Reference Table

PAD Content Requirement	18 CFR § 5.6	PAD Section
Process plan and schedule	(d)(1)	2
Project location, facilities and operations	(d) (2)	3
Description of existing environmental and resource impacts	(d) (3)	4
General requirements	(d) (3)(i)	4
River basin description	(d) (3)(xiii)	4.1
Geology and soils	(d) (3)(ii)	4.2
Water resources	(d) (3)(iii)	4.3
Fish and aquatic resources	(d) (3)(iv)	4.4
Wildlife and botanical resources	(d) (3)(v)	4.5
Wetlands, riparian and littoral habitat	(d) (3)(vi)	4.6
Rare, threatened, and endangered species	(d) (3)(vii)	4.7
Recreation and land use	(d) (3)(viii)	4.8
Aesthetic resources	(d) (3)(ix)	4.9
Cultural resources	(d) (3)(x)	4.10
Socio-economic resources	(d) (3)(xi)	4.11
Tribal resources	(d) (3)(xii)	4.12
Preliminary issues and studies	(d) (4)(i) and (ii)	5.1 and 5.2
List of references	(c)(2)	6
Relevant comprehensive waterway management and resource management plans	(d)(4)(iii) and (iv)	5.3 and 5.4
Summary of contacts	(d) (5)	Appendix A

APPENDIX C – Agent for the Applicant 18 C.F.R. § 5.6 (d)(2)(i)

The exact name, business address, and telephone number of the person authorized to act as agent for FirstLight are John Howard, Director- FERC Hydro Compliance, Northfield Mountain Station, 99 Millers Falls Road, Northfield, MA 01360, and (413) 659-4489.

APPENDIX D – Current License and Amendments

COMPLETE LICENSE ARTICLES
Turners Falls Hydroelectric Project, FERC Project No. 1889

Articles 1-28 were incorporated in the Order Issuing New License, 11 FERC ¶ 61,124 (1980), per the Commission's standard terms and conditions for constructed major projects affecting navigable waters of the United States as set forth in Form L-3, dated October 1975.

Article 1. The entire project, as described in this order of the Commission, shall be subject to all of the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, specifications, and statements described and designated as exhibits and approved by the Commission in its order as a part of the license until such change shall have been approved by the Commission: Provided, however, That if the Licensee or the Commission deems it necessary or desirable that said approved exhibits, or any of them, be changed, there shall be submitted to the Commission for approval a revised, or additional exhibit or exhibits covering the proposed changes which, upon approval by the Commission, shall become a part of the license and shall supersede, in whole or in part, such exhibit or exhibits theretofore made a part of the license as may be specified by the Commission.

Article 3. The project area and project works shall be in substantial conformity with the approved exhibits referred to in Article 2 herein or as changed in accordance with the provisions of said article. Except when emergency shall require for the protection of navigation, life, health, or property, there shall not be made without prior approval of the Commission any substantial alteration or addition not in conformity with the approved plans to any dam or other project works under the license or any substantial use of project lands and waters not authorized herein; and any emergency alteration, addition, or use so made shall thereafter be subject to such modification and change as the Commission may direct. Minor changes in project works, or in uses of project lands and waters, or divergence from such approved exhibits may be made if such changes will not result in a decrease in efficiency, in a material increase in cost, in an adverse environmental impact, or in impairment of the general scheme of development; but any of such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of such results, shall be subject to such alteration as the Commission may direct.

Article 4. The project, including its operation and maintenance and any work incidental to additions or alterations authorized by the Commission, whether or not conducted upon lands of the United States, shall be subject to the inspection and supervision of the Regional Engineer, Federal Energy Regulatory Commission, in the region wherein the project is located, or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall cooperate fully with said representative and shall furnish him such information as he may require concerning the operation and maintenance of the project, and any such alterations thereto, and shall notify him of the date upon which work with respect to any alteration will begin, as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of work for a period of more than one week, and of its resumption and completion.

The Licensee shall submit to said representative a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of any such alterations to the project. Construction of said alterations or any feature thereof shall not be initiated until the program of inspection for the alterations or any feature thereof has been approved by said representative. The Licensee shall allow said representative and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties. The Licensee shall comply with such rules and regulations of general or special applicability as the Commission may prescribe from time to time for the protection of life, health, or property.

Article 5. The Licensee, within five years from the date of issuance of the license, shall acquire title in fee or the right to use in perpetuity all lands, other than lands of the United States, necessary or appropriate for the construction maintenance, and operation of the project. The Licensee or its successors and assigns shall, during the period of the license, retain the possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights or occupancy and use; and none of such properties shall be voluntarily sold, leased, transferred, abandoned, or otherwise disposed of without the prior written approval of the Commission, except that the Licensee may lease or otherwise dispose of interests in project lands or property without specific written approval of the Commission pursuant to the then current regulations of the Commission. The provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear; and mortgage or trust deeds or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article.

Article 6. In the event the project is taken over by the United States upon the termination of the license as provided in Section 14 of the Federal Power Act, or is transferred to a new licensee or to a nonpower licensee under the provisions of Section 15 of said Act, the Licensee, its successors and assigns shall be responsible for, and shall make good any defect of title to, or of right of occupancy and use in, any of such project property that is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and shall pay and discharge, or shall assume responsibility for payment and discharge of, all liens or encumbrances upon the project or project property created by the Licensee or created or incurred after the issuance of the license: Provided, That the provisions of this article are not intended to require the Licensee, for the purpose of transferring the project to the United States or to a new licensee, to acquire any different title to, or right of occupancy and use in, any of such project property than was necessary to acquire for its own purposes as the Licensee.

Article 7. The actual legitimate original cost of the project, and of any addition thereto or betterment thereof, shall be determined by the Commission in accordance with the Federal Power Act and the Commission's Rules and Regulations thereunder.

Article 8. The Licensee shall install and thereafter maintain gages and stream-gaging stations for the purpose of determining the stage and flow of the stream or streams on which the project is located, the amount of water held in and withdrawn from storage, and the effective head on the turbines; shall provide for the required reading of such gages and for the adequate rating of such stations; and shall install and maintain standard meters adequate for the determination of the amount of electric energy generated by the project works. The number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, shall at all times be satisfactory to the Commission or its authorized representative. The Commission reserves the right, after notice and opportunity for hearing, to require such alterations in the number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, as are necessary to secure adequate determinations. The installation of gages, the rating of said stream or streams, and the determination of the flow thereof, shall be under the supervision of, or in cooperation with, the District Engineer of the United States Geological Survey having charge of stream-gaging operations in the region of the project, and the Licensee shall advance to the United States Geological Survey the amount of funds estimated to be necessary for such supervision, or cooperation for such periods as may mutually agreed upon. The Licensee shall keep accurate and sufficient records of the foregoing determinations to the satisfaction of the Commission, and shall make return of such records annually at such time and in such form as the Commission may prescribe.

Article 9. The Licensee shall, after notice and opportunity for hearing, install additional capacity or make other changes in the project as directed by the Commission, to the extent that it is economically sound and in the public interest to do so.

Article 10. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other projects or power systems and in such manner as the Commission any direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 11. Whenever the Licensee is directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of the headwater improvement for such part of the annual charges for interest, maintenance, and depreciation thereof as the Commission shall determine to be equitable, and shall pay to the United States the cost of making such determination as fixed by the Commission. For benefits provided by a storage reservoir or other headwater improvement of the United States, the Licensee shall pay to the Commission the amounts for which it is billed from time to time for such headwater benefits and for the cost of making the determinations pursuant to the then current regulations of the Commission under the Federal Power Act.

Article 12. The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial public uses, including recreational purposes, and the Licensee shall release water from the project reservoir at such rate in cubic feet per second, or such volume in acre-feet per specified period of time, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

Article 13. On the application of any person, association, corporation, Federal agency, State or municipality, the Licensee shall permit such reasonable use of its reservoir or other project properties, including works, lands and water rights, or parts thereof, as may be ordered by the Commission, after notice and opportunity for hearing, in the interests of comprehensive development of the waterway or waterways involved and the conservation and utilization of the water resources of the region for water supply or for the purposes of steam-electric, irrigation, industrial, municipal or similar uses. The Licensee shall receive reasonable compensation for use of its reservoir or other project properties or parts thereof for such purposes, to include at least full reimbursement for any damages or expenses which the joint use causes the Licensee to incur. Any such compensation shall be fixed by the Commission either by approval of an agreement between the Licensee and the party or parties benefiting or after notice and opportunity for hearing. Applications shall contain information in sufficient detail to afford a full understanding of the proposed use, including satisfactory evidence that the applicant possesses necessary water rights pursuant to applicable State law, or a showing of cause why such evidence cannot concurrently be submitted, and a statement as to the relationship of the proposed use to any State or municipal plans or orders which may have been adopted with respect to the use of such waters.

Article 14. In the construction or maintenance of the project works, the Licensee shall place and maintain suitable structures and devices to reduce to a reasonable degree the liability of contact between its transmission lines and telegraph, telephone and other signal wires or power transmission lines constructed prior to its transmission lines and not owned by the Licensee, and shall also place and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling or obstructing traffic or endangering life. None of the provisions of this article are intended to relieve the Licensee from any responsibility or requirement which may be imposed by any other lawful authority for avoiding or eliminating inductive interference.

Article 15. The Licensee shall, for the conservation and development of fish and wildlife resources, construct, maintain, and operate, or arrange for the construction, maintenance, and operation of such reasonable facilities, and comply with such reasonable modifications of the project structures and operation, as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing.

Article 16. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of the Licensee's lands and interests in lands, reservoirs, waterways and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be reasonably prescribed by the Commission in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article.

This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

Article 17. The Licensee shall construct, maintain, and operate, or shall arrange for the construction, maintenance, and operation of such reasonable recreational facilities, including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities, and utilities, giving consideration to the needs of the physically handicapped, and shall comply with such reasonable modifications of the project, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal or State agencies, after notice and opportunity for hearing.

Article 18. So far as is consistent with proper operation of the project, the Licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and for outdoor recreational purposes, including fishing and hunting: Provided, That the Licensee may reserve from public access such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property.

Article 19. In the construction, maintenance, or operation of the project, the Licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion on lands adjacent to streams or other waters, stream sedimentation, and any form of water or air pollution. The Commission, upon request or upon its own motion, may order the Licensee to take such measures as the Commission finds to be necessary for these purposes, after notice and opportunity for hearing.

Article 20. The Licensee shall clear and keep clear to an adequate width lands along open conduits and shall dispose of all temporary structures, unused timber, brush, refuse, or other material unnecessary for the purposes of the project which results from the clearing of lands or from the maintenance or alteration of the project works. In addition, all trees along the periphery of project reservoirs which may die during operations of the project shall be removed. All clearing of the lands and disposal of the unnecessary material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission and in accordance with appropriate Federal, State, and local statutes and regulations.

Article 21. Materials may be dredged or excavated from, or placed as fill in, project lands and/or waters only in the prosecution of work specifically under the license; in the maintenance of the project; or after obtaining Commission approval, as appropriate. Any such material shall be removed and/or deposited in such manner as to reasonably preserve the environmental values of the project and so as not to interfere with traffic on land or water. Dredging and filling in a navigable water of the United States shall also be done to the satisfaction of the District Engineer, Department of the Army, in charge of the locality.

Article 22. Whenever the United States shall desire to construct, complete, or improve navigation facilities in connection with the project, the Licensee shall convey to the United States, free of cost, such of its lands and rights-of-way and such rights of passage through its dams or other structures, and shall permit such control of its pools, as may be required to complete and maintain such navigation facilities.

Article 23. The operation of any navigation facilities which may be constructed as a part of, or in connection with, any dam or diversion structure constituting a part of the project works shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including control of the level of the pool caused by such dam or diversion structure, as may be made from time to time by the Secretary of the Army.

Article 24. The Licensee shall furnish power free of cost to the United States for the operation and maintenance of navigation facilities in the vicinity of the project at the voltage and frequency required by such facilities and at a point adjacent thereto, whether said facilities are constructed by the Licensee or by the United States.

Article 25. The Licensee shall construct, maintain, and operate at its own expense such lights and other signals for the protection of navigation as may be directed by the Secretary of the Department in which the Coast Guard is operating.

Article 26. If the Licensee shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without adequate replacement, or shall abandon or discontinue good faith operation of the project or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address of the Licensee or its agent, the Commission will deem it to be the intent of the Licensee to surrender the license. The Commission, after notice and opportunity for hearing, may require the Licensee to remove any or all structures, equipment and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the United States agency having jurisdiction over its lands or the Commission's authorized representative, as appropriate, or to provide for the continued operation and maintenance of nonpower facilities and fulfill such other obligations under the license as the Commission may prescribe. In addition, the Commission in its discretion, after notice and opportunity for hearing, may also agree to the surrender of the license when the Commission, for the reasons recited herein, deems it to be the intent of the Licensee to surrender the license.

Article 27. The right of the Licensee and of its successors and assigns to use or occupy waters over which the United States has jurisdiction, or lands of the United States under the license, for the purpose of maintaining the project works or otherwise, shall absolutely cease at the end of the license period, unless the Licensee has obtained a new license pursuant to the then existing laws and regulations, or an annual license under the terms and conditions of this license.

Article 28. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

Articles 29 – 42 were required by the Order Issuing New License, 11 FERC ¶ 61,124 (1980), and revised as noted below.

Article 29. Pursuant to Section 10(d) of the Act, a specified reasonable rate of return upon the net investment in the project shall be used for determining surplus earnings of the project for the establishment and maintenance of amortization reserves. One-half of the project surplus earnings, if any, accumulated under the license, in excess of the specified rate of return per annum on the net investment, shall be set aside in a project amortization reserve account as of the end of each fiscal year: Provided, that, if and to the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year under the license, the amount of such deficiency shall be deducted from the amount of any surplus earnings accumulated thereafter until absorbed, and one-half of the remaining surplus earnings, if any, cumulatively computed, shall be set aside in the project amortization reserve account; and the amounts thus established in the project amortization reserve account shall be maintained therein until further order of the Commission.

The annual specified reasonable rate of return shall be the sum of the weighted cost components of longterm debt, preferred stock, and the cost of common equity, as defined herein. The weighted cost component for each element of the reasonable rate of return is the product of its capital ratio and cost rate. The current capital ratios for each of the above elements of the rate of return shall be calculated annually based on an average of 13 monthly balances of amounts properly includable in the Licensee's long-term debt and proprietary capital accounts as listed in the Commission's Uniform System of Accounts. The cost rates for such ratios shall be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity shall be the interest rate on 10-year government bonds (reported as the Treasury Department's 10-year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

Article 30. For the purpose of reimbursing the United States for the cost of administration of Part I of the Act, the Licensee shall pay the United States, a reasonable annual charge as determined by the Commission in accordance with the provisions of its Regulations in effect from time to time:
(1) Effective June 3, 2002, authorized installed capacity for that purpose is 64,037 kilowatts.
(2) Effective June 3, 2003, the authorized installed capacity for that purpose is 67,709 kilowatts.
(Revised by 24 FERC ¶ 62,316 (1983), 102 FERC ¶ 62,102 (2003), and 106 FERC ¶ 62,084 (2004)).

Article 31. Licensee shall implement, and modify when appropriate, the emergency action plan on file with the Commission designed to provide an early warning to upstream and downstream inhabitants and property owners if there should be an impending or actual sudden release of water caused by an accident to, or failure of, project works. That plan shall include: instructions to be provided on a continuing basis to operators and attendants for actions they are to take in the event of an emergency; detailed and documented plans for notifying law enforcement agents, appropriate Federal, State, and local agencies, operators of water-related facilities, and those residents and owners of properties that could be endangered; actions that would be taken to reduce the inflow to the reservoir, if possible, by limiting the outflow from upstream dams or control structures; and actions to reduce downstream flows by controlling the outflow from dams located on tributaries to the stream on which the project is located. Licensee shall also maintain on file with the Commission a summary of the study used as a basis for determining areas that may be affected by an emergency, including criteria and assumptions used. Licensee shall monitor any changes in upstream or downstream conditions which may influence possible flows or affect areas susceptible to damage, and shall promptly make and file with the Commission appropriate changes in the emergency action plan. The Commission reserves the right to require modifications to the plan.

Article 32. Licensee and the Department of the Army, Corps of Engineers (Corps), have entered into an agreement providing for the coordinated operation of the project in the interest of flood control. A conformed copy of the agreement and plan are on file with the Commission. The project operation shall continue in accordance with the agreement and plan. The Commission reserves the right to impose conditions on the Licensee for coordinated operation of the project.

Article 33. The Licensee shall consult with appropriate Federal, State, and local agencies interested in the development of modified plans for the Cabot Woods and Unity Park Areas to provide for optimum public utilization and recreation needs of the project area and, within one year from the date of issuance of this license, shall file for approval a revised Exhibit R conforming to the requirements of §4.41 of the Commission's Regulations and a revised Exhibit K conforming to §4.41 of the Regulations and including within the project boundary all recreation lands contained in the revised Exhibit R. The revised Exhibit R shall include, among other things: (1) any revised site plans for Cabot Woods, Unity Park, and the Branch Canal; (2) any proposed public use facilities to be associated with the operation of the fish passage facilities; (3) costs to develop the proposed recreation facilities; (4) a construction schedule for proposed recreation facilities; (5) measures, such as signs, which would be taken to make canoe portage readily available to river users; and (6) a description of the nature and extent of consultation and cooperation with appropriate agencies.

Article 34. The Licensee shall maintain a continuous minimum flow of 1,433 cfs (0.20 cubic feet per second per square mile of drainage basin) or a flow equal to the inflow of the reservoir, whichever is less, from the project into the Connecticut River. These flows may be modified temporarily: (1) during and to the extent required by operating emergencies beyond the control of the Licensee; and (2) in the interest of recreation and protection of the fisheries resources, upon mutual agreement between the Licensees for Projects Nos. 1889 and 2485 and the Massachusetts Division of Fisheries and Wildlife. During the period of each year from May 1 until there are no substantial numbers of juvenile or adult shad in the reach of the river where the project is located, but in any event no later than October 1, the following portion of that total minimum flow shall be released from the Turners Falls Dam: until the Montague spillway fishway begins operating, 200 cfs; after that fishway begins operating, 400 cfs. Any other portion of the specified total continuous minimum flow may be released from either the Turners Falls Dam or the Cabot Station, except that a sufficient portion shall be released from Cabot Station to allow proper operation of the Cabot Station fishway.

Article 35. Prior to the commencement of any construction or development of any project works or other facilities at the project, the Licensee shall consult and cooperate with the appropriate State Historic Preservation Officer(s) (SHPO) to determine the need for, and extent of, any archeological or historic resource surveys and any mitigative measures that may be necessary. The Licensee shall provide funds in a reasonable amount for such activity. If any previously unrecorded archeological or historic sites are discovered during the course of the construction, construction activity in the vicinity shall be halted, a qualified archeologist shall be consulted to determine the significance of the sites, and the Licensee shall consult with the SHPO to develop a mitigation plan for the protection of significant archeological or historic resources. If the Licensee and the SHPO cannot agree on the amount of money to be expended on archeological or historic work related to the project, the Commission reserves the right to require the Licensee to conduct, at its own expense, any such work found necessary.

Article 36. The Licensee shall, to the satisfaction of the Commission's authorized representative, install and operate any signs, lights, sirens, barriers, or other devices that may be reasonably needed to warn the public of fluctuations in flow from the project and to protect the public in its recreational use of project lands and waters.

[Article 37 was deleted from the license per an amendment dated October 6, 1980].

Article 38. The Licensee shall file with the Commission, within one year from the date of completion of construction of the fish passage facilities, "as-built" drawings of the completed fish passage facilities. Additionally, the Licensee shall, in cooperation with the Massachusetts Division of Fisheries and Wildlife, and the U.S. Fish and Wildlife Service of the Department of the Interior, conduct, or pay for others to conduct, post-operational studies designed to determine the effectiveness of the fish passage facilities in allowing for the upstream migration of anadromous fishes past the Turners Falls Project. The Licensee shall file with the Commission an annual report detailing operation of the facilities, problems in design or operation, and listing the number, by species, of all fish passed upstream.

Article 39. Within six months from the date of issuance of this license the Licensee shall file for approval revised Exhibit L Drawings Nos. L-1, L-2, and L-3 (FERC Drawings Nos. 1889-32, -33 and -34, respectively) to reflect the "as-built" condition of the Turners Falls Dam after the modifications made to increase the storage capacity of the reservoir for use as the lower reservoir for Project No. 2485.

Article 40. The Licensee shall operate the project in coordination with the operation of the Northfield Mountain Pumped Storage Project No. 2485. The Licensees for Project No. 2485 are authorized to utilize the Turners Falls Reservoir as a source of water and as a lower pool for the operation of Project No. 2485.

Article 41. Within six months from the date of issuance of this license, the Licensee shall prepare and file with the Commission a feasibility analysis of: (1) rehabilitating the No. 1 Station to enable utilization of its total installed capacity; and (2) installing additional generating capacity at the Project. These analyses shall take into account, to the extent reasonable, all benefits that would be derived from the rehabilitation or installation, including any contribution to the conservation of non-renewable natural resources. If the studies shows rehabilitation or additional capacity to be economically feasible, the Licensee shall simultaneously file a schedule for, respectively, rehabilitating the No. 1 Station or filing an application to amend its license to install the additional capacity.

Article 42. The Licensee shall coordinate the operation of the project, electrically and hydraulically, with such other power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 43 was added to replace Article 37 per an amendment dated October 6, 1980.

Article 43. (a) In accordance with the provisions of this article, the Licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain other types of use and occupancy, without prior Commission approval. The Licensee may exercise the authority only if the proposed use and occupancy is consistent, with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the Licensee shall also have continuing responsibility to supervise and control the uses and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the Licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the Licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, cancelling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The types of use and occupancy of project lands and waters for which the Licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities; and (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline. To the extent feasible and desirable to protect and enhance the project’s scenic, recreational, and other environmental values, the Licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The Licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the uses and occupancies for which it grants permission are maintained in good repair and comply with applicable State and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the Licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline. To implement this paragraph (b), the

Licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the Licensee's costs of administering the permit program. The Commission reserves the right to require the Licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modifications of those standards, guidelines, or procedures.

(c) The Licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement, expansion, realignment, or maintenance of bridges and roads for which all necessary State and Federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution 'cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the Licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The Licensee may convey, fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary State and Federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary Federal and State water quality certificates or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary Federal and State approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from the edge of the project reservoir at normal maximum surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 45 days before conveying any interest in project lands under this paragraph (d), the Licensee must *file* a letter to the Director, Office of Electric Power Regulation, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G or K map may be used), the nature of the proposed use, the identity of any Federal or State agency official consulted, and any Federal or State approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the Licensee to file an application for prior approval, the Licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraphs (c) or (d) of this article:

(1) Before conveying the interest, the Licensee-shall consult with Federal and State fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the Interest, the Licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved Exhibit R or approved report on recreational resources of an Exhibit E; or, if the project does not have an approved Exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include covenants running with the land adequate to ensure that: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; and (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and, maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project.

(4) The Commission reserves the right to require the Licensee to take reasonable remedial action to correct any - violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G or K drawings would be filed for approval for other purposes.

1 FERC - 75 FERC, 11 FERC ¶61,124, Western Massachusetts Electric Company, Project No. 1889, Federal Energy Regulatory Commission, (May 5, 1980)

Western Massachusetts Electric Company, Project No. 1889

[61,264]

[¶61,124]

Western Massachusetts Electric Company, Project No. 1889

Order Issuing New License (MAJOR)

(Issued May 5, 1980)

Before Commissioners: Charles B. Curtis, Chairman; Georgiana Sheldon, Matthew Holden, Jr. and George R. Hall.

Western Massachusetts Electric Company (WMECO) has filed an application for new major license to authorize the continued operation and maintenance of the constructed Turners Falls Project No. 1889. The project is located on the Connecticut River, a navigable waterway of the United States, in the counties of Franklin, Massachusetts, Windham, Vermont, and Cheshire, New Hampshire. [1]

Notice of the filing of the application was issued and the Environmental Defense Fund,

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Western Massachusetts Public Interest Research Group, Inc., For Land's Sake, Trout Unlimited, and Municipal Electric Association of Massachusetts, Inc. (Municipals) were permitted to intervene. There are no conflicting applications for license pending before the Commission and the constructed project does not affect a government dam.

Description of the Project

The constructed project is generally operated as a run-of-the river project with some neglible pondage and consists of two concrete gravity dam sections (Gill and Montague) joined by an island at mid-river, a 2,110-acre reservoir having a normal high water elevation of 185.0 feet msl, and two powerhouses--Turners Falls No. 1 Station and Cabot Station having an installed capacity of 4,840 kW and 51,000 kW, respectively. The No. 1 Station was a base load plant, but operated only at river flows between 12,000 cfs and 15,000 cfs. [2] Cabot Station is used at all river flows. During low flow periods, the Cabot Station is operated as a peaking plant; during high flows in excess of 12,000 cfs, it operates as a base load plant.

The Turners Falls Reservoir is a joint-use facility with the Northfield Mountain Pumped Storage Project No. 2485, serving as the lower reservoir for that development. [3] Releases from the Turners Falls reservoir are coordinated with the operation of the Northfield Mountain Project and flood control regulation of the U. S. Army Corps of Engineers (Corps). WMECO has also participated in work with the Corps on low flow augmentation studies, in connection with the Comprehensive Study of Water and Related Land Resources of the Connecticut River Basin, and cooperates with the Corps on the use of the Turners Falls Project for low flow augmentation.

In addition, WMECO has entered into an agreement with Esleeck Manufacturing Company for providing flows to dilute treated liquid mill waste before discharge into the Connecticut River. This agreement received approval from the Massachusetts Water Resources Commission, Division of Water Pollution Control, the Division of Fisheries and Game of the Commonwealth of Massachusetts, and the Fish and Wildlife Service (FWS) of the United States Department of the Interior (Interior).

Safety and Adequacy

All project structures, machinery, and equipment were inspected by the staff and generally appeared to be in a safe and stable condition. The spillway capacity of the project is 220,000 cfs with the reservoir at elevation 186.5 feet. River flows larger than 220,000 cfs would cause localized damage to project land and works but would not cause the dams to fail. Staff studies show that the dam would pass the maximum probable flood without sliding or overturning.

Additionally, the staff has analyzed the project works and reports that they are safe against sliding and overturning for various combinations of earthquake, ice, and water loading at the normal and maximum reservoir surface elevations. On the basis of our staff's report, we conclude that the project works are safe and adequate.

Comprehensive Development

The drainage area above Turners Falls Dam is 7,163 square miles or about 64 percent of the total Connecticut River Basin drainage area. Turners Falls Reservoir has a surface area of about 2,110 acres and a total volume of about 21,500 acre-feet at full reservoir elevation 185.0 feet msl. The average summer flow of the Connecticut River at the project is 3,300 cfs. The usable storage is about 8,650 acre-feet. There is a total storage capacity of about 800,000 acre-feet, including about 350,000 acre-feet of power storage capacity, from the drainage area above the Turners Falls Project from which the Licensee benefits. During the spring, the normal average river flow ranges from 40,000 to 60,000 cfs. The Cabot Station uses about 12,000 cfs when generating at rated station capacity of 51,000 kW. Although its rated installed capacity is 4,840 kW, the No. 1 Station had maximum capability of 6,000 kW, using 3,000 cfs, when it was operable. Normal project operation provides that river flows below 12,000 cfs are utilized in total by the Cabot Station. For flows above 12,000 cfs, the No. 1 Station used to be put into operation.

To provide the storage capacity for pumped storage operations of the Northfield Project the water level of Turners Falls Reservoir varies from minimum elevation 176.0 feet to normal operating elevation 183.0 feet. The maximum operating elevation would be 185.0 feet during emergency operation of the Northfield Project, however.

The feasibility of installing 84,000 kW of additional hydrogenerating capacity at Turners Falls was studied by the Commission Staff in a 1968 Water Resources Appraisal Report. The Report considered that additional capacity could be obtained by constructing a new powerhouse with two tube-type turbines, each of 42,000 kW capacity and utilizing a head of about 43 feet, in space that could be made available at the right end of the dam. The analysis at that time revealed a benefit/cost

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ratio of 1.0, which was deemed marginal.

In view of the fact that several years have elapsed since that study was performed, and the cost of alternative sources of energy has escalated appreciably, Article 41 requires that Licensee file within six months the date of issuance of this license an economic study of rehabilitating the No. 1 Station and of whether installation of additional generating capacity at the project is feasible; and if feasible, schedule for rehabilitation or filing an application to add capacity. Under Article 9 of this license, we retain the authority to require WMECO to rehabilitate the No. 1 Station or to install additional capacity that may be economically feasible.

The U. S. Army Corps of Engineers has cited the need for closer coordination of operation between the Corps' projects and the licensed hydroelectric projects located in the Connecticut River Basin. WMECO recognizes the need to coordinate the operation of the tributary flood control reservoirs and the main stem power storage facilities and plants during periods of flood flows. Article 29 of the order issuing the license for Project No. 1889, and Article No. 43 of the license for Project No. 2485, 39 FPC 723, 751, required the licensees to enter into an agreement with the Corps to provide for coordinated operation of Project Nos. 1889 and 2485 during flood conditions, in accordance with rules and regulations prescribed by the Corps; required a copy of the agreement to be filed with the Commission prior to commercial operation of Project No. 2485; and, in the event that no agreement was achieved prior to said operation, licensees were to operate the projects during flood conditions in accordance with a Commission prescribed plan.

On November 29, 1972, licensees filed a copy of the agreement with the Corps for such coordinated operation. Furthermore, on September 2, 1972, licensees filed the Corps' July 27, 1972 letter approving the agreement, together with a copy of the plan, entitled: "Reservoir and River Flow Management Procedures", for Project Nos. 1889 and 2485, which serves as the basis for the operation of the projects during flood conditions.

Therefore, Article 32 of this license requires continued coordination of the project operations with the Corps, in the interests of flood control and navigation, in accordance with the agreement filed with the Commission on November 29, 1972.

We conclude that the project as constructed and as conditioned here makes efficient use of the flow and fall of the Connecticut River; will not be inconsistent with any proposed plans for future development of the basin; and is best adapted to a comprehensive plan for development of the Connecticut River Basin for beneficial public uses.

Federal Takeover

Section 14 of the Federal Power Act reserves to the United States the right to take over a non-publicly owned project upon expiration of the license, after paying the licensee’s net investment in the project, not to exceed the fair value of the property taken, plus any severance damages. No federal department or agency, or state agency recommended takeover or redevelopment of the project by the United States. The project is not in conflict with any project that has been authorized or is under study by the United States. We know of no reason why federal takeover of the project would better serve the public interest than issuance of this license would. Thus, we shall not recommend federal takeover.

Conflicting Applications and Effect on Government Dam

There are no conflicting applications for preliminary permit or license pending before the Commission. The constructed project does not affect a government dam.

Fish Passage Facilities

Interior and the state fisheries agencies recommended that fish passage facilities, needed for the restoration of Atlantic salmon and American shad to upstream reaches of the Connecticut River, should be constructed as soon as possible at the Turners Falls Project. The New Hampshire Office of State Planning, the New England River Basins Commission, and the intervenors in this proceeding expressed similar views. A restoration program was initiated in December 1966. WMECO has cooperated in studies conducted in conjunction with this program and has contributed funds supporting such studies. On November 2, 1976, 56 FPC 2914, in Docket No. E-7561 , the Commission approved a settlement agreement covering installation of fish passage facilities at the Turners Falls Project.

Stream Flow Releases

The Coordinating Committee of the Connecticut River Basin Comprehensive Water and Related Land Resources Study has recommended a minimum flow of 0.2 cfsm (cubic feet per second per square mile of drainage area) for projects on the Connecticut River, to reestablish historic low flow levels. This recommendation would amount to discharges of about 1,433 cfs at Turners Falls.

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As part of the fish facilities settlement agreement, WEMCO has agreed to provide an interim minimum flow of 200 cfs in the river between the Turners Falls Dam and Cabot Station commencing May 1 and continuing until there are no substantial numbers of juvenile or adult shad in that part of the river but no later than October 1. This flow regime started in 1976 and is to continue each year until the spillway-fishway is operational. When the spillway-fishway is operating, 400 cfs will be released through the fishway as attraction water. Article 34 requires WMECO to maintain these releases from the Turners Falls Dam during that period.

During times when there is no spill over the dam, waterflow ceases between the dam and the confluence of the Fall River, approximately one-quarter mile downstream. The relatively low discharge from the Fall river contributes little flow to the Connecticut River. A substantial minimum flow release from the dam would enhance the esthetics and recreational uses of the 2.7-mile section of the Connecticut River from the dam to Cabot Station and could provide for a resident fishery. From field observations, it appears that nearly the entire 1,433 cfs would be needed for those benefits. Although the release of this total amount over the spillway would improve the esthetics and fishery habitat of this 2.7-mile portion of the river, that benefit would be offset by the value of lost project power and energy. Releasing a minimum flow of 1,433 cfs from Cabot Station, instead of over the dam, would provide a sustained flow from the main point of fish facility attraction and would therefore be more beneficial to the anadromous fish program. The licensee would also sustain lower power and energy losses. The fishery agencies did not object to the remainder [4] of the 1,433 cfs minimum flow being released from Cabot Station instead of from the dam.

WMECO originally suggested 0.16 cfsm (1,146 cfs) continuously, and has since modified its proposal to provide that 0.20 cfsm be released through Cabot Station during 12 hours each day, with no minimum flow for the remaining 12 hours. Our staff reports, however, that to benefit the fishery the minimum flow must be released continuously.

In the interest of protecting and enhancing the Connecticut River fishery resourcs, we have required minimum flow releases of 0.2 cfsm in the licenses recently issued for three major projects upstream from the Turners Falls Project--New England Power Company's Vernon Project No. 1904, [5] Bellows Falls Project No. 1855, and Wilder Project No. 1892. These coordinated minimum natural flow requirements represent the estimated minimum flow in the river if the various licensed projects had not been constructed. The consensus of the commenting federal and state agencies, as well as our staff, is that the same requirement should be imposed for the Turners Falls Project. Consistent with the requirements for the upstream projects, and to complement the other measures being taken to restore anadromous fish runs to the Connecticut River, we shall also set a continuous minimum flow release of 0.2 cfsm, or 1,433 cfs, from the Turners Falls Project. The release may be made from either Cabot Station or the Turners Falls dam, except for the portion that must be released from the dam between May 1 and the end of the shad run season. [6]

Recreation

WMECO has encouraged recreational use of the reservoir and is continuing development of project lands adjacent to the reservoir for public use, such as organized play areas and band concert facilities. Development of recreational facilities for the Turners Falls Project as proposed in Exhibit R would include constructing 3 miles of hiking trails in the 100-acre Cabot Woods area. The area would also be used for picnicking, bird watching, and casual sports. A 3-acre site along the Branch Canal and forebay area would be developed for improved fishing access, picnicking, and an open play area. Unity Park of the Town of Turners Falls would be enhanced by better access and shoreline improvement of 2,000 feet of WMECO-owned riverfront lands and development of a boat launch and marina facilities. All three areas would be developed by WMECO and publicized for use by the general public with proper signs. Those lands to be developed have been used on a limited basis for recreational purposes. Although the picnicking, fishing, and play areas and the marina could be used intensively, the greater portion of the land set aside for recreational purposes would receive light to moderate use.

Several local agencies recommended modifications to the proposed recreational development plan, including some suggestions for eliminating the proposed boat marina in favor of other development. WMECO expressed willingness to work with concerned local agencies to explore revisions to the Exhibit R. Accordingly, we are requiring WMECO to consult with interested agencies and file its revised recreational development plan within one year.

Recreational boating and canoeing on the Connecticut River is hampered by the 2.7-mile dewatered reach of the river below the dam. Currently, Applicant provides free portage around the dam by trucking watercraft from

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the State boat launch site at Gill to an area below Cabot Station. This service could be improved by placing signs indicating the procedures for the use of and the availability of the portage service at the takeout area. Article 33 of this license requires that the Exhibit R be modified to prescribe measures to publicize the canoe portage to river users and clarify the procedures for obtaining the portage at the takeout point.

Recreational facilities are planned for development in project areas that were once used for industrial or residential purposes and that are now abandoned or renovated. There are some hazardous areas along the power canal, even though some sections of the canal are fenced. The open canal, which is crossed by several bridges and a railroad trestle, permits the public ready access to some of the hazardous areas. No safety devices are provided at the forebay at the terminus of the canal. When the fish passage facilities are installed and operable, the influx of fishermen into the canal area would increase the likelihood of accidents. Our staff recommends provision for additional fencing and safety devices. Article 36, which we customarily include in licenses now, provides for installation of adequate safety devices at the project, to the satisfaction of the Regional Engineer.

Shoreline Erosion

A study to determine erosion control problems and methods to reduce erosion around various reservoirs on the Connecticut River has been undertaken and completed by the Corps of Engineers. WMECO and the U.S. Forest Service have been jointly studying the effects of water level fluctuations on growth of trees on plots of land within the fluctuation zone. The experimental plots have been made available to the Forest Service for study by WMECO.

In addition, the licensees for the Northfield Mountain Project No. 2485 have been taking remedial measures to minimize bank erosion on the Turners Falls Reservoir, under provisions of the Project No. 2485 license. A river bank protection program has been initiated and consists of such methods as tree clearing, riprapping, and landscaping. If that program does not prove sufficient in the future to control erosion along the Turners Falls Reservoir, additional measures could be required under the Project No. 2485 license or Article 19 of this license, as appropriate.

Historical and Archeological Resources

Portions of the Turners Falls Project are located within the Riverside Archeological District, identified in the National Register of Historic Places, and in view of the fact that important archeological findings have been salvaged in nearby areas, it is in the public interest to require that, prior to any future construction or development at the project, WMECO should consult and cooperate with the Massachusetts Historical Commission to prevent or mitigate the loss of possible archeological remains that may occur within the project boundaries. Article 35, which we normally include as a license condition, [7] will ensure proper protection of archeological and historic resources.

Environmental Considerations

Approval of a new license for Project No. 1889 would permit the continued operation of the project, which was started about 1906. No additional power facilities are presently proposed. The primary environmental issues raised by interested parties during the review of the license application were the need for fish passage facilities, minimum flow releases, and revision of the recreation plan, and each is resolved above. Planned improvements to project recreational facilities would be beneficial and their construction would have only minor and temporary adverse environmental impacts. On the basis of the record, including agency and intervenor comments and the staff's independent analysis, the Commission concludes that issuance of this new license, as conditioned, is not a major federal action significantly affecting the quality of the human environment.

License Term

Our usual policy on relicensing is to limit the license term to 30 years if no substantial redevelopment is contemplated or proposed. [8] In the circumstances of this project, however, we consider a longer term warranted, even though WMECO does not propose to add new generating capacity. The expiration date of the license for the Northfield Mountain Project, No. 2485, which makes joint use of the Turners Falls Reservoir, is April 30, 2018. The recent licenses for the next three projects upstream--Vernon, Bellows Falls, and Wilder--have the same expiration date as the Northfield Mountain Project. In the interests of coordinating the administration of projects on this reach of the Connecticut River, the license for Project No. 1889 will also terminate on April 30, 2018. [9]

Municipals Intervention

Most of the various issues raised by the Municipal Electric Association of Massachusetts, Inc. (Municipals), have already been resolved either in the discussions above, the fish passage settlement previously approved, or

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the orders approving the Northfield Mountain Pumped Storage Project No. 2485. [10] The Municipals also alleged that they were disabled from filing a competing license application for Project No. 1889, and otherwise excluded from access to low-cost power, by anti-competitive actions of regional investor-owned utilities. At the time, however, the New England Power Pool Agreement (NEPOOL), which the Commission had designated as the vehicle for resolving the Municipals anti-competitive practices questions, was being negotiated. The Municipals argued that, until the NEPOOL Agreement was effectuated, preparation of a competing license application would be impractical. Thus, they asked for an extension of time of up to one year from the time the NEPOOL Agreement became effective to apply for a license for the Turners Falls Project.

Negotiations on the NEPOOL Agreement were completed in September 1971 and it was filed with the Commission on November 12, 1971. The Commission approved the Agreement, with modifications, on September 10, 1976. *New England Power Pool Agreement,* Docket No. E-7690 , Opin. No. 775, 56 FPC 1562, *Rehearing denied,* Opin. No. 775-A, 56 FPC 2862 (Nov. 5, 1976). On October 19, 1978, the Commission’s decision was affirmed by the Court of Appeals. *Municipalities of Groton, et al.* v. *F.E.R.C.,* 587 F. 2d 1296 (CADC 1978). The Municipals have not filed a competing application. We find that they have had more than ample opportunity to file a competing application and there is no good reason not to proceed to issue a long-term license to WMECO.

The Commission orders:

(A) This license is issued to Western Massachusetts Electric Company of West Springfield, Massachusetts (Licensee), under Part I of the Federal Power Act (Act), for a period effective the first day of the month in which this license is issued and terminating April 30, 2018, for the continued operation and maintenance of the Turners Falls Project No. 1889, located in Franklin County, Massachusetts, Cheshire County, New Hampshire, and Windham County, Vermont, on the Connecticut River, a navigable waterway of the United States. This license is subject to the terms and conditions of the Act, which is incorporated by reference as part of this license, and subject to the Regulations the Commission issues under the provisions of the Act.

(B) The Turners Falls Project No. 1889 consists of:

(1) All lands, to the extent of the Licensee’s interests in those lands, constituting the project area and enclosed by the project boundary, the project area and boundary being shown and described by certain exhibits which form part of the application for license and which are designated and described as:

Exhibit	FERC No. 1889-	Showing
J Sheet 1	56	General Map of Project Area
K Sheet 1	49	Detail Map of Project Area
K Sheet 1A	50	Detail Map of Project Area
K Sheet 2	46	Detail Map of Project Area
K Sheet 2A	47	Detail Map of Project Area
K Sheet 3	48	Detail Map of Project Area
K Sheet 4	51	Detail Map of Project Area
K Sheet 5	52	Detail Map of Project Area
K Sheet 6	53	Detail Map of Project Area

K Sheet 7	54	Detail Map of Project Area
K Sheet 8	55	Detail Map of Project Area

(2) Project works consisting of: (a) a concrete gravity dam in two sections connected by a natural rock island, including: (i) Gill section, about 55 feet high and 493 feet long, across the east channel, containing 3 taintor gates each 40 feet wide and 39 feet high and (ii) Montague section, about 35 feet high and 630 feet long, across the west channel, surmounted by 4 bascule type gates, each 120 feet long by 13.25 feet wide; (b) a headgate house

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about 214 feet long, containing 17 gates; (c) a reservoir having a gross storage capacity of about 21,500 acre-feet and a surface area of 2,110 acres at normal water surface elevation 185.0 msl; (d) a canal about 2 miles long; (e) a short branch canal extending to (f) a powerhouse known as No. 1 Station, having installed capacity of 4,840 kilowatts, operating under a head of about 43.7 feet; (g) a powerhouse known as Cabot Station, having installed capacity of 51,000 kilowatts, operating under a head of about 60 feet; (h) transmission facilities consisting of: (i) at No. 1 Station, generator leads and the 2.3 kV bus for the six units, two-2.3/13 kV transformer banks, the 13 kV bus, and appurtenant facilities; and (ii) at the Cabot Station, generator leads and the 6.6 kV bus for the six units, two-6.6/69 kV transformer banks and two-6.6/115 kV transformer banks, two-66 kV and two-110 kV transmission lines, each about 200 feet long and extending across the project canal to the Montague Substation, and appurtenant facilities; and (j) appurtenant facilities.

The location, nature and character of these projects works are more specifically shown and described by the exhibits cited above and by certain other exhibits which also form a part of the application for license and which are designated as:

Exhibit L	FERC No. 1889-	Showing
1	32	General Arrangement-Turners Falls Dam
2	33	Montague Spillway-Plan and Sections
3	34	Gill Spillway-Plan and Sections
4	35	Plan and Sections of Headgate House
5	36	Plan of Station No. 1
6	37	Cross Section of Station No. 1
7	38	Plan of Cabot Station
8	39	Cross Section of Cabot Station
9	40	Plan and Sections of Canal
10	41	Keith Drainage Tunnel
11	42	Lower Drainage Tunnel

Exhibit M - "General Description of Structures and Mechanical Electrical and Transmission Equipment," consisting of 6 pages filed June 19, 1969.

(3) All of the structures, fixtures, equipment, or facilities used or useful in the maintenance and operation of the project and located on the project area, all portable property which may be employed in connection with the project, located on or off the project area, as approved by the Commission, and all riparian or other rights which are necessary or appropriate in the maintenance or operation of the project.

(C) Exhibits J, K, and M, designated and described in Ordering Paragraph (B) above, are approved and made a part of the license. Exhibit L designated and described in Ordering Paragraph (B) is approved subject to Article 39.

(D) This license is also subject to Articles 1 through 28 set forth in Form L-3 (revised October 1975), entitled "Terms and Conditions of License for Constructed Major Project Affecting Navigable Waters of the United States", attached to (See 54 FPC 1817) and made a part of this license. This license is also subject to the following additional articles:

ARTICLE 29. Pursuant to Section 10(d) of the Act, a specified reasonable rate of return upon the net investment in the project shall be used for determining surplus earnings of the project for the establishment and maintenance of amortization reserves. One-half of the project surplus earnings, if any, accumulated under the license, in excess of the specified rate of return per annum on the net investment, shall be set aside in a project amortization reserve account as of the end of each fiscal year: Provided, that, if and to the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year under the license, the amount of such deficiency shall be deducted from the amount of any surplus earnings accumulated thereafter until absorbed, and one-half of the remaining surplus earnings, if any, cumulatively computed, shall be set aside in the project amortization reserve account; and the amounts thus established in the project amortization reserve account shall be maintained therein until further order of the Commission.

The annual specified reasonable rate of return shall be the sum of the weighted cost components of long-term debt, preferred stock, and the cost of common equity, as defined herein. The weighted cost component for each

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element of the reasonable rate of return is the product of its capital ratio and cost rate. The current capital ratios for each of the above elements of the rate of return shall be calculated annually based on an average of 13 monthly balances of amounts properly includable in the Licensee’s long-term debt and proprietary capital accounts as listed in the Commission’s Uniform System of Accounts. The cost rates for such ratios shall be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity shall be the interest rate on 10-year government bonds (reported as the Treasury Department’s 10-year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

ARTICLE 30. For the purpose of reimbursing the United States for the cost of administration of Part I of the Act, the Licensee shall pay the United States, effective the first day of the month in which this license is issued, a reasonable annual charge as determined by the Commission in accordance with the provisions of its Regulations in effect from time to time. The authorized installed capacity for that purpose is 74,500 horsepower.

ARTICLE 31. Licensee shall implement, and modify when appropriate, the emergency action plan on file with the Commission designed to provide an early warning to upstream and downstream inhabitants and property owners if there should be an impending or actual sudden release of water caused by an accident to, or failure of, project works. That plan shall include: instructions to be provided on a continuing basis to operators and attendants for actions they are to take in the event of an emergency; detailed and documented plans for notifying law enforcement agents, appropriate Federal, State, and local agencies, operators of water-related facilities, and those residents and owners of properties that could be endangered; actions that would be taken to reduce the inflow to the reservoir, if possible, by limiting the outflow from upstream dams or control structures; and actions to reduce downstream flows by controlling the outflow from dams located on tributaries to the stream on which the project is located. Licensee shall also maintain on file with the Commission a summary of the study used as a basis for determining areas that may be affected by an emergency, including criteria and assumptions used. Licensee shall monitor any changes in upstream or downstream conditions which may influence possible flows or affect areas susceptible to damage, and shall promptly make and file with the Commission appropriate changes in the emergency action plan. The Commission reserves the right to require modifications to the plan.

ARTICLE 32. Licensee and the Department of the Army, Corps of Engineers (Corps), have entered into an agreement providing for the coordinated operation of the project in the interest of flood control. A conformed copy of the agreement and plan are on file with the Commission. The project operation shall continue in accordance with the agreement and plan. The Commission reserves the right to impose conditions on the Licensee for coordinated operation of the project.

ARTICLE 33. The Licensee shall consult with appropriate Federal, State, and local agencies interested in the development of modified plans for the Cabot Woods and Unity Park Areas to provide for optimum public utilization and recreation needs of the project area and, within one year from the date of issuance of this license, shall file for approval a revised Exhibit R conforming to the requirements of §4.41 of the Commission's Regulations and a revised Exhibit K conforming to §4.41 of the Regulations and including within the project boundary all recreation lands contained in the revised Exhibit R. The revised Exhibit R shall include, among other things: (1) any revised site plans for Cabot Woods, Unity Park, and the Branch Canal; (2) any proposed public use facilities to be associated with the operation of the fish passage facilities; (3) costs to develop the proposed recreation facilities; (4) a construction schedule for proposed recreation facilities; (5) measures, such as signs, which would be taken to make canoe portage readily available to river users; and (6) a description of the nature and extent of consultation and cooperation with appropriate agencies.

ARTICLE 34. The Licensee shall maintain a continuous minimum flow of 1,433 cfs (0.20 cubic feet per second per square mile of drainage basin) or a flow equal to the inflow of the reservoir, whichever is less, from the project into the Connecticut River. These flows may be modified temporarily: (1) during and to the extent required by operating emergencies beyond the control of the Licensee; and (2) in the interest of recreation and protection of the fisheries resources, upon mutual agreement between the Licensees for Projects Nos. 1889 and 2485 and the Massachusetts Division of Fisheries and Wildlife. During the period of each year from May 1 until there are no substantial numbers of juvenile or adult shad in the reach of the river where the project is located, but in any event no later than October 1, the following portion of that total minimum flow shall be released from the Turners Falls Dam: until the Montague spillway fishway begins operating, 200 cfs; after that fishway begins operating, 400 cfs. Any other portion of the specified total continuous minimum flow

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may be released from either the Turners Falls Dam or the Cabot Station, except that a sufficient portion shall be released from Cabot Station to allow proper operation of the Cabot Station fishway.

ARTICLE 35. Prior to the commencement of any construction or development of any project works or other facilities at the project, the Licensee shall consult and cooperate with the appropriate State Historic Preservation Officer(s) (SHPO) to determine the need for, and extent of, any archeological or historic resource surveys and any mitigative measures that may be necessary. The Licensee shall provide funds in a reasonable amount for such activity. If any previously unrecorded archeological or historic sites are discovered during the course of the construction, construction activity in the vicinity shall be halted, a qualified archeologist shall be consulted to determine the significance of the sites, and the Licensee shall consult with the SHPO to develop a mitigation plan for the protection of significant archeological or historic resources. If the Licensee and the SHPO cannot agree on the amount of money to be expended on archeological or historic work related to the project, the Commission reserves the right to require the Licensee to conduct, at its own expense, any such work found necessary.

ARTICLE 36. The Licensee shall, to the satisfaction of the Commission's authorized representative, install and operate any signs, lights, sirens, barriers, or other devices that may be reasonably needed to warn the public of fluctuations in flow from the project and to protect the public in its recreational use of project lands and waters.

ARTICLE 37. In the interests of protecting and enhancing the scenic, recreational, and other environmental values of the project, Licensee: (1) shall supervise and control the use and occupancy of the project lands and waters; (2) shall prohibit, without further Commission approval, the further use and occupancy of project lands and waters other than as specifically authorized by this license; (3) may authorize without further

Commission approval, the use and occupancy of project lands and waters for landscape plantings and the construction, operation, and maintenance of access roads, power and telephone distribution lines, piers, landings, boat docks, or similar structures and facilities, and embankments, bulkheads, retaining walls, or other similar structures for erosion control to protect the existing shoreline; (4) shall require, where feasible and desirable, the multiple use and occupancy of facilities for access to project lands and waters; and (5) shall ensure to the satisfaction of the Commission's authorized representative that all authorized uses and occupancies of project lands and waters: (a) are consistent with shoreline aesthetic values, (b) are maintained in a good state of repair, and (c) comply with State and local health and safety regulations. Under item (3) of this article, Licensee may, among other things, institute a program for issuing permits to a reasonable extent for the authorized types of use and occupancy of project lands and waters. Under appropriate circumstances, permits may be subject to the payment of a fee in a reasonable amount. Before authorizing the construction of bulkheads or retaining walls, Licensee shall: (a) inspect the site of the proposed construction, (b) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (c) determine that the proposed construction is needed. If an authorized use or occupancy fails to comply with the conditions of this article or with any reasonable conditions imposed by the Licensee for the protection of the environmental quality of project lands and waters, the Licensee shall take appropriate action to correct the violations, including, if necessary, cancellation of the authorization and removal of any non-complying structures or facilities. The Licensee's consent to an authorized use or occupancy of project lands and waters shall not, without its express agreement, place upon the Licensee any obligation to construct or maintain any associated facilities. Licensee shall, within 60 days prior to commencement of a program for issuing permits, furnish a copy of its guidelines and procedures for implementing the program to the Commission's authorized representative and its Director, Office of Electric Power Regulation. Whenever the Licensee makes any modification to these guidelines and procedures, it shall promptly furnish a copy to each of those persons. The Commission reserves the right to require modifications to these guidelines and procedures.

ARTICLE 38. The Licensee shall file with the Commission, within one year from the date of completion of construction of the fish passage facilities, "as-built" drawings of the completed fish passage facilities. Additionally, the Licensee shall, in cooperation with the Massachusetts Division of Fisheries and Wildlife, and the U. S. Fish and Wildlife Service of the Department of the Interior, conduct, or pay for others to conduct, post-operational studies designed to determine the effectiveness of the fish passage facilities in allowing for the upstream migration of anadromous fishes past the Turners Falls Project. The Licensee shall file with the Commission an annual report detailing operation of the facilities, problems in

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design or operation, and listing the number, by species, of all fish passed upstream.

ARTICLE 39. Within six months from the date of issuance of this license the Licensee shall file for approval revised Exhibit L Drawings Nos. L-1, L-2, and L-3 (FERC Drawings Nos. 1889-32, -33 and -34, respectively) to reflect the "as-built" condition of the Turners Falls Dam after the modifications made to increase the storage capacity of the reservoir for use as the lower reservoir for Project No. 2485.

ARTICLE 40. The Licensee shall operate the project in coordination with the operation of the Northfield Mountain Pumped Storage Project No. 2485. The Licensees for Project No. 2485 are authorized to utilize the Turners Falls Reservoir as a source of water and as a lower pool for the operation of Project No. 2485.

ARTICLE 41. Within six months from the date of issuance of this license, the Licensee shall prepare and file with the Commission a feasibility analysis of: (1) rehabilitating the No. 1 Station to enable utilization of its total installed capacity; and (2) installing additional generating capacity at the Project. These analyses shall take into account, to the extent reasonable, all benefits that would be derived from the rehabilitation or installation, including any contribution to the conservation of non-renewable natural resources. If the studies shows rehabilitation or additional capacity to be economically feasible, the Licensee shall simultaneously file a schedule for, respectively, rehabilitating the No. 1 Station or filing an application to amend its license to install the additional capacity.

ARTICLE 42. The Licensee shall coordinate the operation of the project, electrically and hydraulically, with such other power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

(E) This order is final unless an application for rehearing is filed within 30 days from the date of its issuance, as provided in Section 313(a) of the Act. The filing of an application for rehearing does not operate as a stay of the effective date of this license or of any other date specified in this order, except as specifically ordered by the Commission. Failure of the Licensee to file an application for rehearing shall constitute acceptance of this license. In acknowledgement of acceptance of this license, the license shall be signed for the Licensee and returned to the Commission within 60 days from the date of issuance of this order.

-- Footnotes --

[1]The application was filed on June 19, 1969, and supplemented on February 18 and August 24, 1970, October 2, 1972, March 5, and May 29, 1973, March 14 and 25, and September 15, 1974, and April 21, 1976.

[2]Station No. 1 is not operable now and has not operated since 1973 when the intake racks collapsed. At the time of the most recent inspection, the Licensee was conducting a feasibility study to determine whether it would be economically feasible to return this station to operation. No such study has been furnished to the Commission. Therefore, Article 41 requires a feasibility study of reconditioning No. 1 Station.

[3]Articles 40 and 42 of this license carry over provisions from the Commission’s order licensing Project No. 2485 and modifying the original license for Project No. 1889 to accommodate Project No. 2485.

[4]*I.e.,* that portion of the 1,433 cfs above the 400 cfs WMECO has agreed to release from the dam as fishway attraction water during the May 1 to October 1 period.

[5]For the Vernon Project--the first project upstream, 15 miles above the Turners Falls Project--0.2 cfsm is the equivalent of 1,250 cfs.

[6]The Massachusetts Water Resources Commission has issued a water quality certificate for the project in accordance with Section 401 of the Federal Water Pollution Control Act.

[7]S. D. Warren, Project No. 2897, Order Denying Rehearing (issued February 19, 1980, 10 FERC ¶61,153).

[8]*See,* Montana Power Company, Mystic Lake Project No. 2301, Order Issuing New License (Major) (issued October 5, 1976, 10 FPC 2008).

[9]We are also mindful that WMECO is investing a significant amount of new capital in the project to provide fish passage facilities.

[10]Western Massachusetts Electric Company, Projects Nos. 1889 and 2485, 39 FPC 723 (1968), *rehearing denied,* 40 FPC 296, *affirmed,* Municipal Electric Association of Massachusetts v. F.P.C., 414 F. 2d 1206 (CADC 1969).

Form L-3
(Revised October, 1975)

FEDERAL ENERGY REGULATORY COMMISSION

TERMS AND CONDITIONS OF LICENSE FOR CONSTRUCTED MAJOR PROJECT AFFECTING NAVIGABLE WATERS OF THE UNITED STATES

Article 1. The entire project, as described in this order of the Commission, shall be subject to all of the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, specifications, and statements described and designated as exhibits and approved by the Commission in its order as a part of the license until such change shall have been approved by the Commission: *Provided, however*, That if the Licensee or the Commission deems it necessary or desirable that said approved exhibits, or any of them, be changed, there shall be submitted to the Commission for approval a revised, or additional exhibit or exhibits covering the proposed changes which, upon approval by the Commission, shall become a part of the license and shall supersede, in whole or in part, such exhibit or exhibits theretofore made a part of the license as may be specified by the Commission.

Article 3. The project area and project works shall be in substantial conformity with the approved exhibits referred to in Article 2 herein or as changed in accordance with the provisions of said article. Except when emergency shall require for the protection of navigation, life, health, or property, there shall not be made without prior approval of the Commission any substantial alteration or addition not in conformity with the approved plans to any dam or other project works under the license or any substantial use of project lands and waters not authorized herein; and any emergency alteration, addition, or use so made shall thereafter be subject to such modification and change as the Commission may direct. Minor changes in project works, or in uses of project lands and waters, or divergence from such approved exhibits may be made if such changes will not result in a decrease in efficiency, in a material increase in cost, in an adverse environmental impact, or in impairment of the general scheme of development; but any of such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of such results, shall be subject to such alteration as the Commission may direct.

Article 4. The project, including its operation and maintenance and any work incidental to additions or alterations authorized by the Commission, whether or not conducted upon lands of the United States, shall be subject to the inspection and supervision of the Regional Engineer, of the Commission, in the region wherein the project is located, or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall cooperate fully with said representative and shall furnish him such information as he may require concerning the operation and maintenance of the project, and any such alterations thereto, and shall notify him of the date upon which work with respect to any alteration will begin, as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of work for a period of more than one week, and of its resumption and completion. The Licensee shall submit to said representative a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of any such alterations to the project. Construction of said alterations or any feature thereof shall not be initiated until the program of inspection for the alterations or any feature thereof has been approved by said representative. The Licensee shall allow said representative and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties. The Licensee shall comply with such rules and regulations of general or special applicability as the Commission may prescribe from time to time for the protection of life, health, or property.

Article 5. The Licensee, within five years from the date of issuance of the license, shall acquire title in fee or the right to use in perpetuity all lands, other than lands of the United States, necessary or appropriate for the construction, maintenance, and operation of the project. The Licensee or its successors and assigns shall, during the period of the license, retain the possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and none of such properties shall be voluntarily sold, leased, transferred, abandoned, or otherwise disposed of without the prior written approval of the Commission, except that the Licensee may lease or otherwise dispose of interests in project lands or property without specific written approval of the Commission pursuant to the then current regulations of the Commission. The provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear; and mortgage or trust deeds or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article.

<u>Article 6</u>. In the event the project is taken over by the United States upon the termination of the license as provided in Section 14 of the Federal Power Act, or is transferred to a new licensee or to a non-power licensee under the provisions of Section 15 of said Act, the Licensee, its successors and assigns shall be responsible for, and shall make good any defect of title to, or of right of occupancy and use in, any of such project property that is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and shall pay and discharge, or shall assume responsibility for payment and discharge of, all liens or encumbrances upon the project or project property created by the Licensee or created or incurred after the issuance of the license: <u>Provided</u>, That the provisions of this article are not intended to require the Licensee, for the purpose of transferring the project to the United States or to a new licensee, to acquire any different title to, or right of occupancy and use in, any of such project property than was necessary to acquire for its own purposes as the Licensee.

<u>Article 7</u>. The actual legitimate original cost of the project, and of any addition thereto or betterment thereof, shall be determined by the Commission in accordance with the Federal Power Act and the Commission's Rules and Regulations thereunder.

<u>Article 8</u>. The Licensee shall install and thereafter maintain gages and stream-gaging stations for the purpose of determining the stage and flow of the stream or streams on which the project is located, the amount of water held in and withdrawn from storage, and the effective head on the turbines; shall provide for the required reading of such gages and for the adequate rating of such stations; and shall install and maintain standard meters adequate for the determination of the amount of electric energy generated by the project works. The number, character, and location

of gages, meters, or other measuring devices, and the method of operation thereof, shall at all times be satisfactory to the Commission or its authorized representative. The Commission reserves the right, after notice and opportunity for hearing, to require such alterations in the number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, as are necessary to secure adequate determinations. The installation of gages, the rating of said stream or streams, and the determination of the flow thereof, shall be under the supervision of, or in cooperation with, the District Engineer of the United States Geological Survey having charge of stream-gaging operations in the region of the project, and the Licensee shall advance to the United States Geological Survey the amount of funds estimated to be necessary for such supervision, or cooperation for such periods as may be mutually agreed upon. The Licensee shall keep accurate and sufficient records of the foregoing determinations to the satisfaction of the Commission, and shall make return of such records annually at such time and in such form as the Commission may prescribe.

Article 9. The Licensee shall, after notice and opportunity for hearing, install additional capacity or make other changes in the project as directed by the Commission, to the extent that it is economically sound and in the public interest to do so.

Article 10. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other projects or power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 11. Whenever the Licensee is directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of the headwater improvement for such part of the annual charges for interest, maintenance, and depreciation thereof as the Commission shall determine to be equitable, and shall pay to the United States the cost of making such determination as fixed by the Commission. For benefits provided by a storage reservoir or other headwater improvement of the United States, the Licensee shall pay to the Commission the amounts for which it is billed from time to time for such headwater benefits and for the cost of making the determinations pursuant to the then current regulations of the Commission under the Federal Power Act.

<u>Article 12</u>. The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial public uses, including recreational purposes, and the Licensee shall release water from the project reservoir at such rate in cubic feet per second, or such volume in acre-feet per specified period of time, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

<u>Article 13</u>. On the application of any person, association, corporation, Federal agency, State or municipality, the Licensee shall permit such reasonable use of its reservoir or other project properties, including works, lands and water rights, or parts thereof, as may be ordered by the Commission, after notice and opportunity for hearing, in the interests of comprehensive development of the waterway or waterways involved and the conservation and utilization of the water resources of the region for water supply or for the purposes of steam-electric, irrigation, industrial, municipal or similar uses. The Licensee shall receive reasonable compensation for use of its reservoir or other project properties or parts thereof for such purposes, to include at least full reimbursement for any damages or expenses which the joint use causes the Licensee to incur. Any such compensation shall be fixed by the Commission either by approval of an agreement between the Licensee and the party or parties benefiting or after notice and

opportunity for hearing. Applications shall contain information in sufficient detail to afford a full understanding of the proposed use, including satisfactory evidence that the applicant possesses necessary water rights pursuant to applicable State law, or a showing of cause why such evidence cannot concurrently be submitted, and a statement as to the relationship of the proposed use to any State or municipal plans or orders which may have been adopted with respect to the use of such waters.

Article 14. In the construction or maintenance of the project works, the Licensee shall place and maintain suitable structures and devices to reduce to a reasonable degree the liability of contact between its transmission lines and telegraph, telephone and other signal wires or power transmission lines constructed prior to its transmission lines and not owned by the Licensee, and shall also place and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling or obstructing traffic or endangering life. None of the provisions of this article are intended to relieve the Licensee from any responsibility or requirement which may be imposed by any other lawful authority for avoiding or eliminating inductive interference.

Article 15. The Licensee shall, for the conservation and development of fish and wildlife resources, construct, maintain, and operate, or arrange for the construction, maintenance, and operation of such reasonable facilities, and comply with such reasonable modifications of the project structures and operation, as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing.

Article 16. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of the Licensee's lands and interests in lands, reservoirs, waterways and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be reasonably prescribed by the Commission in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

Article 17. The Licensee shall construct, maintain, and operate, or shall arrange for the construction, maintenance, and operation of such reasonable recreational facilities, including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities, and utilities, giving consideration to the needs of the physically handicapped, and shall comply with such reasonable modifications of the project, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal or State agencies, after notice and opportunity for hearing.

Article 18. So far as is consistent with proper operation of the project, the Licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and for outdoor recreational purposes, including fishing and hunting: Provided, That the Licensee may reserve from public access such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property.

Article 19. In the construction, maintenance, or operation of the project, the Licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion on lands adjacent to streams or other waters, stream sedimentation, and any form of water or air pollution. The Commission, upon request or upon its own motion, may order the Licensee to take such measures as the Commission finds to be necessary for these purposes, after notice and opportunity for hearing.

Article 20. The Licensee shall clear and keep clear to an adequate width lands along open conduits and shall dispose of all temporary structures, unused timber, brush, refuse, or other material unnecessary for the purposes of the project which results from the clearing of lands or from the maintenance or alteration of the project works. In addition, all trees along the periphery of project reservoirs which may die during operations of the project shall be removed. All clearing of the lands and disposal of the unnecessary material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission and in accordance with appropriate Federal, State, and local statutes and regulations.

Article 21. Material may be dredged or excavated from, or placed as fill in, project lands and/or waters only in the prosecution of work specifically authorized under the license; in the maintenance of the project; or after obtaining Commission approval, as appropriate. Any such material shall be removed and/or deposited in such manner as to reasonably preserve the environmental values of the project and so as not to interfere with traffic on land or water. Dredging and filling in a navigable water of the United States shall also be done to the satisfaction of the District Engineer, Department of the Army, in charge of the locality.

Article 22. Whenever the United States shall desire to construct, complete, or improve navigation facilities in connection with the project, the Licensee shall convey to the United States, free of cost, such of its lands and rights-of-way and such rights of passage through its dams or other structures, and shall permit such control of its pools, as may be required to complete and maintain such navigation facilities.

Article 23. The operation of any navigation facilities which may be constructed as a part of, or in connection with, any dam or diversion structure constituting a part of the project works shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including control of the level of the pool caused by such dam or diversion structure, as may be made from time to time by the Secretary of the Army.

Article 24. The Licensee shall furnish power free of cost to the United States for the operation and maintenance of navigation facilities in the vicinity of the project at the voltage and frequency required by such facilities and at a point adjacent thereto, whether said facilities are constructed by the Licensee or by the United States.

Article 25. The Licensee shall construct, maintain, and operate at its own expense such lights and other signals for the protection of navigation as may be directed by the Secrétary of the Department in which the Coast Guard is operating.

Article 26. If the Licensee shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without adequate replacement, or shall abandon or discontinue good faith operation of the project or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address of the Licensee or its agent, the Commission will deem it to be the intent of the Licensee to surrender the license. The Commission, after notice and opportunity for hearing, may require the Licensee to remove any or all structures, equipment and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the United States agency having jurisdiction over its lands or the Commission's authorized representative, as appropriate, or to provide for the continued operation and maintenance of nonpower facilities and fulfill such other obligations under the license as the Commission may prescribe. In addition, the Commission in its discretion, after notice and opportunity for hearing, may also agree to the surrender of the license when the Commission, for the reasons recited herein, deems it to be the intent of the Licensee to surrender the license.

Article 27. The right of the Licensee and of its successors and assigns to use or occupy waters over which the United States has jurisdiction, or lands of the United States under the license, for the purpose of maintaining the project works or otherwise, shall absolutely cease at the end of the license period, unless the Licensee has obtained a new license pursuant to the then existing laws and regulations, or an annual license under the terms and conditions of this license.

Article 28. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

NORTHEAST UTILITIES
THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

P.O. BOX 270
HARTFORD, CONNECTICUT 06101
(203) 666-6911

October 6, 1980

FERC Project No. 1889
Turners Falls

Mr. Kenneth F. Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

Dear Mr. Plumb:

Amendment of the License for Project No. 1889
By Adding Article No. 43
And By Deleting Article No. 37

We have received a letter from Mr. William W. Lindsay, Director of the Office of Electric Power Regulation, offering us an opportunity to amend the license for Project No. 1889, Turners Falls, by adding a new standard article.

The new article gives the Licensee authority to grant permission for certain uses of project lands and waters and to convey certain interests in project lands, without prior Commission approval. By this letter, we accept that new article as an amendment to the project license. The new article should be designated Article No. 43. A copy of the new article with that article number filled in, is attached to this letter.

In our judgment, the new article substantially replaces the authority currently contained in Article No. 37 of the license for Project No. 1889. Accordingly, we request that the license be amended to delete Article No. 37.

Very truly yours,

WESTERN MASSACHUSETTS ELECTRIC COMPANY

W. G. Counsil

W. G. Counsil
Senior Vice President

Attachment: New License Article No. 43

VERIFICATION

State of Connecticut)
) ss: Hartford
County of Hartford)

October 6, 1980

William G. Counsil, being first duly sworn, deposes and says that he is Senior Vice President of the Western Massachusetts Electric Company, that he is authorized to verify and file the foregoing document, and that he has examined the foregoing document and knows the contents thereof; and that all statements therein are true to the best of his knowledge, information, and belief.

William G. Counsil

Subscribed and sworn to before me this 6th day of October 1980.

Notary Public
My Commission Expires March 31, 1983

(SEAL)

Article 43. (a) In accordance with the provisions of this article, the Licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain other types of use and occupancy, without prior Commission approval. The Licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the Licensee shall also have continuing responsibility to supervise and control the uses and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the Licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the Licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, cancelling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The types of use and occupancy of project lands and waters for which the Licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities; and (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the Licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The Licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the uses and occupancies for which it grants permission are maintained in good repair and comply with applicable State and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the Licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline. To implement this paragraph (b), the Licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the Licensee's costs of administering the permit program. The Commission reserves the right to require the Licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modifications of those standards, guidelines, or procedures.

(c) The Licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement, expansion, realignment, or maintenance of bridges and roads for which all necessary State and Federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the Licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The Licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary State and Federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary Federal and State water quality certificates or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary Federal and State approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from the edge of the project reservoir at normal maximum surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 45 days before conveying any interest in project lands under this paragraph (d), the Licensee must file a letter to the Director, Office of Electric Power Regulation, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G or K map may be used), the nature of the proposed use, the identity of any Federal or

State agency official consulted, and any Federal or State approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the Licensee to file an application for prior approval, the Licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraphs (c) or (d) of this article:

(1) Before conveying the interest, the Licensee shall consult with Federal and State fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the Licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved Exhibit R or approved report on recreational resources of an Exhibit E; or, if the project does not have an approved Exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include covenants running with the land adequate to ensure that: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; and (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project.

(4) The Commission reserves the right to require the Licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G or K drawings would be filed for approval for other purposes.

1 FERC - 75 FERC, 24 FERC ¶62,316, Western Massachusetts Electric Company, Project No. 1889-005, Federal Energy Regulatory Commission, (Sep. 16, 1983)

Western Massachusetts Electric Company, Project No. 1889-005

[63,536]

[¶62,316]

Western Massachusetts Electric Company, Project No. 1889-005

Order Amending License

(Issued September 16, 1983)

Lawrence R. Anderson, Director, Office of Electric Power Regulation.

On September 7, 1982, Western Massachusetts Electric Company (Licensee) filed a request for amendment of its license for the Turners Falls Project No. 1889, located on the Connecticut River in the counties of Franklin, Massachusetts, Windham, Vermont and Cheshire, New Hampshire. [12]

Under the license, Licensee is authorized for the operation and maintenance of the Turners Falls No. 1 and Cabot Stations with an installed capacity of 4,840 kW and 51,000 kW, respectively. Licensee states that it has refurbished the Turners Falls No. 1 Station (rewinding of generators, *inter alia*), which resulted in changes in the capacity of existing generating units, for a total additional capacity of 853 kW.

It is concluded that the approval of this request is an administrative action and does not constitute a major Federal action significantly affecting the quality of the human environment.

It is ordered that:

(A) The request for amendment of the license filed on September 7, 1982, for Project No. 1889 is approved.

(B) The installed capacity of the Turners Falls No. 1 Station stated in Ordering Paragraph (B)(2) of the license is changed from 4,840 kW to 5,693 kW.

(C) Article 30 of the license is amended to read:

Article 30. For the purpose of reimbursing the United States for the cost of administration of Part I of the Act, the Licensee shall pay the United States a reasonable annual charge as determined by the Commission in accordance with the provisions of its regulations in effect from time to time: (1) For the period May 1, 1980 to September 30, 1983, the authorized installed capacity for that purpose is 74,500. (2) For the period commencing October 1, 1983, the authorized installed capacity for that purpose is 75,600 horsepower.

(D) The Licensee's failure to file a petition appealing this order to the Commission shall constitute acceptance of this license. In acknowledgment of acceptance of this order and its terms and conditions, it shall be signed by the Licensee and returned to the Commission within 60 days from the date this order is issued.

-- Footnotes --

[1] Authority to act on this matter is delegated to the Director, Office of Electric Power Regulation, under §375.308 of the Commission's regulations, 18 C.F.R. §375.308 (1982), *FERC Statutes and Regulations*¶30,238 . This order may be appealed to the Commission by any party within 30 days of its issuance pursuant to Rule 1902, 18 C.F.R. §385.1902 , *FERC Statutes and Regulations*¶29,052 , 47 Fed. Reg. 19014 (1982). Filing an appeal and final Commission action on that appeal are prerequisites for filing an application for rehearing as provided in Section 313(a) of the Act. Filing an appeal does not operate as a stay of the effective date of this order or any other date specified in this order, except as specifically directed by the Commission.

[2] The new license for Project No. 1889 was issued on May 5, 1980 [11 FERC ¶61,124], and will terminate on April 30, 2018.

FERC 102 to Current Volume, Northeast Generation Company, Project No. 1889-040, 102 FERC ¶62,102, Federal Energy Regulatory Commission, (Feb. 12, 2003)

[64,154]

Northeast Generation Company,

Project No. 1889-040

Order Amending License and Revising Annual Charges

February 12, 2003

Mohamad Fayyad,Engineering Team Lead, Engineering and Jurisdiction Branch, Division of Hydropower Administration and Compliance.

On January 23, 2003, Northeast Generation Services Company (NGSC), on behalf of Northeast Generation Company (NGC), licensee for the Turners Falls Project, FERC Project No. 1889, filed information on the rehabilitated turbine-generator units at the Cabot Station powerhouse of the project. The project is located on the Connecticut River, in the counties of Franklin, Massachusetts, Windham, Vermont, and Cheshire, New Hampshire.

Background

The Turners Falls Project as authorized consists of two powerhouses—Turners Falls No. 1 Station and Cabot Station, having an installed capacity of 5, 693 and 51,000 kW respectively. The authorized installed capacity of the project for annual charge purposes is 75,600 horsepower. [1]

In a November 13, 2000 letter, filed with the Secretary of the Commission, NGSC informed the Commission, in order to provide reliable electric generation, it is conducting a maintenance program over a three-year period beginning in 2001 to overhaul the original Cabot Station units which have been in operation since 1916, and completing two units each year.

Review

In its filing, NGSC stated that Cabot Station Units 1 and 2 were overhauled, and overhaul of Units 3 and 4 is currently underway. NGSC provided information on the start and completion

[64,155]

dates, and installed capacity for the overhauled units. Staff requested NGSC to provide information on individual generator and best gate turbine capacities of the units, and any changes in the hydraulic capacities of the turbines. By an e-mail NGSC provided the requested information. [2] According to NGSC there has been no change in the hydraulic capacity of the units.

According to the Commission's regulations at 18 C.F.R. §11.1(i) which state in part "authorized installed capacity means the lesser of the ratings of the generator or turbine units ....The rating of a turbine is the product of the turbine capacity in horsepower (hp) at best gate (maximum efficiency point) opening under the manufacturer's rated head times a conversion factor of 0.75kW/hp ....." Issuance of this order is necessary to revise: (a) the project description to reflect as-built conditions; and (b) the authorized installed capacity of the project. The authorized installed capacity of the Turners Falls Project after the rehabilitation of Cabot Station Units 1 and 2 would be 60,365 kW as shown in Table 1. Ordering Paragraph (D) of this order requires the licensee to install nameplates reflecting the new ratings of the rehabilitated units.

Table 1

Powerhouse	Unit	Before Rehab, MW		After Rehab, MW		Authorized Capacity,	On-line Date
		Turbine (T)	Generator (G)	Turbine	Generator	MW	After Rehab

	1	9.375	8.5	10.4	10.336	10.336 (G)	3/19/02
	2	9.375	8.5	10.4	10.336	10.336 (G)	4/02/02
	3	9.375	8.5	9.375	8.5	8.5 (G)	-
Cabot Station							
	4	9.375	8.5	9.375	8.5	8.5 (G)	-
	5	9.375	8.5	9.375	8.5	8.5 (G)	-
	6	9.375	8.5	9.375	8.5	8.5 (G)	-
Turners Falls No. 1 Station						5.693	-
		Total Authorized Capacity of the Project				**60.365**	

Note: Turbine Capacities are at best-gate.

In accordance with the Commission's policy, the effective date of the revised annual charges will be the date the revised capacity went on-line. [3] Since the rehabilitated units went on-line within a span of two weeks, we will use for practical purposes, the latter date of April 2, 2002, as the effective date for revised annual charges.

Upon completion of the rehabilitation of Cabot Station Units, which according to NGSC would be early 2004, the licensee must file a revised Exhibit M, and necessary revised exhibits reflecting as- built conditions.

The Director Orders:

(A) The license for the Turners Falls Project, FERC Project No. 1889 is amended as provided by this order effective the day this order is issued.

(B) Paragraph 1 of Ordering Paragraph (B)(2) of the license is revised to read as follows:

Project works consisting of: (a) a concrete gravity dam in two sections connected by a natural rock island, including: (i) Gill section, about 55 feet high and 493 feet long, across the east channel, containing 3 taintor gates each 40 feet wide and 39 feet high; and (ii) Montague section, about 35 feet high and 630 feet long, across the west channel, surmounted by 4 bascule type gates, each 120 feet long by 13.25 feet wide; (b) a headgate house about 214 feet long, containing 17 gates; (c) a reservoir having a gross storage capacity of about 21,500 acre-feet and a surface area of 2,110 acres at normal water surface elevation 185.0 msl; (d) a canal about 2 miles long; (e) a short branch canal extending to; (f) a powerhouse known as No. 1 Station, containing five turbine- generator units for an authorized capacity of 5,693 kilowatts, operating under a head of about 43.7 feet; (g) a powerhouse known as Cabot Station, containing six turbine-generator units for an authorized capacity of 54,672 kilowatts, operating under a head of about 60 feet, for a total authorized installed capacity of 60,365 kilowatts (*see* Table 1); (h) transmission facilities consisting of: (i) at No. 1 Station, generator leads and the 2.3 kV bus for the six units, two-2.3/13 kV transformer banks, the 13 kV bus, and appurtenant facilities; and (ii) at the Cabot Station, generator leads and the 6.6 kV bus for the six units, two-6.6/69 kV transformer banks and two-6.6/115 kV transformer banks, two-66 kV and two-110 kV transmission lines, each about 200 feet long and extending across the project canal to the Montague Substation, and appurtenant facilities; and (j) appurtenant facilities.

[64,156]

(C) Article 30 of the license for the Turners Falls Project is revised to read:

> *Article 30.* For the purposes of reimbursing the United States for the cost of administration of Part I of the Act, the licensee shall pay the United States, a reasonable amount as determined by the Commission in accordance with the provisions of its regulations in effect from time to time. Effective April 2, 2002, the authorized installed capacity for that purpose is 60,365 kilowatts.

(D) Within 90 days from the date of this order the licensee is required to install new nameplates for the rehabilitated units. The nameplate for each turbine must reflect the best-gate rating.

(E) This order constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. §385.713.

Footnotes

1 24 FERC ¶62,316 *Order Amending License,* issued September 16, 1983.

2 E-mail from Mr. John Howard, dated January 22, 2003. A copy of the e-mail is in the Commission's public files under Docket No. P-1889-040.

3 66 FERC ¶61,086 *Order on Rehearing,* issued January 18, 1994.

FERC 102 to Current Volume, Northeast Generation Company, Project No. 1889-046, 106 FERC ¶62,084, Federal Energy Regulatory Commission, (Feb. 5, 2003)

[64,136]

Northeast Generation Company,

Project No. 1889-046

Order Amending License and Revising Annual Charges

February 5, 2004

[64,137]

Mohamad Fayyad, Engineering Team Lead, Engineering and Jurisdiction Branch, Division of Hydropower Administration and Compliance.

On January 22, 2004, Northeast Generation Services Company (NGSC), on behalf of Northeast Generation Company (NGC), licensee for the Turners Falls Project, FERC Project No. 1889, filed information on the rehabilitated turbine-generator Units 3 and 4 at the Cabot Station powerhouse of the project. The project is located on the Connecticut River, in the counties of Franklin, Massachusetts, Windham, Vermont, and Cheshire, New Hampshire.

Background

The Turners Falls Project consists of two powerhouses—Turners Falls No. 1 Station and Cabot Station. In a November 13, 2000 letter, filed with the Secretary of the Commission, NGSC informed the Commission, in order to provide reliable electric generation, it is conducting a maintenance program over a three-year period beginning in 2001 to overhaul the original Cabot Station units which have been in operation since 1916, and completing two units each year.

In an order issued on February 12, 2003, we amended the license for the Turners Falls Project to reflect the overhaul of Cabot Station Units 1 and 2, and revised the total authorized capacity to 60,365 kilowatts, of which 5,693 kilowatts is Turners Falls Station No. 1 capacity and 54,672 kilowatts is Cabot Station capacity. [1]

Review

In its January 22, 2004 filing, NGSC stated that Cabot Station Units 3 and 4 were overhauled, and overhaul of Units 5 and 6 is currently underway. NGSC provided information on the start and completion dates, and installed capacity for the overhauled units. Staff requested NGSC to provide information on individual generator and best gate turbine capacities of the units, and any changes in the hydraulic capacities of the turbines. By an e- mail NGSC provided the requested information. [2] According to NGSC there has been no change in the hydraulic capacity of the units.

Since the overhaul of Cabot Station Units 5 and 6 is underway, and according to NGSC the capacities of turbines and generators would be same as those of Units 1 through 4 after the overhaul, [3] we would include the capacity of the Units 5 and 6 in determining the authorized capacity of the Turners Falls Project.

According to the Commission's regulations at 18 C.F.R. §11.1(i) which state in part “authorized installed capacity means the lesser of the ratings of the generator or turbine units…. The rating of a turbine is the product of the turbine capacity in horsepower (hp) at best gate (maximum efficiency point) opening under the manufacturer's rated head times a conversion factor of 0.75 kW/hp….” Issuance of this order is necessary to revise: (a) the project description to reflect as-built conditions; and (b) the authorized installed capacity of the project. The authorized installed capacity of the Turners Falls Project after the rehabilitation of Cabot Station Units would be 67,709 kW as shown in Table 1. Ordering Paragraph (D) of this order requires the licensee to install nameplates reflecting the new ratings of the rehabilitated units.

In accordance with the Commission's policy, the effective date of the revised annual charges will be the date of the start of construction on units' overhaul. [4] The total authorized capacity and its effective date for annual charge purposes is shown in Ordering Paragraph (C) of this order.

Upon completion of the rehabilitation of Cabot Station Units 5 and 6, which according to NGSC would be spring 2004, the licensee must file a revised Exhibit M, and necessary revised exhibits reflecting as-built conditions.

Table 1

		Before Rehab, MW		***After Rehab, MW***			
Powerhouse	***Unit***	***Turbine (T)***	***Generator (G)***	***Turbine***	***Generator***	***Authorized Capacity MW***	***Start of Construction Date***
	1	10.4	10.336	10.4	10.336	10.336 (G)	
	2	10.4	10.336	10.4	10.336	10.336 (G)	
Cabot Station	3	9.375	8.5	10.4	10.336	10.336 (G)	6/3/2002
	4	9.375	8.5	10.4	10.336	10.336 (G)	6/3/2002
	5	9.375	8.5	10.4	10.336	10.336 (G)	6/3/2003
	6	9.375	8.5	10.4	10.336	10.336 (G)	6/3/2003
Turners Falls No. 1 Station						5.693	
		Total Authorized Capacity of the Project				**67.709**	

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Note: Turbine Capacities are at best-gate.

The Director orders:

(A) The license for the Turners Falls Project, FERC Project No. 1889 is amended as provided by this order effective the day this order is issued.

(B) Paragraph 1 of Ordering Paragraph (B)(2) of the license is revised to read as follows:

Project works consisting of: (a) a concrete gravity dam in two sections connected by a natural rock island, including: (i) Gill section, about 55 feet high and 493 feet long, across the east channel, containing 3 taintor gates each 40 feet wide and 39 feet high and (ii) Montague section, about 35 feet high and 630 feet long, across the west channel, surmounted by 4 bascule type gates, each 120 feet long by 13.25 feet wide; (b) a headgate house about 214 feet long, containing 17 gates; (c) a reservoir having a gross storage capacity of about 21,500 acre-feet and a surface area of 2,110 acres at normal water surface elevation 185.0 m.s.l.; (d) a canal about 2 miles long; (e) a short branch canal extending to (f) a powerhouse known as No. 1 Station, containing five turbine-generator units for an authorized capacity of 5,693 Kilowatts, operating under a head of about 43.7 feet; (g) a powerhouse known as Cabot Station, containing six turbine-generator units for an authorized capacity of 62,016 kilowatts, operating under a head of about 60 feet—for a project's total authorized installed capacity of 67,709 kilowatts (*see* Table 1); (h) transmission facilities consisting of: (i) at No. 1 Station, generator leads and the 2.3 kV bus for the six units, two-2.3/13 kV transformer banks, the 13 kV bus; and (ii) at the Cabot Station, generator leads and the 6.6 kV bus for the six units, two-6.6/69 kV transformer banks and two-6.6/115 kV transformer banks, two-66 kV and two-110 kV transmission lines, each about 200 feet long and extending across the project canal to the Montague Substation; and (j) appurtenant facilities.

(C) Article 30 of the license for the Turners Falls Project is revised to read:

Article 30. For the purposes of reimbursing the United States for the cost of administration of Part I of the Act, the licensee shall pay the United States, a reasonable amount as determined by the Commission in accordance with the provisions of its regulations in effect from time to time:

(1) Effective June 3, 2002, authorized installed capacity for that purpose is 64,037 kilowatts.

(2) Effective June 3, 2003, the authorized installed capacity for that purpose is 67,709 kilowatts.

(D) Within 90 days from the date of this order the licensee is required to install new nameplates for the rehabilitated units. The nameplate for each turbine must reflect the best-gate rating.

(E) Within 90 days from the date of this order the licensee must file with the Commission, and the Division of Dam Safety and Inspections—New York Regional Office, a set of photographs of the nameplates of the overhauled units showing the new rated capacities.

(F) This order constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. §385.713.

Footnotes

1 102 FERC ¶62,102*Order Amending License and Revising Annual Charges*, issued February 12, 2003.

2 E-mail from Mr. John Howard, dated January 26, 2004. A copy of the e-mail is in the Commission's public files under Docket No. P-1889-046.

3 E-mail from Mr. John Howard, dated January 29, 2004. A copy of the e-mail is in the Commission's public files under Docket No. P-1889-046.

4 66 FERC ¶61,086*Order on Rehearing*, issued January 18, 1994.

COMPLETE LICENSE ARTICLES
Northfield Mountain Pumped Storage Project, FERC Project No. 2485

Articles 1-29 were incorporated in the Opinion and Order Issuing and Amending Licenses, 39 FPC 723 (1968), per the Commission's standard terms and conditions for unconstructed projects affecting navigable waters of the United States as set forth in Form L-4 (1964), and revised as noted below.

Article 1. The entire project, as described in the order of the Commission, shall be subject to all the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, specifications, and statements described and designated as exhibits and approved by the Commission in its order as a part of the license until such change shall have been approved by the Commission: Provided, however, that if the Licensee or the Commission deems it necessary or desirable that said approved exhibits, or any of them, be changed, there shall be submitted to the Commission for approval amended, supplemental, or additional exhibit or exhibits covering the proposed changes which, upon approval by the Commission, shall become a part of the license and shall supersede, in whole or in part, such exhibit or exhibits theretofore made a part of the license as may be specified by the Commission.

Article 3. Said project works shall be constructed in substantial conformity with the approved exhibits referred to in Article 2 herein or as changed in accordance with the provisions of said article. Except when emergency shall require for the protection of navigation, life, health, or property, no substantial alteration or addition not in conformity with the approved plans shall be made to any dam or other project works under the license without the prior approval of the Commission; and any emergency alteration or addition so made shall thereafter be subject to such modification and change as the Commission may direct. Minor changes in the project works or divergence from such approved exhibits may be made if such changes will not result in decrease in efficiency, in material increase in cost, or in impairment of the general scheme of development; but any of such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of such results, shall be subject to such alteration as the Commission may direct. The Licensee shall comply with such rules and regulations of general or special applicability as the Commission may from time to time prescribe for the protection of life, health, or property.

Article 4. The construction, operation, and maintenance of the project and any work incident to additions or alterations shall be subject to the inspection and supervision of the Regional Engineer, Federal Power Commission, in the region wherein the project is located, or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall cooperate fully with said representative and shall furnish him a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of the project. Construction of the project works or any feature thereof shall not be initiated until the program of inspection for the project works or any such feature thereof has been approved by said representative. The Licensee shall also furnish to said representative such further information as he may require concerning the construction, operation, and maintenance of the project, and of any alteration thereof, and shall notify him of the date upon which work will begin, and as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of work for a period of more than one week, and of its resumption and completion. The Licensee shall allow him and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties.

Article 5. Upon the completion of the project, or at such other time as the Commission may direct, the Licensee shall submit to the Commission for approval revised maps, plans, specifications, and statements insofar as necessary to show any divergence from or variations in the project area and project boundary as finally located or in the project works as actually constructed when compared with the area and boundary shown and the works described in the license or in the maps, plans, specifications, and statements approved by the Commission, together with a statement in writing setting forth the reasons which in the opinion of the Licensee necessitated or justified variations in or divergence from the approved maps, plans, specification, and statements. Such revised maps, plans, specifications, and statements shall, if and when approved by the Commission, be made a part of the license under the provisions of Article 2 hereof.

Article 6. Insofar as any material is dredged or excavated in the prosecution of any work authorized under the license, or in the maintenance of the project, such material shall be removed and deposited so it will not interfere with navigation, and will be to the satisfaction of the District Engineer, Department of the Army, in charge of the locality.

Article 7. The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operation of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial public uses, including recreational purposes; and the Licensee shall release water from the project reservoir at such rate in cubic feet per second, or such volume in acre-feet per specified period of time, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

Article 8. Whenever the United States shall desire to construct, complete, or improve navigation facilities in connection with the project, the Licensee shall convey to the United States, free of cost, such of its lands and its rights-of-way and such right of passage through its dams or other structures, and permit such control of pools as may be required to complete and maintain such navigation facilities.

Article 9. The Licensee shall furnish free of cost to the United States power for the operation and maintenance of navigation facilities at the voltage and frequency required by such facilities and at a point adjacent thereto whether said facilities are constructed by the Licensee or by the United States.

Article 10. The operation of any navigation facilities which may be constructed as a part of or in connection with any dam or diversion structure constituting a part of the project works shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including the control of the level of the pool caused by such dam or diversion structure, as may be made from time to time by the Secretary of the Army.

Article 11. The Licensee shall for the protection of navigation, construct, maintain and operate at its own expense such lights and other signals on fixed structures in or over navigable waters of the United States as may be directed by the Secretary of the Department in which the Coast Guard is operating.

Article 12. The actual legitimate original cost of the original project, and of any addition thereto or betterment thereof, shall be determined by the Commission in accordance with the Act and the Commission's rules and regulations thereunder.

Article 13. After the first twenty (20) years of operation of the project under the license, six (6) percent per annum shall be the specified rate of return on the net investment in the project for determining surplus earnings of the project for the establishment and maintenance of amortization reserves, pursuant to Section 10(d) of the Act; one-half of the project surplus earnings, if any, accumulated after the first twenty years of operation under the license, in excess of (6) percent per annum on the net investment, shall be set aside in a project amortization reserve account as of the end of each fiscal year, provided that, if and to the extent that there is a deficiency of project earnings below six (6) percent per annum for any fiscal year or years after the first twenty years of operation under the license, the amount of such deficiency shall be deducted from the amount of any surplus earnings accumulated thereafter until absorbed, and one-half of the remaining surplus earnings, if any, thus cumulatively computed, shall be set aside in the project amortization reserve account; and the amounts thus established in the project amortization reserve account shall be maintained therein until further order of the Commission. This article is effective through August 22, 1976. (*Amended by letter order dated October 27, 1976*).

Article 14. The Licensee shall install additional capacity or make other changes in the project as directed by the Commission, to the extent that it is economically sound and in the public interest to do so, after notice and opportunity for hearing.

Article 15. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order. As a part of that coordination and pursuant to the continuing regulatory jurisdiction of this Commission, Licensees shall make provisions for selling and making available to all electric systems which may request project service, such portions of project capacity as are excess to Licensees' system needs, all upon just, reasonable and non-discriminatory terms and conditions. The provisions of this Article shall remain binding and in force upon the Licensee with respect to any additional generating capacity which they shall install at the Northfield Project. Prior to any future filing to increase generation at such project, the Licensees shall consult with other electric systems, including those under public or cooperative ownership, as to their needs and possible sales from the new units, if any sales from such new units are contemplated to any other party. (*Amended by 40 FPC 296 (1968*)).

Article 16. The Licensee shall, for the conservation, and development of fish and wildlife resources, construct, maintain, and operate, or arrange for the construction, maintenance and operation of such facilities and comply with such reasonable modifications of the project structures and operation as may be ordered by the Commission upon it own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing and upon findings based on substantial evidence that such facilities and modifications are necessary and desirable, reasonably consistent with the primary purpose of the project, and consistent with the provisions of the Act.

Article 17. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of Licensee's lands and interest in lands, reservoirs, waterways and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be prescribed by the Commission, reasonably consistent with the primary purpose of the project, in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

Article 18. The Licensee shall construct, maintain and operate or shall arrange for the construction, maintenance and operation of such recreational facilities including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities and utilities, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal and State agencies, after notice and opportunity for hearing and upon findings based upon substantial evidence that such facilities are necessary and desirable, and reasonably consistent with the primary purpose of the project.

Article 19. So far as is consistent with proper operation of the project, the licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and recreational purposes, including fishing and hunting, and shall allow to a reasonable extent for such purposes the construction of access roads, wharves, landings, and other facilities on its lands the occupancy of which may in appropriate circumstances be subject to payment of rent the Licensee in a reasonable amount: Provided, that the Licensee may reserve from public access, such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property and Provided further, that the Licensee's consent to the construction of access roads, wharves, landings, and other facilities shall not, without its express agreement, place upon the Licensee any obligation to construct or maintain such facilities. These facilities are in addition to the facilities that the Licensee may construct and maintain as required by the license.

Article 20. The Licensee shall be responsible for and shall minimize soil erosion and siltation on lands adjacent to the stream resulting from construction and operation of the project. The Commission upon request, or upon its own motion, may order the Licensee to construct and maintain such preventive works to accomplish this purpose and to revegetate exposed soil surface as the Commission may find to necessary after notice and opportunity for hearing.

[Article 21 was deleted from the license by letter dated December 26, 1980].

Article 22. The Licensee, its successors and assigns shall, during the period of the license, retain the possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and none of such properties necessary or useful to the project and to the development, transmission, and distribution of power thereform will be voluntarily sold, transferred, abandoned, or otherwise disposed of without the approval of the Commission: Provided, that a mortgage or trust deed or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article. In the event the project is taken over by the United States upon the termination of the license, as provided in Section 14 of the Act, or is transferred to a new licensee under the provisions of Section 15 of the Act, the Licensee, its successors and assigns will be responsible for and will make good any defect of title to or of right of user in any of such project property which is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and will pay and discharge, or will assume responsibility for payment and discharge, of all liens or incumbrances upon the project or project property created by the Licensee or created or incurred after the issuance of the license: Provided, that the provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear, or to require the Licensee, for the purpose of transferring the project to the United States or to a new Licensee, to acquire any different title to or right of user in any of such project property than was necessary to acquire for its own purposes as Licensee.

Article 23. For the purpose of determining the stage and flow of the stream or streams from which water is diverted for the operation of the project works, the amount of water held in and withdrawn from storage, and the effective head on the turbines, the Licensee shall install and thereafter maintain such gages and stream-gaging stations as the Commission may deem necessary and best adapted to the requirements; and shall provide for the required readings of such gages and for the adequate rating of such stations. The Licensee shall also install and maintain standard meters adequate for the determination of the amount of electric energy generated by said project works. The number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, shall at all times be satisfactory to the Commission and may be altered from time to time if necessary to secure adequate determinations, but such alteration shall not be made except with the approval of the Commission or upon the specific direction of the Commission. The installation of gages, the ratings of said stream or streams, and the determination of the flow thereof, shall be under the supervision of, or in cooperation with, the District Engineer of the United States Geological Survey having charge of stream-gaging operations in the region of said project, and the Licensee shall advance to the United States Geological Survey the amount of funds estimated to be necessary for such supervision or cooperation for such periods as may be mutually agreed upon. The Licensee shall keep accurate and sufficient record of the foregoing determinations to the satisfaction of the Commission, and shall make return of such records annually at such time and in such form as to the Commission may prescribe.

Article 24. In the construction and maintenance of the project works, the Licensee shall place and maintain suitable structures and devices to reduce to a reasonable degree the liability of contact between its transmission lines, and telegraph, telephone, and other signal wires or power transmission lines constructed prior to its transmission lines and not owned by the Licensee, and shall also place and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling and obstructing traffic and endangering life on highways, streets, or railroads. None of the provisions of this article is intended to relieve the Licensee from any responsibility or requirement which may be imposed by other lawful authority for avoiding or eliminating inductive interference.

Article 25. If the Licensee shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without replacement, or shall abandon or discontinue good faith operation of the project for a period of three years, or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address to the Licensee or its agent, the Commission will deem it to be the intent of the Licensee to surrender the license, and not less than 90 days after public notice may in its discretion terminate the license.

Article 26. Upon abandonment of the project the Licensee shall remove all buildings, equipment and power lines from lands of the United States and restore said lands to a condition satisfactory to agency having jurisdiction over the lands and shall fulfill such other obligations under the license as the Commission may prescribe.

Article 27. The right of the licensee and of its transferees and successors to use or occupy navigable waters of the United States under the license for the purpose of maintaining the project works or otherwise, shall absolutely cease at the end of the license period, unless a new license is issued pursuant to the then existing laws and regulation.

Article 28. Whenever the Licensee is directly benefited by the construction work of another Licensee, a permittee, or of the United States of a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of the headwater improvement for such part of the annual charges for interest, maintenance, and depreciation thereon as the Commission shall determine to be equitable, and shall pay to the United States the cost of making such determination as fixed by the Commission. For benefits provided by a storage reservoir or other headwater improvement of the United States the Licensee shall pay to the Commission the amounts for which it is billed from time to time for such headwater benefits and for the costs of making the determinations pursuant to the then current Commission Regulations under the Federal Power Act within 60 days from the date of rendition of a bill therefor and, upon failure to do so, shall thereafter be subject to the payment of the penalties specified in the then current Regulations. The Licensee shall have the right to pay such amounts under protests within the 60-day period and to reconsideration of the amounts billed or a hearing as provided by the then current Regulations under the Act.

Article 29. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

Articles 30 – 48 were required by the Order Issuing and Amending Licenses, 39 FPC 723 (1968), and revised as noted below.

Article 30. The Commission reserves the right, after notice and opportunity for hearing, to redetermine at any time during the term of this license what transmission facilities, if any, should be included or excluded as project works under this license.

Article 31. The Licensees shall commence construction within one year from the effective date of the license and shall thereafter in good faith and with due diligence prosecute such construction and shall complete construction of such project works by April 30, 1973. (*Amended by order dated April 28, 1972).*

Article 32. The Licensees shall submit in accordance with the Commission's rules and regulations Exhibit L drawings showing the final designs of the project works, and the Licensees shall not begin construction of the project structures until the Commission has approved such exhibits.

Article 33. The Licensee shall, within one year from the date of completion of the project, file for Commission approval revised Exhibits F and K, in accordance with Commission rules and regulations, to describe the proposed project boundary.

Article 34. The Licensees shall submit to the Commission a report on the model and computer studies or hydraulic effects in the lower reservoir which they have ordered for design purposes. The report, which is to be submitted promptly upon completion of the studies, shall summarize the various assumptions under which the studies were made and the results under each set of assumptions.

Article 35. The Licensees shall submit to the Commission a report on studies of the electrical stability of the 345 kilovolt grid carrying project power. The report, which is to be submitted promptly upon completion of any such studies, shall summarize the various assumptions under which the studies were made and the results under each set of assumptions.

Article 36. The Licensees shall employ an independent board of consultants, having at least three qualified members, to review the designs, specifications, and construction of the dams, dikes, reservoir floor, power chamber and other project facilities. The Licensees shall submit a report of the board covering each portion of the project prior to the submittal of revised Exhibit L drawings therefor. Prior to commencement of filling the upper reservoir, the Licensees shall submit a report of the board commending a schedule for such filling. The Licensees shall also submit a final report of the board upon completion of the project.

Article 37. The Licensees shall provide duplicate automatic means of stopping the units from pumping when the water surface in the Northfield Mountain upper reservoir exceeds elevation 1,000 feet mean sea level datum.

Article 38. The Licensees shall, prior to impounding water, clear all lands in the bottom and margins of the upper reservoir up to high-water level and shall dispose of all temporary structures, unused timber, brush refuse or inflammable material resulting from the clearing of the lands or from the construction, operation, or maintenance of project works. In addition, all trees along the margins of the reservoir within the project boundary which may die from operation of the reservoir shall be removed. The clearing of the lands and the disposal of the material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission.

Article 39. The Licensees, following completion of the model and computer studies of the hydraulic effect of project operation in the Turners Falls reservoir, but before completion of the project, shall consult with appropriate state and Federal agencies concerned with navigation and boating safety and shall solicit their comments and submit them to the Commission. The Licensees, after notice and opportunity for hearing, shall make such modifications in the project works, operate the project in such manner, and take such steps as the Commission may order in the interest of boating safety upon its own motion or upon the recommendation of the Chief of Engineers, U.S. Army, Corps of Engineers; the U.S. Coast Guard; or an interested agency of the Commonwealth of Massachusetts.

Article 40. The Licensees, following consultation with the U.S. Fish and Wildlife Service of the Department of the Interior and the fishery agencies of the Commonwealth of Massachusetts, shall make or pay the cost of making studies relating to fish protection at Project No. 2485. If the Licensees and the above-named agencies are unable to reach agreement respecting such studies, the Commission may prescribe the Licensees' obligations after notice and opportunity for hearing. The Commission may require further studies if it finds that changed fishery conditions or changed use of fishery in the Connecticut River so warrant.

Article 41. The Licensees shall expend $1,350,000 in the initial development of recreational resources associated with the project and make available to the Commonwealth of Massachusetts the land needed for the Pauchaug Brook area. With remaining monies, the Licensees shall develop such additional recreation resources as the Commission may approve or require. In planning for the recreational development, the Licensees shall consult and cooperate with the Department of Environmental Management of the Commonwealth of Massachusetts, the Bureau of Outdoor Recreation, and the Fish and Wildlife Service of the Department of the Interior. The Licensees shall submit to the Commission for its approval, site layout drawings of all recreation development, together with cost estimates, including land costs. (*Amended by* *order issued July 5, 1977).*

Article 42. The Licensees shall, prior to commencement of construction, consult with the Massachusetts Archeological Society, Bronson Museum, Attleboro, Massachusetts, on the need for an archeological survey, and if the Society believes, that such survey would be useful, the Licensees shall provide funds not to exceed $2,000 for its conduct. The Licensees shall report to the Commission whether the Society, on the basis of the survey, believes that archeological salvage is necessary, and the Licensees shall make available such reasonable funds as the Commission, after notice and opportunity for hearing, may approve or direct for the conduct of salvage.

Article 43. The Licensees, in cooperation with the licensee for Project No. 1889, shall enter into an agreement with the Department of the Army providing for the coordinated operation of the Project Nos. 1889 and 2485 during flood conditions on the Connecticut River in accordance with rules and regulations prescribed by the Secretary of the Army. A conformed copy of the agreement shall be filed with the Commission prior to commencement of commercial operation of Project No. 2485. In the event that agreement with the Department of the army cannot be achieved prior to that time, Project No. 2485 shall be operated during flood conditions in accordance with a plan prescribed by the Commission.

Article 44. The Licensees for Project No. 2485 are authorized to utilize the Turners Falls reservoir as a source of water and as a lower pool for the operation of the project when operating under this license.

Article 45. The operating of Project No. 2485 shall be coordinated with the operation of Project No. 1889.

Article 46. The Licensees of Project No. 2485 shall make an annual payment to the licensee or owner of Project No. 1889 consisting of:

a. A fixed annual charge on the capital cost of the modifications made at Project No. 1889 so that its reservoir may serve as the lower pool of Project No. 2485. This fixed annual charge shall be determined by multiplying the depreciated capital cost of such modifications by a factor comprised of the following items: cost of money, straight-line depreciation, interim replacements, insurance, non-levelized federal income tax, non-levelized state income tax, and miscellaneous federal taxes.

b. Annual municipal taxes attributable to such modifications at Project No. 1889.

c. Annual operation and maintenance cost and administrative and general expense (hereinafter collectively called O & M cost) attributable to such modifications at Project No. 1889. This amount shall be fixed by multiplying the total O & M cost for the modifications and existing Turners Falls joint-use facilities by the ratio of the depreciated capital cost of the modifications to the sum of the depreciated capital cost of the modifications and the depreciated capital cost of such existing facilities.

d. A portion of the fixed annual charge and O & M cost on the existing joint-use facilities at Project No. 1889. This portion shall be fixed under the procedures utilized in *Susquehanna Power Company,* 32 FPC 826 (1964).

Article 47. The Licensees shall compensate the licensee or owner of Project No. 1889 for any loss of generation incurred during the modification of that project so that its reservoir may serve as the lower pool of Project No. 2485.

Article 48. For the purpose of reimbursing the United States for the costs of administration of Part I of the FPA, a reasonable amount as determined in accordance with the provisions of the Commission's regulations in effect from time to time. The authorized installed capacity for such purposes is as follows:

Item	Authorized Capacity MW	Effective Date
After Unit 3 Upgrade	1,095.4	January 3, 2011
After Unit 2 Upgrade	1,119.2	November 28, 2011

(Amended by 138 FERC ¶ 62,293 (2012)).

Article No. 49 was added to the license by letter dated October 27, 1976.

Article 49. Pursuant to Section 10(d) of the Act, after the first 20 years of operation of the project under the license, a specified reasonable rate of return upon the net investment in the project shall be used for determining surplus earnings of the project for the establishment and maintenance of amortization reserves. One half of the project surplus earnings, if any, accumulated after the first 20 years of operation under the license, in excess of the specified rate of return per annum on the net investment, shall be set aside in a project amortization reserve account as of the end of each fiscal year: Provided, that, if and to the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year or years after the first 20 years of operation under the license, the amount of such deficiency shall be deducted from the amount of any surplus earnings accumulated thereafter until adsorbed, and one-half of the remaining surplus earnings, if any, thus cumulatively computed, shall be set aside in the project amortization reserve account; and the amounts thus established in the project amortization reserve account shall be maintained until further order of the Commission.

The annual specified reasonable rate of return shall be the sum of the weighted cost components of long-term debt, preferred stock, and the cost of common equity, as defined herein. The weighted cost component for each element of the reasonable rate of return is the product of its capital rations and cost rate. The current capital ratios for each of the above elements of the rate of return shall be calculated annually based on an average of 13 monthly balances of amounts properly includable in the Licensee's long-term debt and proprietary capital accounts as listed in the Commission's Uniform System of Accounts. The cost rates for such ratios shall be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity shall be the interest rate on 10-year government bonds (reported as the Treasury Department's 10 year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

Articles 50-51 were added by order issued July 5, 1977.

Article 50. The Licensee, after consulting with the Division of Fisheries and Wildlife of the Massachusetts Department of Environmental Management, the Fish and Wildlife Service of the U.S. Department of the Interior, and the Town of Northfield, Massachusetts, shall, within one year of the date of issuance of this order, file for Commission approval a cooperative land and water management plan for the Bennett Meadow Wildlife Management Area. The plan shall include provision for the compatible use of the land for agricultural and wildlife management purposes. In the event that the Licensees are unable to develop such a plan, the Commission reserves the right to prescribe a management plan, after notice and opportunity for hearing.

Article 51. In the event that the Licensees find, during the construction, operation, or maintenance of the developments approved as part of Exhibit R, any fossils or archeological artifacts, the Licensees shall immediately report such findings to the Commission and to the Massachusetts Historical Commission, and the Commission reserves the right, on its own motion or upon the recommendation of the Massachusetts Historical Commission, and after notice and opportunity for hearing, to require such archeological or paleontological surveys, or such salvage operations, as are deemed necessary to prevent the destruction or loss of the findings.

Article 52 was originally added to the license under the incorrect designation of Article 49 by letter dated October 6, 1980. It was correctly redesignated as Article 52 by letter dated December 26, 1980.

Article 52. (a) In accordance with the provisions of this article, the Licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain other types of use and occupancy, without prior Commission approval. The Licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the Licensee shall also have continuing responsibility to supervise and control the uses and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the Licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the Licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, cancelling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

> (b) The types of use and occupancy of project lands and waters for which the Licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities; and (3) embankments, bulkheads, retaining walls, or similar structures for

erosion control to protect the existing shoreline. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the Licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The Licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the uses and occupancies for which it grants permission are maintained in good repair and comply with applicable State and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the Licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline. To implement this paragraph (b), the Licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the Licensee's costs of administering the permit program. The Commission reserves the right to require the Licensee to file description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modifications of those standards, guidelines, or procedures.

(c) The Licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement, expansion, realignment, or maintenance of bridges and roads for which all necessary State and Federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the Licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar-year, the type of interest conveyed, the location of the lands subject to the conveyance; and the nature of the use for which the interest was conveyed.

(d) The Licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary State and Federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary Federal and State water quality certificates or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary Federal and State approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from the edge of the project reservoir at normal maximum surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 45 days before conveying any interest in project lands under this paragraph (d), the Licensee must file a letter to the Director, Office of Electric Power Regulation, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G or K map may be used), the nature of the proposed use, the identity of any Federal or State agency official consulted, and any Federal or State approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the Licensee to file an application for prior approval, the Licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraphs (c) or (d) of this article:

(1) Before conveying the interest, the Licensee shall consult with Federal and State fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the Licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved Exhibit R or approved report on recreational resources of an Exhibit E; or, if the project does not have an approved Exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include covenants running with the land adequate to ensure that: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; and (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and_ maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project.

(4) The Commission reserves the right to require the Licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries., The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G or R drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals.to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G or R drawings would be filed for approval for other purposes.

WESTERN MASSACHUSETTS ELECTRIC COMPANY, PROJECT NO. 1889; THE CONNECTICUT LIGHT AND POWER COMPANY, THE HARTFORD ELECTRIC LIGHT COMPANY AND WESTERN MASSACHUSETTS ELECTRIC COMPANY, PROJECT NO. 2485

OPINION NO. 541

FEDERAL POWER COMMISSION

39 F.P.C. 723; 1968 FPC LEXIS 538

May 14, 1968 *

* Initial decision appears on p. 779.See order issued July 11, 1968 granting rehearing for purpose of giving further consideration; see also Opinion No. 541-A and order issued August 15, 1968 denying application for rehearing, 40 FPC 296. Affirmed, *Municipal Electric Association of Massachusetts* v.. *F.P.C.*, 414 F. 2d 1206 (CADC-1969)

[*1]

OPINION AND ORDER ISSUING AND AMENDING LICENSES

SYLLABUS:

1. Alternatives to Northfield Project either lack potential capacity or do not possess the economic advantages and engineering feasibility of Northfield.

2. Commission *finds* that Northfield Project will not adversely affect the aesthetic, conservational and recreational aspects of the area in which it will be constructed.

3. On basis of the record and particularly in light of dependence of Northfield Project upon Applicants' thermal generating facilities and transmission network, Commission *finds* that Northfield is not the type of project to be undertaken by the United States.

4. The three 345 kilovolt transmission lines emanating from the Northfield farms Switchyard and the Switchyard, itself, are part of Applicants' "interconnected primary transmission system" and therefore not subject to licensing under the Federal Power Act.

5. It is clear from Section 3(11) of the Federal Power Act that, in determining whether a line is a primary line, the test to be applied is that of the basic purpose of the line in relation to other facilities.

6. Evidence conclusively demonstrates that each of the three 345 kilovolt transmission [*2] lines was conceived and designed to function as an important segment of a regional transmission grid -- they will be built whether or not

Northfield is authorized.

7. Holding here does not preclude possibility of future license amendments to include additional lines in the event their function as primary project transmission lines is established -- a test so dependent upon the facts of any given situation may well dictate a different conclusion should conditions change.

8. While Applicants' planning studies are not as broadly conceived in all respects as might be desired, they are adequate to show that Northfield Project is needed to meet power requirements of the region; that it is economic and engineeringly sound.

9. *Discussing* restraint of trade issue, Commission *rejects* argument that Applicants and other investor-owned power companies in New England area are engaging in practices that violate or tend to violate Section 10(h) of the Power Act and the anti-trust laws and policies of the United States.

10. Essential purpose of instant proceeding is to determine whether public interest will be served by issuance of a license for Northfield Project; showing with respect [*3] to restraint of trade issue has not convinced Commission that license should be qualified in manner suggested by Staff and Municipals.

11. Lobbying activities of Applicants before Massachusetts legislature and Congress of United States does not under prior precedent constitute violations of anti-trust laws.

12. While Commission takes official notice of documents relating to restraint of trade issue [excluded by Examiner], it does not find that they have relevant decisional significance with respect to final resolution of issues here.

13. While at this point Commission cannot specify precisely what agreement should be reached between the parties, it is consistent with the public interest that excess capacity from project be sold and made available to all on a just, reasonable and non-discriminatory basis; and license is so conditioned.

14. Mere fact that Applicants agreed to undertake an obligation does not relieve Commission of its duty to protect the public interest; in conditioning license, however, Commission does not reach question of whether it has authority under Part I of the Act to order wheeling beyond primary lines.

15. In a proceeding under Section 4 of the Federal [*4] Power Act, Commission *issues* major license for Northfield Mountain Pumped Storage Project and *amends* existing license for Turners Falls development.

Chairman White *concurring.*

Commissioner Ross *concurring* and *dissenting.*

Before Commissioners: Lee C. White, Chairman; L. J. O'Connor, Jr., Charles R. Ross, Carl E. Bagge and John A. Carver, Jr.

David R. Pokross, Robert S. Cummings and *Maurice L. Zilber* for The Connecticut Light and Power Company, The Hartford Electric Light Company and Western Massachusetts Electric Company

Edmund W. O'Brien for Northeast Utilities Service Co.

Jerome Ackerman for Holyoke Water Power Co.

Joel Suisman for Connecticut Municipal Electric and Gas Association

George Spiegal for Municipal Electric Association of Massachusetts, and Municipal Electric Departments and Plants of Chicopee, Shrewsbury, and Wakefield

Joseph E. Frank for Public Service Board of State of Vermont

George Bruder for the Staff of the Federal Power Commission

OPINIONBY: BAGGE

OPINION:

BAGGE, *Commissioner:*

This is a consolidated proceeding involving the following applications under Part I of the Federal Power Act: First, The Connecticut [*5] Light and Power Company (Connecticut Light), The Hartford Electric Light Company (Hartford Electric), and the Western Massachusetts Electric Company (Western Massachusetts) (all three referred to as the Applicants), seek a license to construct and operate the proposed Northfield Mountain Pumped Storage Project, FPC No. 2485 (Northfield Project), on the east bank of the Connecticut River in Franklin County, Massachusetts.Second, Western Massachusetts seeks the amendment of its existing license for the Turners-Falls hydroelectric development (FPC No. 1889) to authorize the raising of the Turners-Falls reservoir to enable it to be used as the lower pool of the proposed Northfield Project. The proceedings on these two applications were consolidated for hearing by the Commission's order of August 9, 1966.

The Public Service Board of the State of Vermont filed a notice of intervention. Petitions to intervene were filed by (1) The Municipal Electric Association of Massachusetts and the electric departments of the City of Chicopee, Town of Shrewsbury, and Town of Wakefield, Massachusetts (Massachusetts Municipals); (2) The Holyoke Water Power Company (Holyoke Power); (3) The Connecticut [*6] Municipal Electric and Gas Association (Connecticut Association); and (4) Robert B. Shearer, owner of a dairy farm on the east bank of the Connecticut River upstream from the Northfield Project. The Commission granted these petitions to intervene.

On September 12, 1967, the presiding Examiner, Martin E. Rendelman, issued an initial decision approving the requested applications, subject to certain specified conditions. The Examiner found that the Northfield Project shouls include as necessary transmission facilities the proposed Northfield Farms Switchyard and two proposed 345 kilovolt transmission lines emanating from such Switchyard. One of these 345 kilovolt lines is to extend 30 miles south to the Ludlow Switching Station near Springfield, Massachusetts; the second 345 kilovolt line is to extend 14 miles north to the Vermont Nuclear Switching Station in New Hampshire. The Examiner qualified his approval with the *proviso*, among others, that the license for the Northfield Project, FPC No. 2485, was not to become effective until after Western Massachusetts applied for and obtained authorization under the Federal Power Act to construct, operate, and maintain the [*7] Northfield Farms Switchyard, the 30-mile line to the Ludlow Switching Station, and the Massachusetts segment of the line to the Vermont Nuclear Switching Station.

This proceeding is before us based upon exceptions and replies to exceptions filed by Applicants, the Massachusetts Municipals, and staff to the Examiner's decision.

Applicants concur in the Examiner's resolution of all issues except those relating to the transmission facilities and lines to be included in the Northfield Project license. Applicants contend that neither the Northfield Farms Switchyard nor any of the transmission lines emanating therefrom are subject to the licensing authority of the Commission. On the transmission line question, staff in general supports the Examiner. The Massachusetts Municipals, however, claim that the Examiner erred in failing to include among the lines subject to licensing a 345 kilovolt line extending approximately 85 miles southwest from the Northfield Farms Switchyard to the New Scotland Substation of the Niagara Mohawk Power Corporation (Niagara Mohawk), southwest of Albany, New York. The Massachusetts Municipals also argue that the Applicants' proposed transmission lines are [*8] inadequate for the growing needs of the New England area, and they urge that the Commission should require a further study of the New England regional needs before it approves the proposal for a 345 kilovolt system.

The Massachusetts Municipals further maintain that the Applicants and other investor-owned power companies in the New England area are engaged in practices which violate or tend to violate Section 10(h) of the Federal Power Act n1 and the antitrust laws and policies of the United States. They assert that the Examiner erred in not so finding, and ask that the licenses be conditioned to require that Applicants purge themselves of all practices and associations which tend to prevent the Massachusetts Municipals from obtaining low-cost bulk power supply and transmission services. Staff also recommends that the Commission condition Applicants' licenses with the requirement that the Applicants terminate all practices which may be in restraint of trade.

n1 Section 10(h) of the Federal Power Act provides: Sec. 10. All licenses issued under this Part shall be on the following conditions:

* * *

(h) That combinations, agreements, arrangements, or understandings, express or implied, to limit the output of electrical energy, to restrain trade, or to fix, maintain or increase prices for electrical energy ro service are hereby prohibited.

[*9]

Holding

For the reasons set forth below we find that the exceptions advanced by Applicants with respect to the licensing of the contested transmission facilities and lines are well founded and should be granted. We further find that the exceptions of the Massachusetts Municipals and of staff regarding the restraint of trade issue are not persuasive and do not warrant our reversal of the Examiner's decision. Furthermore, we find ample support in the record for the Examiner's finding as to the adequacy of Applicants' proposed transmission system.

Background

Applicants are the three principal operating companies of Northeast Utilities, Inc., a voluntary business trust registered with the Securities and Exchange Commission as a holding company under the *Public Utility Holding Company Act of 1935.* Each of the Applicants is the owner of an integrated power system, and the three together with the United Illuminating Company and Holyoke Power comprise the Connecticut Valley Electric Exchange (CONVEX), which serves, either directly or through sales for resale, practically all of Connecticut and most of western Massachusetts.

Applicants own the Northfield Project [*10] properties as tenants in common, with Connecticut Light having 53 percent; Hartford Electric, 28 percent; and Western Massachusetts, 19 percent. These interests are approximately in the same proportions as the Applicants' respective loads. Transmission lines will be owned by the individual applicant within whose service area such lines are located.

The proposed Northfield Project is located about five and one-half miles above the Turners Falls Dam of the Turners Falls Project, and almost eight river miles downstream from the Vermont and New Hampshire State lines. The existing pond formed in the Connecticut River behind the Turners Falls Dam will constitute the lower reservoir. The upper reservoir will be in the hollow formed by scooping out the summit of Northfield Mountain, and will be formed by a rock-filled dam with a concrete face, all about one and one-half miles east of the Connecticut River. The upper reservoir's maximum elevation will be 1,000 feet above the mean sea level, and approximately 800 feet above the elevation of the river. The total storage capacity of the upper reservoir will be 17,050 acre feet, of which 12,750 acre feet will be usable for generation with [*11] a normal maximum drawndown of 62 feet to elevation 938, sufficient for

8,500 megawatt-hours of generation. The Applicants' proposal will have a rated capacity of 1,000 megawatts, and studies are now being conducted as to the feasibility of increasing this capacity to 1,500 megawatts. The Applicants also propose to utilize the Northfield Project's pumping and storage facilities to supply Connecticut River water at times of high freshet river flows to the Quabbin Reservoir of the Metropolitan District Commission which supplies water to the Boston metropolitan area. The Metropolitan District Commission submitted a report to the Massachusetts Legislature in December, 1966, indicating support for this water diversion plan.

The powerhouse of the Northfield Project will be located in an underground cavern to be excavated in the bedrock of Northfield Mountain, and will be connected with the upper pool by a concretelined pressure tunnel 31 feet in diameter, making a steep descent from an elevation of about 900 feet to somewhat less than 100 feet. The turbines in the powerhouse will provide a minimum of 348,000 horsepower each at a net head of 745 feet. When operating as pumps, [*12] the units will require an input of not more than 323,000 horsepower (241 megawatts) at a minimum head of 740 feet. Each generator will have a nameplate rating of 250 megawatts at an 80-degree centigrade temperature rise. The generating voltage will be increased to 345 kilovolts by two transformers housed in an excavated vault near the powerhouse cavern. Power will be transmitted from the transformers to the Northfield Farms Switching Station, located near the tunnel portal by two 345-kilovolt pipe-type cables installed in the access tunnel.

The Turners Falls Project, FPC No. 1889, will be modified to provide an additional 12,600 acre feet of storage by raising the reservoir 5.4 feet to elevation 185 at the dam. Western Massachusetts proposes to substitute bascule gates and hinge-type flashboards for the pin-type flashboards now in use, and to raise portions of the floor of the gatehouse at the dam.

Applicants propose to operate the Northfield Project as a generator during peak load hours by the release of water from its upper reservoir through the turbines to the lower reservoir at Turners Falls. During off peak hours the water previously used for generation and stored in the [*13] lower reservoir will be pumped back to the upper reservoir. Power for operation of the pumps will be furnished from nonproject generation sources. For normal operations, it is expected that the upper reservoir will fluctuate from a total capacity of about 17,000 acre feet of storage, at full elevation 1,000, down to 12,750 acre feet at elevation 938, thus retaining enough water to generate an additional 2,500 megawatt-hours in an emergency. Applicants estimate that the pumping to generating ratio will be 1,45 kilowatt hours of pumping energy for every kilowatt hour of generation, making the over-all efficiency of the project approximately 69 percent.

Applicants plan to use the Northfield Project as a peak power installation and as a reserve unit. Accordingly, they propose to operate it at a comparatively low load factor on a modified weekly cycle. Extensive pumping will be done on the weekend, principally in the early hours of Sunday morning, to fill the upper pool. On weekdays the plant will generate for two hours at the time of the morning peak, except on Monday, and from four to seven hours on the evening peak.

According to the Applicants' estimates, CONVEX, without [*14] the Northfield Project, faces a shortage of some 314,000 kilowatts by 1971, which will increase to a shortage of 666,000 kilowatts by 1973. Applicants calculate that CONVEX will utilize 750,000 kilowatts of the output of the Northfield Project in 1973, and that CONVEX will absorb the entire 1,000,000 kilowatts of the project's production by 1976 or 1977. Prior to 1976 or 1977, the Applicants propose to market under short-term contracts the capacity not utilized by CONVEX.

Economic Feasibility and General Desirability of Project

Evidence submitted by the Applicants shows that the capital cost of the Northfield Project will approximate an estimated $69,000,000, and that the cost of the alterations at Turners Falls will total approximately $3,000,000. Additional costs of $2,350,000 may be involved in proposed recreational development and in the installation of fish protection facilities. Based upon a capital cost of $72,000,000, the cost per kilowatt of generation from the Northfield Project would be $72. According to an economic feasibility study submitted by a staff witness, the total annual cost of the project's operation would be $12,080,000 or $12.08 per kilowatt year, [*15] based upon an assumed cost of money at seven percent, and further assuming an average annual load factor of 12.6 percent. This calculation is based upon the assumption that the average cost of pumping energy will be two mills per kilowatt hour, and that the pumping to generation ratio will be 1.45 to 1. Staff also submitted evidence which demonstrated that the Northfield Project represents the most economical means of supplying Applicants with 1,000 megawatts of peaking power at load factors up to 20 percent, as compared with alternate sources of power, namely: (1) peaking fossil-fueled steam electric generators, (2) nuclear-fueled steam electric generators, (3) base load fossil-fueled steam electric generators, and (4) jet gas turbine electric generators. Based upon staff's computations, it was shown that the annual savings for peaking purposes resulting from the Northfield Project as opposed to these other sources will range from $4,380,000 in the case of fossil-fueled steam generators to $8,900,000 in the case of jet gas turbine generators.

The Applicants also submitted evidence in support of their contentions that insofar as the Northfield Project is concerned (1) [*16] there are no feasible alternative generating sources available to the Applicants on a more economic basis; (2) there are no other feasible hydroelectric sites within the Applicants' service territory or an adjacent territory where the Applicants may wish or be permitted to do business which are more favorable economically; (3) there are no competing interests of a recreational, scenic, conservational, historic or economic nature which would dictate that the public interest would be better served if the generating facility were not built. The record shows that numerous other possible pumped storage sites were studied by the Applicants and by the Commission's staff, as well, and that the Northfield Project site was found to be superior to all others from the standpoint of location, cost of construction, accessibility to the Applicants' transmission systems, and general suitability.

The evidence regarding alternatives to the Northfield Project warrants our finding that such alternatives either lack the potential capacity or do not possess the economic advantages and engineering feasibility of the Northfield Project.

The record further shows that the Applicants propose to provide for [*17] the conservation and recreation interests of the areas adjacent to the Northfield Project by a comprehensive plan involving approximately ten different sites along the Connecticut River between the Massachusetts-Vermont-New Hampshire border and the Turners Falls Dam. Included in this plan are play fields and facilities for swimming, boating, camping, horseback riding, picnicking, hiking, and fishing, as well as facilities to encourage fish reproduction and a watering area for wildlife. The Applicants state that this plan was developed after consultation with numerous federal, state, and local agencies, and interested citizens' organizations. The recreation and conservation proposals of the Applicants have received the support of the Massachusetts Department of Natural Resources, federal and state representatives from the western Massachusetts area, and local officials. Staff's recreation expert testified that the Applicants' recreation proposals appear to be adequate for initial development. The Applicants have also given consideration to the problem of fish protection, and they have designed the Northfield Project in such a manner to allow the installation of fish protection [*18] devices if their need is established.

We are satisfied by the above showing that the Northfield Project will not adversely affect the aesthetic, conservational, and recreational aspects of the area in which it will be constructed. *Cf. Scenic Hudson Preservation Conference* v.. *Federal Power Commission*, 354 F.2d 608 (CA2-1965), cert. denied, 384 U.S. 941 (1966).

In accordance with the provisions of Section 7(b) of the Federal Power Act, the Commission has also given consideration to the question as to whether the construction of the Northfield Project should be undertaken by the United States rather than by the Applicants. On the basis of the record before us, and particularly in light of the dependence of the Northfield Project upon the thermal generating facilities and transmission network of the Applicants, we find that this is not the type of project to be undertaken by the United States.

The Examiner found that the past experience of Applicants in raising money for construction projects did not indicate that any difficulty would be encountered in financing the project. The Commission agrees with the Examiner's finding.

The Primary Lines of The Northfield [*19] *Project*

Turning now to one of the highly contested issues in the proceeding, Applicants maintain that the three 345 Kilovolt transmission lines emanating from the Northfield Farms Switchyard and the Switchyard, itself, are part of their "interconnected primary transmission system," and therefore are not subject to licensing under the Federal Power Act. They urge that the only transmission lines which come within the scope of the definition of Section 3(11) of the Act are the two 345 kilovolt cables extending from the two project transformers in the transformer vault to the Northfield Farms Switchyard.

In the application of Section 3(11) to the lines in question, we conclude that the Applicants' exceptions are well founded. Section 3(11) provides in pertinent part:

"project" means complete unit of improvement or development, consisting of a power house, all water conduits, all dams and appurtenant works and structures (including navigation structures) which are a part of said unit, and * * * the primary line or lines transmitting power therefrom to the point of junction with the distribution system or with the interconnected primary transmission system, * * *

It is clear from [*20] Section 3(11) that, in determining whether a line is a primary line, the test to be applied is that of the basic purpose of the line in relation to other facilities. In determining which of the many purposes of any given line is the basic purpose we must, therefore, look to the specific facts before us. The evidence submitted by the Applicants conclusively demonstrates that each of the three 345 kilovolt transmission lines was conceived and designed to function as an important segment of a regional transmission grid. The primary function of these lines will be to link together the major generating, switching, and transmission facilities of the Applicants. These lines are scheduled to be in service in 1970, about a year before the commercial operation of the Northfield Project is expected to commence. The generating facilities which will be thus tied together will include, in addition to the Northfield Project, important thermal generating plants of the Applicants and such major nuclear projects as the Vermont Yankee, the Maine Yankee, and the Connecticut Yankee nuclear plants. While the precise location of the lines in question may have been influenced by the Applicants' [*21] concurrent proposal to construct the Northfield Project, it is evident that lines of the same voltage and serving the same general areas would have been built by the Applicants in any event.

With reference to the 30-mile line extending south from the Northfield Farms Switchyard to the Ludlow Switching Station (the Ludlow Line), Applicants have shown that it will transmit power 100 percent of the time in one direction or another from generating sources throughout New England and New York. Applicants state that the Ludlow Line is designed to function as an important part of the outlet facilities for the Vermont Yankee, the Maine Yankee, and the Connecticut Yankee nuclear plants in which Applicants are substantial participants, as well as the Northfield Project. They also have shown that this line is designed to provide outlet facilities to some extent for other plants of the Big 11 Power Loop, and that it, together with the Vermont Nuclear Line, will provide a loop or parallel path for the north-south flow of power in the New England Region.

Applicants similarly assert with respect to the 16-mile line extending north from the Northfield Farms Switchyard to the Vermont Nuclear Switching [*22] Station (the Vermont Nuclear Line), that this line will transmit power 100 percent of the time in one direction or another from generating sources throughout New England and New York.

In the case of the 85-mile line extending west from the Northfield Farms Switchyard to the New Scotland Substation near Albany, New York (the New Scotland Line), Applicants have shown that this line is designed to serve as a major interregional tie line on the New England -- New York transmission grid. They point out that it will transmit power 100 percent of the time in one direction or another from generating sources throughout New England and New York.

We agree with Applicants' contention that each of the three lines is part of Applicants' "interconnected primary transmission system," within the meaning of Section 3(11), and that, since the Northfield Farms Switching Station is the facility by which these three circuits are interconnected, such Switching Station, by necessity, is also part of such system. Therefore, "the point of junction" of the Northfield Project with the Applicants' "interconnected primary transmission system" must be at the Northfield Farms Switching Station. Applicants' [*23] primary lines which are subject to licensing consist, therefore, of two 345 kilovolt cables which connect the Project's transformer vault with the Northfield Farms Switching Station. These cables will carry the power generated at the Northfield Project to the point of junction at the Switching Station from Which the Power can flow in any one or more of three directions to load centers in New England and in New York. The viability of the Northfield Project for Section 3(11) purposes thus is adequately safeguarded by the licensing of the two cables.

We have given full consideration to the arguments presented by staff and the Massachusetts Municipals that the Ludlow Line and the Vermont Nuclear Line are primary lines subject to licensing. Consideration has also been given to the contention of the Massachusetts Municipals that the New Scotland Line, in addition to the two above mentioned, should be licensed as a primary line. We are not persuaded by the positions advanced by staff and by the Massachusetts Municipals. Staff and the Massachusetts Municipals rely upon *Montana Power Company* v.. *Federal Power Commission*, 112 F.2d 371 (CA9-1940). Such reliance, in view of the [*24] particular facts of this case, is not well founded essentially because of the basic differences in the facts involved in these two proceedings. In *Montana Power* the lines found to be primary lines were constructed specifically for the purpose of transmitting project power to major load centers of the utility and would be utilized almost exclusively to serve that purpose. Such is not the case with the Northfield Project. As stated above, the lines here in question will be built by Applicants whether or not the Northfield Project is authorized, and will function as major links of a regional transmission grid, interconnecting important generating plants serving several states.

We have also given consideration to the contention of the Massachusetts Municipals that the lines necessary for the transmission of pumping energy must be licensed as part of the Northfield Project. Assuming, without deciding, that this argument can be made within the purview of Section 3(11), it is clear that the basic purpose of the lines in question is not to transmit pumping power to the Northfield Project any more than it is to transmit power from the Project. The Massachusetts Municipals' [*25] argument must, therefore, be rejected for precisely the same reasons as we have rejected their and Staff's arguments above relating to the transmission of power from the Project.

We should make explicit what is implicit in everything we have said in discussing the basic purpose test to this point; that is, that our holding in this case does not preclude the possibility of future license amendments to include additional lines in the event that their function as primary project transmission lines is established. Clearly, a test so dependent upon the facts of any given situation may well dictate a different conclusion should conditions change. See Article 30 of Project No. 2485 license.

The Adequacy of the Proposed Lines

The Massachusetts Municipals reiterate in their exceptions the argument which they advanced unsuccessfully before the Examiner that the Applicants' proposed transmission lines are inadequate for the growing needs of the New England area, and that the Commission should withhold its approval of these lines and order the Applicants to make and submit a proper regional study of transmission needs. The Municipals assert that the Applicants made their selection of [*26] 345 kilovolts as the primary transmission voltage for New England on the basis of an out-of-date 1963 economic-engineering study and did not give adequate consideration to the proposed generation of the Northfield Project or of the Vermont and Maine Yankee nuclear plants. The Municipals argue that lines of 500 kilovolt capacity will better serve New England, and that substantial benefits will result from a 500 kilovolt backbone transmission system from New Scotland, New York, through central New England to the Dickey-Lincoln School Project in Maine.

Our holding above that the lines emanating from Northfield Farms Switchyard constitute a portion of the "interconnected primary transmission system" of the applicant and are not subject to licensing as part of the Northfield Project in large part vitiates the exceptions taken by the Massachusetts Municipals on this particular issue. To the extent that these arguments could be said to raise questions of area resource development, they have been considered and found not to warrant reversal of the Examiner's holding on this issue. The Applicants have satisfactorily demonstrated that the 345 kilovolt lines are suited to fit in with their [*27] existing grid of 115 kilovolt and 69 kilovolt transmission lines, as well as with their other new 345 kilovolt circuits and that a 345 kilovolt system is better designed for their needs than a 500 kilovolt system because it will require less step-down transformations to service the heavy load density in the CONVEX market areas. The Applicants have further shown that at the present time there are no 500 kilovolt transmission lines in New England or in New York and that no 500 kilovolt lines are being planned for New York. They have also submitted cost studies indicating that through 1980 a backbone grid for the New England area of 345 kilovolts will cost about $52,000,000 less than a comparable 500 kilovolt system. The Commission's staff studies corroborate the Applicants' position as to the suitability and desirability of a 345 kilovolt transmission grid for New England.

With respect to the question of the adequacy of the Applicants' planning studies, we find that, while these studies are not as broadly conceived in all respects as might be desired, they are nevertheless adequate to show that the Northfield Project is needed to meet the power requirements of the region, [*28] that it is economic, and that it is engineeringly sound.

The Restraint of Trade Issue

The pleadings filed by the Massachusetts Municipals clearly show that one of their primary purposes for intervening in this proceeding was to call to the Commission's attention certain alleged practices of the Applicants and other investor-owned power companies in the New England area which the Municipals assert violate or tend to violate Section 10(h) of the Federal Power Act n2 and the antitrust laws and policies of the United States.

n2 Section 10(h) of the Act provides:

> That combinations, agreements, arrangements or understandings, express or implied, to limit the output of electric energy, to restrain trade, or to fix, maintain, or increase prices for electrical energy or service are hereby prohibited.

Specifically, the Massachusetts Municipals claimed that the Applicants, together with other investor-owned power companies, are unlawfully preventing the Municipals from obtaining low-cost bulk power supply and transmission services. They urged that as a condition to the grant of the licenses applied for in this proceeding the Applicants be required to purge themselves of such activities [*29] and to adopt positive policies in the public interest to strengthen fair and sound competition for bulk power supplies, wholesale electric business, and retail electric business.

Staff urged the Examiner to require the Electric Coordinating Council of New England (ECCNE), of which the Applicants are members, to permit all segments of the electric industry in New England, including the Municipals, to be admitted to membership in the planning activities of such Council.

The Examiner found that the argument of the Massachusetts Municipals was "entirely collateral to the intended purpose" of this proceeding. He referred the Municipals to Section 306 of the Federal Power Act for the appropriate procedure to be followed in filing complaints with the Commission regarding alleged violations of the Act by any licensee or public utility. He also noted that, insofar as the future operation of the Northfield Project is concerned, Section 10(h) is required by statute to be included in the project license and is presently a part of the Turners Falls license. The Examiner also found that staff's suggestion was not well taken. He pointed out that the license for the Northfield Project [*30] will be issued not to ECCNE, but to the Applicants, and he stated that it was not clear how staff's suggested condition would operate to compel compliance on the part of ECCNE, since the Applicants number only three out of the 19 members of ECCNE.

The Massachusetts Municipals and staff have filed exceptions to the Examiner's rulings on the restraint of trade issue, relying upon the decision of the United States Supreme Court in *Silver* v.. *New York Stock Exchange,* 373 U.S.

341 (1963); *Associated Press* v.. *United States,* 326 U.S. 1 (1945); and *United States* v.. *Terminal Railroad Association,* 224 U.S. 383 (1912). All of these cited decisions involved exclusionary arrangements or collective boycotts, referred to as "bottleneck" agreements. It is the position of the Municipals that ECCNE, with its admitted exclusion of municipally-owned utilities from the regional planning carried on by ECCNE, is a Section 1 Sherman Act combination in restraint of trade and a Section 2 Sherman Act combination to monopolize.

The record in this proceeding shows that ECCNE was originally organized in 1947 as an outgrowth of a World War II coordinating committee composed of the [*31] chief executives of New England's investor-owned utilities. Its membership is now specifically limited to such utilities, and thereby excludes municipally-owned utilities.The Council was reactivated in 1964 and at present consists of 19 members including the board chairmen of the Applicant companies. The companies represented generate approximately 80 percent of the available electrical energy in New England. The stated purposes of ECCNE are to promote in New England the continued coordinated economic operation of existing generating facilities, to promote over-all planning for the integrated and balanced expansion of new generating plants, and to present publicly the views of the Council on problems affecting the New England investor-owned utilities. ECCNE has no staff as such. Its functions are performed by three standing committees -- the Planning Committee, the Connecticut River Watershed Committee and the Public Information Committee.

The Massachusetts Municipals applied for membership in ECCNE in April, 1966, but their application was denied because membership in the Council is limited by its by-laws to executives of investorowned utilities. According to the [*32] testimony of Applicants' policy witness, a past president of ECCNE, the Council's denial of the Municipals' application was motivated by the Council's view that the admission to ECCNE of a large number of members who neither generate nor transmit power might not further the expeditious conduct of ECCNE's business, and also by the fact that the positions of the municipal utilities and the investor-owned utilities on certain policy issues, such as the Dickey-Lincoln School project, are so fundamentally opposed that participation by the municipals in ECCNE would not be conducive to the achievement of its purposes.

The Applicants contend in opposition to the positions taken by the Municipals and by staff that it is questionable whether the "bottleneck" boycott theory should be applied to the electric industry. They point out that under the provisions of the Federal Power Act the Municipals are protected against a refusal by a generating utility to supply them with electricity and against unreasonable discriminatory pricing of such electricity. See *New England Power Company* v.. *Federal Power Commission,* 349 F. 2d 258 (CA1-1965). They also maintain that the Massachusetts Municipals [*33] are not in direct competition with the investor-owned utilities in the major area of their activities, namely their sales to ultimate consumers, because of the policy of the State of Massachusetts of protecting one electric utility against the entry of another electric utility into its service area.

The Applicants further state that, assuming, *arguendo,* that the "bottleneck" boycott theory is applicable to the electric industry, they nevertheless have not been party to any antitrust violation. They urge that the *Silver, Associated Press,* and *Terminal* decisions, *supra,* each involved the withholding of a commodity by the concerted action of the boycotting group, which commodity was essential to the business of the excluded party. The Applicants point out that the business of each of the Massachusetts Municipals is essentially the distribution of electricity within its own service area, and they maintain that the Municipals have made no showing that their participation in the planning activities of ECCNE would have any causal connection with their obtaining bulk supplies of electricity from any new plants built by the New England investor-owned utilities. In this [*34] connection, the Applicants emphasize that the decision to build new generating plants is never made by the Planning Committee of ECCNE, but rather by the individual utility system responsible for the construction and financing of such plants.

Upon consideration of the arguments set forth by the various parties, we find that the Municipals and staff have not satisfactorily demonstrated that ECCNE has engaged in any significant planning activities, the denial of participation in which resulted in any important adverse consequences to the Municipals. Furthermore, we note that various segments of the New England electric power industry during the past 12 months have been engaged in the formulation of programs for area power coordination. That activity is directed to the creation of a proposed New England Power Pool. It is our understanding and expectation that membership in the proposed power pool will be open to qualifying municipally owned utilities as well as privately and cooperatively owned systems. In view of these developments, it appears that appropriate access to regional planning which the Municipals seek will be accomplished. The proposed interstate New England [*35] Power Pool arrangement will be subject to the continuing regulatory jurisdiction of this Commission under the Federal Power Act.

In any event, we agree with the Examiner that the essential purpose of this proceeding is to determine whether the public interest will be served by the issuance of a license for construction of the Northfield Project by the Applicants. The showing made by the Municipals and staff in connection with the restraint of trade issue has not convinced the Commission that the license issued to the Applicants should be qualified in the manner suggested by the Municipals or by staff. This does not mean, however, that the future activities of the Applicants, whether as members of ECCNE or otherwise, will be immune from scrutiny to ascertain their satisfactory compliance with the provisions of Section 10(h) or other provisions of the Act. Should such compliance be deemed questionable, Section 306 of the Federal Power Act affords the Municipals the appropriate procedure to be followed for remedial action.

The Municipals have also filed exceptions to the Examiner's exclusion of certain evidence which the Municipals assert is relevant to show that applicants are [*36] restraining trade in violation of Sections 1 and 2 of the Sherman Act. They ask the Commission to take official notice of such evidence together with a number of items published after the close of the hearing record in the Congressional Record and in New England newspapers. We agree with the Examiner that the lobbying activities of the applicants before the Massachusetts legislature and the Congress of the United States does not under the precedent of *Eastern Railroad Presidents Conference* v.. *Noerr Motor Freight, Inc.*, 365 U.S. 127 (1961), constitute violations of the antitrust laws. Accordingly, although we grant the request of the Massachusetts Municipals that we take official notice of the documents identified as Exhibits 94 through 100, which were offered by them in evidence and were ruled inadmissible by the Examiner, as well as certain excerpts from speeches and publications attached as appendices to their pleadings on exceptions, we do not find that these documents or excerpts have relevant decisional significance with respect to the final resolution of the issues in this proceeding.

The Availability of Project Power to the Municipals

The Massachusetts [*37] Municipals except to the Examiner's decision that it is not necessary to include a condition in the license which would require the Applicants to make excess project capacity available to municipal utilities and investor-owned utilities on an equal basis. Although the Applicants state that they "are willing to sell excess capacity of the Northfield Project to all utilities on the same basis" and that they "are willing to transmit electricity for municipals over their transmission lines, given proper contract considerations and fair and reasonable term," n3 they oppose imposition of any condition requiring the execution of such promises on the basis that "a license is no place to write a power contract or a transmission contract." n4

n3 Reply Brief of Applicants before the Examiner, p. 26, referring to the Record at Tr. 1556, Exhibit 92, and Tr. 164-167

n4 Applicants' Reply Brief on Exceptions of Staff and Massachusetts Municipals, p. 31.

While we agree with the Applicants that we cannot, at this point in time, specify precisely what agreement should be reached between the parties, we do believe that it is consistent with the public interest that excess capacity from the project [*38] shall be sold and made available to all on a just, reasonable, and nondiscriminatory basis; and we shall so condition this license. See Article 15 as set forth in ordering paragraph (D) of license in Project No. 2485. The mere fact that Applicants have agreed to undertake an obligation does not relieve this Commission of its duty to protect the public interest. *Cf. Transwestern Pipeline Company, et al.*, 36 FPC 176 (1966). In so conditioning the license, however, we do not reach the question of whether the Commission has authority under Part I of the Act to order wheeling beyond the primary lines.

The incorporation of the above condition in the Applicants' license renders it unnecessary for the Commission to rule on the merits of the motion filed by the Massachusetts Municipals on March 8, 1968 to reopen the record in this case to admit additional evidence purporting to show that the Massachusetts Municipals were in danger of being denied the opportunity to purchase surplus power from the Northfield Project. Since the Massachusetts Municipals are now assured of an opportunity to purchase surplus power on a just, reasonable, and non-discriminatory basis, the motion [*39] is moot and should be denied.

The Municipals also except to the failure of the Examiner to require Western Massachusetts to make available transmission capacity on the primary project lines upon payment of reasonable rates, or, where available, the same rates as are charged to investor-owned utilities. In light of our determination concerning the primary line issue, we see no need to consider this exception further.

The Commission further finds:

(A) With respect to the application for the proposed Northfield Mountain Pumped Storage Development, Project No. 2485:

(1) The Connecticut Light and Power Company and The Hartford Electric Light Company are corporations organized under the laws of Connecticut and have submitted satisfactory evidence of compliance with all applicable state laws insofar as necessary to effectuate the purposes of the license for the proposed project.

(2) The Western Massachusetts Electric Company is a corporation organized under the laws of Massachusetts and has submitted satisfactory evidence of compliance with all applicable state laws insofar as necessary to effectuate the purposes of the license for the proposed project.

(3) Public notice of [*40] the filing of the application has been given. No conflicting application is before the Commission.

(4) The project will be located on a navigable water of the United States.

(5) The power to be produced by the project is necessary to meet the load growth in the service area of the Applicants, the CONVEX pool, and New England.

(6) The Applicants have submitted satisfactory evidence of their financial ability to construct and operate the project.

(7) The estimated cost of developing the project compared with the estimated cost of developing alternative sources of power is reasonable.

(8) Subject to the terms and conditions hereinafter imposed, the project will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for use or benefit of interstate or foreign commerce, for the improvement and utilization of water power development, and for other beneficial public uses, including recreational purposes.

(9) The installed horsepower capacity of the project hereinafter authorized for the purpose of computing the administrative annual charge is 1,333,000 horsepower, and the amount of annual charges based on such capacity to be paid under [*41] the license for the project, for the costs of administration of Part I of the Act, is reasonable.

(10) The issuance of a license as hereinafter provided will not adversely affect the development of any water resources for public purposes which should be undertaken by the United States.

(11) The primary lines of the Northfield Project within the meaning of Section 3(11) of the Federal Power Act

consist of two 345 kilovolt cables which connect the two project transformers located in the transformer vault to the Northfield Farms Switching Station, located adjacent to the access tunnel adit, together with the pot heads at the Northfield Farms Switching Station.

(12) The exhibits designated and described in the ordering paragraphs below conform to the Commission's rules and regulations and should be approved as part of the license for the project to the extent therein indicated.

(13) The exceptions of the Applicants to the effect that the Northfield Farms Switchyard and the transmission lines emanating therefrom are not part of the Northfield Mountain Project should be granted.

(14) The request of the Massachusetts Municipals that the Commission take official notice of the documents [*42] identified as Exhibits 94 through 100, of Appendices A and B attached to the Massachusetts Municipals' Brief on Exceptions, and of Appendices A-1 through B-2 attached to the Massachusetts Municipals' Brief Opposing Exceptions should be granted.

(15) Apart from the exceptions which shoud be granted in finding paragraphs (13) and (14) above, and as elsewhere indicated in this opinion, the exceptions to the Examiner's decision should be denied.

(16) The motion filed by the Massachusetts Municipals on March 8, 1968 to reopen the record to admit additional evidence should be denied.

(B) With respect to the application to amend the existing license for the Turners Falls hydroelectric development, Project No. 1889:

(1) The changes hereinafter approved in the Turners Falls development, Project No. 1889, will enable the Turners Falls reservoir to function as a water source and lower pool for the Northfield Mountain Pumped Storage Development, Project No. 2485, without adversely affecting the generating capacity of the Turners Falls plant.

(2) The changes in the Turners Falls development will reduce the maintenance costs of the projects by eliminating the necessity for the annual removal [*43] and installation of flashboards on the Gill and Montague dams.

(3) The changes in the Turners Falls development will increase its spillway discharge capacity.

(4) Public notice of the filing of the application for amendment of the license has been given.

(5) It is appropriate and in the public interest to amend the license for Project No. 1889 as provided below in the Commission's ordering paragraphs.

(6) Exhibit L1A, FPC No. 1889-27, entitled "Project Structures," conforms to the Commission's rules and regulations and should be approved as part of the amended license, supplementing Exhibits L1 and L2 now a part of the license, but only insofat as it shows the general layout of the proposed modifications.

The Commission orders:

(1) With respect to the application for the proposed Northfield Mountain Pumped Storage Development, Project No. 2485:

(A) This license is issued jointly to The Connecticut Light and Power Company, The Hartford Electric Company, and the Western Massachusetts Electric Company (the Licensees) under Section 4(e) of the Federal Power Act for a period of 50 years, effective as set out below in paragraph (B), for the construction, operation, [*44] and maintenance of Project No. 2485, to be known as the Northfield Mountain Pumped Storage Project, on the Connecticut River in Franklin County, Massachusetts, subject to the terms and conditions of the Act and subject to such rules and regulations as the Commission has issued or prescribed under the provisions of the Act.

(B) The license shall be effective as of the first day of the month in which the Licensees have filed with the Commission acknowledgment of acceptance of this license. This license creates no rights in the Licensees until it becomes effective.

(C) Project No. 2485 consists of:

(i) All lands constituting the project area and enclosed by the project boundary or limits which are otherwise defined, and/or interest in such lands necessary or appropriate for the purposes of the project, whether such lands or interests therein are owned or held by the Licensees or the United States; such project area and project boundary being more specifically shown and described by certain exhibits which formed a part of the application for license, and which are designated and described as follows:

Exhibit	Project No.	Showing
J	2485-6	General map of project area.
K	2485-7	Project area -- River to intake at upper reservoir.
K	2485-8	Project area -- Upper reservoir.

[*45]

(ii) All project works consisting of: (1) a rockfill concrete-faced dam across Briggs Brook and low dikes of similar design creating (2) an upper reservoir having a gross storage of 17,050 acre-feet and a usable storage of 12,750 acre-feet with 62 feet of drawdown from maximum water surface elevation 1,000 feet; (3) intake works; (4) an inclined 31-foot diameter concrete-lined pressure tunnel; (5) a horizontal transition section; (6) four 14-foot diameter steel penstocks; (7) four spherical valves; (8) an underground powerplant containing four reversible Francis type pump turbines connected to motor generators rated at 250,000 kilowatts each; (9) four 50-foot diameter surge chambers each having two 20-foot wide horseshoe-shaped horizontal surge tunnels; (10) a 26-foot wide horseshoe-shaped tailrace tunnel extending about 4,440 feet from the surge chambers to (11) outlet works on the Connecticut River; (12) use of Turners Falls reservoir (Project No. 1889) as the lower pool causing a fluctuation of about five or six feet at the Turners Falls Dam; (13) an underground transformer hall containing two 15/245 kilovolt transformers and circuit breakers; (14) two underground 345 [*46] kilovolt transmission lines leading to the Northfield Farms Switching Station; and (15) appurtenant facilities, the location, nature, and character of which are more fully described by the exhibits hereinbefore cited and by certain other exhibits which also formed a part of the application for license and which are designated and described as follows:

Exhibit L	Project No.	Showing
Sheet 1	2485-9	General plan.
Sheet 2	2485-10	Section through powerhouse and water conduits.
Sheet 3	2485-11	Powerhouse details and tunnel cross sections.
Sheet 4	2485-12	Plan of upper reservoir and dam details.

The above Exhibit L drawings are approved only as to the general layout of project structures.

Exhibit M, entitled "General Description of Structures and Mechanical, Electrical, and Transmission Equipment," filed January 14, 1966.

Exhibit R, Project No. 2485-30, showing Four Mile Brook and Pauchaug recreation areas.

(iii) All other structures, fixtures, equipment or facilities used or useful in the maintenance and operation of the project area, including such portable property as may be used or useful in connection with the project or any part thereof, whether located on or off [*47] the project area, if and to the extent that the inclusion of such property as a part of the project is approved or acquiesced in by the Commission; also all riparian or other rights, the use or possession of which are necessary or appropriate in the maintenance and operation of the project.

(D) This license is also subject to the terms and conditions set forth in Form L-4, entitled "Terms and Conditions of License for Unconstructed Major Project Affecting Navigable Waters of the United States," *infra*, p. 795) which terms and conditions, designated as Articles 1 through 29 are attached hereto and made a part hereof, except that Article 15 therein is amended to read as follows:

Article 15. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order. As a part of that coordination and pursuant to the continuing regulatory jurisdiction [*48] of this Commission, Licensees shall make provisions for selling and making available to all electric systems which may request project service, such portions of project capacity as are excess to Licensees' system needs, all upon just, reasonable and non-discriminatory terms and conditions.

This license is further subject to the special conditions designated by the Examiner in his initial decision of September 12, 1967, as Articles 32 through 50, which, as revised, and renumbered as Articles 30 through 48, are incorporated herein and made a part hereof, as follows:

Article 30. The Commission reserves the right, after notice and opportunity for hearing, to redetermine at any time during the term of this license what transmission facilities, if any, should be included or excluded as project works under this license.

Article 31. The Licensees shall commence construction within one year from the effective date of the license and shall thereafter in good faith and with due diligence prosecute such construction and shall complete construction of such project works witnin four years from the effective date of the license.

Article 32. The Licensees shall submit in accordance [*49] with the Commission's rules and regulations Exhibit L drawings showing the final designs of the project works, and the Licensees shall not begin construction of the project structures until the Commission has approved such exhibits.

Article 33. The Licensee shall, within one year from the date of completion of the project, file for Commission approval revised Exhibits F and K, in accordance with Commission rules and regulations, to describe the proposed project boundary.

Article 34. The Licensees shall submit to the Commission a report on the model and computer studies or hydraulic effects in the lower reservoir which they have ordered for design purposes. The report, which is to be submitted promptly upon completion of the studies, shall summarize the various assumptions under which the studies were made and the results under each set of assumptions.

Article 35. The Licensees shall submit to the Commission a report on studies of the electrical stability of the 345 kilovolt grid carrying project power. The report, which is to be submitted promptly upon completion of any such studies, shall summarize the various assumptions under which the studies were made [*50] and the results under each set of assumptions.

Article 36. The Licensees shall employ an independent board of consultants, having at least three qualified members, to review the designs, specifications, and construction of the dams, dikes, reservoir floor, powerchamber and other project facilities. The Licensees shall submit a report of the board covering each portion of the project prior to the submittal of revised Exhibit L drawings therefor. Prior to commencement of filling the upper reservoir, the Licensees shall submit a report of the board commending a schedule for such filling. The Licensees shall also submit a final report of the board upon completion of the project.

Article 37. The Licensees shall provide duplicate automatic means of stopping the units from pumping when the water surface in the Northfield Mountain upper reservoir exceeds elevation 1,000 feet mean sea level datum.

Article 38. The Licensees shall, prior to impounding water, clear all lands in the bottom and margins of the upper reservoir up to high-water level and shall dispose of all temporary structures, unused timber, brush refuse or inflammable material resulting from the clearing of the [*51] lands or from the construction, operation, or maintenance of project works. In addition, all trees along the margins of the reservoir within the project boundary which may die from operation of the reservoir shall be removed. The clearing of the lands and the disposal of the material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission.

Article 39. The Licensees, following completion of the model and computer studies of the hydraulic effect of project operation in the Turners Falls reservoir, but before completion of the project, shall consult with appropriate state and Federal agencies concerned with navigation and boating safety and shall solicit their comments and submit them to the Commission. The Licensees, after notice and opportunity for hearing, shall make such modifications in the project works, operate the project in such manner, and take such steps as the Commission may order in the interest of boating safety upon its own motion or upon the recommendation of the Chief of Engineers, U.S. Army, Corps of Engineers; the U.S. Coast Guard; or an interested agency of the Commonwealth of Massachusetts.

[*52] *Article 40.* The Licensees, following consultation with the U.S. Fish and Wildlife Service of the Department of the Interior and the fishery agencies of the Commonwealth of Massachusetts, shall make or pay the cost of making studies relating to fish protection at Project No. 2485. If the Licensees and the above-named agencies are unable to reach agreement respecting such studies, the Commission may prescribe the Licensees' obligations after notice and opportunity for hearing. The Commission may require further studies if it finds that changed fishery conditions or changed use of fishery in the Connecticut River so warrant.

Article 41. The Licensees shall expend $1,350,000 in the initial development of recreational resources associated with the project. The Licensees, from these monies, shall construct, operate, and maintain or provide for the construction, operation, and maintenance, of the outdoor recreation resources at the Four Mile Brook area, generally as shown in Exhibit R (Project No. 2485-30), which formed a part of the application, and shall purchase and make available to the Commonwealth of Massachusetts the land needed for the Pauchaug Brook area. With remaining [*53] monies, the Licensees shall develop such additional recreation resources as the Commission may approve or require. In planning further initial development, the Licensees shall consult and cooperate with the Department of Natural Resources of the Commonwealth of Massachusetts and the Bureau of Outdoor Recreation of the Department of the Interior. The Licensees shall submit to the Commission for its approval site layout drawings of any further recreation development, together with cost estimates including land costs.

Article 42. The Licensees shall, prior to commencement of construction, consult with the Massachusetts Archeological Society, Bronson Museum, Attleboro, Massachusetts, on the need for an archeological survey, and if the Society believes, that such survey would be useful, the Licensees shall provide funds not to exceed $2,000 for its conduct. The Licensees shall report to the Commission whether the Society, on the basis of the survey, believes that archeological salvage is necessary, and the Licensees shall make available such reasonable funds as the Commission, after notice and opportunity for hearing, may approve or direct for the conduct of salvage.

[*54] *Article 43.* The Licensees, in cooperation with the licensee for Project No. 1889, shall enter into an agreement with the Department of the Army providing for the coordinated operation of the Project Nos. 1889 and 2485 during flood conditions on the Connecticut River in accordance with rules and regulations prescribed by the Secretary of the Army. A conformed copy of the agreement shall be filed with the Commission prior to commencement of commercial operation of Project No. 2485. In the event that agreement with the Department of the army cannot be achieved prior to that time, Project No. 2485 shall be operated during flood conditions in accordance with a plan prescribed by the Commission.

Article 44. The Licensees for Project No. 2485 are authorized to utilize the Turners Falls reservoir as a source of water and as a lower pool for the operation of the project when operating under this license.

Article 45. The operating of Project No. 2485 shall be coordinated with the operation of Project No. 1889.

Article 46. The Licensees of Project No. 2485 shall make an annual payment to the licensee or owner of Project No. 1889 consisting of:

a. A fixed annual charge [*55] on the capital cost of the modifications made at Project No. 1889 so that its reservoir may serve as the lower pool of Project No. 2485. This fixed annual charge shall be determined by multiplying the depreciated capital cost of such modifications by a factor comprised of the following items: cost of money, straight-line depreciation, interim replacements, insurance, non-levelized federal income tax, non-levelized state income tax, and miscellaneous federal taxes.

b. Annual municipal taxes attributable to such modifications at Project No. 1889.

c.Annual operation and maintenance cost and administrative and general expense (hereinafter collectively called O & M cost) attributable to such modifications at Project No. 1889. This amount shall be fixed by multiplying the total O & M cost for the modifications and existing Turners Falls joint-use facilities by the ratio of the depreciated capital cost of the modifications to the sum of the depreciated capital cost of the modifications and the depreciated capital cost of such existing facilities.

d. A portion of the fixed annual charge and O & M cost on the existing joint-use facilities at Project No. 1889. This portion shall be fixed [*56] under the procedures utilized in *Susquehanna Power Company*, 32 FPC 826 (1964).

Article 47. The Licensees shall compensate the licensee or owner of Project No. 1889 for any loss of generation incurred during the modification of that project so that its reservoir may serve as the lower pool of Project No. 2485.

Article 48. The Licensees shall pay to the United States the following annual charges:

For the purpose of reimbursing the United States for the costs of administration of Part I of the Act, a reasonable annual charge as determined by the Commission in accordance with the provisions of its regulations, in effect from time to time. The authorized installed capacity for such purposes is 1,333,000 horsepower.

(E) The exhibits designated and described in the above ordering paragraphs are hereby approved as part of this license to the extent therein indicated.

(F) The exceptions of the Applicants to the effect that the Northfield Farms Switchyard and the transmission lines emanating therefrom are not part of the Northfield Mountain Project are granted.

(G) The request of the Massachusetts Municipals that the Commission take official notice of the documents [*57] identified as Exhibits 94 through 100, of Appendices A and B attached to the Massachusetts Municipals' Brief on Exceptions, and of Appendices A-1 through B-2 attached to the Massachusetts Municipals' Brief Opposing Exceptions is granted.

(H) Apart from the exceptions granted in ordering paragraphs (F) and (G) above, the exceptions to the Examiner's decision are denied.

(I) The motion filed by the Massachusetts Municipals on March 8, 1968 to reopen the record to admit additional evidence is denied.

(J) This order shall become final 30 days from the date of its issuance unless application for rehearing shall be filed as provided in Section 313(a) of the Act, and failure to file such an application shall constitute acceptance of this license. In acknowledgment of the acceptance of this license, it shall be signed for the Licensees and returned to the Commission within 60 days from the date of issuance of this order.

(2) With respect to the application to amend the existing license for the Turners Falls hydroelectric development, Project No. 1889:

(A) At such time as the license for the Northfield Mountain Pumped Storage Development, Project No. 2485, becomes effective, the license [*58] issued to the Western Massachusetts Electric Company (the Licensee) on January 17, 1944, for the Turners Falls hydroelectric development, Project No. 1889, on the Connecticut River in Franklin County, Massachusetts, and subsequently amended, is further amended as follows:

(B) Articles 2 and 5 are modified to read:

Article 2. The project covered by and subject to this license, known as the Turners Falls development, is located in Franklin County, Massachusetts, and consists of:

A. All lands constituting the project area and enclosed by the project boundary, the use and occupancy of which are or will be valuable or serviceable in the maintenance and operation of the project works or to which are appurtenant the rights, easements or interests necessary or useful for the purposes of the project; such project area and project boundary being more specifically shown and described by certain exhibits which formed part of the application for license or for amendment thereof and which are designated and described as follows:

Exhibit J: Entitled "General Map of Project Area" in one sheet (FPC No. 1889-1), signed July 23, 1942, Western Massachusetts Electric Company by [*59] Harry E. Duren, President.

Exhibit K: Entitled "Detail Map of Project" in seven sheets (FPC Nos. 1889-18 to -24, inclusive), signed Western Massachusetts Electric Company by Fred C. Abercrombie, President.

Sheets 2 to 7 (FPC Nos. 1889-19 to 1889-24, inclusive) were approved as part of the license order adopted May 31, 1946, and Revised Sheet No. 1 (FPC No. 1889-18) was approved as part of the license by order adopted September 20, 1950.)

B. All project works consisting principally of: (1) a concrete gravity dam (Gill) about 300 feet long across the east channel and surmounted by hinged flashboards; (2) a concrete structure comprised of two bays of flashboards and two bays of bascule type gates across an island in the center of the river; (3) a concrete gravity dam (Montague) about 560 feet long across the west channel and surmounted by bascule type gates; (4) a headgate house about 214 feet long; (5) a reservoir having a gross storage of about 21,500 acre-feet at normal water surface elevation 185.0; (6) a canal about 2 miles long; (7) a short branch canal extending to (8) a powerhouse known as No. 1 station, having installed capacity of about 4,840 kilowatts operating under [*60] a head of about 43.7 feet; (9) a powerhouse known as Cabot Station, having installed capacity of about 51,000 kilowatts operating under a head of about 60 feet; and (10) two 66 kilovolt and two 110 kilovolt transmission circuits between Cabot Station and the Montague switching station located about 200 feet across its project canal, and appurtenant equipment, the location, nature, and character of which project works are more fully shown and described by the exhibits hereinbefore cited and by certain other exhibits which also formed part of the application for license or for amendment thereof and which are designated and described as follows:

Exhibit L:

Sheet 1 - (FPC No. 1889-9) designated "Plan and Sections of Dam";

Sheet 1A - (FPC No. 1889-27) designated "Project Structures";

Sheet 2 - (FPC No. 1889-10) designated "Plan, Section and Elevations of Gate House";

Sheet 3 - (FPC No. 1889-11) designated "Plan of Station No. 1";

Sheet 4 - (FPC No. 1889-12) designated "Cross Section of Station No. 1";

Sheet 5 - (FPC No. 1889-13) designated "Plan of Cabot Station";

Sheet 6 - (Revised) - (FPC No. 1889-25) designated "Cross Section of Cabot Station";

Sheet 7 - (FPC [*61] No. 1889-15) designated "Plan and Sections of Canal";

Sheet 8 - (FPC No. 1889-16) designated "Keith Drainage Tunnel";

Sheet 9 - (FPC No. 1889-17) designated "Lower Drainage Tunnel."

(Sheets 1 to 5 and 7 to 9 signed July 23, 1942, Western Massachusetts Electric Co. by Harry E. Duren, President; Sheet 6 signed September 28, 1949, Western Massachusetts Electric Co. by Howard J. Cadwell, President.)

Exhibit L, sheet 1A above is approved only insofar as it shows the general layout of the structures.

Exhibit M:

A typewritten statement in sixteen pages designated "Descriptions and Specifications of Equipment and Appurtenances."

(Pages 1 to 11 and 14 to 16 signed July 23, 1942, Western Massachusetts Electric Company by Harry E. Duren, President; Revised pages 12 and 13 signed September 28, 1949, Western Massachusetts Electric Company by Howard J. Cadwell, President.)

Article 5. The construction, operation, and maintenance of the project and any work incident to additions or alterations shall be subject to the inspection and supervision of the Regional Engineer, Federal Power Commission, in the region wherein the project is located, or of such other officer or agent as the Commission [*62] may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall cooperate fully with said representative and shall furnish him a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of the project. Construction of the project works or any feature thereof shall not be initiated until the program of inspection for the project works or any such feature thereof has been approved by said representative. The Licensee shall also furnish to said representative such further information as he may require concerning the construction, operation, and maintenance of the project, and of any alteration thereof, and shall notify him of the date upon which work will begin, and as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of work for a period of more than one week, and of its resumption and completion. The Licensee shall allow him and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands [*63] and project works in the performance of their official duties. The Licensee shall comply with such rules and regulations of general and special applicability as the Commission may from time to time prescribe for the protection of life, health, or property.

(C) The following articles are added:

Article 26. The Licensee shall commence construction of the modification of Project No. 1889 within two years from the effective date of the license for Project No. 2485, as described in ordering paragraph (B) of the license for that project, and the Licensee shall in good faith and with due diligence prosecute such construction and shall complete construction of the project works within four years of the effective date of that authorization.

Article 27. The Licensee shall submit in accordance with the Commission's rules and regulations Exhibit L drawings showing the final designs of the proposed modifications and shall not begin construction of such modifications until the Commission has approved such exhibits.

Article 28. The Licensee shall, within one year from the date of completion of the project, file for Commission approval revised Exhibits F and K, in accordance with [*64] the Commission's rules and regulations, to describe the proposed project boundary.

Article 29. The Licensee, in cooperation with the licensees for Project No. 2485, shall enter into an agreement with the Department of the Army providing for the coordinated operation of the Project Nos. 1889 and 2485 during flood conditions on the Connecticut River in accordance with rules and regulations prescribed by the Secretary of the Army. A conformed copy of the agreement shall be filed with the Commission prior to commencement of commercial operation of Project No. 2485. In the event that agreement with the Department of the Army cannot be achieved prior to that time, Project No. 1889 shall be operated during flood conditions in accordance with a plan prescribed by the Commission.

Article 30. The operation of Project No. 1889 shall be coordinated with the operation of Project No. 2485.

Article 31. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses [*65] of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 32. The Licensee shall, prior to raising the level of the reservoir, clear all lands in the bottom and margins of the reservoir up to high-water level and shall dispose of all temporary structures, unused timber, brush refuse of inflammable material resulting from the clearing of the lands or from the construction, operation, or maintenance of project works. In addition, all trees along the margins of the reservoir within the project boundary which may die from operation of the reservoir shall be removed.The clearing of the lands and the disposal of the material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission.

Article 33. The Licensee shall cooperate with the U.S. Fish and Wildlife Service of the Department of the Interior and the fishery agencies of the Commonwealth of Massachusetts in studies of fish passage at the Turners Falls Dam. The Licensee shall make, pay for, or contribute to the cost of such studies, as the Commission may direct after notice and opportunity for [*66] hearing.

Article 34. The Licensee shall, for the conservation and development of fish and wildlife resources, construct, maintain, and operate or arrange for the construction, maintenance and operation of such fish passage facilities and comply with such reasonable modifications of the project structures and operation as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing and upon findings based on substantial evidence that such facilities and modifications are necessary and desirable, reasonably consistent with the primary purpose of the project, and consistent with the provisions of the Act.

Article 35. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of Licensee's lands and interest in lands, reservoirs, waterways and project [*67] works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be prescribed by the Commission, reasonably consistent with the primary purpose of the project, in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

(D) The exhibit as designated and described in finding (6) for this Project No. 1889 is hereby approved as part of the license for such project, but only insofar as it shows the general layout of the proposed modifications.

(E) This amendment to the manner set out above shall not operate to alter or amend the license in any other respect, and shall not in any way constitute a waiver of any part, provision or condition of the license.

(F) This order shall become final 30 days from the date of its issuance unless application [*68] for rehearing shall be filed as provided in Section 313(a) of the Act, and failure to file such an application shall constitute acceptance of this license amendment. In acknowledgment of the acceptance of the license amendment, it shall be signed for the Licensee and returned to the Commission within 60 days from the date of issuance of this order.

Chairman White *concurring.*

Commissioner Ross *concurring* and *dissenting.*

CONCURBY: WHITE; ROSS

CONCUR:

WHITE, *Chairman, concurring:*

While I am in general agreement with the Commission's decision and conclusions, there are several matters which I believe require further comment.

1. *Primary lines*

As the decision herein makes clear, the Commission is rethinking its position on primary lines. This is not surprising; Section 3(11) of the Act was far from clear as to meaning and intent in 1920, and, regardless of the construction given the language, is hopelessly obsolete in context of the electric power industry as it exists today. I concur in the Commission's present determination because it (1) is as consistent with the statutory requirements as any other, (2) is simpler in administration, and (3) makes clear that the Commission [*69] retains full authority to revise the determination if there is a demonstrated need to do so in the future.

As of 1920, the principal, if not the sole, objective of the primary-line exercise was to ensure that a viable project, capable of moving power from the often remote sites of hydroelectric projects, would be available if the United States exercised its power to recapture the project at the end of the license term. Even then the potential conflict was recognized between a line serving as the conduit of project power to the load center and one, often the same one, serving as a part of the primary interconnected system of a utility. The industry wished to protect the integrity of the remaining system following recapture; the Government did not wish to be in a position where it might be forced to recapture the backbone of a transmission system it did not need for its purposes, with consequent liability for greatly increasing the recapture price (both as a matter of severance damages, and increased net investment costs).

Whatever the utility of this scheme as of 1920, it has virtually none when applied to the typical electric system of today. This is well illustrated by the facts [*70] of the present case. Assuming the intervener municipalities to be correct in their broadest claim as to what constituted the primary lines of the proposed Northfield project, their inclusion in the license would almost certainly not be adequate to get the project power to most, if not all, of the load centers to be served by either the United States, were it eventually to recapture the project, or a new licensee, were it to prevail over Northfield's present owners in a relicensing proceeding. Furthermore, any savings in money resulting from the new owners not needing to construct or otherwise secure transmission facilities for the distances covered by the primary lines could be offset in large part by additional severance damages which would have to be paid to the existing licensee, if portions of its backbone transmission system were to be converted to new and incompatible uses.

I do not mean to suggest that under some circumstances inclusion of major portions of a company's backbone grid in a project's primary line, assuming this was lawful, could not give the new licensee (federal or otherwise) enhanced bargaining power exceeding the additional cost. However, this is an exceedingly [*71] difficult, if not impossible, determination to make at the time of licensing. The classification of a line as primary or not primary is clearly dependent on the facts in a given situation. As the majority points out, the basic purpose of a line must be viewed in its relation to a system's other lines; since the purpose of a particular line may change over time, the Commission must remain prepared to redetermine the status of a transmission line as its use changes. In this case, the Commission in Article 32 has plainly given applicant notice that if the use of those lines may change at some time in the future, so also may be status of those lines as non-project lines be changed.

However, in addition to the recapture issue, there are other issues which must be weighed in licensing such projects to the transmission lines emanating from licensed projects, including routing, right-of-way and safety problems, as well as considerations of alternative and perhaps more economical ways of moving the power. The use of such lines by other systems can also be an important consideration. Where appropriate, the Commission has in issuing licenses included conditions tied to the primary [*72] lines with respect to these considerations. n1 But, while the Commission's ingenuity in working within the limitations of primary line concepts has provided some consideration of transmission line questions, it is clear that reliance upon the fortuitous and changing determinations of what part of a system's lines are primary lines cannot guarantee that the public interest will adequately be protected. Past actions of the Commission suggest that the Commission might have a considerable degree of authority in these areas irrespective of the primary line question. n2 The more specific authority to deal with these matters contained in the Commission's proposed Electric Reliability Act would, of course, permit us to deal effectively with these important issues even where there is no licensed project directly involved.

n1 See, for emample, *Consolidated Edison Company of New York, Inc.,* 33 FPC 428 (1965), set aside 354 F. 2d 608 (CA2-1965), cert. denied *sub nom. Consolidated Edison Company of New York, Inc.* v.. *Scenic Hudson Preservation Conference, et al.,* 384 U.S. 941 (1966); *F.P.C.* v.. *Idaho Power Co.,* 344 U.S. 17 (1952).

n2 *Consolidated Edison Company of New York, supra; Udall* v.. *F.P.C.,* 387 U.S. 428 (1967); *Power Authority of the State of New York,* Project No. 2216, 19 FPC 186 (1958) and 12 FPC 172 (1953).

[*73]

2. *"Wheeling"*

The majority opinion, correctly in my judgment, has not rested with the statement by the applicants of their willingness to sell appropriate portions of any surplus project power to the intervening municipals and to transmit over their transmission lines "given proper contract considerations and fair and reasonable terms." Recognizing the Commission's responsibility to protect the public interest, and the potential difficulty of different segments of the industry reaching agreement on new types of coordination efforts, the Commission has included, as part of Article II of the license, a condition directing the licensee, subject to the continuing regulatory authority of the Commission, to make available upon an equitable basis such excess power to all electric systems so requesting. The opinion also properly notes that this action moots the motion to reopen the record which was directed to this issue.

My difficulty is not with the Commission's action in this area, but how it is represented in both the majority opinion and dissent. The majority inclusion of a sentence disclaiming any intent to pass upon the Commission's authority to order "wheeling" [*74] under Part I of the Act, not only casts what I believe to be unintended doubt on the scope of the condition, but suggests that, had not the applicants voluntarily agreed to sell and transmit excess Northfield power to the interveners, we might not have had authority to impose any condition to require such action. I do not read our authority under Sections 10(a) and (g) of the Act so narrowly, and neither has the Commission in the past. n3 Within the last few years the Supreme Court has expressly held that the reference to the "interests of interstate commerce" in Section 23 of the Act was not limited to waterway commerce (*F.P.C.* v.. *Union Electric Co.,* 381 U.S. 90) and certainly its more recent opinion in *Udall* v.. *F.P.C.,* 387 U.S. 428, does not indicate that it would treat the similar language in Section 10(a) any differently.

n3 *Power Authority of the State of New York* (Project No. 2000), 12 FPC 172, 177, 192-193 (Art. 28). *Cf.,* *Powr Authority of the State of New York* (Project 2216), 19 FPC 186, 193-94. I do not understand my colleagues to suggest that the comprehensive development standard of Section 10(a) requires less regional coordination of private licensees' projects than from the public bodies involved in those cases. *Cf., F.P.C.* v.. *Idaho Power Co.*, 344 U.S. 17, 23-24.

[*75]

I conclude, and this, I stress, is material to any agreement with the majority on the primary line issue, that under our Part I licensing authority we can impose any reasonable condition upon the utilization of the project works by the licensee, including the power generated thereform, as may be essential to ensure that the resource is put to optimum utilization. This, of course, would include the power to order transmission of power to another party over the facilities of the licensee's system.

To my way of thinking, this conclusion does not involve the question of "wheeling" at all. This is, of course, a non-statutory term, which though in frequent use, to the best of my knowledge, has no single meaning. For example, in commercial parlance it has a marketing connotation and serves as a convenient way of describing operating approximations which assume point to point transfers of electric power and energy. n4 In certain economic planning analyses of electric systems based upon static conditions, wheeling may be used to describe the function of interrelating production sources and consumptive markets. In the language of particular legal arguments wheeling tends to [*76] serve as a shorthand by which to allude to and apply through analogy determinations arising in other fields of utility service, principally the transportation industry where the utility service rendered is physical movement. Electric energy, when produced, and commingled with other generation, is not so easily directed -- on an undirectional basis. At best, wheeling is an imprecise tool of analysis when applied to the electric industry. At worst, it is an unfortunate mixture of assumptions and confusion of concepts.

n4 As our recent Part II jurisdictional cases demonstrate, point to point transfers do not necessarily occur under multiple connection coordinated condition arrangements or the type generally in existence in various parts of the Nation today, including New England. See *Florida Power & Light Company*, 37 FPC 544, 833 (1967) and the cases cited therein.

Applied to the case now before us, I had not thought it implied the transmission of power by the system generating it to the points where its transmission system interconnects with other systems. If this was the case "wheeling" and transmission -- at least beyond a plant's busbar -- would be synonymous. To [*77] me, the term "wheeling" connotes a very different type of power transmission -- transmission of energy over a system's lines for the account of a second system either to move the second system's power between two not connected points, or, perhaps more frequently, to permit the second system to sell and deliver power to a third party with which it has no direct connection. Certainly this was what was involved in the several Idaho Power licenses which we have specifically conditioned to provide the United States with the right to utilize excess capacity to transmit energy from its system to preference customers with which it then was not connected upon the payment of reasonable charges.

Whatever may be the proper terminology, this distinction between the two types of transmission is significant in my thinking. As indicated, I have no doubt of our authority, where necessary to comprehensive development, to require a would-be licensee to use its non-project facilities to effectuate the plan. However, I do not see how Part I of the Act permits us to go beyond the licensee. In terms of the present case, I do not believe we have authority under Part I over any of the non-licensee utilities [*78] whose transmission facilities might be necessary, in the absence of new construction, to "wheel" Northfield power to some of the intervening municipals. Nor do I believe it would be appropriate to condition what all agree is a useful project for the entire region upon the licensee's ability to secure satisfactory "wheeling" arrangements with other licensees.

Any such lack of authority under our Part I licensing responsibility worries me less than it apparently does my dissenting colleague. Like the majority, I am somewhat uncertain of the extent of our authority to order "wheeling" of

Northfield energy by an isolated utility under Section 202(b), even assuming it would be appropriate to do so. But, in the electric world of 1968, where the major utilities of the nation, and of New England in particular, are as a matter of economic and technological necessity in closer and closer voluntary coordination with one another, the Commission's authority under Sections 205 and 206 of the Act to ensure that such arrangements are just and reasonable, and not unduly discriminatory and prejudicial, gives us considerable authority over system interrelations, *cf. Pennsylvania Water* [*79] *& Power Co.* v.. *F.P.C.*, 343 U.S. 414 (1952). I wish to make clear that I am not here expressing any view as to the extent of such authority or how it should be exercised. The difficult policy problems where existing customers of utility seek authority to utilize excess utility transmission capacity to secure lower-cost power from other utility sources are not before us here. Their resolution must necessarily await an appropriate factual record in a specific controversy.

3. *Regional Planning and Coordination*

The record in this case details what has long been a matter of common knowledge -- the gross inadequacy of regional planning among the numerous electric systems operating in New England. Part of this picture is the almost complete polarization of such limited degree of planning as has occurred between the private and public segments of the industry. Put in context of what is one of the highest power cost regions in the country, it is, I believe, almost a classic example of why inter-segmental regional planning of the type proposed in our Electric Reliability Bill is essential, not only to prevent repetitions of the blackout which hit the area in 1965, but to provide [*80] New England with the less costly power it deserves and can achieve.

The record does not support the conspiracy theory of regional planning suggested by some of the intervener's pleadings. Far from constituting a link in a well-forged chain to exclude the interveners as a group from such benefits of the economies of scale to which they might be entitled, the Northfield project emerges from this record as a proposal initiated and almost entirely carried through by the CONVEX group with their own load requirements in mind. This planning was conducted with only a minimal degree of coordination with the other New England investor-owned utilities who are members of the Electric Coordinating Council of New England; and none at all with the utilities in New York.

The licensees plan to sell excess project peaking power to other ECCNE members but they have stated on the record their willingness to make available upon timely request reasonable amounts of such power to the municipals upon proper terms and to provide the municipals with access to the licensee' transmission facilities, also on proper terms, to move the power from Northfield. Interveners do not ask participation in [*81] the ownership of Northfield as they have in certain area nuclear plants. They do not contend Northfield construction should be conditioned upon the immediate installation of equipment capable of producing more than 1,000 kw presently contemplated. And while interveners did contend that the 345-kv transmission loop being constructed by the applicants and others to transmit project and other area power is inadequate, I agree with the contrary conclusions of the majority.

The record also indicates that while the applicants made use of certain ECCNE planning studies, in their own studies for the Northfield project, and that the location and voltage of the 345-kv transmission loop, which the applicant companies will participate in constructing, was necessarily the product of multilateral discussions, ECCNE's role in the planning of Northfield was minimal and nothing ECCNE did affected the Northfield planning in a manner adverse to the interveners.

In this context, I do not look upon the present licensing proceeding as the appropriate vehicle for taking such regulatory steps as may well be indicated to aid in substituting rational regional planning for the admitted inadequacies of the [*82] past. One does not have to endorse the organizational structure of the Northeast Power Coordination Council (which includes not only representatives of the New England utilities, but also those of New York) or the still embryonic NEPOOL, agreement, to recognize that the focus of industry planning and joint operation has already advanced far beyond that which in the past was provided to a very limited degree by ECCNE and its planning committee, to which so much of the evidence in this case was directed.

I do not read the Commission's opinion as suggesting that the mere hope for a better future obviates the need for action in the present. If the ECCNE planning committee is to play any continuing role of significance then, as a minimum, its efforts should be made available on a timely basis to non-member utilities, whether public or private. Moreover, its future planning activities should be opened to all interested systems, at least upon a representative basis, regardless of whether they have the necessary common interests to justify full membership in what is, in large part, a trade association of the investor-owned segment of the industry. We must insure that limited [*83] membership groups like ECCNE, do not function as *de facto* steering committees of broader regional planning organizations, but we should set our sights well beyond the older mechanisms which have proved so ineffectual.

I recognize that there are real problems, both administrative and doctrinal, in joint planning between groups with different types of financial and legal structures, who traditionally have largely occupied a buyer-seller relationship. Differences in relative size may also be significant, though in recent years the New England investorowned utilities have shown an increasing ability to overcome this problem which is so prevalent in the area. But, comparable organizations in other areas of the country have demonstrated that these problems are not insoluble. If these difficulties cannot be overcome in New England so planning can be done on a truly regional basis and involving all ownership segments, the Commission may take appropriate action within our existing authority to bring about such planning under either Part I or Part II of the Act. Thus, in my view, joint planning arrangements like ECCNE, may well involve practices or contracts "affecting" rates and charges [*84] within the purview of Section 206 of the Federal Power Act. Furthermore, as strenuously argued in this record, it may well be that such exclusionary planning practices would constitute violation of the anti-trust laws and could be prosecuted on that basis.

DISSENTBY: ROSS

DISSENT:

Ross, *Commissioner*, *concurring* and *dissenting:*

For the last nine years I have been concerned as a regulator with the high costs of power in New England. Vermont, as a result of self-help plus a dash of Senator Aiken and pinch of PASNY, seasoned with Robert Moses, has managed to improve its relative position as compared to the other New England states. The rest of New England, however, has not been so fortunate.

When I came to the Federal Power Commission in 1961, I was hopeful that this august body, sparked by the know-how of a former counsel of the TVA and backed up by the Federal Power Act, might secure a breakthrough. n1 The first confrontation with the power industry of New England was not too encouraging -- we had to grant a rate increase. The *quid pro quo* was supposed to be the gradual dismantling of the old tes kettles which were a millstone around the neck of the power companies.

n1 See the following excerpt from former Chairman Swidler's speech of October 19, 1962, before the Electric Council of New England, in which he pointedly called upon, the New England utilities to reduce their high rates:

No one can blame the New England power systems because their area does not have large deposits of low cost fuel, but with fuel costs high, it would be natural to expect the New England utilities to concentrate their efforts on the development and installation of highly efficient generating units which would make the best possible use of the expensive fuel supply. The more costly the fuel the greater should be the incentive towards efficiency in its use. Progress is now being made in New England toward installing larger and more efficient units, but there is still a long way to go to rectify past failure to keep New England's power systems abreast of the industry technology in efficient use of fuel.

[*85]

The sun did shine a little brighter when the Commission was upheld in its *Shrewsbury* decision, which permitted the Commission to ignore the middleman when it wasn't performing a useful function. Furthermore, certain rate reductions to the New England electric customers were promised and secured. These reductions, however, were not wide-scale since the private utilities found it necessary to retain some of the tea kettles in order to avert a power shortage which their planning failed to provide for. The Maine companies, whether as a result of the authorization of Dickey-Lincoln or other pressures, also initiated some reductions.

About this time, too, like the sudden blossoming of the apple trees in Vermont, there appeared on the scene (via the New England newspapers) the announcement of a "Big Eleven Power Loop" -- including a transmission grid throughout New England as well as a number of generating stations, including both nuclear and pumped storage.

Fortunately for New England, in one sense, the private utilities had to file a license application for the Northfield pumped storage project. n2 It was fortunate since Part I of the Federal Power Act offers the only opportunity [*86] for a look-see as to the generation and transmission plans of the New England utilities unless a State Commission under Section 207 were willing to file a complaint that interstate service was inadequate or insufficient.

n2 The *Taum Sauk* case established the Commission's authority to license pumped storage projects under Part I of the Federal Power Act, *F.P.C.* v.. *Union Electric Company*, 381 U.S. 90 (1965).

I can see no reason why such a complaint ought not to be filed by the New England Commissions jointly. It would be proof at least of the concern of the New England State Commissions. I am well aware that it might be hard to secure the unanimous approval, but the effort should be made and a report made to the governors of the respective states as to the reasons why such action could not be undertaken if that be the case. n3 In addition, I would suggest that the state commissions utilize Section 19 of the Federal Power Act, which requires every public-service licensee to "abide by such reasonable regulation of the services to be rendered to customers or consumers of power, and of the rates and charges of payment therefor, as may from time to time be [*87] prescribed by any duly constituted agency of the State in which the service is rendered or the rate charged." This section, though rarely if ever utilized, might provide an area for coordinated action between the state commissions and the FPC.

n3 The Massachusetts legislature is currently holding hearings on the high cost of power to Massachusetts. If Massachusetts' concern were channeled through its state commission and its sister New England commissions through Section 207, this Commission may be able to provide some answers and concrete resolutions as to the region's high-cost power. *Cf.* my dissent in the matter relating to the acquisition of the City of Rushville's facilities by *Public Service Company of Indiana, Inc.*, Docket No. E-7392, order issued April 22, 1968, 39 FPC 498, 499.

Since action cannot be initiated by the Commission under Section 207 or under Section 202(b) of the Federal Power Act, as a practical matter a licensing procedure offers the only feasible method of exploring the adequacy of Part I, dealing with hydroelectric project licensing, and Part II relating to rate regulation in achieving the objectives of Section 202(a):

For the purpose of [*88] assuring an abundant supply of electric energy throughout the United States with the greatest possible economy and with regard to the proper utilization and conservation of natural resources, the Commission is empowered and directed to divide the country into regional districts for the voluntary interconnection and coordination of facilities for the generation, transmission, and sale of electric energy * * * It shall be the duty of the Commission to promote and encourage such interconnection and coordination within each such district and between such districts * * *

This proceeding and in fact the majority opinion itself speak as clearly as possible why there are so many bills pending in Congress today seeking to amend the Federal Power Act. n4 If the public were satisfied with the results achieved under the Federal Power Act, there certainly would be no such expressions of overwhelming, crying need to improve the Act. If this opinion does nothing else, I hope and pray that it will move into action those forces proposing amendments to the Federal Power Act.

n4 (a) Original Electric Power Reliability Act (S. 1934 and H.R. 10727) would authorize FPC to establish regional councils encompassing all electric systems in a region. The regions would file plans with the FPC. These plans could be modified or set aside by the Commission. The bill would require filing for certificates for EHV facilities 2 years prior to construction. Where applicant elects to seek federal condemnation, it is subject to notice and hearing. The bill also provides antitrust immunity for actions taken pursuant to a Commission approved plan.

(b) Moss Bill (H.R. 12322) is essentially the same but would include conditions governing use of excess capacity of facilities and authorize Commission to order third parties to enlarge existing EHV facilities. The bill deletes antitrust immunity and adds a section requiring FPC survey of testing facilities in U.S.

(c) Kennedy-Ottinger Bill (S. 2889) is essentially like Moss Bill, except it restores antitrust immunity and would authorize unlimited suspension period. A National Council on the Environment is established to review plans under Parts I and Sec. 410 of the Act. Additional language on "protection and enhancement" of scenic, historic and recreation assets is added. In addition, annual reporting of all utility expenditures for advertising promotion, public relations and contributions is required as well as study of impact of overhead transmission lines.

(d) S. 1835 would require certificates of public convenience and necessity for EHV lines and would require such projects to include sufficient capacity for all needs within the affected area for transmission capacity.

(e) S. 1834 is similar to S. 1835 except it specifically states that an EHV certificate can be conditioned to make excess capacity available on a common carrier basis.

(f) In addition, there is the Aiken-Kennedy Bill (S. 2564) which would require license applicants for atomic generating plants to show that all interested persons were given an opportunity to participate in the ownership and/or output of atomic plants for electric generation. Also, the AEC would have to find that the proposed facility can meet reasonable demands for electric energy in the region and adequate transmission capacity is or will be male available to provide reasonable service to all ownerparticipants and purchasers of electric energy.

[*89]

Background of this Case

It is impossible to consider this case without discussing the background against which it is framed. The licensing of Northfield has surfaced all the major power questions that have faced and will continue to face New England and the rest of the Nation. What the majority has said -- and not said -- in this opinion will undoubtedly influence the turn of future events in the New England power picture and possibly elsewhere. Because the majority opinion takes a narrow, case-by-case approach in licensing Northfield, without regard to the necessarily interrelated considerations of river basin development and the most economic electric bulk power supply within a region, I feel compelled to discuss this in the depth required as a practical and legal matter.

Since the Passamaquoddy and the St. John River projects were actively under consideration in 1963, the public power groups, interested citizens, and some state and federal officials in New England have been engaged in an attempt to bring cheap power to their notoriously, high-cost power region. n5 To date, there has been no federal project constructed within New England. It is no secret that such [*90] development has been strongly resisted by the private power companies in New England and this resistance may well be the determining reason why New England has yet to see a federal power project.During this period, the Massachusetts Municipals (Intervenors) in this case attempted to purchase units or stock ownership in the new generating plants that are being built in New England -- both fossil fuel and atomic. To date, these attempts have been unsuccessful. n6

n5 See FPC's letter to Director, Bureau of Budget, dated September 27, 1963, relative to Report to the President by the Secretary of the Interior and the International Passamaquoddy Tidal Power Project and the Upper St. John River Hydroelectric Power Development:

Before offering our specific comments on the Secretary's report, we should like to comment on the general problem of the high cost of electric power in New England which is a matter of great concern to this Commission. The average cost of electricity in New England today is the highest of any region in this country and the average use is the lowest. New England is handicapped by the fact that it does not have large deposits of low cost fuel and this handicap is enlarged by the fact that the industry in the area is only beginning to install larger and more efficient units to replace the small and relatively inefficient units which make up much of the existing power supply. This fact underscores the need for prompt development of all of the economic hydroelectric sites in the region or in adjoining areas where through stronger interconnections lower cost power can serve to reduce the cost of electricity in New England.

n6 Vermont provides an exception. The Vermont investor-owned companies participating in Vermont Yankee, at the prompting of the state's Public Service Board, offered to sell shares (from their allocation of Vermont Yankee) to all Vermont utilities. The City of Burlington, a municipal, has accepted and the bond issue approving the purchase has been passed. Burlington and other Vermont municipals and coops have the opportunity to participate in additional unit purchases through Velco, which makes its transmission available to all systems in Vermont.

[*91]

In its *National Power Survey,* the Commission had stated that "consumers are entitled to be served a economically as possible regardless of how ownership of the facilities may be shared among individual systems." n7 The Intervenors in this case challenged the Commission to make good on the promises in the *Survey* and to give them an opportunity to change their status within the power picture in New England. They wanted to share directly in the planning costs and benefits of the large-sized, technologically-advanced generation and transmission rather than waiting until the large private companies, who generate the bulk of the power, got around to reducing rates to their municipal buyers or proceeding with the construction of smaller, higher-cost units with duplicate transmission.

n7 *National Power Survey,* Vol. 1, p. 173.

However, instead of picking up the gauntlet, the majority ends up condoning the very actions of Applicants which it has steadfastly maintained as undesirable in the *Survey* and the proposed Electric Reliability Bill. By refusing to take the broad view, the majority have not done all they legally could do nor have they discussed the situation with [*92] the thoroughness which it deserves.

Relationship of Part I and Part II of the Federal Power Act

I cannot emphasize too strongly my disagreement with the majority's decision to ignore their concomitant responsibilities under both Parts I and II of the Act in this proceeding.

By leaving untouched the Part II authority found in Sections 202 (to assure an abundant economic supply of electricity and encourage and promote interconnection and coordination), and 205 and 206 (to determine just and reasonable rates for the sale and transmission of electric energy), the majority has come dangerously close to rendering meaningless the mandate Congress gave it to license hydroelectric projects according to a best adapted, comprehensive plan.

Such a result could not be more in contrast to prior judicial opinions on the scope of the Commission's authority.

In *Pennsylvania Water & Power Co.* v.. *F.P.C.,* 343 U.S. 414 (1952), the Court stated, at pp. 418, 419:

A major purpose of the whole Act [i.e., Parts I and II of the Federal Power Act] is to protect power consumers against excessive prices * * * Part II * * * provides for a more expansive federal regulation than that [*93] authorized under Part I. It would hinder, not help, the Power Act's program if we should impliedly exempt Part I licensees from the more expansive Part II regulation * * *

The Court held that "the Federal Power Commission has complete authority to regulate all of this commingled power flow" n8 and that "the duty of Penn Water to continue its coordinated operations with Consolidated springs from the Commission's authority, not from the law of private contracts." n9 The Court then discussed the powers given to the Commission under Sections 205, 206 and 202 of the Act and found that Penn Water, a licensee under Part I had to show that a change in its coordinated operations was in the public interest before it could discontinue any or all of the services for coordinated sale and distribution of electric power which it had filed under the Commission's Part II rate regulating jurisdiction.

n8 The Court's understanding of the facts was related, at p. 420:

> The central fact disclosed by the record about Penn Water's sales in Pennsylvania is that they are not sales of the output of Penn Water's own plant, but sales of output of the integrated and coordinated interstate electric system of which Penn Water's facilities are an integral part * * *
>
> Energy flows in, across, and out of the system transmission network as the needs of the interconnected members develop from minute to minute and day to day.
>
> It is accordingly evident that the operations of the unified system enterprise are completely interstate in character, notwithstanding the fact that system energy transactions at some particular times may involve energy never crossing the State boundary.

n9 *Penn Water, supra,* at p. 422.

[*94]

Later judicial decisions have explicitly told the Commission that it cannot adopt a narrow standard and meet the Part I mandate. In *Scenic Hudson Preservation Conference* v.. *F.P.C.*, 354 F. 2d 608 (CA2-1965), cert. den. 384 U.S. 941 (1966), the court stated:

Congress gave the Federal Power Commission sweeping authority and a specific planning responsibility. (at p. 613)

The totality of a project's immediate and long range effects, and not merely the engineering and navigation aspects, are to be considered in a licensing proceeding. (at p. 620)

Moreover, in *Udall* v.. *F.P.C.* 387 U.S. 428 (1967) the Court found, at p. 450:

Nor is the test solely whether the region will be able to use the additional power. The test is whether the project will be in the public interest. And that determination can be made only after an exploration of all issues relevant to the "public interest".

The Commission itself has looked at the regional power needs in other Part I license cases and specifically has included license conditions directed towards improving the interstate commerce of electricity within a region, rather than limiting itself simply to the electrical needs [*95] of a single applicant system.

For example, in Project No. 2216, *Power Authority of the State of New York,* the license requires that in disposing of 50 percent of the project power the Licensee "give preference and priority to public bodies and non-profit cooperatives *within economic transmission distance."* n10 In Article 21 of the same license, the Commission required that up to 20 percent of the power subject to the preference provisions be made "available for use within reasonable economic transmission distance in neighboring States." Moreover, as a means of guaranteeing that the power to be made available was realistically available to the customers of PASNY, the Commission specifically required in a separate license that transmission capacity be purchased or built. n11

n10 19 FPC 186, at 193 (1958).

n11 Article 23 states: "The Licensee shall, if available on reasonable terms and conditions, acquire by purchase or other agreement, the ownership or use of, or if unable to do so, construct such transmission lines as may be necessary to make the power and energy generated at the project available in wholesale quantities for sale on fair and reasonable terms and conditions to privately owned companies, to the preference customers enumerated in Article 20, and to the neighboring States in accordance with Article 21."

[*96]

In a previous PASNY license, Project No. 2000, the Commission ordered in a specific article that the power developed by the project in the International Rapids section of the St. Lawrence River be made available not only in New York State, but also within economic transmission distance in nearby states. n12

n12 In discussing the license condition, the Commission stated, 12 FPC 117-8: "In order to insure conformance with comprehensive plans of development, the power should be made available not only in New York State, where the generators are to be located, but within economic transmission distance in nearby states."

The Commission conditioned the license for Project No. 2177, issued to *Georgia Power Company,* 21 FPC 296 (1959), so as to require coordination of the project and Licensee's systems operations with interconnected systems. n13 Similar conditions were also included in Article 24 of *Yadkin, Inc.'s,* Project No. 2197, 19 FPC 704 and Article 26 of *Duke Power Company's,* Project No. 2232, 20 FPC 360 (1958).

n13 Article 29. The Licensee shall to the maximum feasible extent coordinate the operation of the project under this license with the systems with which it may be interconnected, taking into account existing and future situations as to: amount of regulated flow available at-site and upstream from the project; generating capacity at hydroelectric and other power plants; and magnitudes and characteristics of loads to be served not only by the Licensees but also by interconnected electric utilities; and, the Commission reserves the right, after opportunity for hearing, to order such coordination of operations or changes therein as it finds to be economically feasible and in the public interest, and to require the submission of reports and filing of agreements, contracts, and other papers relating to the coordination of operations whenever requested by the Commission or changes are made or accepted by the Licensee: Provided, however, That the provisions of this article shall not be construed to require interconnection and coordination without compensation for benefits conferred upon other systems.

[*97]

As recently as August, 1967, the Commission considered regional coordination of power systems within a Part I context in Project No. 2617, involving Pacific Power & Light's proposed transmission line from the Hells Canyon development to a substation at Walla Walla, Washington. One of the issues raised by the Secretary of the Interior in that case was whether the Commission should proceed without requiring coordination of the project with the plans and projects of other power systems in the area. n14 A conference was held and the Commission conditioned the license to Pacific Power & Light with wheeling and coordination provisions similar to those in the license for Project No. 1971, licensed to Idaho Power Company. In its order, the Commission stated:

Under these provisions * * * the Commission may order the licensee to coordinate its facilities with other systems and to increase the capacity of the lines at the request of the Secretary of the Interior.

n14 38 FPC 545, issued August 31, 1967.

I cite these judicial and Commission precedents to illustrate instances in which the Commission has had to bring into its consideration Part II concepts of a coordinated electric supply [*98] and reasonable terms for the sale and transmission of energy during a Part I proceeding if it were to achieve the Section 10(a) test required for licensing.

For the same reasons that the Commission has been required to look at Part II in past cases, the Intervenors in this proceeding had to seek relief under Part II concepts. In essence, the Intervenors sought the coordination of its electric needs with those of the private systems within the New England region as well as just and reasonable terms for the sale and transmission of an important, hydroelectric generating source.

The majority stopped short of granting the Intervenors' request. This is most unfortunate since the potential purchasers of Northfield Power have no idea whether they can get the power from the Northfield substation to any point at which they can utilize the power. Nor do they know whether the Commission believes it has the authority under Part II to require any transmission once a sale has been negotiated. n15

n15 The majority says it does "not reach the question of whether the Commission has authority under Part I of the Act to order wheeling beyond the primary line." The luxury of this restraint on the part of the Commission coupled with equal restraint on the Commission's part under Part II illustrates only too well to the Intervenors and to the public that the broad purposes of coordination and best use of water power under the Act may well be a total sham.

[*99]

As a New Englander, I am confident that in this case, the licensees and other interested New England utilities, in light of the problems raised by this case, will conscientiously endeavor to make the record right by their future performance.

Since we have been informed that power needs in New England are critical and with the above in mind, I concur rather than seek a remanded proceeding.

Antitrust Issues

Perhaps no other issue illustrates the harm in the majority's narrow approach as does their antitrust discussion. To the Municipals, this was an important issue. The majority, on the other hand, treated it like an unwelcome intruder.

It found the antitrust arguments "entirely collateral to the intended purpose of this proceeding" and failed to overrule the Examiner's statement that the "positions of the municipal utilities and the investor-owned utilities on certain policy issues, such as the Dickey-Lincoln School project, are so fundamentally opposed that participation by the municipals in ECCNE would not be conducive to the achievement of its purposes," *e.g.,* over-all planning in New England!

The reliance of the majority on the undesirability of public-private [*100] power planning organizations as a reasonable basis for excluding the public entities is remarkable in view of their support of the Electric Reliability Bill, which advocates such organizations.

Furthermore, the focusing by the majority on proof of specific antitrust activities by ECCNE as the pivotal point in their antitrust discussion misses the mark. As Donald F. Turner, head of the Antitrust Division of the Justice

Department, testified recently:

If only those distribution companies which have access on their own to the economies of scale in generation are to survive, the structure of the industry will be greatly changed, and, I suggest, almost certainly for the worse.

In our view the antitrust laws have definite relevance to the issue of whether small utility companies should be able to participate in joint ventures which open up the possibility of realizing the economies of nuclear generation. n16 What is of concern to the Antitrust Department with regard to atomic generation should equally concern this Commission as to pumped storage projects and access into planning supply organizations like ECCNE. n17

n16 PP. 4, 5 of Statement of Donald F. Turner before the Joint Committee on Atomic Energy on S. 2564 on April 30, 1968.

n17 Section 10(h) of the Federal Power Act states:

That combinations, agreements, arrangements, or understandings, express or implied, to limit the output of electrical energy, to restrain trade, or to fix, maintain, or increase prices for electrical energy or service are hereby prohibited.

[*101]

For all practical purposes, ECCNE is or has been the sole planning group for the private systems in New England. Mr. Cadwell, the president of ECCNE, testified that the planning committee of ECCNE conducted its operations through "meetings of the appointees of the chief executives, generally their top engineering people who are members of the planning committee." n18 In addition, there are task forces whose findings "are made known to the companies either through their engineering representatives or through the chief executives * * *". n19 Mr. Cadwell was definite in describing the composition of ECCNE, to wit, his statement that "it has been the feeling of the majority of the membership and agreed to by everyone, that this is an investor-owned organization -- an organization of the executives of the investor-owned companies." n20

n18 P. 316 of transcript.

n19 *Ibid.*

n20 P. 314 of transcript.

Moreover, although Applicants' counsel vigorously denied there was consultation as to Northfield's construction with other members of ECCNE, how much of this was due to fear of antitrust accusations raised by the Municipals is unclear. What is clear, however, is that [*102] as far back as August 1963, the Charles T. Main Corporation had prepared a report for the Electric Council of New England, composed of the private systems, which stated that "Hydro pumpedstorage power will be taken as the proper alternative to the proposed Passamaquoddy peaking power. A number of such sites have been located in the area and are now in the *active* or *preliminary* planning stage." [emphasis added] n21

n21 Report prepared by Charles T. Main, Inc. for Electric Council of New England, August 21, 1963, at p. 7.

See also the *Planning Status Report for the Connecticut River Basin*, prepared by Bureau of Power, F.P.C. in 1966, p. 14:

The Electric Coordinating Council of New England, an association composed of 19 private electric companies in the region, is making a long range study of all hydroelectric development and redevelopment potentials in the basin, together with consideration of the thermal development potentials, both nuclear and fossil-fueled. The Council plans to employ consultants, as needed, to coordinate power planning with other water uses and requirements for water supply, flood control, recreation, pollution abatement, and irrigation.

Moreover, [*103] the SEC, too, recognized the planning entailed in the transmission grid needed to tie together various major generating units in New England when it approved the financing of Vermont Yankee, an atomic plant sponsored by 10 electric companies, eight of whom are members of ECCNE. According to the DEC, there is a "New England transmission grid" which services all these companies and this, "plus the *planned* additions to the grid * * * will be adequate to assure each sponsor company the equivalent of its entitlement to power generated at the plant at economical transmission costs." n22 [emphasis added]

n22 *In the Matter of Vermont Yankee Nuclear Power Corp.,* S.E.C. Opinion issued February 6, 1968, at p. 5.

Unlike most other industries, the electric industry depends on coordination of construction and operations within the entire region. If a company is not informed in advance whether a particular pumped storage site is being utilized, how can it know what to count on for its future power supply? Keeping in mind that the lead time for many generating units is in the range of 3-7 years, it is easy to see that plans must be coordinated to assure the companies a [*104] reliable supply of electricity and to give them time to build additional transmission to convey the electricity generated in a reliable and economical fashion. Add to these factors the necessity for even the largest systems to combine their assets to build the large-sized units now available n23 and it is evident that exclusion from ECCNE, which represents 85 percent of the power demand in New England, could spell the demise of the municipals if not the small private companies as indentifiable entities in the power picture To quote Staff Council, "If one is to conclude that the exclusion of the municipals from planning involves no anticompetitive element, one must be blind to this underlying reality." n24

n23 This combining is necessary because of the undesirability of any one system's putting all its reliance on one, large unit. However, since the larger the unit, the greater the savings -- several utilities can combine through joint ownership or buying the "excess" in order to build a larger unit than would be considered by an individual system.

n24 PP. 26, 27: Commission Staff Brief on Exceptions:

There are other implications that the Commission legally cannot ignore. [*105] For example, the Intervenors filed a motion to reopen the record in light of correspondence received by Intervenors' counsel that Applicants were contracting its "excess" Northfield power in exchange for power from Boston Edison's Plymouth (atomic) plant. This has occurred despite statements made by Applicants during the hearings that they would make available to the Municipals the excess capacity from Northfield and despite rejections by Boston Edison of offers by the Municipals to purchase Plymouth power. The "game" of delaying until all the unit power is sold -- in the face of offers to purchase by the Municipals -- has evidently worked with great success in the case of Boston Edison's New Boston units, Nepco's Brayton Point Plant and New England G&E's Canal plant as well as Maine and Vermont Yankee. What surprises me is that the majority refuses to stop this chain of exclusion when it has it within its authority to do so.

The only real explanation given by the majority is their "understanding and expectation" as to participation by the Municipals in a prospective plan for a New England Power Pool, which has been formulated by the private sector and is embodied in [*106] a document known as the NEPOOL agreement. This document is an unfiled draft of major provisions subject to change. Moreover, my analysis of the proposed NEPOOL arrangement indicates that it may not meet the needs of the Municipals or the smaller, investor-owned systems. The committees within the pool will be dominated by the major private systems in New England.

It is quite possible that a small participant would fare no better (in fact, possibly worse) than a non-participant in terms of power costs. Although there are understandably wide variations in pool arrangements throughout the United States, the NEPOOL agreement would seem to deal less favorably with the smaller systems than is customary. For example, most pools base their transactions on incremental cost or share-the-savings formulae. The NEPOOL agreement, however, would measure savings in relation to a theoretical electrically isolated condition applied to each individual member regardless of size. Such capacity and energy charges would introduce a concept that is inconsistent with coordination being practiced by the electric utility industry throughout most of the country and with existing regulatory principles. [*107] The NEPOOL arrangement would not reflect the size unit the individual systems have been installing or could install if they were not electrically isolated.

Other features lacking in the NEPOOL arrangement as presently drafted include a failure to set standards for determining system capabilities and establishing principals to establish other basic obligations of each participant. Items that could prove to be of considerable friction such as how individual members can arrange to obtain their share of new capacity resources to avoid capacity deficiencies are not mentioned or provided for. The prohibition of sub-pooling may be defended only if there is express provision for participation of non-members in reserve capacity sharing and in the benefits of scale of size through an interconnection agreement with a participant. Such bilateral interconnection agreements, if established under uniform region-wide standards, would discourage the installation of duplicating generation and transmission facilities, and would extend coordination to the entire New England region. Unless NEPOOL provides for such satellite status by non-members as an intermediate step to pool membership, it is questionable [*108] whether the prohibition of sub-pooling can be supported. Charges for the various potential transmission services are quite complex and in some instances involve fully distributed costs when such costs are not warranted.

Although the NEPOOL agreement as proposed is a positive step towards the regional coordination of electric power in the New England region, it has not received the full scrutiny in this case that such an arrangement should receive in order to make sure that a monopolistic situation is not being parpetuated to the detriment of the electric consumers in the region. I cannot understand the majority's willingness to accept the document as curative of the many complaints raised by Intervenors unless perhaps they have read the Agreement more carefully than I.

However, even if I could find that the proposed NEPOOL arrangements were consistent with the Act, I still am at a loss to understand the majority's reliance on it as sufficient answer to the antitrust and power supply issues raised in the case. After all, the proposed agreement is no more than a piece of paper without a trace of legality or binding effect on any party -- it is no solution to the very [*109] real problems raised by the Intervenors.

Conditions

The above discussion demonstrates to me a clear need for the Commission to adopt conditions in the Northfield project relating to antitrust. There is no question certainly as to the Commission's authority to do so. As was stated recently by the Court of Appeals in the *Niagara Mohawk* case n25:

The statutory authority to issue certificates or permits on conditions implies broad authority to take effective action to achieve regulation in the public interest. We are mindful of the liberal interpretation the Supreme Court has given similar provisions in other statutes as reflecting a broad authority, and in appropriate cases a correlative duty, to effectuate the public interest.

n25 *Niagara Mohawk Power Corp.* v.. *F.P.C.,* 379 F.2d 153 at p. 158 (CADC-1967).

For these reasons, I would recommend:

1. In addition to the condition requiring Applicants to sell excess capacity from the Northfield project to the municipalities on the same basis as they would sell to investor-owned utilities, Applicant shall provide transmission for

such electricity over the applicant's transmission lines at fair and reasonable terms [*110] be included as a specific license condition.

Applicants have agreed to such transmission both in oral argument and during the course of the hearing. Moreover, it is necessary to include the condition since the sales of capacity required of the Applicants by the majority would be a sham without a transmission arrangement to carry power from the project. I cannot understand why the majority would thus find it appropriate to condition the license upon making the capacity available without including as well the necessary transmission over Applicants' lines.

2. A condition in Applicants' license to the effect that prior to any furture filing to increase generation at Northfield, the Applicants must consult with other electric systems, including Intervenors, as to their needs and possible sales from the new units or of a percentage of the units, if any such sales are contemplated to any other party.

3. A condition that the Applicants cease and desist from further activities that would exclude Intervenors or any other electric system from engaging in future regional power planning should be granted.

The Applicants supply approximately 30 percent of New England's power use. [*111] While this one condition cannot reshape or create the kind of regional planning body envisioned by the *Power Survey,* at least it will preclude specifically the kinds of exclusive actions which Applicants have heretofore engaged in to a significant degree.

I believe that punitive action is not required against the Applicants as a result of their past actions. However, the Commission can no longer condone similar behavior in the future or refrain from exercising its authority under the Act. The SEC order approving the Vermont Yankee transaction made it eminently clear that "issues with respect to wholesale supply of power, applicable rates, and charges of discrimination thereunder, are subject to regulation and review by the FPC, so that Intervenors (*i.e.* Massachusetts Municipals) may present any complaints they might have in these respects to that agency." n26

n26 P. 6, S.E.C. Opinion.

Inasmuch as the condition would be consonant with not only the purposes of Section 10(h) of the Act but may well preclude an additional and unnecessary action under Section 306 of the Act, I think such prohibition should be included as a condition in the license, as well as the other [*112] condition noted above. Indeed, I find simply incredible the statement of the majority on p. 738 that future compliance questions as to ECCNE's activities should be brought under Section 306 by the Municipals. ECCNE is clearly a planning organization however poow its planning may be, and if exclusion from a major pumped storage source of 1,000 megawatts is not exclusion in terms of Section 10(h), I think it fair to say that the majority will hardly ever find a Section 306 action well-founded, in addition to deferring action that could definitely hurt the Intervenors. n27

n27 See the *Denver* case, in which the Court found that the ICC was not justified. in delaying consideration of the anticompetitive affects of a purchase by Greyhound of Railway Express Agency stock. *Denver & Rio Grand Western Railroad Co.* v.. *U.S.,* 387 U.S. 485, at 507 (1967).

Primary Lines and Comprehensive Development

It is with reluctance that I concur in the majority's finding that the primary lines from the Northfield project terminate at the Switching Station, a distance of one-half mile.

My reluctance, however, is tempered by the fact that there is presently legislation [*113] proposed, *i.e.,* the Electric Reliability Bill and the Aiken-Kennedy bill, which, if enacted into law, would assist this Commission in bridging the gaps created by new technology that seem to prevent it from fulfilling its duties under both Parts I and II of the Act.

In discussing the relationship of pending legislation to this case, however, I should like to review briefly the purposes behind the primary line concept.

In including primary lines as part of the project to be licensed, Congress wanted to assure the federal government or municipals an outlet for project power in the event that the government decided to recapture a project. Because it did not want to make the price of recapture prohibitive by including the entire transmission network of a public utility licensee, Congress decided that ownership of the lines up to the main transmission grid would suffice to make the power marketable.

The issue is not wholly academic. The license for the Turners Falls project which comprises the lower pool for the Northfield project expires in 1970. Three other projects (which together with Turners Falls constitute 4 of the largest generating projects) on the Connecticut River, [*114] on which the Northfield site is located, also have licenses that expire in 1970. n28 Without some coordination of power supply, the Municipals may be forced to seek recapture by the federal government of every expired license that serves as a pool for a pumped storage project in order to gain some bargaining leverage to obtain project power. n29

n28 See the following table:

Project No.	Project Name	Licensee
1855	Bellows Falls	New England Power Co.
1892	Wilder	New England Power Co.
1904	Vernon	New England Power Co.

n29 Under Section 14 of the Federal Power Act, the U.S. Government has the right upon the expiration of any license "to take over and thereafter to maintain and operate any project or projects * * *" upon payment of net investment. This is commonly referred to as "recapture," or in the language of the industry "take-over."

Since the Commission has made few statements "defining" primary lines, any explanatory statements are quite significant to those who have the option to urge recapture of projects which would fit into their power supply within the next few years. In this case the majority has accepted the "stub" concept of a primary line.This [*115] may be a reasonable finding in terms of the new technology represented in this case but one can easily see how the Congressional intent to provide Congress with a real choice may have been motivated by such a finding.

For example, once past the stub, how is a municipal or a state agency to get the project power to its distribution system? It can either build duplicating transmission lines, at great expense, or it can transmit power over existing transmission facilities of the former licensee. While the latter appears to make more economic sense, the Commission has not been willing to state that it can order such transmission, so transmission over existing facilities may depend on the voluntary actions of the owners of the inter-connected grid. n30

n30 It seems appropriate that the Commission sponsor legislation that would empower it in cases of recapture to order such transmission in appropriate circumstances, that is, where it makes economic sense and with due regard for aesthetic and conservation purposes.

Second, a primary line determination is important at the outset and during the term of the license because it authorizes the Commission to designate the routing of such [*116] lines n31 and to order wheeling over these lines. n32 In addition, the Commission retains the right to designate primary lines under Section 3(11) for Section 10(a) purposes during the term of the license.

n31 *Scenic Hudson Preservation Conference* v.. *F.P.C.*, 354 F. 2d 608 (CA2-1965), cert. den., 384 U.S.

941.

n32 *F.P.C.* v.. *Idaho Power Company,* 344 U.S. 17 (1952).

In this case, the Applicants to some extent circumscribed the Commission's consideration of the primary line issue by refusing to file an application for the lines in question, despite the urging of Staff Counsel. Thus, no-public notice has been given on this issue. The practical effect of a decision by the Commission that any of the three lines emanating from the Northfield Switching Station was a primary line would necessarily have entailed further delay for notice to the public and possibly, public hearings.

The Applicants' motives in refusing to file are clear. As Applicants' counsel stated:

We read the papers and we know what happened in New York and the problems of Con Ed, and we said "We really don't believe these lines are part of the project." If they are put in, you have got to send [*117] notices out, you have got to invite everybody within the areas through which these lines may run.

You have to give these people a chance to come in, and these things can produce a tremendous amount of controversy. n33

n33 Transcript, p. 1587.

So, no one has questioned whether or not the routes proposed do, in fact, traverse a route that minimizes the aesthetic shock to the landscape. Further, the Commission's determination precludes parties like the Intervenors from suggesting changes in the routing that may result in lower transmission costs to them.

Frankly, I believe that the public does have a right to know where the lines are traversing and to require the companies to justify their particular route if aesthetic and other conservation considerations are being ignored. I believe, too, that the Municipals should be informed early enough of the transmission route and be given an opportunity to suggest changes in routing or loading patterns that might accrue to the mutual benefit of the power systems in the regions.

The Electric Reliability Bill would provide for certification of all transmission lines of the magnitude discussed in Northfield and thus safeguard, [*118] to the extent administratively feasible, the aesthetic and conservation considerations mentioned above. In addition, it would require the Commission to determine that the lines to be constructed are consistent with plans developed by regional councils, which shall include representatives of all the systems in the region. The Aiken-Kennedy Bill would provide for adequate transmission when any party purchases power from an atomic generating plant, thereby precluding the need for duplicate transmission by a minority purchaser or participant in such plant.

Without certification authority, however, we shall see yet more duplication of transmission lines and inefficient use of land before some order can be made out of the New England situation. Without the authority to direct wheeling of energy, the Commission may be unable to assure itsolf that the licensed project is being fully utilized. For example, in this case, there is a lingering doubt as to whether Northfield should be constructed to provide 1500 MW instead of the 100 MW proposed if, in fact, other parties could be assured that they were within transmitting distance of Northfield via wheeling. It is also clear that we do [*119] not know the extent of additional generation, although we have been told that there is a great need in New England for additional generation and transmission.

The Commission is literally working in the dark as to the future power supply of New England, and no one will profit from our ignorance. This case demonstrates only too well that early participation by the Municipals in the planning of the Northfield project, backed up by additional authority in the Federal Power Commission, might well have prevented much of the aggravation and delays that resulted from their initial exclusion.

I have always interpreted the standard of the word *waterway* in Section 10(a) of the Act in a broad fashion consistent with the regional responsibilities of the Commission for bulk power supply under Part II. The majority, contrary to previous statements n34, now appears to view its Section 10(a) authority more restrictively, that is, without consideration of the impact of the project being licensed on the *regional* bulk power supply. If that is the case, it seems to me that Section 10(a) of Part I should probably be revised to refer to a project best adapted to a comprehensive plan [*120] for improving or developing *a region*, rather than waterway. This would encompass not only river basin concepts but also the electrical coordination referred to in Section 202. n35

n34 *Cf.* letter of transmittal to the Speaker of the House of Representative, dated proposing amendments to Part I with regard to re-licensing of hydroelectric projects at p. 6:

This statutory standard (i.e. Section 10(a) is understood to call for optimum development and accommodation, where a conflict arises, in terms of resource values including * * * optimum power development and coordination with other systems in light of regional power needs * * *

n35 This is actually an operating concept in the Pacific Northwest. See the Pacific Northwest Coordination Agreement in which the private utilities, public utility districts, municipals, federal agencies and a private industrial, agreed that "* * * coordination for the production of power must take into consideration non-power uses for water resources and must be achieved as a part of the comprehensive development of water resources for maximum sustained benefit for the public good."

Thus in defining a "system" for purposes of the Agreement, the contract recognized that facilities located in different river basins would be essential for coordination of power and non-power uses. S. 2564 also adopts a regional approach to electric supply.

[*121]

Such a change would make sense in light of new technology like that represented by the pumped storage project in this case. For example, the line between Vermont Yankee and the Northfield project may not basically be a primary line, such as to warrant licensing, but it is indeed an integral part of the project such that without it, the project simply isn't economically feasible. n36 The idea that one plant located miles away would be a "slave" to another plant was simply not contemplated by Congress. When two such plants, one a source of pumping energy and the other the generation of peaking power, are located within an interconnected grid extending over a region, the situation becomes even more remote from the simplistic notion of a single hydro plant with a connecting line to its distribution point. n37

n36 It is evident that the relationship of nuclear units plus pumped storage projects will become more frequent in New England. Several studies have been made recommending such tandem operations in New England as an economical way to meet peaking needs. The application for NEPCO's Bear Swamp pumped storage project as well as this very project indicate such recommendations are being adopted.

n37 As for the licensing of the atomic or other fossil-fuel plants, it may be that these licenses should include a condition that energy to the extent furnished by such plants to any pumped storage project be continued despite a change in the ownership of the pumped storage project. This would insure the viability of a pumped storage project if it were recaptured or rellcensed to another party. This would also be consistent with the Congressional intent that Congress have a real choice at the expiration of the license terms.

[*122]

Apart from the result reached by the majority with regard to the primary line issue, I cannot agree with their reasoning. Because of possible implications for primary line determinations in other licensing cases unrelated to pumped storage projects, I wish to make clear my differences. According to the majority, the tests for determining a primary line with pumped storage projects are (1) whether the lines would have been built without the project and (2) whether they will function as major links of a regional transmission grid, interconnecting important generating plants. If the answer to either question is "yes," the line is not a primary line.

Examination of the tests indicates they are unrealistic in the context of the power situation today. The Commission is presented with a 345-kv transmission grid that just happens to pass conveniently close to both Northfield and Vermont Yankee. When a project like Northfield comprises approximately 25 percent of a system's peak, it's difficult to think of a transmission line being built that could have failed to consider the proximity of the project. The upshot of trying to use such a test is it reduces the Commission to [*123] a "which came first -- the chicken or the egg?" situation. That is certainly not the most sophisticated way of assessing the best comprehensive use.

As for the second test, there is scarcely a plant being built today that does not link to another major source of generation. It is simply the way electric systems are being built now to assure the intergrity of service or as in the case of pumped storage, simply to operate. n38 Also, these links have to be major because of the size of the plants in an industry that is dominated by economies of scale.

n38 See the finding made by the Atomic Safety and Licensing Board in its Order issuing a license for Vermont Yankee, December 8, 1967, at p. 14:

> Four separate transmission lines will tie the Vermont Yankee Nuclear Power Station into the New York-New England electrical network. The Applicant believes that the diversity of sources and physical separation of the ties will make the electrical network a reliable source of emergency power.

It is most unfortunate for the Intervenor that the present state of the law has lagged behind developments in the industry. However, I wish to make clear that for my part, I see the answer not in [*124] terms of reworking already overworked concepts like primary lines but early enactment of the legislation mentioned herein.

Until such legislation is enacted, however, it is my feeling that the Commission is obligated to provide what relief it can under its existing authority. n39 To this end, I would recommend that the Commission initiate, on its own motion, a Section 19 proceeding to determine the extent to which the respective state commissions do "regulate and control the service to be rendered by such licensee or *by its customer engaged in public service,* or the rates and charges of payment therefor, or the amount or character of securities to be issued by any of said parties * * * [emphasis added]. To the extent that any state commission does not have such empowering legislation, the Commission should "exercise such regulation and control" as provided by the statute to ensure that no licensee is using the waters licensed to it in a manner inconsistent with its best development "for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, and for other public uses, including recreational purposs."

n39 See, for example, the Court's language in *Denver & R.G.W.R. Co.* v.. *U.S., supra* note 27:

> Section 20a, like Section 5, must after all be read in the context of overall ICC responsibilities * * * In sum, as we said in *McLean Trucking, supra,* while transportation "legislation constitutes the immediate frame of reference within which the Commission operates * * * and the policies expressed in it must be the basic determinants of its action * * * in executing those policies the Commission may be faced with overlapping and at times inconsistent policies embodied in other legislation enacted at different times and with different problems in view. When this is true, it cannot, without more, ignore the latter."

[*125]

The Federal Power Act is a well-thought-out broadly-conceived piece of legislation that has, where vigorously pursued, served the consumers well. Like most legislation, however, it needs to be amended from time to time to keep in touch with changing events. That does not detract, however, from the lucidity of its purpose or the effectiveness of the powers it bestowed on the Commission.

What is so disappointing is that the majority in the present opinion has held back from the broad perspective the Act assumed would be taken by the agency and consequently, it has not utilized fully the remedies it already has under the present Act. Thus, parties are going without remedies and the public has not been given the protection it has a right to expect from an agency with such a broad man-date. Under such circumstances, the FPC is hardly likely to get more from Congress.

Form L-4 (1964)

TERMS AND CONDITIONS OF LICENSE FOR UNCONSTRUCTED PROJECT AFFECTING NAVIGABLE WATERS OF THE UNITED STATES

Article 1. The entire project, as described in the order of the Commission, shall be subject to all the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, specifications, and statements described and designated as exhibits and approved by the Commission in its order as a part of the license until such change shall have been approved by the Commission: Provided, however, that if the Licensee or the Commission deems it necessary or desirable that said approved exhibits, or any of them, be changed, there shall be submitted to the Commission for approval amended, supplemental, or additional exhibit or exhibits covering the proposed changes which, upon approval by the Commission, shall become a part of the license and shall supersede, in whole or in part, such exhibit or exhibits theretofore made a part of the license as may be specified by the Commission.

Article 3. Said project works shall be constructed in substantial conformity with the approved exhibits referred [*39] to in Article 2 herein or as changed in accordance with the provisions of said article. Except when emergency shall require for the protection of navigation, life, health, or property, no substantial alteration or addition not in conformity with the approved plans shall be made to any dam or other project works under the license without the prior approval of the Commission; and any emergency alteration or addition so made shall thereafter be subject to such modification and change as the Commission may direct. Minor changes in the project works or divergence from such approved exhibits may be made if such changes will not result in decrease in efficiency, in material increase in cost, or in impairment of the general scheme of development; but any of such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of such results, shall be subject to such alteration as the Commission may direct. The Licensee shall comply with such rules and regulations of general or special applicability as the Commission may from time to time prescribe for the protection of life, health, or property.

Article 4. The construction, [*40] operation, and maintenance of the project and any work incident to additions or alterations shall be subject to the inspection and supervision of the Regional Engineer, Federal Power Commission, in the region wherein the project is located, or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall cooperate fully with said representative and shall furnish him a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of the project. Construction of the project works or any feature thereof shall not be initiated until the program of inspection for the project works or any such feature thereof has been approved by said representative. The Licensee shall also furnish to said representative such further information as he may require concerning the construction, operation, and maintenance of the project, and of any alteration thereof, and shall notify him of the date upon which work will begin, and as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing

[*41] of any suspension of work for a period of more than one week, and of its resumption and completion. The Licensee shall allow him and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties.

Article 5. Upon the completion of the project, or at such other time as the Commission may direct, the Licensee shall submit to the Commission for approval revised maps, plans, specifications, and statements insofar as necessary to show any divergence from or variations in the project area and project boundary as finally located or in the project works as actually constructed when compared with the area and boundary shown and the works described in the license or in the maps, plans, specifications, and statements approved by the Commission, together with a statement in writing setting forth the reasons which in the opinion of the Licensee necessitated or justified variations in or divergence from the approved maps, plans, specification, and statements. Such revised maps, plans, specifications, and statements shall, if and when [*42] approved by the Commission, be made a part of the license under the provisions of Article 2 hereof.

Article 6. Insofar as any material is dredged or excavated in the prosecution of any work authorized under the license, or in the maintenance of the project, such material shall be removed and deposited so it will not interfere with navigation, and will be to the satisfaction of the District Engineer, Department of the Army, in charge of the locality.

Article 7. The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operation of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial [*43] public uses, including recreational purposes; and the Licensee shall release water from the project reservoir at such rate in cubic feet per second, or such volume in acre-feet per specified period of time, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

Article 8. Whenever the United States shall desire to construct, complete, or improve navigation facilities in connection with the project, the Licensee shall convey to the United States, free of cost, such of its lands and its rights-of-way and such right of passage through its dams or other structures, and permit such control of pools as may be required to complete and maintain such navigation facilities.

Article 9. The Licensee shall furnish free of cost to the United States power for the operation and maintenance of navigation facilities at the voltage and frequency required by such facilities and at a point adjacent thereto whether said facilities are constructed by the Licensee or by the United States.

Article 10. The operation of any navigation facilities which may be constructed as a part of or in connection [*44] with any dam or diversion structure constituting a part of the project works shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including the control of the level of the pool caused by such dam or diversion structure, as may be made from time to time by the Secretary of the Army.

Article 11. The Licensee shall for the protection of navigation, construct, maintain and operate at its own expense such lights and other signals on fixed structures in or over navigable waters of the United States as may be directed by the Secretary of the Department in which the Coast Guard is operating.

Article 12. The actual legitimate original cost of the original project, and of any addition thereto or betterment thereof, shall be determined by the Commission in accordance with the Act and the Commission's rules and regulations thereunder.

Article 13. After the first twenty (20) years of operation of the project under the license, six (6) percent per annum shall be the specified rate of return on the net investment in the project for determining surplus earnings of the project for the establishment and maintenance of amortization [*45] reserves, pursuant to Section 10(d) of the Act; one-half of the project surplus earnings, if any, accumulated after the first twenty years of operation under the license, in excess of (6) percent per annum on the net investment, shall be set aside in a project amortization reserve account as of the end of each fiscal year, provided that, if and to the extent that there is a deficiency of project earnings below six (6) percent per annum for any fiscal year or years after the first twenty years of operation under the license, the amount of such deficiency shall be deducted from the amount of any surplus earnings accumulated thereafter until absorbed, and one-half of the remaining surplus earnings, if any, thus cumulatively computed, shall be set aside in the project amortization reserve account; and the amounts thus established in the project amortization reserve account shall be maintained therein until further order of the Commission.

Article 14. The Licensee shall install additional capacity or make other changes in the project as directed by the Commission, to the extent that it is economically sound and in the public interest to do so, after notice and opportunity for hearing. [*46]

Article 15. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 16. The Licensee shall, for the conservation, and development of fish and wildlife resources, construct, maintain, and operate, or arrange for the construction, maintenance and operation of such facilities and comply with such reasonable modifications of the project structures and operation as may be ordered by the Commission upon it own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing and upon findings based on substantial evidence that such facilities and modifications are necessary and desirable, reasonably consistent with the primary purpose of the project, and consistent with the provisions [*47] of the Act.

Article 17. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of Licensee's lands and interest in lands, reservoirs, waterways and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be prescribed by the Commission, reasonably consistent with the primary purpose of the project, in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

Article 18. The Licensee shall construct, maintain and operate or shall arrange for the construction, maintenance and operation [*48] of such recreational facilities including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities and utilities, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal and State agencies, after notice and opportunity for hearing and upon findings based upon substantial evidence that such facilities are necessary and desirable, and reasonably consistent with the primary purpose of the project.

Article 19. So far as is consistent with proper operation of the project, the licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and recreational purposes, including fishing and hunting, and shall allow to a reasonable extent for such purposes the construction of access roads, wharves, landings, and other facilities on its lands the occupancy of which may in appropriate circumstances be subject to payment of rent the Licensee [*49] in a reasonable amount: Provided, that the Licensee may reserve from public access, such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property and Provided further, that the Licensee's consent to the construction of access roads, wharves, landings, and other facilities shall not, without its express agreement, place upon the Licensee any obligation to construct or maintain such facilities. These facilities are in addition to the facilities that the Licensee may construct and maintain as required by the license.

Article 20. The Licensee shall be responsible for and shall minimize soil erosion and siltation on lands adjacent to the stream resulting from construction and operation of the project. The Commission upon request, or upon its own motion, may order the Licensee to construct and maintain such preventive works to accomplish this purpose and to revegetate exposed soil surface as the Commission may find to necessary after notice and opportunity for hearing.

Article 21. No lease of the project or any part thereof whereby the lessee is granted the occupancy, possession, or use of the [*50] project, or any part thereof, shall be made without prior written approval of the Commission; and the Commission may, if in its judgment the situation warrants, require that all the conditions of the license, of the Act, and of the rules and regulations of the Commission shall be applicable to such property so leased to the same extent as if the lessee were the Licensee: Provided, that the provisions of this article shall not apply to leases of land or buildings or other property while not required to achieve the purposes of the license.

Article 22. The Licensee, its successors and assigns shall, during the period of the license, retain the possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and none of such properties necessary or useful to the project and to the development, transmission, and distribution of power thereform will be voluntarily sold, transferred, abandoned, or otherwise disposed of without the approval of the Commission: Provided, that a mortgage or trust deed or judicial sales made thereunder, or tax [*51] sales, shall not be deemed voluntary transfers within the meaning of this article. In the event the project is taken over by the United States upon the termination of the license, as provided in Section 14 of the Act, or is transferred to a new licensee under the provisions of Section 15 of the Act, the Licensee, its successors and assigns will be responsible for and will make good any defect of title to or of right of user in any of such project property which is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and will pay and discharge, or will assume responsibility for payment and discharge, of all liens or incumbrances upon the project or project property created by the Licensee or created or incurred after the issuance of the license: Provided, that the provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for futher service due to wear and tear, or to require the Licensee, for the purpose of transferring the project to the [*52] United States or to a new Licensee, to acquire any different title to or right of user in any of such project property than was necessary to acquire for its own purposes as Licensee.

Article 23. For the purpose of determining the stage and flow of the stream or streams from which water is diverted for the operation of the project works, the amount of water held in and withdrawn from storage, and the effective head on the turbines, the Licensee shall install and thereafter maintain such gages and stream-gaging stations as the Commission may deem necessary and best adapted to the requirements; and shall provide for the required readings of such gages and for the adequate rating of such stations. The Licensee shall also install and maintain standard meters adequate for the determination of the amount of electric energy generated by said project works. The number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, shall at all times be satisfactory to the Commission and may be altered from time to time if necessary to secure adequate determinations, but such alteration shall not be made except with the approval of the Commission [*53] or upon the specific direction of the Commission. The installation of gages, the ratings of said stream or streams, and the determination of the flow thereof, shall be under the supervision of, or in cooperation with, the District Engineer of the United States Geological Survey having charge of stream-gaging operations in the region of said project, and the Licensee shall advance to the United States Geological Survey the amount of funds estimated to be necessary for such supervision or cooperation for such periods as may be mutually agreed upon. The Licensee shall keep accurate and sufficient record of the foregoing determinations to the satisfaction of the Commission, and shall make return of such records annually at such time and in such form as to the Commission may prescribe.

Article 24. In the construction and maintenance of the project works, the Licensee shall place and maintain suitable structures and devices to reduce to a reasonable degree the liability of contact between its transmission lines, and telegraph, telephone, and other signal wires or power transmission lines constructed prior to its transmission lines and not owned by the Licensee, and shall also place [*54] and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling and obstructing traffic and endangering life on highways, streets, or railroads.None of the provisions of this article is intended to relieve the Licensee from any responsibility or requirement which may be imposed by other lawful authority for avoiding or eliminating inductive interference.

Article 25. If the Licensee shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without replacement, or shall abandon or discontinue good faith operation of the project for a period of three years, or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address to the Licensee or its agent, the Commission will deem it to be the intent of the Licensee to surrender the license, and not less than 90 days after public notice may in its discretion terminate the license.

Article 26. Upon abandonment of the project the Licensee shall remove all buildings, equipment and power lines from lands of the United States and restore said lands to a [*55] condition satisfactory to agency having jurisdiction over the lands and shall fulfill such other obligations under the license as the Commission may prescribe.

Article 27. The right of the licensee and of its transferees and successors to use or occupy navigable waters of the United States under the license for the purpose of maintaining the project works or otherwise, shall absolutely cease at the end of the license period, unless a new license is issued pursuant to the then existing laws and regulation.

Article 28. Whenever the Licensee is directly benefited by the construction work of another Licensee, a permittee, or of the United States of a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of the headwater improvement for such part of the annual charges for interest, maintenance, and depreciation thereon as the Commission shall determine to be equitable, and shall pay to the United States the cost of making such determination as fixed by the Commission. For benefits provided by a storage reservoir or other headwater improvement of the United States the Licensee shall pay to the Commission the amounts for which it is billed from [*56] time to time for such headwater benefits and for the costs of making the determinations pursuant to the then current Commission Regulations under the Federal Power Act within 60 days from the date of rendition of a bill therefor and, upon failure to do so, shall thereafter be subject to the payment of the penalties specified in the then current Regulations. The Licensee shall have the right to pay such amounts under protests within the 60-day period and to reconsideration of the amounts billed or a hearing as provided by the then current Regulations under the Act.

Article 29. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

WESTERN MASSACHUSETTS ELECTRIC COMPANY, PROJECT NO. 1889; THE CONNECTICUT LIGHT AND POWER COMPANY, THE HARTFORD ELECTRIC LIGHT COMPANY AND WESTERN MASSACHUSETTS ELECTRIC COMPANY, PROJECT NO. 2485

OPINION NO. 541-A

FEDERAL POWER COMMISSION

40 F.P.C. 296; 1968 FPC LEXIS 673

August 15, 1968

[*1]

MEMORANDUM OPINION AND ORDER DENYING APPLICATION FOR REHEARING

SYLLABUS:

1. In considering the market feasibility of a 1500 mw installation, Commission is not limited to needs of Licensees alone -- comprehensive development of a river basin involves broader considerations -- and Licensees will be expected to discuss market needs of other regional utilities, including the Massachusetts Municipals.

2. Consolidation of two projects in a single joint proceeding is not in the public interest where application for one project was filed more than a year after issuance of Examiner's decision in first case and where, as here, record does not indicate any basic conflict or inconsistency in prior construction by Licensee and subsequent construction proposed by New England Electric Power Co.

3. Upon rehearing, Commission *amends* license order to require that prior to any future filing to increase generation at Northfield Project, Licensees shall consult with other electric systems, including Massachusetts Municipals, as to their needs and possible purchases from the new units, if sales are contemplated to any other party. In all other respects, application for rehearing is *denied.*

Chairman [*2] White *adheres* to the views set forth in his statement accompanying Opinion No. 541.

Commissioner Ross *adheres* to his original statement accompanying Opinion No. 541.

Before Commissioners: Lee C. White, Chairman; L. J. O'Connor, Jr., Charles R. Ross, Carl E. Bagge and John A. Carver, Jr.

OPINIONBY: BAGGE

OPINION:

BAGGE, *Commissioner:*

By Opinion No. 541 and order dated May 14, 1968, 39 FPC 723, the Commission issued a 50-year license jointly to The Connecticut Light and Power Company, The Hartford Electric Light Company, and the Western Massachusetts Electric Company (the Licensees) under Section 4(e) of the Federal Power Act for the construction, operation and maintenance of the Northfield Mountain Pumped Storage Project No. 2485 (Northfield Project), on the Connecticut River in Franklin County, Massachusetts, subject to the terms and conditions of the Act and to the rules and regulations prescribed by the Commission thereunder. In that Opinion and order the Commission also amended the existing license for the Turners Falls hydroelectric development, Project No. 1889, so as to enable the Western Massachusetts Electric Company to modify that project to provide an additional 12,600 [*3] acre feet of storage by raising the reservoir 5.4 feet.

On June 13, 1968, the Municipal Electric Association of Massachusetts and the electric departments of the City of Chicopee, Town of Shrewsbury, and Town of Wakefield, Massachusetts (Massachusetts Municipals), who had intervened in this proceeding and had raised as issues the question of licensing three proposed 345 kilovolt transmission lines of the Licensees, the adequacy of the proposed project, and the antitrust aspects of certain alleged restraint of trade activities of the Licensees, filed an application for rehearing of the above Opinion and order, stating that the Commission had erred in the following eight respects:

(1) In approving the Licensees' proposal for a 1,000 mw pumped storage project without a complete record as to the feasibility of a 1,500 mw project for the same site;

(2) In not finding that the Licensees' participation in the Electric Coordinating Council of New England violated the antitrust law and Section 10(h) of the Federal Power Act;

(3) In allegedly failing to consider evidence that the Licensees together with other New England electric companies have prevented the Massachusetts Municipals [*4] from obtaining bulk power from nuclear generating plants, and have lobbied against legislation desired by the Municipals for the creation of new sources of bulk power;

(4) In issuing a license for this project in the alleged absence of a showing of adequate regional planning studies or studies as to the stability of the proposed 345 kv transmission system, and in failing to take official notice of the application pending before the Commission by the New England Electric Power Company to construct a 500 mw pumped storage plant at the Bear Swamp site on the Deerfield River and in not consolidating such project with the Northfield Project in a single comparative proceeding;

(5) In not finding that the Northfield Farm Switching Station and the three 345 kv lines emanating therefrom and connecting respectively south to the Ludlow Switching Station, north to the Vermont Nuclear Switching Station, and west to the New Scotland Substation, were either primary lines or otherwise parts of the licensed project;

(6) In subjecting to notice and opportunity for hearing the Licensees' obligation to sell and make available excess project service to all electric systems;

(7) In failing to make [*5] specific that the Licensees' sale and availability of excess project service is to be accomplished at the limits or interconnection points of the Licensees' transmission systems;

(8) In concluding that 345 kv is the proper voltage to be used for the Northfield Project output and transmission facilities.

On July 11, 1968, the Commission issued an order granting the rehearing requested by the Massachusetts Municipals for the purpose of further considering the issues raised in their application. The response of the Licensees to the application for rehearing was filed on July 26, 1968.

The Commission finds, upon consideration of the application of the Massachusetts Municipals and the numerous arguments set forth therein, that the ground advanced for rehearing are not persuasive. Most of the issues argued by the Massachusetts Municipals, apart from the recommendation for consolidation with the Bear Swamp Project in (4) above, and the criticism of the notice and hearing provision in (6) above, are simply restatements, often in similar terms, of arguments advanced by the Massachusetts Municipals earlier in this proceeding before the Examiner and before the Commission.

The Commission [*6] finds no merit in the allegations of the Massachusetts Municipals that the Commission cannot make a supportable finding that the proposed 1,000 mw Northfield Project is "best adapted to a comprehensive plan * * * of water power development" under Section 10(a) of the Federal Power Act, and that approval of such project should be denied until the Licensees have submitted final reports as to the feasibility of a 1,500 mw plant. The record in this proceeding plainly shows that there is an urgent need in the Licensees' service area for the 1,000 mw capacity of the Northfield Project; that the project site selected by the Licensees is superior to all others considered by the Licensees from the standpoint of location, cost of construction, accessibility to the Licensees' transmission systems, and general suitability; that there are no feasible alternative generating sources available to the Licensees on a more economic basis; and that the proposed initial development of a 1,000 mw capacity for the Northfield Project is the maximum development which the Licensees have established to be feasible. Whether or not a 1,500 mw installation should be ordered for this project is still [*7] debatable, both from an engineering and a use standpoint. Questions which still require resolution are the hydraulic discharge effects of the larger installation, the probability of flood damage to the property around the shores of the Turners Falls reservoir, and the practicality of the shorter period of time during which the full capacity of the 1,500 mw project would be available.

The Licensees have stated that should expansion of the Northfield Project to 1,500 mw be found to be feasible both from an engineering standpoint and a market standpoint, they will be able to increase the capacity of the project by 500 mw in a two-stage expansion at no significant increase in cost over a one-stage building program. Thus, the Licensees estimated the construction cost of a 1,000 mw Northfield Project (exclusive of land costs, interest during construction, and legal and administrative charges) at $63,900,000 or approximately $64 per kw, the cost of a 1,500 mw project constructed in one stage at $87,900,000 or approximately $59 per kw, and the cost of a 1,500 mw project constructed in two stages of 1,000 mw first and an additional 500 mw later at $90,400,000 or approximately $60 per kw. [*8] The Licensees pointed out that the differential between a one-stage and a two-stage 1,500 mw project is $2,500,000 or less than three percent of the total construction cost for a 1,500 mw development, and they stated that such a differential can be more than completely offset by the financial savings which can be accomplished in any deferment of the larger project. In light of these showings, it appears that the Massachusetts Municipals have misstated the case when they claim that it will "be significantly cheaper" on an incremental basis per kw to construct the 1,500 mw plant at one time rather than in two separate stages. We agree with the Licensees that the incremental difference which would exist should be largely if not entirely offset by the interest savings in the deferment of the larger project.

In any event, the Massachusetts Municipals have apparently failed to give adequate consideration to the fact that the Northfield Project is subject to the Commission's standard license provision which states that the "Licensee shall install additional capacity or make other changes in the project as directed by the Commission, to the extent that it is economically sound [*9] and in the public interest to do so, after notice and opportunity for hearing." Pursuant to this provision, the Commission directed the Licensees for Project No. 2485 to submit a report on the model and computer studies of hydraulic effects in the lower reservoir showing consequences of increasing the project capacity to 1500 mw. On July 25, 1968, the Licensees complied with this directive and submitted river model studies and other reports dealing with the engineering and market feasibility of increasing the capacity of the Northfield Project by 500 mw. There has not been sufficient time since the receipt of this material to enable the Commission to determine whether action will be required under the above license provision with respect to a hearing on the installation of additional capacity at the Northfield Project. Pending the Commission's study of the Licensees' reports, copies of this material will be made available to the Massachusetts Municipals and to the other parties in this proceeding for appropriate attention and comment. We stress that in considering the market feasibility of a 1500 mw installation, we shall not be limited to the needs of the Licensees alone; comprehensive [*10] development of a river basin involves broader considerations, and we will expect the Licensees to discuss market needs of other regional utilities, including the Massachusetts Municipals.

The concern expressed by the Massachusetts Municipals that the Licensees are currently contracting away the future enlarged capacity of the Northfield Project is not well founded. Contracts for the sale of the additional capacity of the project will be subject to the regulatory jurisdiction of this Commission. Moreover, should the project license be amended to provide for an expansion to 1,500 mw capacity, then the provisions now set forth in ordering paragraph 1(D), Article 15, of Opinion No. 541 and order, shall be made applicable to the enlarged capacity of the Northfield Project. In this connection, we deem it advisable to amend Opinion No. 541 and order to add as a further condition to the License for Project No. 2485 the requirement that prior to any future filing to increase generation at the Northfield Project, the Licensees must consult with other electric systems, including the Massachusetts Municipals, as to their needs and possible purchases from the new units, if sales [*11] are contemplated to any other party.

With respect to the antitrust and restraint of trade allegations advanced by the Massachusetts Municipals in their assertions of error (2) and (3), no further comment is required except to note parenthetically that we stated in Opinion No. 541 and order that the future activities of the Licensees will be scrutinized to ascertain their satisfactory compliance with the provisions of Section 10(h) and other provisions of the Act. Consistent with this position, the Commission takes cognizance of the fact that the Licensees and the other large investor-owned New England electric utilities are currently working toward the creation of a new interim planning committee of the New England electric utilities whose membership will be open to governmentally or cooperatively owned electric systems. It is the Commission's understanding that with the creation of the new interim planning committee, the operations of the Planning Committee of the Electric Coordinating Council of New England will become inactive.

The Commission finds no basis for rehearing in the Massachusetts Municipals' assertion that the Commission improperly ignored the Bear Swamp Project [*12] No. 2669 of the New England Electric Power Company in this proceeding. Moreover, we do not agree with the Municipals that the public interest will be served by our consolidation of the two projects in a single joint proceeding. The application for the Bear Swamp Project was filed with the Commission on February 15, 1968, or more than a year after the issuance of the Examiner's initial decision in this proceeding. The record in this matter shows that the Licensees considered the Bear Swamp site as a possible alternative to the Northfield site, and that they found Northfield superior for their purposes because Bear Swamp was limited by the small size of its upper pool to a much smaller capacity. Furthermore, the record does not indicate that there is any basic conflict or inconsistency in the prior construction of a 1,000 mw project at Northfield by the Licensees and in the subsequent construction of a pumped storage project at Bear Swamp by the New England Electric Power Company. The pressing need for the capacity of the Northfield Project has been established in this proceeding. Under such circumstances we do not find that the public interest will be served by a consolidated [*13] proceeding which can only operate to delay the issuance of the Northfield license.

Finally, we do not find merit in the objection of the Massachusetts Municipals to the requirement in ordering paragraph 1(D), Article 15, which subjects to "notice and opportunity for hearing" the Licensees' obligation to coordinate the operation of the project, electrically and hydraulically with other power systems. The license as issued fixes the Licensees' obligation to initiate actions to make provisions for selling and making available to all electric systems which may request project service such portions of project capacity as are excess to the Licensees' system needs. The contention of the Municipals that the "notice and hearing" requirement in the event that there is a dispute as to the proper manner of carrying out these obligations, will provide unnecessary hearing and decision delays is not persuasive. Specifically, other sales which might be made in the interim are necessarily subject to compliance with this substantive standard.

The Commission finds:

The assignments of error and grounds for rehearing set forth in the Application for Rehearing filed in this proceeding [*14] by the Massachusetts Municipals present no facts or legal principles which would warrant any change in or modification of the Commission's Opinion No. 541 and order except as specified below.

The Commission orders:

(A) The following new sentences are added to Article 15 in ordering paragraph 1(D) of Commission Opinion No. 541 and order with respect to the license for Project No. 2485:

The provisions of this Article shall remain binding and in force upon the Licensees with respect to any additional generating capacity which they shall install at the Northfield Project. Prior to any future filing to increase generation at such project, the Licensees shall counsult with other electric systems, including those under public or cooperative ownership, as to their needs and possible sales from the new units, if any sales from such new units are contemplated to any other party.

(B) Except as provided in ordering paragraph (A) above the Application for Rehearing filed in this proceeding is in all respects denied.

(C) The motion of the Massachusetts Municipals that the Commission consolidate the Application of the New England Electric Power Company for Bear Swamp Project No. 2669 [*15] with this proceeding is denied.

Chairman White adheres to the views set forth in his separate statement accompanying Opinion No. 541 issued May 14, 1968, 39 FPC at 753.

Commissioner Ross adheres to his original statement accompanying Opinion No. 541 issued May 14, 1968, 39 FPC at 760. He also notes the opinion issued June 21, 1968, in *Northern Natural Gas Co., et al* v.. *Federal Power Commission,* C.A.D.C. No. 21333, and its pertinence to the antitrust issues raised by this case.

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UNITED STATES OF AMERICA
FEDERAL POWER COMMISSION

INSTRUMENT NO. 3
NPS 3.2.3

Before Commissioners: John N. Nassikas, Chairman;
John A. Carver, Jr., Albert B. Brooke, Jr., Pinkney Walker, and Rush Moody, Jr.

The Connecticut Light and Power Company Hartford Electric Light Company and Western Massachusetts Electric Company	)	Project No. 2485

ORDER EXTENDING TIME FOR COMPLETION
OF PROJECT CONSTRUCTION

(Issued April 28, 1972)

On March 27, 1972, the Connecticut Light and Power Company, the Hartford Electric Light Company and Western Massachusetts Electric Company joint licensees for Northfield Project No. 2485, filed an application requesting that the time for completing construction of their project works be extended until May 1, 1973. Under Article 31 of the license, the Licensees were required to complete the project works within four years of the effective date of the license. Accordingly, the project should have been completed by April 30, 1972.

In support of their request, the Licensees represent that completion of the project works has been delayed for the following reasons:

(1) Late deliveries of turbine components, especially the embedded parts.

(2) Delays in field erection of turbine components resulting from poor fit of parts.

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(3) Delays in generator erection caused by (a) lower than anticipated productivity of skilled workers, and (b) quality control problems caused by manufacturing errors and equipment having been in storage over one year.

(4) Labor problems

In addition, an accident on April 22, 1972, caused flooding of the underground powerhouse which will further delay completing construction of the project.

The Licensees have not complied with Section 5.3 of the Commission's Regulations which requires an application for extension of the time fixed in the license for completion of construction of project works to be filed not less than three months prior to the date fixed in the license. The Licensees should have filed their request for an extension of time no later than January 31, 1972.

The Commission finds:

(1) In view of the circumstances recited above, it is appropriate and in the public interest in administering Part I of the Federal Power Act to grant the extension of time as hereinafter provided.

(2) It is in the public interest to waive the requirement of Section 5.3 of the Commission's Regulations in this instance as to time of filing for extension of time to complete construction of the project.

The Commission orders:

(A) Article 31 of the license for Project No. 2485 is hereby modified to read as follows:

> Article 31. The Licensees shall commence construction within one year from the effective date of the license and shall thereafter in good faith and with due diligence prosecute such construction and shall complete construction of such project works by April 30, 1973.

(B) The requirement of Section 5.3 of the Commission's regulations pertaining to extension of time is hereby waived.

By the Commission.

(S E A L)

Mary B. Kidd,
Acting Secretary.

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

INSTRUMENT NO. 8

IN REPLY REFER TO:

PWR-LP
Project No. 2485-Massachusetts
Northeast Utilities Service
Company

Mr. F. L. Kinney
Vice President and Secretary
Northeast Utilities Service
Company
P.O. Box 270
Hartford, Connecticut 06101

OCT 27 1976

Subject: Amendment of License Article No. 13
and Addition of Article No. 49
to the License for Project No. 2485.

Dear Mr. Kinney:

Pursuant to the authority vested in me by Commission Order No. 550, issued June 24, 1976, and your Application for Amendment of License filed August 23, 1976, you are hereby advised that your license for Project No. 2485 is amended to the following extent.

1. License Article No. 13 is amended by adding the following sentence to the end of the Article.

   This Article is effective through August 22, 1976.

2. The following new Article is added to your license effective August 23, 1976, through the remaining term of the license.

   Article No. 49. Pursuant to Section 10(d) of the Act, after the first 20 years of operation of the project under license, a specified reasonable rate of return upon the net investment in the project shall be used for determining surplus earnings of the project for the establishment and maintenance of amortization reserves. One half of the project surplus earnings, if any, accumulated after the first 20 years of operation under the license, in excess of the specified rate of return per annum on the net investment, shall be set aside in a project amortization reserve account as of

AMERICAN REVOLUTION BICENTENNIAL 1776-1976 the end of each fiscal year: Provided, that, if and to the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year or years after the first 20 years of operation under the license, the amount of such deficiency shall be deducted from the amount of any surplus earnings accumulated thereafter until absorbed, and one-half of the remaining surplus earnings, if any, thus cumulatively computed, shall be set aside in the project amortization reserve account; and the amounts thus established in the project amortization reserve account shall be maintained until further order of the Commission.

The annual specified reasonable rate of return shall be the sum of the weighted cost components of long-term debt, preferred stock, and the cost of common equity, as defined herein. The weighted cost component for each element of the reasonable rate of return is the product of its capital ratios and cost rate. The current capital ratios for each of the above elements of the rate of return shall be calculated annually based on an average of 13 monthly balances of amounts properly includable in the Licensee's long-term debt and proprietary capital accounts as listed in the Commission's Uniform System of Accounts. The cost rates for such ratios shall be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity shall be the interest rate on 10-year government bonds (reported as the Treasury Department's 10 year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

This document should be regarded as an official license instrument and be filed accordingly.

Very truly yours,

Kenneth F. Plumb

Secretary

Instrument 9

INSTRUMENT NO. 9

UNITED STATES OF AMERICA
FEDERAL POWER COMMISSION AMENDMENT NO. 1

LICENSE AMENDMENT;
EXHIBIT R

Before Commissioners: Richard L. Dunham, Chairman;
Don S. Smith, and John H. Holloman III.

The Connecticut Light and Power Company The Hartford Electric Light Company Western Massachusetts Electric Company	)	Project No. 2485

ORDER AMENDING LICENSE AND
APPROVING REVISED EXHIBIT R

(Issued July 5, 1977)

I. Background

On May 14, 1968, the Commission issued a license to The Connecticut Light and Power Company, The Hartford Electric Light Company, and Western Massachusetts Electric Company (hereinafter Licensees) for the Northfield Mountain Project, FPC No. 2485, a pumped storage project which utilizes the reservoir of Western Massachusetts Electric Company's Turners Falls Project, FPC No. 1889, as its lower reservoir. 1/ The Northfield Mountain Project is located in and near the Towns of Erving and Northfield, Franklin County, Massachusetts. The Turners Falls Project reservoir is located on the Connecticut River.

Article 41 of the license for Project No. 2485, governing recreational development at the Northfield Mountain Project, provides as follows:

1/ Opinion No. 541, Western Massachusetts Electric Co., Project No. 1889; The Connecticut Light and Power Co., The Hartford Electric Light Co. and Western Massachusetts Electric Co., Project No. 2485, 39 F.P.C. 723 (1968), reh. den. Opinion No. 541-A, 40 F.P.C. 296 (1968), affirmed, Municipal Electric Assoc. of Massachusetts v. FPC, 414 F.2d 1206 (D.C. Cir. 1969).

<u>Article 41</u>. The Licensees shall expend $1,350,000 in the initial development of recreational resources associated with the project. The Licensees, from these monies, shall construct, operate, and maintain or provide for the construction, operation, and maintenance, of the outdoor recreation resources at the Four Mile Brook area, generally as shown in Exhibit R (Project No. 2485-30), which formed a part of the application, and shall purchase and make available to the Commonwealth of Massachusetts the land needed for the Pauchaug Brook area. With remaining monies, the Licensees shall develop such additional recreation resources as the Commission may approve or require. In planning further initial development, the Licensees shall consult and cooperate with the Department of Natural Resources of the Commonwealth of Massachusetts and the Bureau of Outdoor Recreation of the Department of the Interior. The Licensees shall submit to the Commission for its approval site layout drawings of any further recreation development, together with cost estimates including land costs.

The lands for the Pauchaug Brook area referred to in Article 41 were purchased by Licensees and conveyed to the Commonwealth of Massachusetts in August, 1971. The Pauchaug Brook area, consisting of about 160 acres located on the east bank of the Turners Falls Project reservoir immediately south of the Massachusetts - New Hampshire border, is administered by the Commonwealth as a fish and wildlife management area.

The proposed development of the Four Mile Brook area, also referred to in Article 41, generated opposition among citizens in the locality of the project. On January 29, 1971, Licensees filed an application for amendment of the license for Project No. 2485 to delete the Four Mile Brook area requirement from Article 41. Licensees stated that, if the application were approved, the monies earmarked for the Four Mile Brook area would be expended on other recreational resources at the project. The Commission has not acted on the application for amendment of license.

By separate filings of November 3, 1972, April 20, 1973, and August 7, 1973, in further compliance with Article 41, Licensees submitted revised plans for development of eight recreational sites at the Northfield Mountain Project. 2/ As proposed, these plans included the following:

1. Observation Tower and Mountaintop Picnic Area, to be located on project land atop Northfield Mountain, would include road access and parking, picnic facilities, a two-level observation tower, sanitary facilities, and interpretive signs and exhibits.

2. Riverview Family and Group Picnic Area, to be located on project land on the east bank of the Connecticut River just north of the project tailrace, would include parking, picnic facilities, a river overlook platform, a self-guiding nature trail, sanitary facilities, exhibits, and floating docks for boat access.

3. Munn's Ferry Boat Camping Recreation Area, opened for public use in 1968 on the east bank of the Connecticut River, includes a shelter, tent camping platforms and picnic facilities, drinking water, sanitary facilities, fireplaces, and a floating dock.

4. Barton Cove Nature Area, to be located in the Town of Gill, Massachusetts, on a peninsula extending from the west bank of the Connecticut River, would include a parking lot-staging area, with transportation provided by Licensees from the parking lot to the recreation area, picnic facilities, nature trails, boat docks, cabins, lean-tos, tent platforms, a shelter with interpretive exhibits, wildlife observation blinds, canoe and boat rentals, and sanitary facilities.

5. Northfield Mountain Tour and Trail Center, to be located on a meadow just above the main entrance to the project powerhouse, would include a building containing an information center, a lounge for relaxation, outdoor equipment rentals, interpretive exhibits, a classroom, and a theater.

6. Northfield Mountain Trail System would be comprised of a complex of trails for various uses, which would interconnect with a larger system of existing trails and other trails to be constructed by the Commonwealth of Massachusetts on adjacent lands, and would include staging facilities at the Northfield Mountain Tour and Trail Center.

2/ This scheme of development was supplemented by a letter filed on July 5, 1974, proposing to include facilities for handicapped persons in the recreation plans.

7. Interpretive Riverboat Tours, to originate from a dock near the Riverview Picnic Area, would feature regularly scheduled public and special group tours on shallow-draft diesel boats, with commentary on the historical, ecological, and geological features of the river.

8. Bennett Meadow Wildlife Management Area, a 200-acre site downstream from Pauchaug Brook on the west bank of the river, would be utilized for wildlife management purposes.

By letter dated September 16, 1974, Licensees stated that they were experiencing "severe financial problems" which necessitated a review of all proposed construction expenditures. This review, added Licensees, would encompass the recreation plan proposals, and would entail, at the minimum, abandonment of plans for the new Northfield Mountain Tour and Trail Center. Licensees submitted that the existing visitors' center at the Northfield Mountain Project could be modified at minimal cost to serve most of the purposes intended for the Tour and Trail Center. Licensees concluded by requesting that the Commission withhold action on the recreation plan until March 31, 1975, by which time a revised proposal for recreational development would be filed. This request was granted.

On April 2, 1975, Licensees filed a revised Exhibit R to supersede the plan filed previously. Licensees stated that, whereas the original proposals had been dependent for their accomplishment upon action by the Massachusetts Department of Natural Resources, the revised proposals place responsibility for completing and operating the proposed facilities entirely upon Licensees. Moreover, the new proposals place greater emphasis upon integration of outdoor recreational activity with an interpretive and educational program. Licensees stated that the recreation facilities, as proposed, would be completed within two years following the Commission's approval.

II. Description of Proposed Recreational Development

The revised Exhibit R proposes development of eight sites in addition to the Pauchaug Brook Wildlife Management Area.

Several of the sites include facilities that are either partially or wholly constructed and in operation. The eight sites and their respective facilities are as follows:

1. Mountaintop Observation Area, to be located atop Northfield Mountain, would include road access, parking, a single-level viewing platform, and interpretive signs and markers. The observation area would be accessible from the Northfield Mountain Trail System.

2. Boat Tour and Riverview Picnic Area is located just north of the project tailrace. Existing facilities at the site include picnic facilities and a dock, which serves Licensees' tour boat as well as private boats. Further proposed development would include family and group picnic facilities, a footbridge across a brook for access to the northern portion of the area, flush toilets, and a potable water supply. Licensees state that the boat tour on the Turners Falls reservoir, for which a fee is charged, has been used extensively and will be continued. Reservations for the boat tour are made at the Tour and Trail Center.

3. Munn's Ferry Boat Camping Recreation Area is located on the east bank of the Connecticut River about three miles upstream from the Boat Tour and Riverview Picnic Area. As noted above, this area has been open for public use since 1968. Area facilities include sealed-vault pumpout sanitary facilities, a potable water supply, a covered woodshed, a floating boat dock, an informational bulletin board, a wooden footbridge, a wooden lean-to shelter with fireplace, tent platforms, and picnic facilities.

4. Barton Cove Nature Area is located in the Town of Gill, Massachusetts, on a peninsula extending from the west bank of the Connecticut River. This area has been partially developed and open for public use for several years. As ultimately developed, the area facilities would include road access and parking; picnic facilities; group and family camping areas with appurtenant picnic facilities, woodshed, water supply, and sanitary facilities; a one-mile-long nature trail with overlooks at points of interest and a written interpretive guide; an administrative center with office, public restrooms and showers, and rental of canoes, boats, and camping equipment; and a dock serving day-use river traffic, river-traveling campers, and as a stopping point for Licensees' tour boat. The camping and picnic facilities are situated away from the parking area. Licensees offer a service to transport campers and their

equipment to the campsites, and picnickers may walk to the riverfront area from their autos. Camping is conducted on a reservation and user-fee basis, while picnicking, fishing, and hiking are available without charge.

5. Tour and Trail Center would be located in a building originally utilized as a construction field office and now used as a visitors' center. The center would ultimately include a reception alcove with a receptionist and information on project recreation facilities; an exhibit area with interpretive displays on native wildlife, local history, land use, and outdoor recreation activities; a lounge with vending machines and restrooms; a workshop/classroom area; a lecture room/audio visual center; an equipment rental shop; and office space for the staff. This center would be provided in lieu of the more elaborate Northfield Mountain Tour and Trail Center proposed in prior Exhibit R filings.

6. Northfield Mountain Trail System is a developed network of trails that may be interconnected with trails on, or leading to, adjacent State forest lands. 3/ Certain of the trails would be used seasonally for either cross-country skiing or horseback riding, while other trails would be reserved for either snowshoeing or hiking. The trail system consists of six miles of snowshoeing/hiking trails and 25 miles of cross-country skiing/equestrian trails. Licensees also propose to construct an interpretive nature trail featuring views of a variety of wildlife habitats and explanations of the effects of man's past use of the land. Signs, markers, and maps are provided on all trails for visitor orientation.

7. Pine Grove Picnic Area would be located in a meadow on the main trail leading north from the Tour and Trail Center. The site would be developed to include family and group picnic areas, a potable water supply, and flush toilets.

8. Bennet Meadow Wildlife Management Area is a 200-acre site owned by Licensees and consisting in large, as part of an alluvial floodplain on the west bank of the Connecticut River.

3/ In May, 1976, the Secretary of the Interior designated the Northfield Mountain Trail System as a Recreation Trail, part of the National Trails System established under the National Trails System Act, 16 U.S.C. §1241 *et seq*.

The land is currently leased to local farmers for agricultural use, and hunting and fishing by the general public is also permitted. The Massachusetts Department of Environmental Management, Division of Fisheries and Wildlife, stocks birds on the site and has considered stocking fish in Bennett Brook. Licensees submit that properly managed crop production, together with existing wetlands, forest cover, and river frontage, could provide excellent wildlife habitat for nesting, resting, and feeding. Licensees state further that Bennett Brook feeds an extensive beaver flowage and a slough which, if improved, would create excellent habitat for waterfowl. Licensees therefore propose in the Exhibit R that the land to be sold to the Division of Fisheries and Wildlife be utilized as a wildlife management area. Proceeds from the sale would be used for further development of other recreation areas at the project. This proposal has been controversial (see discussion in Part III of this order, infra).

Licensees state that the recreation plan, as outlined above, would call for an expenditure of $1,350,000 as required by Article 41 of the license. Development of the more extensive facilities described in the prior application would cost approximately $2,500,000. Licensees state further that the more modest plans remain compatible with the plans of the Commonwealth of Massachusetts and would still meet the objectives set forth in the earlier application. Anticipated maximum visitor use following completion of the proposed facilities is 130,000 annual visitations.

Licensees believe that the updated proposal should constitute both the initial and the ultmiate plan for development of recreational resources associated with the Northfield Mountain Project. Accordingly, Licensees request that Article 41 of the license be amended to read as follows:

> Article 41. The Licensees shall expend $1,350,000 in the development of recreational resources comprised of the nine areas shown on Exhibit R, Revision 2, Sheet 1B, associated with the project. In addition to assuming the development cost, the Licensees shall operate and maintain or provide for the operation and maintenance of the Munn's Ferry Boat Camping Recreation Area, the Boat Tour and Riverview

Picnic Area, the Mountaintop Observation Area, the Tour and Trail Center, the Northfield Mountain Trail System, the Barton Cove Nature Area and the Pine Grove Picnic area. The Licensees shall, as part of the $1,350,000, purchase and make available to the Commonwealth of Massachusetts the land needed for the Pauchuag Brook Wildlife Management Area. Further, the Licensees shall either make available to the public the land needed for the Bennett Meadow Wildlife Management Area, or shall sell such land to a public agency and expend all proceeds of such sale for the further development of the above areas 1 through 7. In planning the development of recreational resources, the Licensees shall consult and cooperate with the Department of Natural Resources of the Commonwealth of Massachusetts and the Bureau of Outdoor Recreation of the Department of the Interior. The Licensees shall submit to the Commission for its approval, site layout drawings of the above recreation areas, together with cost estimates including land costs.

In conjunction with the proposed revised article, Licensees seek approval of the facilities and resources, both constructed and proposed, that are discussed above and specifically mentioned in the article. Licensees state that such approval should constitute acknowledgment of the fulfillment by Licensees of their responsibility for recreational development at the project.

III. Comments on the Recreation Plan

Various persons and agencies were afforded an opportunity to comment on Licensees' proposed recreation plan. We turn now to a discussion of these comments.

The U.S. Environmental Protection Agency (EPA), by letter of March 6, 1973, commented on Licensees' previously filed recreation plan. EPA stated that the sewage and solid waste collected and removed from the recreation sites by Licensees should be disposed of in an area capable of handling the projected loads. In addition, the removal of ground cover and intensive use of certain areas may present erosion problems that should be anticipated and met with preventive measures. Finally, EPA stated that all useable waste from land clearing and construction should be saved as fuel for campfires, and all other construction wastes disposed of in a sanitary manner.

Licensees have stated that management and maintenance of the recreation facilities, including the collection and disposal of sewage and sanitary wastes, will be carried out by their own employees, thereby avoiding any added burden on the manpower and resources of the local jurisdictions. Section 2.7(f) of the Commission's General Rules, 18 C.F.R. §2.7(f) (1976), provides that all licensees should comply with Federal, State, and local regulations for health, sanitation, and public safety, and should either provide or arrange for facilities for the adequate processing of sewage, litter, and other wastes from recreation areas. With regard to the need for erosion control measures, Article 20 of the license for Project No. 2485 provides that Licensees shall be responsible for, and take reasonable measures to prevent, soil erosion resulting from construction, operation, or maintenance of the project, and entitles the Commission, upon request or upon its own motion, to require such construction of preventive works and revegetation of exposed soil surfaces as is deemed to be necessary. Finally, Licensees' application shows that useable wood waste from construction has been made available for campfires.

By letter of August 20, 1975, the U.S. Department of Agriculture noted that the recreation proposals do not involve National Forest lands, and that no other programs under the Department would be affected. Agriculture recommended approval of the application.

The U.S. Department of the Army, Corps of Engineers (Corps), by letter dated September 4, 1975, stated that Licensees' proposals, if implemented, would have no adverse effect on flood control. The Corps added, however, that permits under Section 10 of the River and Harbor Act of 1899 would be necessary for certain of the facilities. The Corps stated that applications for permits for the Boat Tour and Riverview Picnic Area and the Barton Cove Nature Area, as well as an application to build floats at the confluence of Four Mile Brook and the Connecticut River, had been submitted, with final action being held in abeyance pending issuance of State licenses. No application had been received for the Munn's Ferry Boat Camping Recreation Area, however. The Corps also noted the requirement under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 that a permit be obtained for the discharge of any dredged or fill material into navigable waters.

In a letter dated September 16, 1976, responding to agency comments, Licensees stated that permits for boat docks at the Riverview Picnic Area and the Barton Cove Nature Area had been issued by the Corps and the Commonwealth of Massachusetts Division of Waterways since the Corps' letter of September, 1975. Licensees added that the Munn's Ferry Boat Camping Recreation Area was constructed in 1968, prior to the date that the Corps asserted jurisdiction over that reach of the Connecticut River, and that a Corps permit is therefore not required. Communication between the Commission staff and personnel of the Corps' New England Division Office has confirmed that the Corps concurs in this view.

By letter dated August 18, 1975, the U.S. Department of the Interior (Interior) recommended that Licensees consult with the State Historic Preservation Officer to make certain that no properties either on, or eligible for nomination to, the National Register of Historic Places, would be affected by development of the recreation facilities. Interior also recommended that Licensees obtain a professional opinion on the likelihood of uncovering archeological resources in the area. Interior stated that the facilities, as planned, would help alleviate the recreational needs and demands identified in the Massachusetts Statewide Comprehensive Outdoor Recreation Plan. Interior added, however, that provision should be made for an update and revision of the recreation plan on a periodic basis in cooperation with local, State, and Federal agencies.

With regard to National Register properties, the Massachusetts Historical Commission commented by letter of August 11, 1975, that a review of inventory files had revealed no historical or archeological properties that would be directly affected by the recreation developments. 4/ The Historical Commission

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4/ The Commission staff has conducted an independent review of properties listed in, and identified as eligible for nomination to, the National Register of Historic Places and the National Registry of Natural Landmarks. No listed properties would be directly affected by the recreation facilities.

oted, however, that the Barton Cove Nature Area is in close proximity to a National Register property known as the Riverside Archeological District, and stated that "great care" must be taken to ensure that the archeological district is in no way affected.

A quarry in the area now designated as Barton Cove Nature Area was excavated at the time of the Civil War, when local citizens discovered what they thought were bird tracks in the rock strata. A local amateur archeologist correctly identified these prints as dinosaur tracks. Prints from the quarry were subsequently supplied to many educational institutions. The remains of the quarry have been incorporated into the interpretive nature program at the Barton Cove Nature Area. Given the fact that the area of Barton Cove is recognized for its unusual geologic and paleontological features, and taking into account the concerns expressed by Interior and the Massachusetts Historical Commission, we find that provision should be made for the protection of any additional archeological or paleontological remains of significance that may be found during construction, operation, and maintenance of the recreation facilities. Article 51 is hereinafter added to the license for Project No. 2485 for this purpose.

With respect to Interior's concerns over the possible future need to update or revise the recreation plan, we note Article 18 of the project license, which provides that the Licensees shall construct, operate, and maintain such recreational facilities at the project as are deemed necessary by the Commission on its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal or State agencies, after notice and opportunity for hearing. This license provision retains sufficient authority for any future requirement of additional recreational development that is established as necessary and in the public interest.

The U.S. Department of Health, Education, and Welfare and the U.S. Department of Transportation, Coast Guard, by letters dated July 2, 1975, and August 25, 1975, respectively, acknowledged receipt of the recreation plan for review. Neither agency had substantive comments with regard to the plan.

The Massachusetts Department of Natural Resources (now the Department of Environmental Management), by letter dated August 12, 1975, stated that: (1) the nine areas included in Licensees' plan are worthwhile and should serve as enduring public recreational assets; (2) costs should be explained in detail in order to determine whether a viable relationship between costs and actual "on the ground" facilities exists; (3) no costs should be allowed, as part of the expenditure of $1,350,000 required by Article 41, for items that do not reflect actual public recreational benefit, either because they were found infeasible for economic or other reasons or were discontinued because of negative public reaction; and (4) Barton Cove Nature Area should be operated with a user fee for camping comparable to those fees charged in the public and private camping sectors.

In the letter replying to agency comments, Licensees stated that none of the cost estimates in their application cover items which are not part of the facilities proposed. With regard to the comments concerning a user fee system for camping, we note that the fee for camping at the Barton Cove Nature Area during the 1976 summer recreation season was $4.00 per day for a campsite and 50 cents per person per day for group camping. The Massachusetts State Park system also charges a fee of $4.00 per day for camping. We therefore find that the fees charged by Licensees are reasonable in comparison with fees charged at publicly owned camping facilities in Massachusetts. 5/

In a letter dated September 29, 1975, Ralph K. Leach and Virginia E. Leach of Northfield, Massachusetts, recommended that the Four Mile Brook proposal be deleted from any conditions of the project license. As we have noted, Licensees' most recent recreation plan does not include a proposal for development of facilities at the Four Mile Brook site, and Licensees have themselves requested that the requirement for such development be deleted from Article 41.

The proposal for the Bennett Meadow Wildlife Management Area has proven to be particularly controversial. By letter dated June 17, 1975, the Town of Northfield, Massachusetts

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5/ Section 2.7 of the Commission's General Rules, 18 C.F.R. §2.7 (1976), provides, in part, that "[t]he Commission will not object to licensees and operators of recreational facilities within the boundaries of a project charging reasonable fees to users of such facilities in order to help defray the cost of constructing, operating, and maintaining such facilities."

(Northfield) stated that use of Bennett Meadow in the manner proposed would have a substantial negative effect on the agricultural economy of Northfield. 6/ Citing past experiences with the Pauchaug Brook area, Northfield stated that transferral of ownership of Bennett Meadow to a State agency to be administered in part as a wildlife management area would surely limit agricultural production on the land. Such use, averred Northfield, would result in eventual loss of one large farm unit in the area within a few years. Hence, the potential loss of agricultural production would outweigh any limited gains in wildlife production. Northfield proposed several alternatives for disposition of the land in such a way as to protect its interests: (1) return the land to private ownership and retain any flowage rights, thus ensuring agricultural production and economic stability and allowing Licensees to expend the proceeds on other recreational development while leaving open the option for the owners to reach an agreement with the State agency; (2) allow Licensees to retain ownership but place conditions in the license sufficient to ensure that there is full agricultural production on lands that are suitable for the purpose, with use of other lands for wildlife management; or (3) transfer ownership to the State agency with restrictions to keep agricultural lands in production.

In a letter dated July 16, 1976, Northfield reiterated its position concerning the importance of maintaining Bennett Meadow in a state of agricultural productivity. Northfield also related an account of various meetings involving Northfield officials, Licensees, State agencies, and local sportsmen and farmers regarding the best use of the Bennett Meadow area. While the State agencies had stated that a proposed management plan would be forthcoming, Northfield had received none by the date of the letter. Meanwhile, the Northfield Fish and Game Club had offered its own proposal. Northfield once again proposed several alternatives for disposition of the Bennett Meadow area: (1) retain ownership of the land by Licensees, utilizing it for agricultural production and wildlife management along the lines suggested by the Northfield Fish and Game Club; (2) sell the land to private interests, with the stipulation that it be maintained in agricultural

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6/ On October 30, 1975, Northfield filed a petition to intervene in the proceeding on Licensees' application, alleging that use of Bennett Meadow as proposed by Licensees would damage the agricultural economy of Northfield. On February 24, 1976, the Commission issued an order permitting Northfield to intervene.

production; or (3) sell the land to the Town of Northfield for nominal sum with the stipulation that it be used for riculture and wildlife management and kept open to sportsmen.

Finally, by letter of August 30, 1976, Northfield stated that, in the interim since its letter of July 16, it had received a proposal from the Massachusetts Division of Fisheries and Wildlife for management of the Bennett Meadow area. Copies of the proposal and Northfield's response were enclosed. Northfield stated that it could not approve the transfer of ownership of Bennett Meadow to the Division of Fisheries and Wildlife under the terms proposed, because there was no obligation on the part of the State agency to maintain a maximum amount of tillable land in agricultural production.

The County Commissioners of Franklin County, Massachusetts, by letter dated July 1, 1975, expressed agreement with the Town of Northfield, and stated that any decision that would tend to reduce the amount of land used for agriculture would have to have compelling justification, in view of the ecological and economic consequences.

Massachusetts State Representative Jonathan F. Healy, by letter of July 2, 1976, stated his agreement with Northfield's concern for the future of the Bennett Meadow area, which, he said, represents almost one-fifth of the best farmland in Northfield.

By letter of September 3, 1975, the Franklin Conservation District (District) stated that it unanimously and enthusiastically supports the current efforts of the State Commissioner of Agriculture to reverse the decline in agricultural production which has taken place in Massachusetts in recent years. The District stated that every effort should be made to avoid taking any reasonably good crop land away from farming, and that the Commission should therefore proceed with the utmost caution and consideration for local agricultural and economic needs in acting on Licensees' application.

The Massachusetts Farm Bureau Federation, Inc., by letter dated June 23, 1975, stated that it supports the concept of keeping Bennett Meadow in private ownership, and added that any controls placed on the land should allow for full agricultural production.

Recent communications between the Commission staff and the Massachusetts Division of Fisheries and Wildlife have disclosed that the State agency is no longer in a position to purchase the Bennett Meadow area from Licensees. We believe, however, that the goal of joint and compatible use of the land for agricultural and wildlife management purposes may be attained while retaining ownership by Licensees. We believe further that any plan for such cooperative use should be prepared after consultation with the Town of Northfield, the Massachusetts Department of Environmental Management, Division of Fisheries and Wildlife, and the U.S. Department of the Interior, Fish and Wildlife Service. We will therefore include Article 50 in the license for Project No. 2485 to require Licensees to formulate such a plan for cooperative use after consultation with those entities.

IV. Environmental Considerations and the Need for the Proposed Facilities

Much of the limited construction work associated with the proposed recreation facilities has already been carried out, and has not resulted in lasting significant effects on the environment. The largest of the structures originally proposed, the Northfield Mountain Tour and Trail Center, has been superseded in the scheme of development by a renovation of the existing visitors' center. The minor construction that remains to complete the several recreation areas would create impacts of a minimal and short-term nature. We have already noted Licensees' plans for collection and disposal of sewage and sanitary wastes and the license provisions calling for preventive measures against erosion. We conclude that our approval of the recreation plan, as hereinafter conditioned, would not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of Section 102(2)(C) of the National Environmental Policy Act of 1969, 42 U.S.C. §4332(2)(C). Hence, preparation of an environmental impact statement would not be necessary.

We have considered Licensees' proposed scheme of recreation development, and we find that it is adequate to meet the recreation needs of the area and fulfill Licensees' responsibilities at the present time. We cannot agree with Licensees, however, that approval of this plan must constitute our acknowledgment that no further recreation development need be undertaken during the balance of the license term. As we have pointed out, Article 18 of the license for Project No. 2485 provides that further such development may be required, after notice and opportunity for hearing, if the Commission deems the development necessary. This license provision will ensure continuing authority to require additional recreation facilities in the event that the needs of the area grow with the passage of time.

We find further that the Four Mile Brook area, development of which was required under Article 41 of the license, is no longer a necessary or desirable component of the recreation plan. We will therefore delete the requirement for development of that area from the license provisions as requested by Licensees in their application of January 29, 1971.

Development of the recreation areas as proposed could involve lands not heretofore included within the project boundary. We will therefore require the filing of revised Exhibits F and K to reflect incorporation of any such lands within the project.

V. Public Notice

Public notice of the application for approval of the revised Exhibit R was issued on August 21, 1975, with September 29, 1975, as the last day for filing protests and petitions to intervene. Notice of the application was published in the Federal Register on August 29, 1975, 40 Fed. Reg. 39937. Aside from the late-filed petition to intervene of the Town of Northfield, no protests, notices of intervention, or petitions to intervene were received.

The Commission finds:

(1) The application by The Connecticut Light and Power Company, The Hartford Electric Light Company, and Western Massachusetts Electric Company for Commission approval of the revised Exhibit R for Project No. 2485 conforms to the Commission's Rules and Regulations.

(2) Approval of the revised Exhibit R, as hereinafter conditioned, would not constitute a major Federal action significantly affecting the quality of the human environment.

(3) It is appropriate for the purposes of the Federal Power Act and in the public interest that the revised Exhibit R be approved, subject to the conditions hereinafter imposed, and that the license for Project No. 2485 be amended accordingly.

The Commission orders:

(A) The description of Exhibit R contained in paragraph (c)(ii) of the license for Project No. 2485 is hereby modified to read as follows:

Exhibit R, filed on April 2, 1975, and consisting of pages 1 through 22, 28 through 30, and 32 through 51 of the text; Appendices 1 through 4; and the following drawings:

Sheet No.	FPC No. 2485	Title
1B	-61	Location of Recreation Areas
3A	-62	Mountaintop Observation Area
4A	-63	Boat Tour and Riverview Picnic Area
5	-64	Munn's Ferry Boat Camping Recreation Area
6A	-65	Barton Cove Nature Area
7A	-66	Tour and Trail Center
10	-67	Northfield Mountain Trail System
11	-68	Pine Grove Picnic Area and Nature Trail
12	-69	Bennett Meadow Wildlife Management Area

(B) The description of Exhibit R initially included in paragraph (C)(ii) of the license for Project No. 2485 is hereby deleted from the license.

(C) Article 41 of the license for Project No. 2485 is hereby amended to read as follows:

> Article 41. The Licensees shall expend $1,350,000 in the initial development of recreation resources associated with the project. The Licensees, from these monies,

shall purchase and make available to the Commonwealth of Massachusetts the land needed for the Pauchaug Brook area. With remaining monies, the Licensees shall develop such additional recreation resources as the Commission may approve or require. In planning for the recreation development, the Licensees shall consult and cooperate with the Department of Environmental Management of the Commonwealth of Massachusetts, and the Bureau of Outdoor Recreation and the Fish and Wildlife Service of the U.S. Department of the Interior. The Licensees shall submit to the Commission for its approval site layout drawings of all recreation development, together with cost estimates, including land costs.

(D) The following articles are hereby included in the license for Project No. 2485:

Article 50. The Licensees, after consulting with the Division of Fisheries and Wildlife of the Massachusetts Department of Environmental Management, the Fish and Wildlife Service of the U.S. Department of the Interior, and the Town of Northfield, Massachusetts, shall, within one year of the date of issuance of this order, file for Commission approval a cooperative land and water management plan for the Bennett Meadow Wildlife Management Area. The plan shall include provision for the compatible use of the land for agricultural and wildlife management purposes. In the event that the Licensees are unable to develop such a plan, the Commission reserves the right to prescribe a management plan, after notice and opportunity for hearing.

Article 51. In the event that the Licensees find, during the construction, operation, or maintenance of the developments approved as part of Exhibit R, any fossils or archeological artifacts, the Licensees shall immediately report such findings to the Commission and to the Massachusetts Historical Commission, and the Commission reserves the right, on its own motion or upon the recommendation of the Massachusetts Historical Commission, and after notice and opportunity for hearing, to require such archeological or paleontological surveys, or such salvage operations, as are deemed necessary to prevent the destruction or loss of the findings.

(E) The Licensees shall, within one year of the date of issuance of this order, file a revised Exhibit F and, for Commission approval, a revised Exhibit K, to include within the project boundary all lands proposed for recreation development.

(F) This order shall become final 30 days from the date of its issuance unless an application for rehearing shall be filed as provided in Section 313(a) of the Federal Power Act, and failure to file such an application shall constitute acceptance of this license amendment. In acknowledgment of the acceptance of this license amendment, it shall be signed for the Licensees and returned to the Commission within 60 days from the date of issuance of this order.

By the Commission.

(S E A L)

Kenneth F. Plumb

Kenneth F. Plumb,
Secretary.

Project No. 2485

IN TESTIMONY of its acknowledgment of acceptance of all of the provisions, terms, and conditions of this license amendment, The Connecticut Light and Power Company, this 26th day of July, 1977, has caused its corporate name to be signed hereto by W. F. Fee, its Vice President, and its corporate seal to be affixed hereto and attested by F. L. Kinney, its Secretary, pursuant to a resolution of its Board of Directors duly adopted on the 25th day of July, 1977, a certified copy of the record of which is attached hereto.

By____________________
Vice President

ATTEST:

____
Secretary

(Executed in quadruplicate)

I HEREBY CERTIFY that at a meeting of the Board of Directors of The Connecticut Light and Power Company, duly called and held on July 25, 1977, at which a quorum was present and acting throughout, the following action was taken:

> RESOLVED, that the Chairman of the Board, the President, or any Vice President is hereby authorized to execute in the name and on behalf of the Company an amendment to the license for the hydroelectric development of this Company known as the Northfield Mountain Project, FPC Project No. 2485, in the form set forth in the Order Amending License and Approving Revised Exhibit R in the matter of The Connecticut Light and Power Company, The Hartford Electric Light Company and Western Massachusetts Electric Company, Project No. 2485, by the Federal Power Commission on July 5, 1977 and that the Secretary or any Assistant Secretary is hereby authorized to affix the seal of the Company to said amendment to the license so executed by the Chairman of the Board, the President or any Vice President and to attest the same.

I DO FURTHER CERTIFY that the foregoing resolution is still in full force and effect as of this date.

IN WITNESS WHEREOF, I have caused the corporate seal of said Company to be hereunto affixed, duly attested by me this 26th day of July, 1977.

F. L. Kinney - Secretary

Project No. 2485

IN TESTIMONY of its acknowledgment of acceptance of all of the provisions, terms, and conditions of this license amendment, The Hartford Electric Light Company, this 26th day of July, 1977, has caused its corporate name to be signed hereto by W. F. Fee, its Vice President, and its corporate seal to be affixed hereto and attested by F. L. Kinney, its Secretary, pursuant to a resolution of its Board of Directors duly adopted on the 25th day of July, 1977, a certified copy of the record of which is attached hereto.

By ______________________
Vice President

ATTEST:

____
Secretary

(Executed in quadruplicate)

I HEREBY CERTIFY that at a meeting of the Board of Directors of The Hartford Electric Light Company, duly called and held on July 25, 1977, at which a quorum was present and acting throughout, the following action was taken:

> RESOLVED, that the Chairman of the Board, the President, or any Vice President is hereby authorized to execute in the name and on behalf of the Company an amendment to the license for the hydroelectric development of this Company known as the Northfield Mountain Project, FPC Project No. 2485, in the form set forth in the Order Amending License and Approving Revised Exhibit R in the matter of The Connecticut Light and Power Company, The Hartford Electric Light Company and Western Massachusetts Electric Company, Project No. 2485, by the Federal Power Commission on July 5, 1977 and that the Secretary or any Assistant Secretary is hereby authorized to affix the seal of the Company to said amendment to the license so executed by the Chairman of the Board, the President or any Vice President and to attest the same.

I DO FURTHER CERTIFY that the foregoing resolution is still in full force and effect as of this date.

IN WITNESS WHEREOF, I have caused the corporate seal of said Company to be hereunto affixed, duly attested by me this 26th day of July, 1977.

F. L. Kinney - Secretary

Project No. 2485

IN TESTIMONY of its acknowledgment of acceptance of all of the provisions, terms, and conditions of this license amendment, Western Massachusetts Electric Company, this 26th day of July, 1977, has caused its corporate name to be signed hereto by W. F. Fee, its Vice President, and its corporate seal to be affixed hereto and attested by F. L. Kinney, its Secretary, pursuant to a resolution of its Board of Directors duly adopted on the 25th day of July, 1977, a certified copy of the record of which is attached hereto.

By W. F. Fee
Vice President

ATTEST:

F. L. Kinney
Secretary

(Executed in quadruplicate)

I HEREBY CERTIFY that at a meeting of the Board of Directors of Western Massachusetts Electric Company, duly called and held on July 25, 1977, at which a quorum was present and acting throughout, the following action was taken:

RESOLVED, that the Chairman of the Board, the President, or any Vice President is hereby authorized to execute in the name and on behalf of the Company an amendment to the license for the hydroelectric development of this Company known as the Northfield Mountain Project, FPC Project No. 2485, in the form set forth in the Order Amending License and Approving Revised Exhibit R in the matter of The Connecticut Light and Power Company, The Hartford Electric Light Company and Western Massachusetts Electric Company, Project No. 2485, by the Federal Power Commission on July 5, 1977 and that the Secretary or any Assistant Secretary is hereby authorized to affix the seal of the Company to said amendment to the license so executed by the Chairman of the Board, the President or any Vice President and to attest the same.

I DO FURTHER CERTIFY that the foregoing resolution is still in full force and effect as of this date.

IN WITNESS WHEREOF, I have caused the corporate seal of said Company to be hereunto affixed, duly attested by me this 26th day of July, 1977.

NORTHEAST UTILITIES
THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

P.O. BOX 270
HARTFORD, CONNECTICUT 06101
(203) 666-6911

October 6, 1980

FERC Project No. 2485
Northfield

Mr. Kenneth F. Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

Dear Mr. Plumb:

Amendment of the License for Project No. 2485
By Adding Article No. 49

We have received a letter from Mr. William W. Lindsay, Director of the Office of Electric Power Regulation, offering us an opportunity to amend the license for Project No. 2485, Northfield, by adding a new standard article.

The new article gives the Licensee authority to grant permission for certain uses of project lands and waters and to convey certain interests in project lands without prior Commission approval. By this letter, we accept that new article as an amendment to the project license. The new article should be designated Article No. 49. A copy of the new article, with that article number filled in, is attached to this letter.

Very truly yours,

WESTERN MASSACHUSETTS ELECTRIC COMPANY

W. G. Counsil

W. G. Counsil
Senior Vice President

Attachment: New License Article No. 49

VERIFICATION

State of Connecticut)
) ss: Hartford
County of Hartford)

October 6, 1980

William G. Counsil, being first duly sworn, deposes and says that he is Senior Vice President of the Western Massachusetts Electric Company, that he is authorized to verify and file the foregoing document, and that he has examined the foregoing document and knows the contents thereof; and that all statements therein are true to the best of his knowledge, information, and belief.

William G. Counsil

Subscribed and sworn to before me this 6th day of October 1980.

Notary Public
My Commission Expires March 31, 1983

(SEAL)

Article 49. (a) In accordance with the provisions of this article, the Licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain other types of use and occupancy, without prior Commission approval. The Licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the Licensee shall also have continuing responsibility to supervise and control the uses and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the Licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the Licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, cancelling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The types of use and occupancy of project lands and waters for which the Licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities; and (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the Licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The Licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the uses and occupancies for which it grants permission are maintained in good repair and comply with applicable State and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the Licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline. To implement this paragraph (b), the Licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the Licensee's costs of administering the permit program. The Commission reserves the right to require the Licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modifications of those standards, guidelines, or procedures.

(c) The Licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement, expansion, realignment, or maintenance of bridges and roads for which all necessary State and Federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the Licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The Licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary State and Federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary Federal and State water quality certificates or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary Federal and State approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from the edge of the project reservoir at normal maximum surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 45 days before conveying any interest in project lands under this paragraph (d), the Licensee must file a letter to the Director, Office of Electric Power Regulation, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G or K map may be used), the nature of the proposed use, the identity of any Federal or

State agency official consulted, and any Federal or State approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the Licensee to file an application for prior approval, the Licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraphs (c) or (d) of this article:

(1) Before conveying the interest, the Licensee shall consult with Federal and State fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the Licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved Exhibit R or approved report on recreational resources of an Exhibit E; or, if the project does not have an approved Exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include covenants running with the land adequate to ensure that: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; and (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project.

(4) The Commission reserves the right to require the Licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G or K drawings would be filed for approval for other purposes.

NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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GFL ~~[illegible]~~ File
R. Osella

December 26, 1980

FERC Project No. 2485
Northfield Project

Mr. Kenneth F. Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D. C. 20426

References:
1. Letter, W. W. Lindsay to All Licensees, dated June 18, 1980
2. Letter, W. G. Counsil to K. F. Plumb, dated October 6, 1980
3. Letter, J. D. Hebson to R. A. Reckert, dated December 1, 1980

Dear Mr. Plumb:

CORRECTION OF AMENDMENT OF THE LICENSE FOR PROJECT NO. 2485
BY ADDING ARTICLE NO. 52 AND BY DELETING ARTICLE NO. 21

In Reference 1, we were afforded an opportunity to amend the license for Project No. 2485, Northfield, by adding a new standard article. The new article gives the Licensee authority to grant permission for certain uses of project lands and waters and to convey certain interests in project lands without prior Commission approval.

In Reference 2, we have accepted that new article as an amendment to the project license, but had designated it as Article No. 49. In Reference 3 (copy enclosed), we were advised that the new article should have been designated as Article No. 52. Therefore, we now submit the attached new article with the correct article number filled in.

In further reviewing the matter, the new article, in our judgment, substantially replaces the authority currently contained in Article No. 21 (Form L-4, revised June 1, 1964) of the license for Project No. 2485. Accordingly, we request that the license be amended to delete Article No. 21.

Very truly yours,

NORTHEAST UTILITIES SERVICE COMPANY
As Agent for Western Massachusetts
Electric Company

W. G. Counsil

W. G. Counsil
Senior Vice President

Attachment: Corrected New License
Article No. 52

cc: Mr. W. W. Lindsay, Director
Office of Electric Power Regulation
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D. C. 20426

Mr. J. D. Hebson, Regional Engineer
Federal Energy Regulatory Commission
26 Federal Plaza
New York, New York 10278

Mr. Fred E. Springer, Chief
Applications Branch
Division of Hydropower Licensing
Federal Energy Regulatory Commission
400 First Street, N.W.
Washington, D. C. 20426

FERC 102 to Current Volume, FirstLight Hydro Generating Company, Project No. 2485-060, 138 FERC ¶62,293, Federal Energy Regulatory Commission, (Mar. 23, 2012)

[64,982]

FirstLight Hydro Generating Company,

Project No. 2485-060

Order Amending License and Revising Annual Charges

March 23, 2012

M. Joseph Fayyad,Engineering Team Lead, Division of Hydropower Administration and Compliance.

1. On August 17, 2011, and supplemented on January 17, 2012, February 14, 2012, and February 24, 2012, FirstLight Hydro Generating Company (FirstLight), licensee for the Northfield Mountain Hydroelectric Project, FERC No. 2485, filed an amendment application to revise the authorized installed capacity of the project. The project is located on the Connecticut River in Franklin County, Massachusetts. The project does not occupy any federal or tribal lands.

Background

2. The license for the Northfield Mountain Project was issued on May 14, 1968, which authorized, among other things, a powerhouse containing four reversible Francis-type pump turbines connected to motor-generators rated at 250 megawatts (MW) each. [1] The authorized installed capacity for the project is 1,333,000 horsepower (approximately 1,000 MW).

Proposed Amendment

3. In the August 17, 2011 filing, FirstLight requests an amendment of the license to revise the authorized installed capacity of Unit 3 in accordance with 18 C.F.R. §11.1(i). In this filing, FirstLight explains that in letters to the Commission's Division of Dam Safety and Inspections New York Regional Office dated September 15 and October 28, 2010, it notified the Commission of the planned rehabilitation of Unit 3 and replacement of the associated main step-up transformer. The Unit 3 rehabilitation began on January 3, 2011, and was completed with its return to service on June 17, 2011. The transformer replacement was completed on April 5, 2011. Additionally, the licensee's February 14, 2012, supplement requested an amendment of the license to reflect the increased capacity of Unit 2 due to the rewinding of its motor-generator, and replacement of its turbine runner with a design identical to the Unit 3 upgrade. The work on Unit 2 began on November 28, 2011, and is expected to be completed with a planned return to service on May 16, 2012.

Discussion

A. *Installed Capacity*

4. As originally licensed, the project consists of four reversible Francis-type pump turbines connected to motor-generators rated at 250 MW each. Due to increased power demand in the late 1980's, the licensee completed testing on the generating units to investigate the possibility of operating the units at higher temperature limits to produce additional power. [2] Based on the testing, the licensee filed revised declarations and supporting data with the New England Power Exchange on February 22, 1989, demonstrating each unit was capable of producing about 270 MW, [3] for a total project capacity of about 1,080 MW. Although the project license was not amended at the time to reflect the increase in capacity, various Commission issuances in the interim have stated the project's installed capacity is about 1,080 MW. [4] As such, the licensee's proposed amendment uses units' tested capacity as a baseline.

5. The Unit 1 turbine runner was replaced in 2004 with an identical design as Units 2 and 3; however, no change to the capacity of its generator occurred. Therefore, the Unit 1, 2, and 3 turbine capacities would each increase to 395,600 horsepower (296.7 MW), and the Unit 2 and 3 generator capacities would each increase to 291.7 MW. The Unit 1 and 4 generator capacities would increase to 267.9 MW to reflect the testing com

[64,983]

pleted in the late 1980's. No change to the individual unit or total project hydraulic capacities would occur.

6. In 1995, the Commission amended its annual charge regulations to define “authorized installed capacity” as the lesser of the ratings of the generator or turbine units. See 18 C.F.R. §11.1(i). Section 11.1(i) states further:

> The rating of a generator is the product of the continuous-load capacity rating of the generator in kilovolt-amperes (kVA) and the system power factor in kW/kVA.… The rating of a turbine is the product of the turbine's capacity in horsepower (hp) at best gate (maximum efficiency point) opening under the manufacturer's rated head times a conversion factor of 0.75 kW/hp. If the generator or turbine installed has a rating different from that authorized in the license or exemption, or the installed generator is rewound or otherwise modified to change its rating, or the turbine is modified to change its rating, the licensee or exemptee must apply to the Commission to amend its authorized installed capacity to reflect the change.

7. The preamble to the rulemaking noted: “The capacity would be based on the actual power of the equipment in question without regard to whatever ‘nameplate’ rating might be physically affixed to the unit ….” [5]

8. Based on the above, the authorized installed capacity of the project would be revised from 1,000 MW to 1,119.2 MW, as shown in Table 1. Ordering paragraph (B) of this order revises ordering paragraph (C)(ii) of the license to reflect the upgrades. This order will require the licensee to affix new nameplates to the turbine-generator units reflecting the installed capacity of each as discussed in this order and to file photographs of the units' nameplates, as shown in ordering paragraph (E).

Table 1

	As Licensed	**After Upgrades**			
Unit	**Unit Capacity**	**Turbine**		**Generator**	**Limiting Capacity** [2/]
	MW	**hp**	**MW**	**MW**	**MW**
1	250	395,600	296.7	267.9	267.9
2	250	395,600	296.7	291.7	291.7
3	250	395,600	296.7	291.7	291.7
4	250	348,000	261.0 [1/]	267.9	267.9
Installed Capacity	1,000 MW				**1,119.2 MW**

[1/]Listed Unit 4 turbine capacity is based on the unit's original nameplate; however, per the testing completed in 1988, each turbine-generating unit has an actual capacity of 267.9 MW.

[2/]As per 18 C.F.R. §11.1(i) and the unit testing.

B. *Annual Charges*

9. The Commission collects annual charges from licensees for administration of Part I of the Federal Power Act and for the use, occupancy and enjoyment of federal lands. The revision to the authorized installed capacity would require revising the annual charges for the project under Article 48 of the license, as shown in Ordering Paragraph (D). In accordance with the Commission's regulations, the effective date for the purpose of annual charges is the date of commencement of construction of new authorized capacity. [6] As such, the effective date for the upgrade of Unit 3 is January 3, 2011, and for Unit 2 the effective date is November 28, 2011. [7]

C. *Revised Exhibits*

10. In the February 24, 2012 supplement, the licensee included a revised Exhibit M. The proposed amendment is not likely to require revisions to the general design drawings or the project boundary, and no revised Exhibit K or L drawings were filed. [8] Commission staff reviewed the revised Exhibit M, and determined it is necessary and will approve relevant sections, as shown in ordering paragraph (C).

[64,984]

The Director orders:

(A) The request for amendment of the license for the Northfield Mountain Hydroelectric Project No. 2485, filed by FirstLight Hydro Generating Company on August 17, 2011, and supplemented on January 17, 2012, February 14, 2012, and February 24, 2012, is approved as provided by this order, effective the day this order is issued.

(B) The project description in ordering paragraph (C)(ii) of the license is revised, in part, as follows:

(ii) All project works consisting of: …(8) an underground powerplant containing four reversible Francis type pump turbines: units 1 and 4 each have an installed capacity of 267.9 MW, and units 2 and 3 with an installed capacity of 291.7 MW;…

(C) The revised sections 3(B), 3(C), and 3(F) of the Exhibit M, filed February 24, 2012, are approved and made part of the license, superseding the previously approved sections 3(B), 3(C), and 3(F).

(D) Article 48 of the license is revised to read:

(a) For the purpose of reimbursing the United States for the costs of administration of Part I of the FPA, a reasonable amount as determined in accordance with the provisions of the Commission's regulations in effect from time to time. The authorized installed capacity for that purpose is as follows:

Item	Authorized Capacity MW	Effective Date
After Unit 3 Upgrade	1,095.4	January 3, 2011
After Unit 2 Upgrade	1,119.2	November 28, 2011

(E) Within 90 days of the completion of Unit 2 upgrade, the licensee shall affix new nameplates to all turbine-generator units reflecting the installed capacities of each as discussed in this order, and file with the Commission and the Division of Dam Safety and Inspections-New York Regional Office, photo documentation of the new nameplates.

(F) This order constitutes final agency action. Any party may file a request for rehearing of this order within 30 days from the date of its issuance, as provided in section 313(a) of the Federal Power Act, 16 U.S.C. §825l (2006), and the Commission's regulations, 18 C.F.R. §385.713 (2011). The filing of a request for rehearing does not operate as a stay of the effective date of this order, or of any other date specified in this order. The licensee's failure to file a request for rehearing shall constitute acceptance of this order.

Footnotes

1 See, *Western Massachusetts Electric Co.*, Order Issuing Major License, 39 FPC 723 (1976).

2 *See*, FirstLight's supplement filed January 17, 2012.

3 According to the licensee, the reference to the 270 MW value seems to be a rounding of the value 267.9 MW.

4 *See, e.g., Northeast Generation Company*, 95 FERC ¶61,336 (2001), *Northeast Generation Company* , 115 FERC ¶62,261 (2006), *FirstLight Hydro Generating Company* , 126 FERC ¶61,025 (2009).

5 *See*106 FERC ¶62,086 (2004), which establishes that the "authorized installed capacity" can be based on the actual capacity that is different from what is authorized in the license or exemption but that is not the result of physical modifications to the unit.

6 18 C.F.R. §11.1(c)(5) (2011).

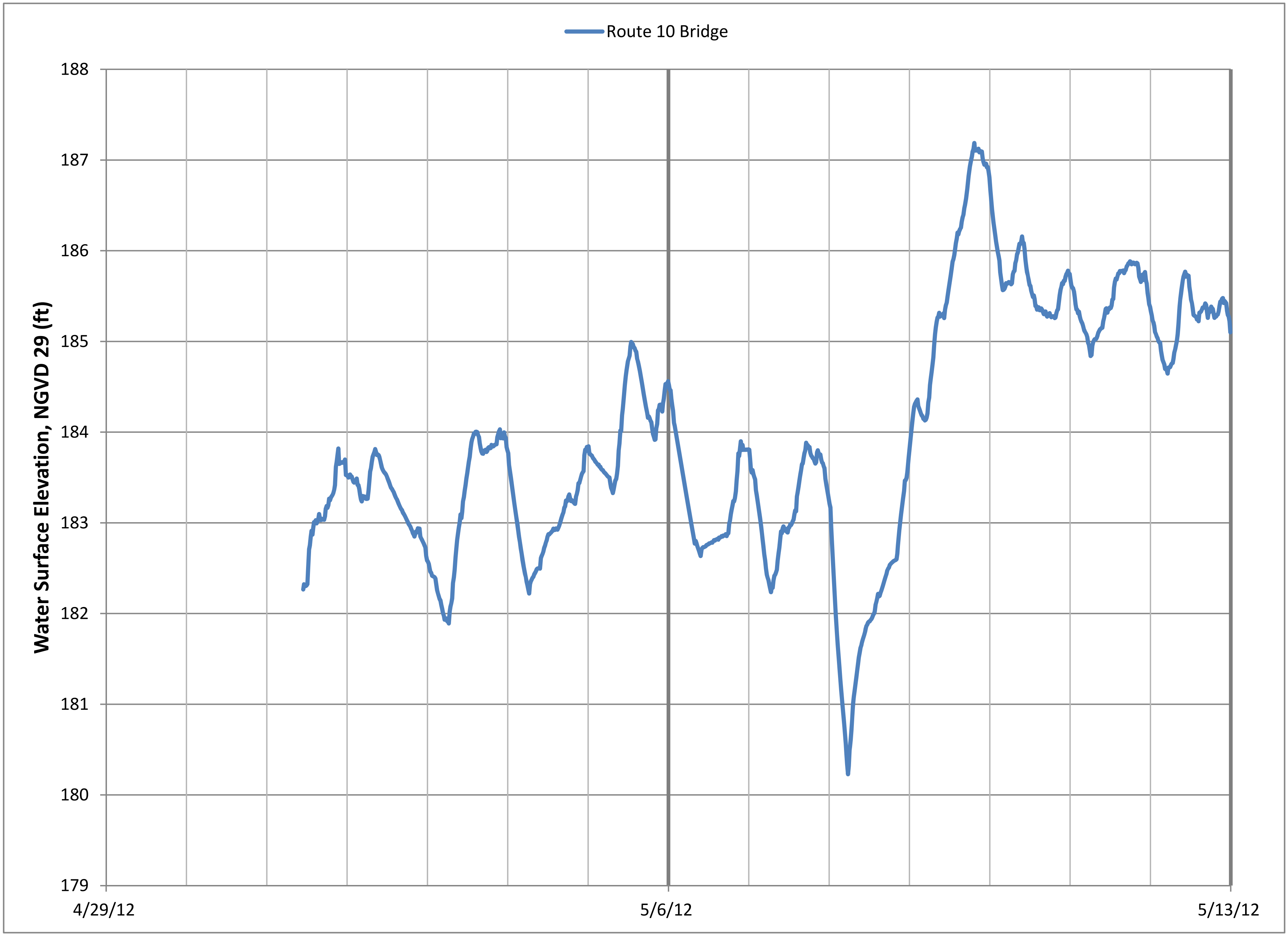
7 The upgrade to Unit 3 increased the installed capacity to 1,095.4 MW (Units 1, 2, & 4 at 267.9 MW and Unit 3 at 291.7 MW), while the upgrade of Unit 2 increased the installed capacity to 1,119.2 MW (Units 1 & 4 at 267.9 MW and Units 2 &3 at 291.7 MW).

8 At the time the project was licensed, the naming conventions the Commission used were different: Exhibit K refers to project maps [currently referred to as Exhibit G in 18 C.F.R. §4.41(h)], Exhibit L refers to general design drawings [currently referred to as Exhibit F in 18 C.F.R. §4.41(g)], and Exhibit M refers to the project description [currently referred to as Exhibit A in 18 C.F.R. §4.41(b)]. To be consistent with the original license, we will continue to use the Exhibit K, L, and M designations.

APPENDIX E – 2012 Water Elevation Plots

APPENDIX E – 2012 Water Elevation Plots

- **Turners Falls Impoundment (Weeks 1-9)**
- **Bypass Reach (Weeks 1-9)**
- **Below Cabot Station (Weeks 1-9)**



Route 10 Bridge
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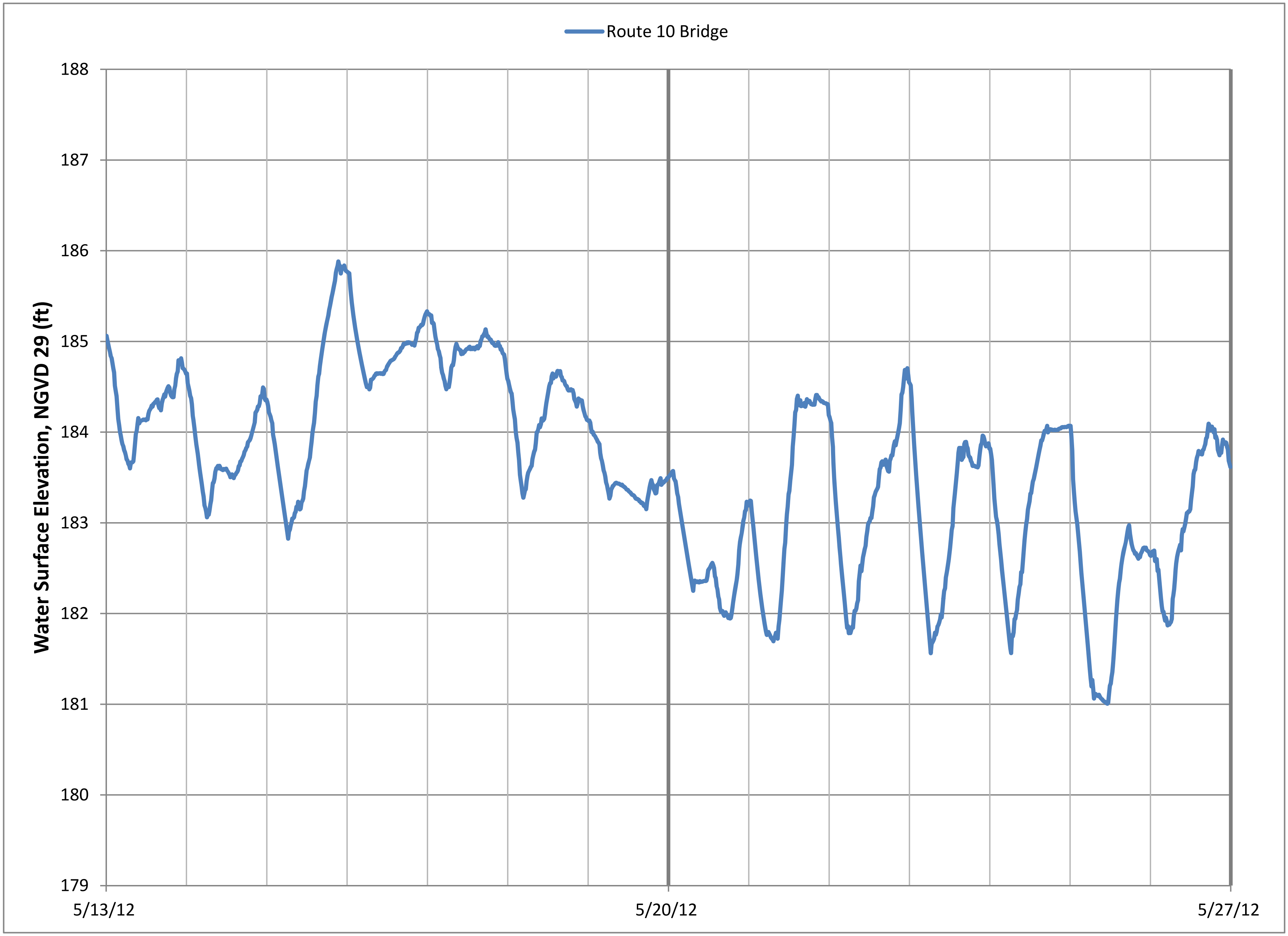
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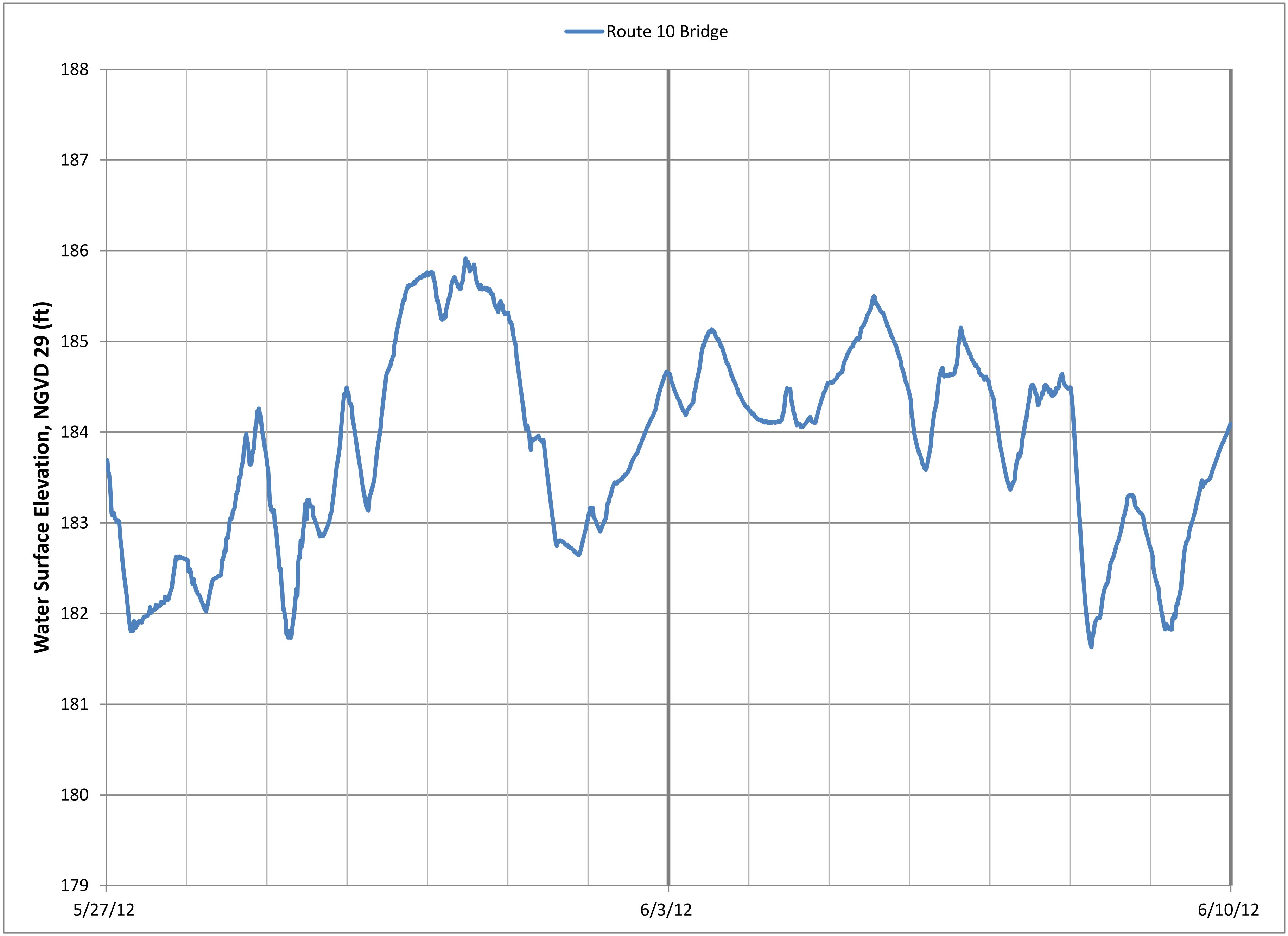

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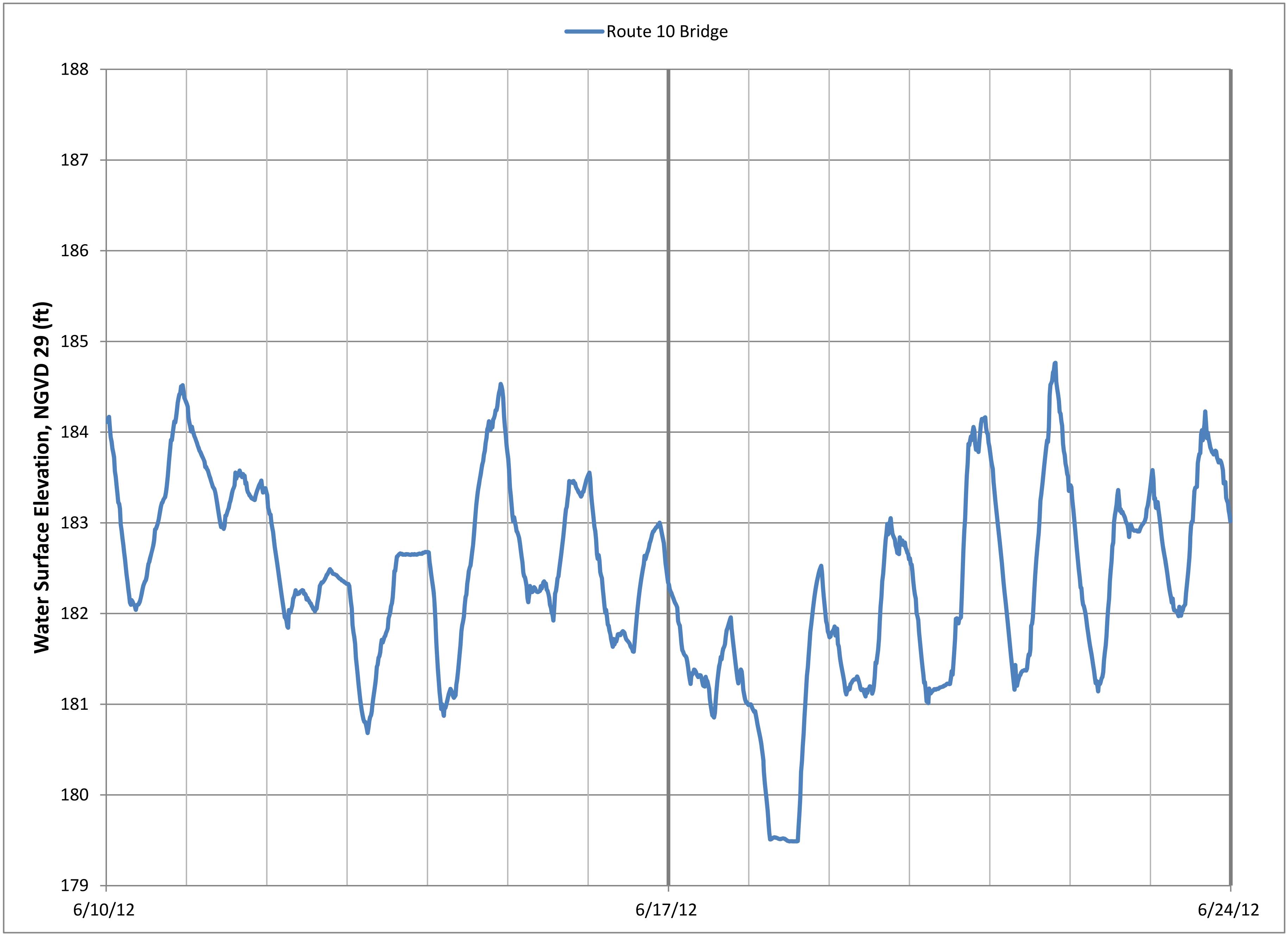
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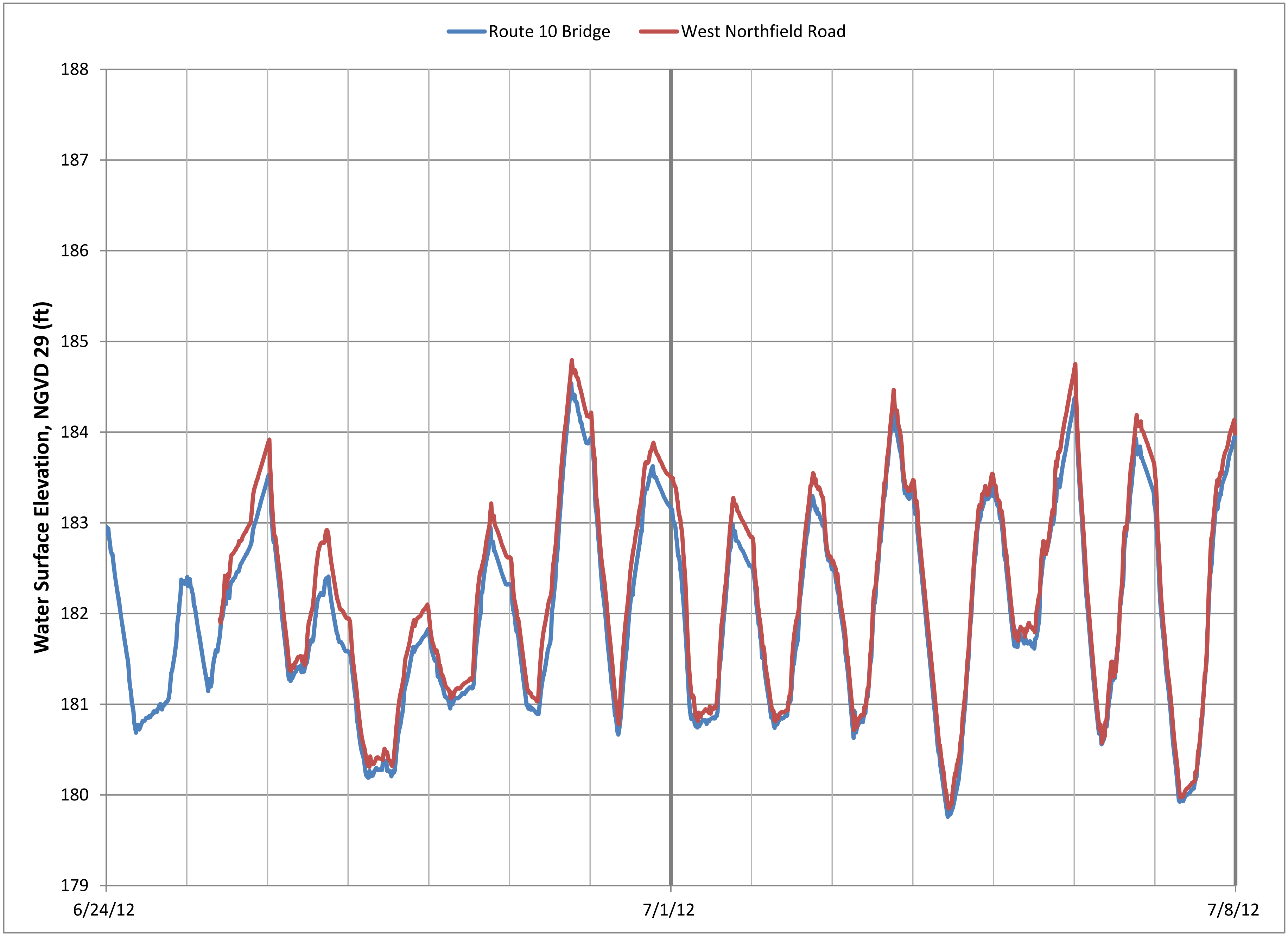

Route 10 Bridge
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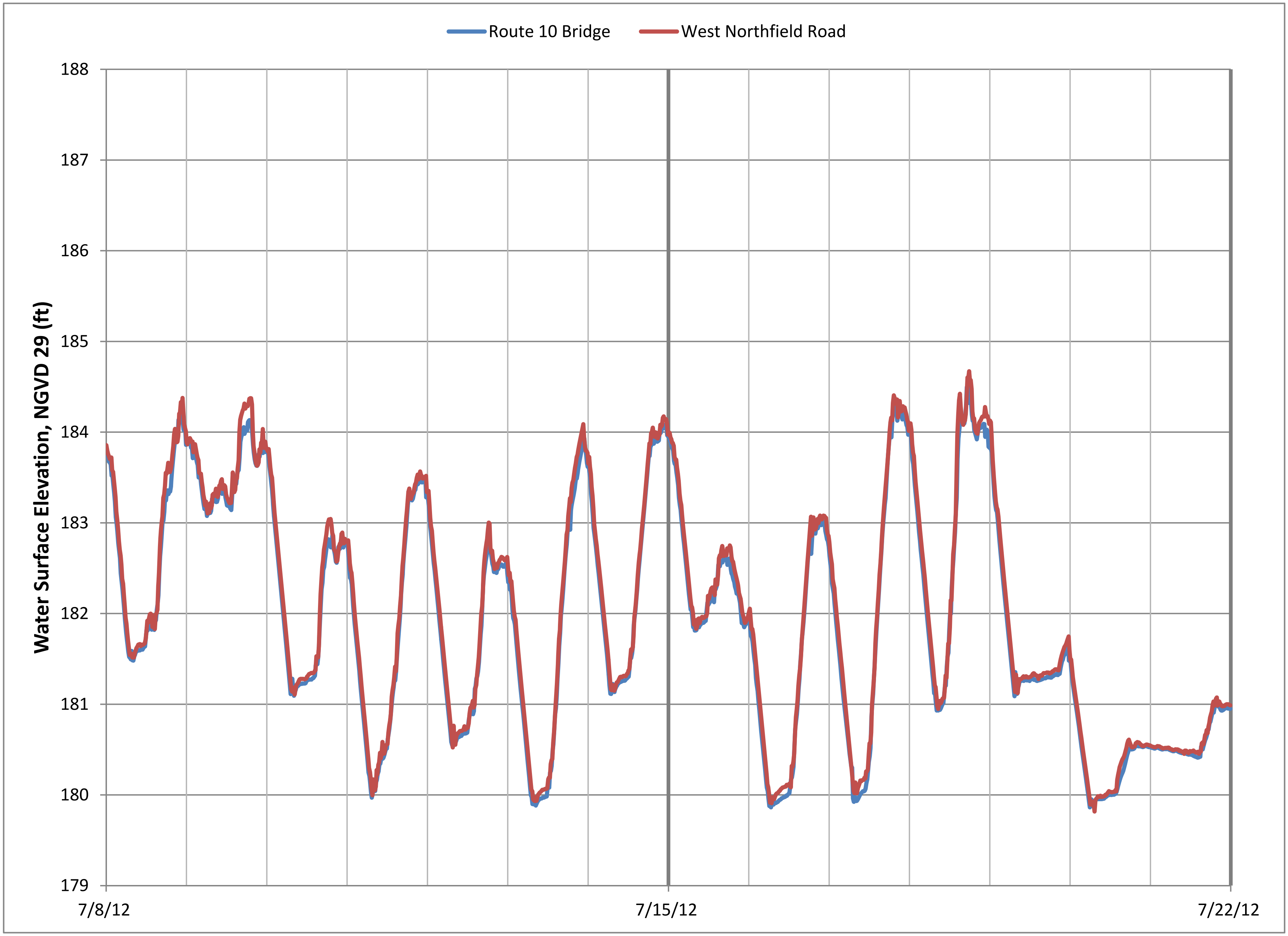
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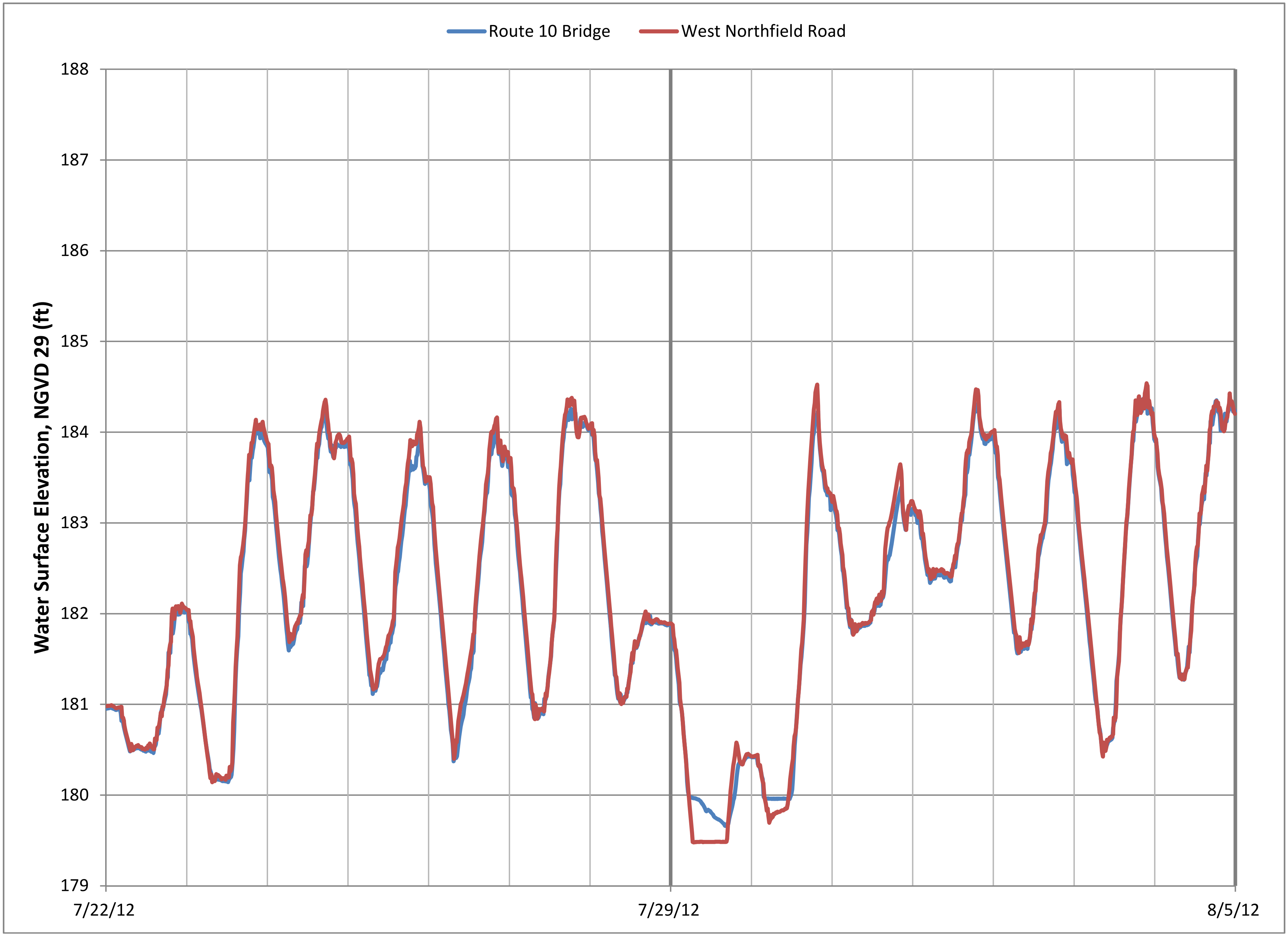

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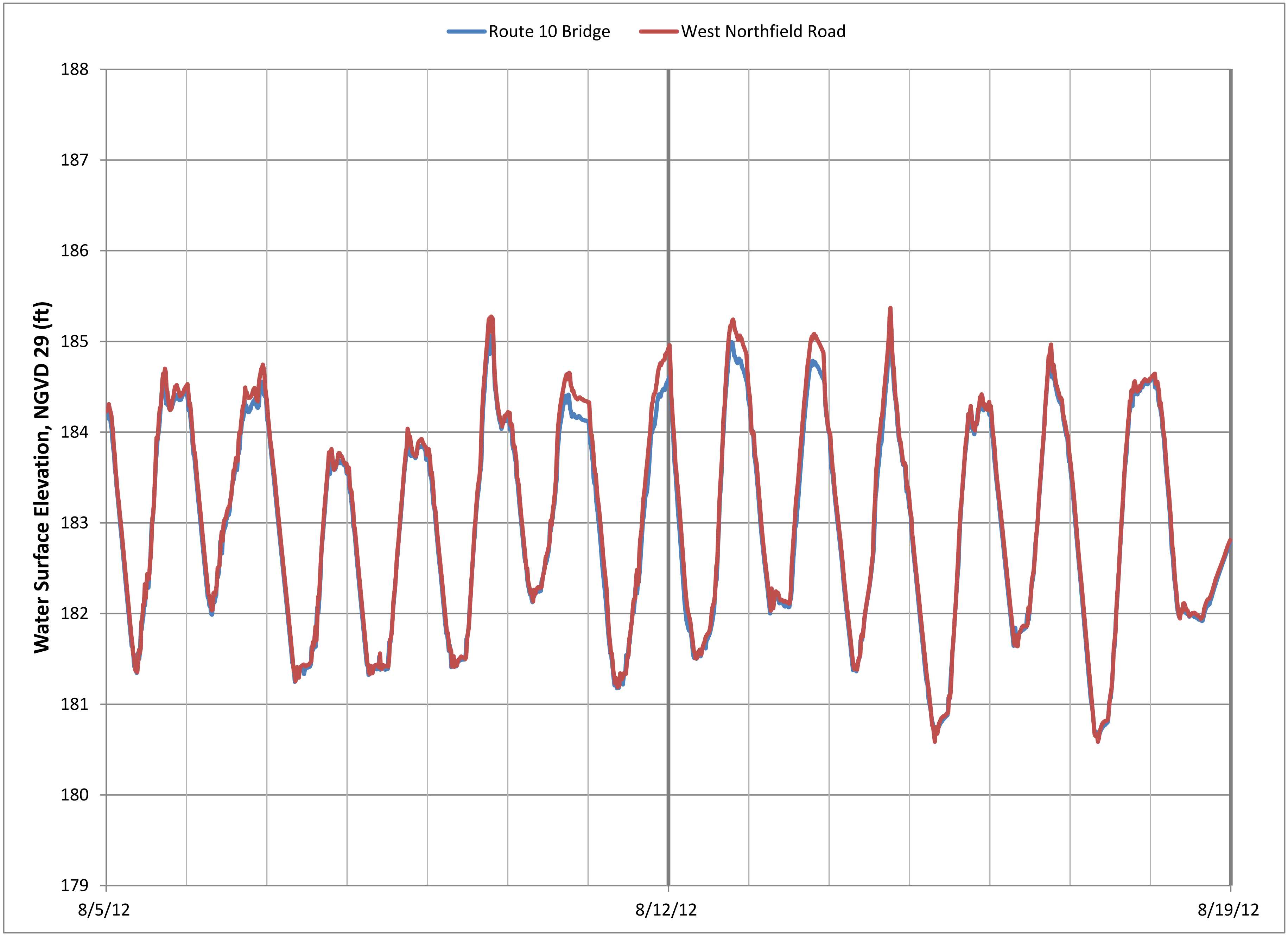

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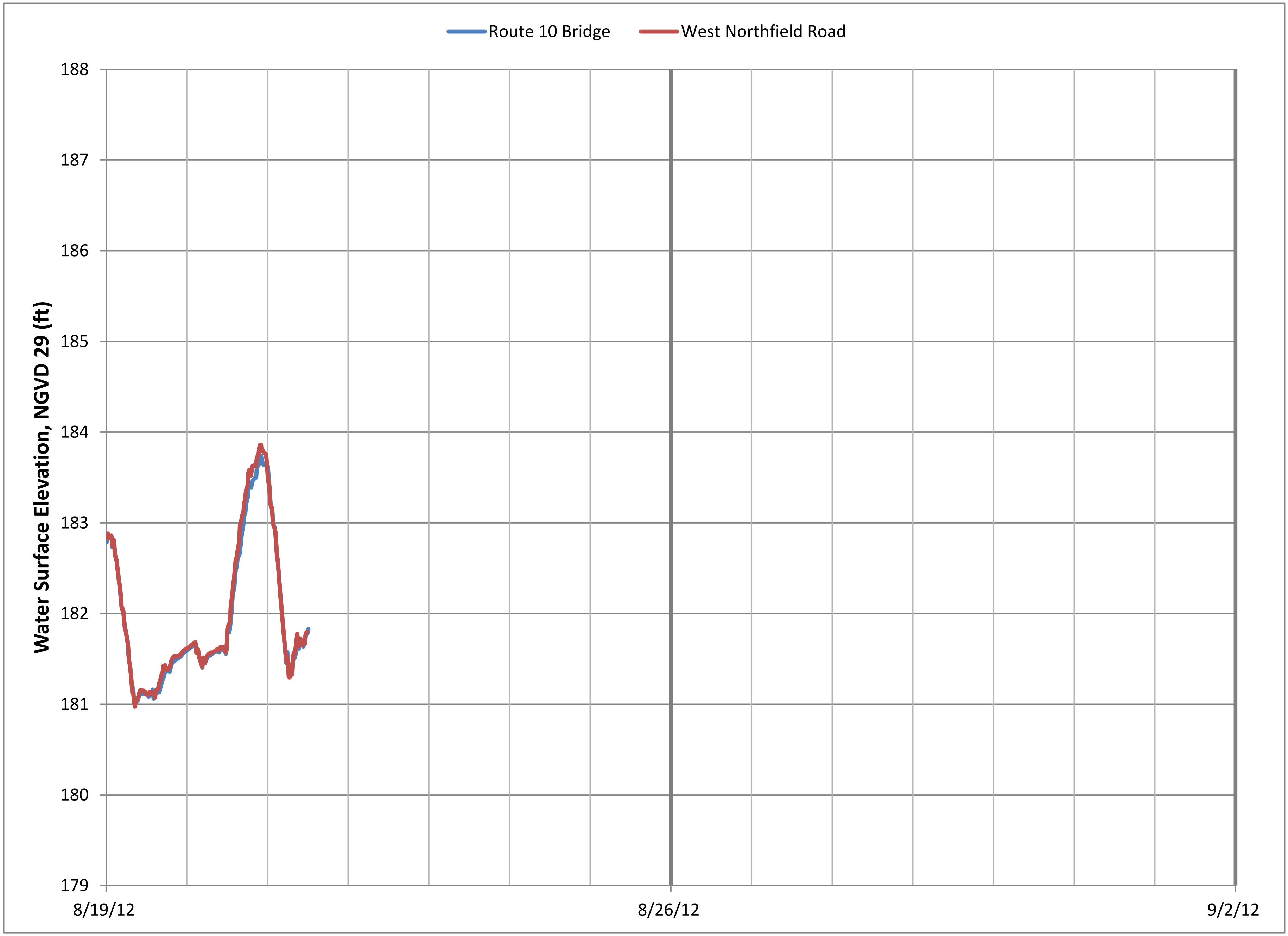
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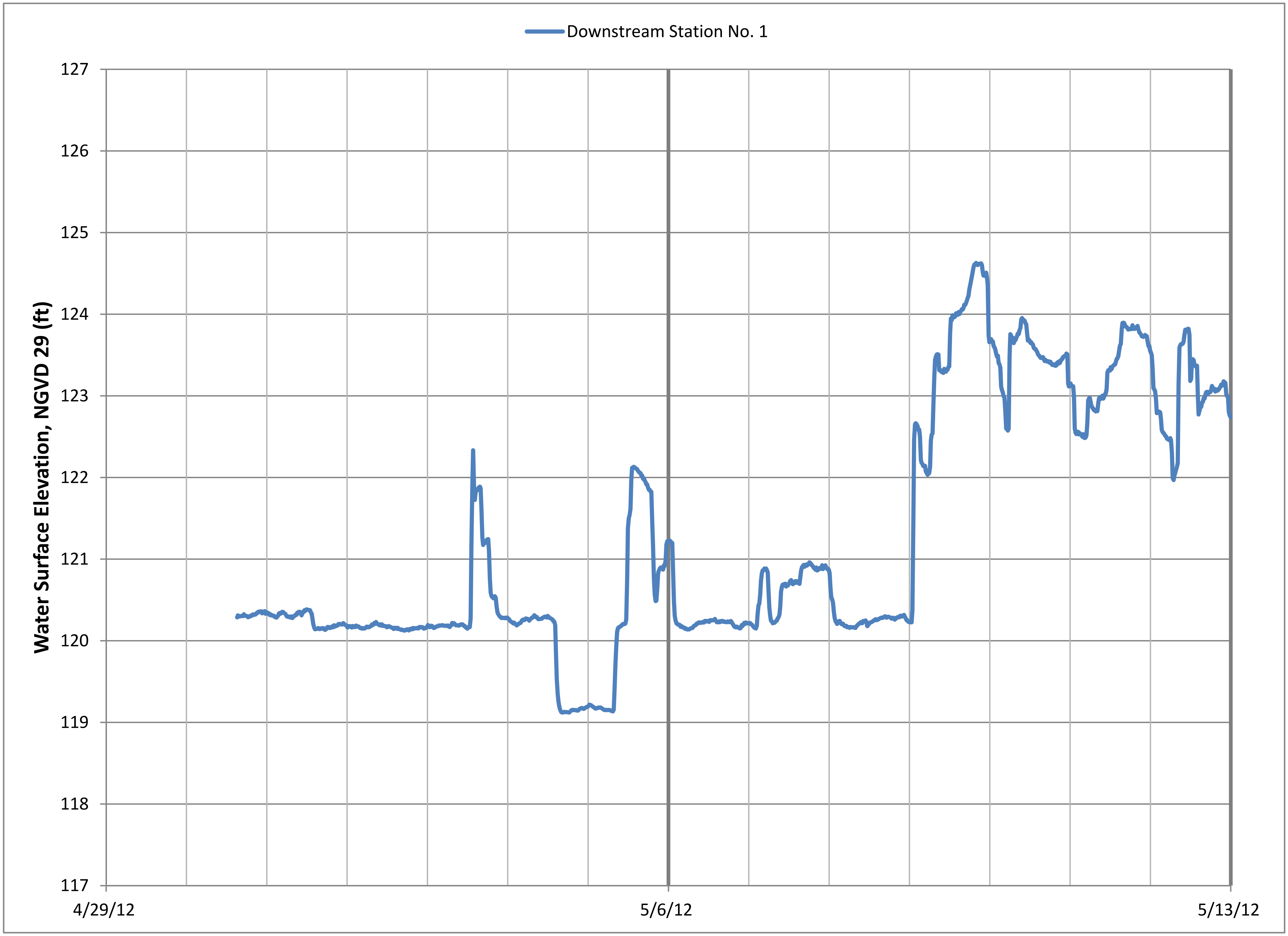
Downstream Station No. 1
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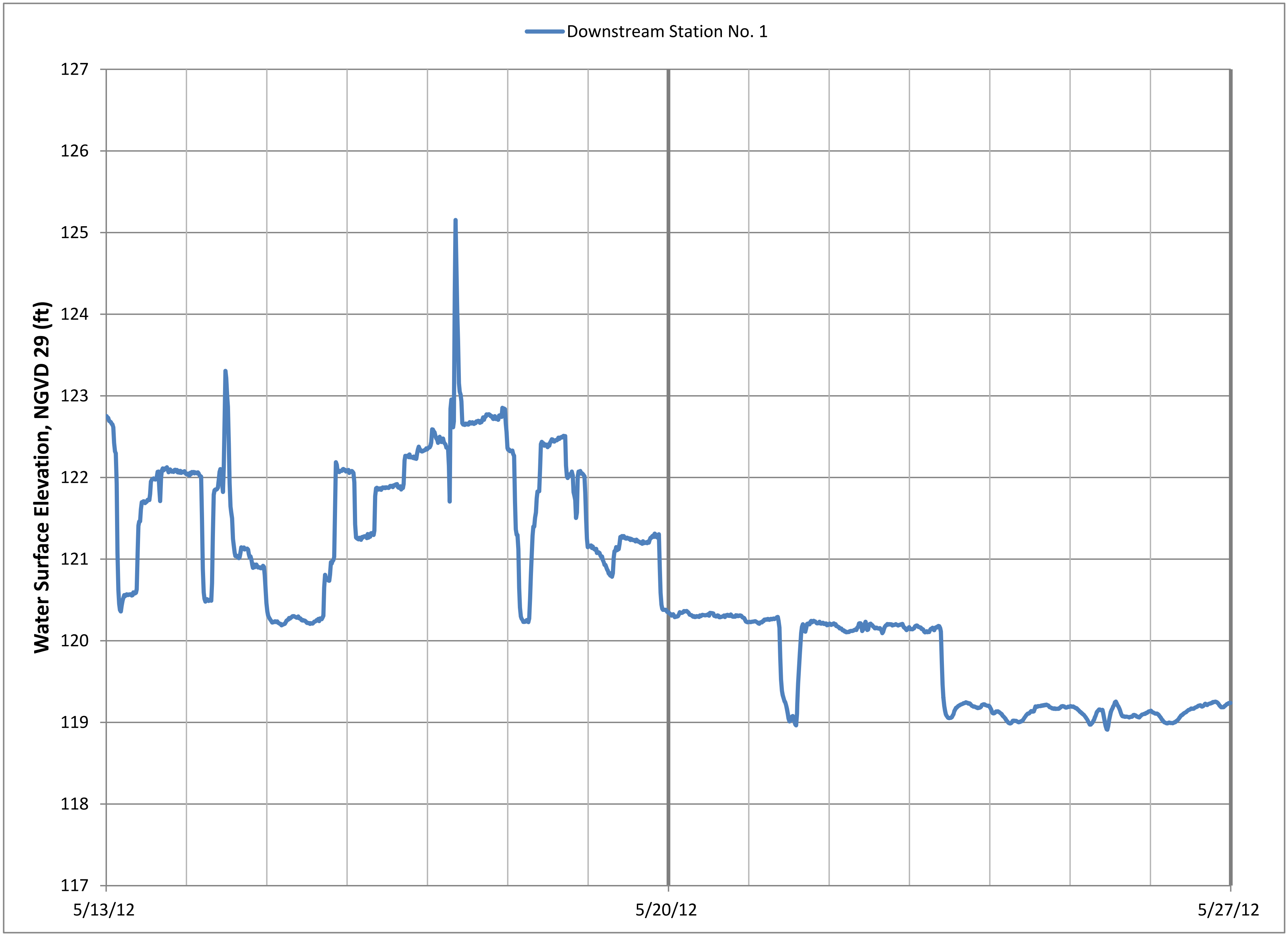

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Water Surface Elevation, NGVD 29 (ft)
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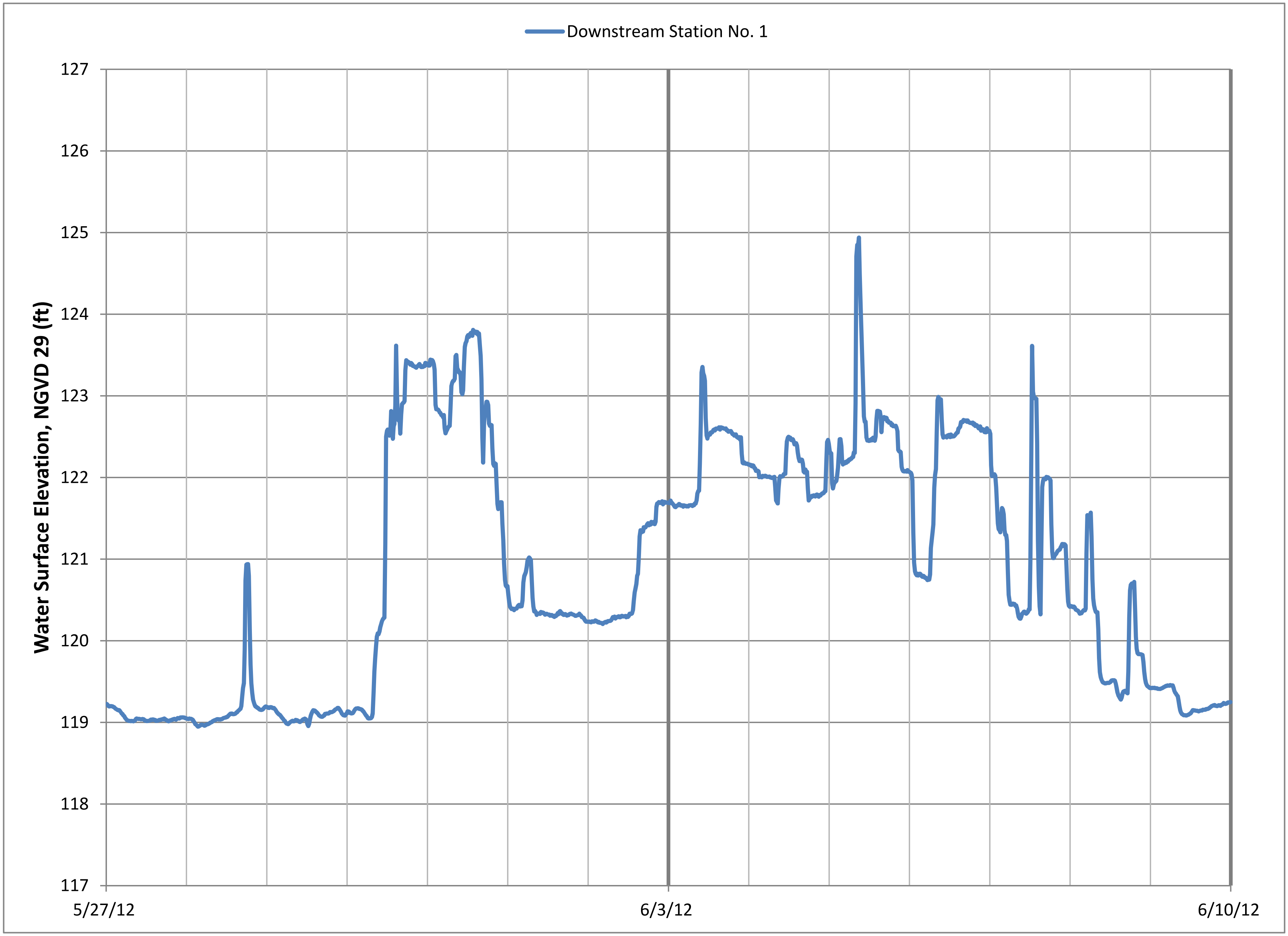

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Water Surface Elevation, NGVD 29 (ft)
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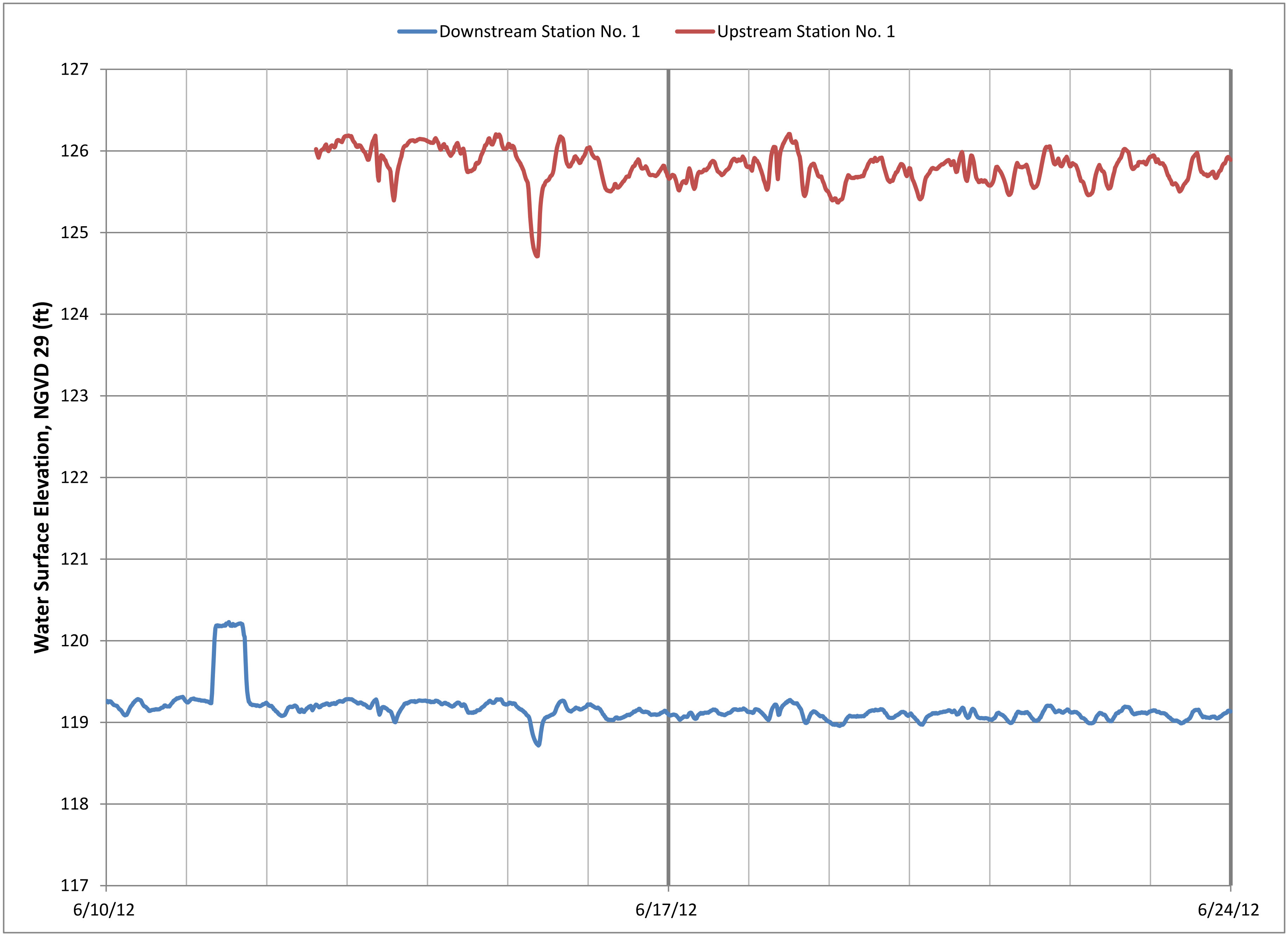
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Upstream Station No. 1
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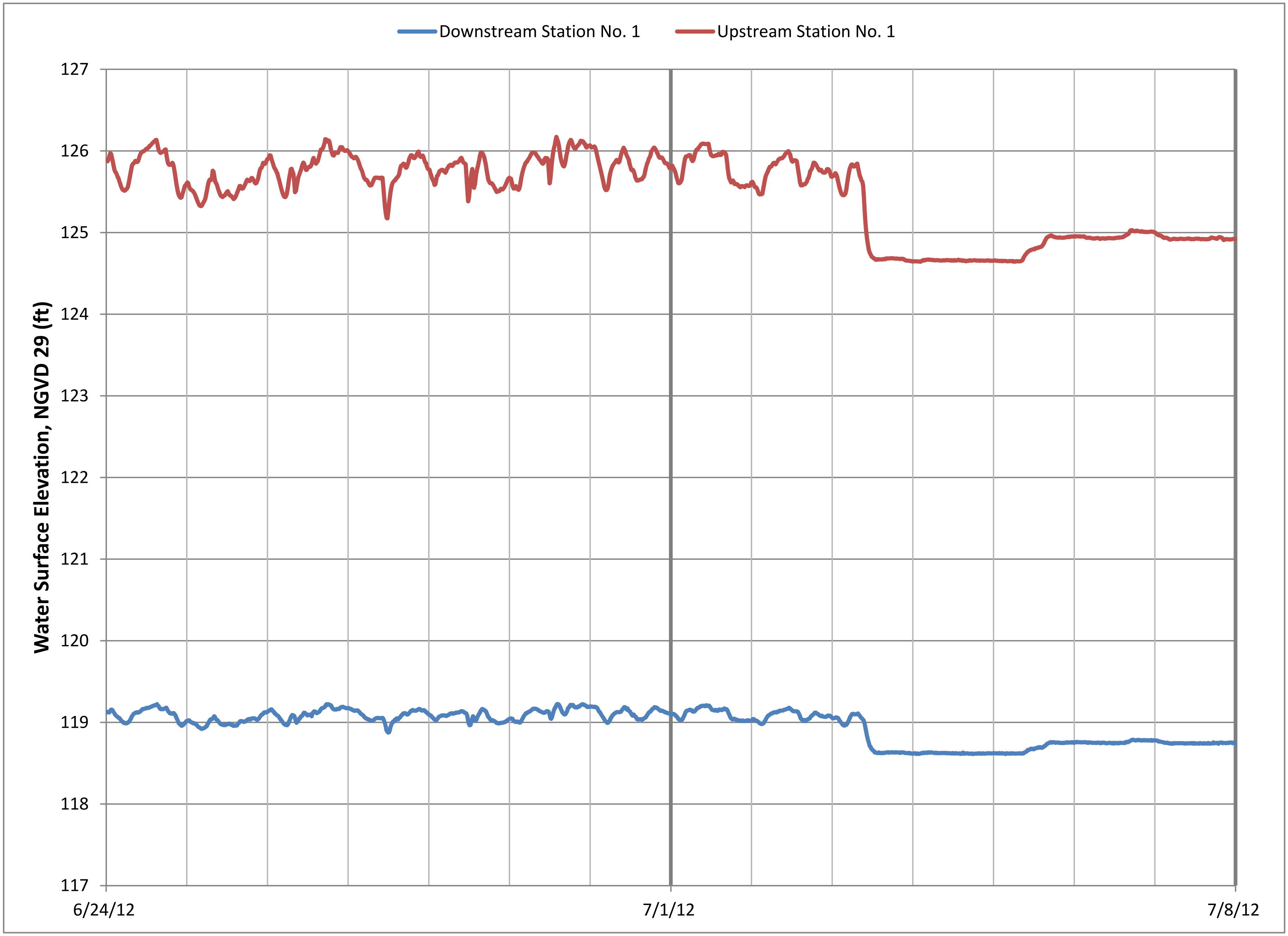

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Upstream Station No. 1
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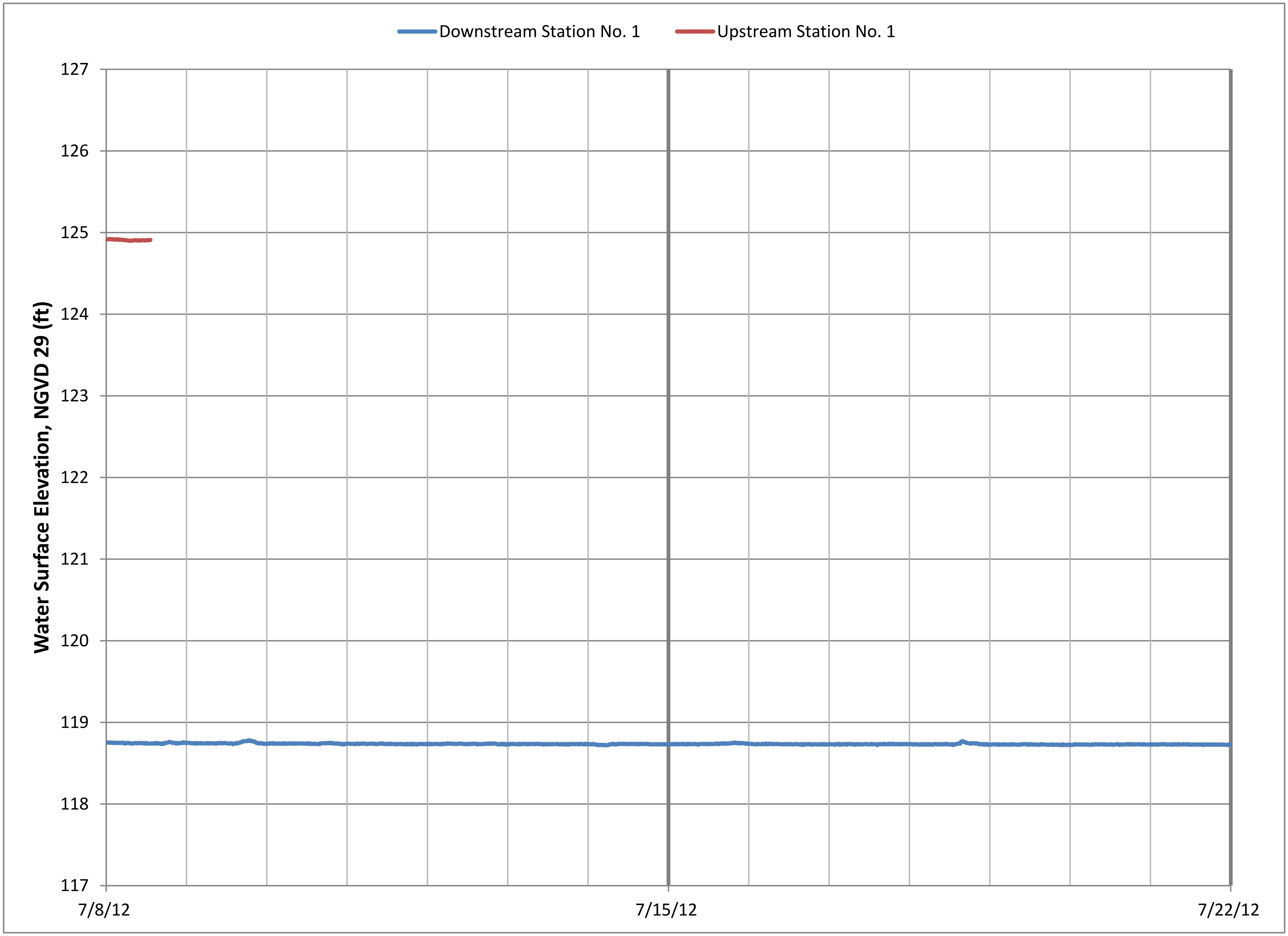

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Upstream Station No. 1
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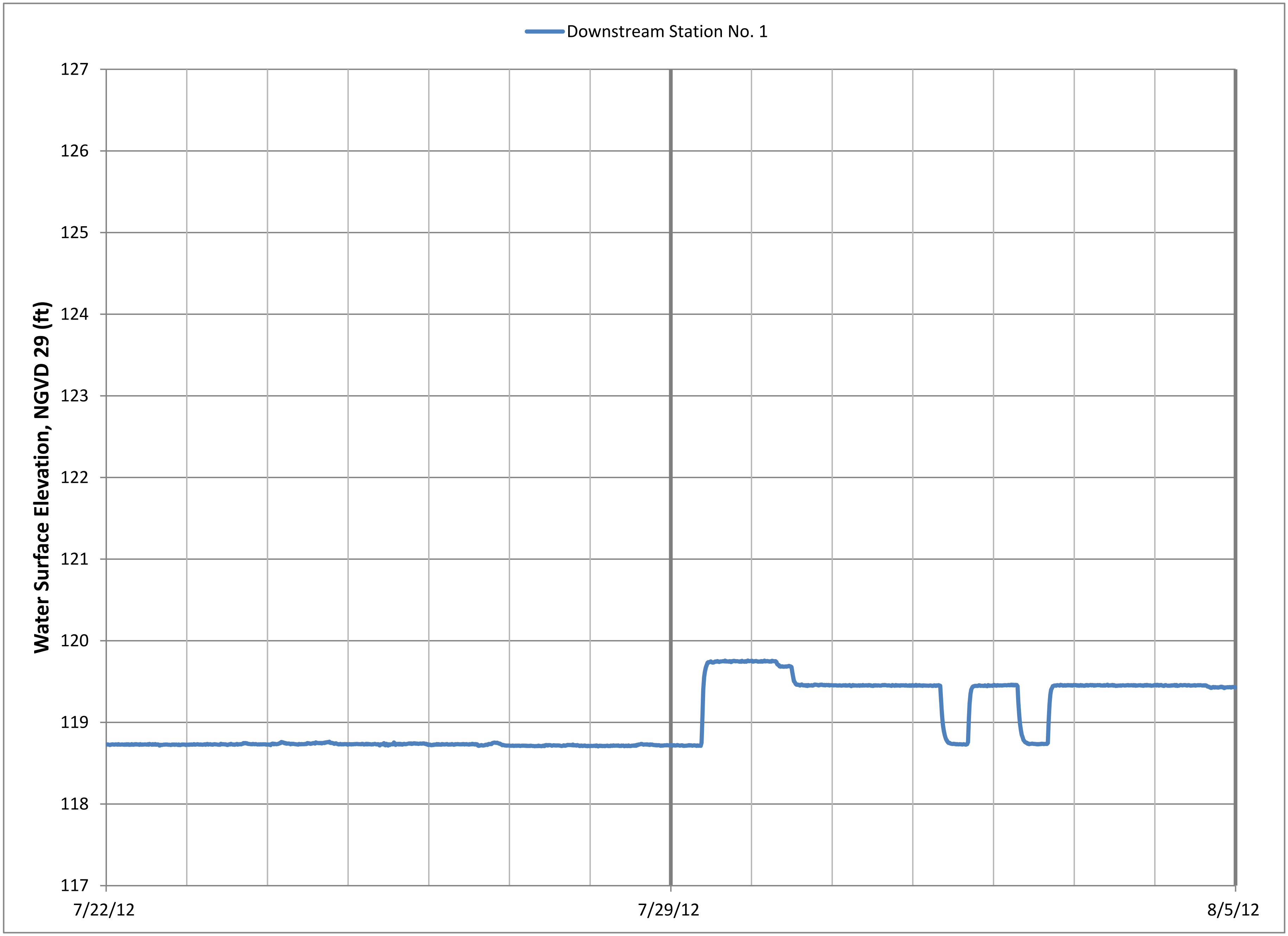

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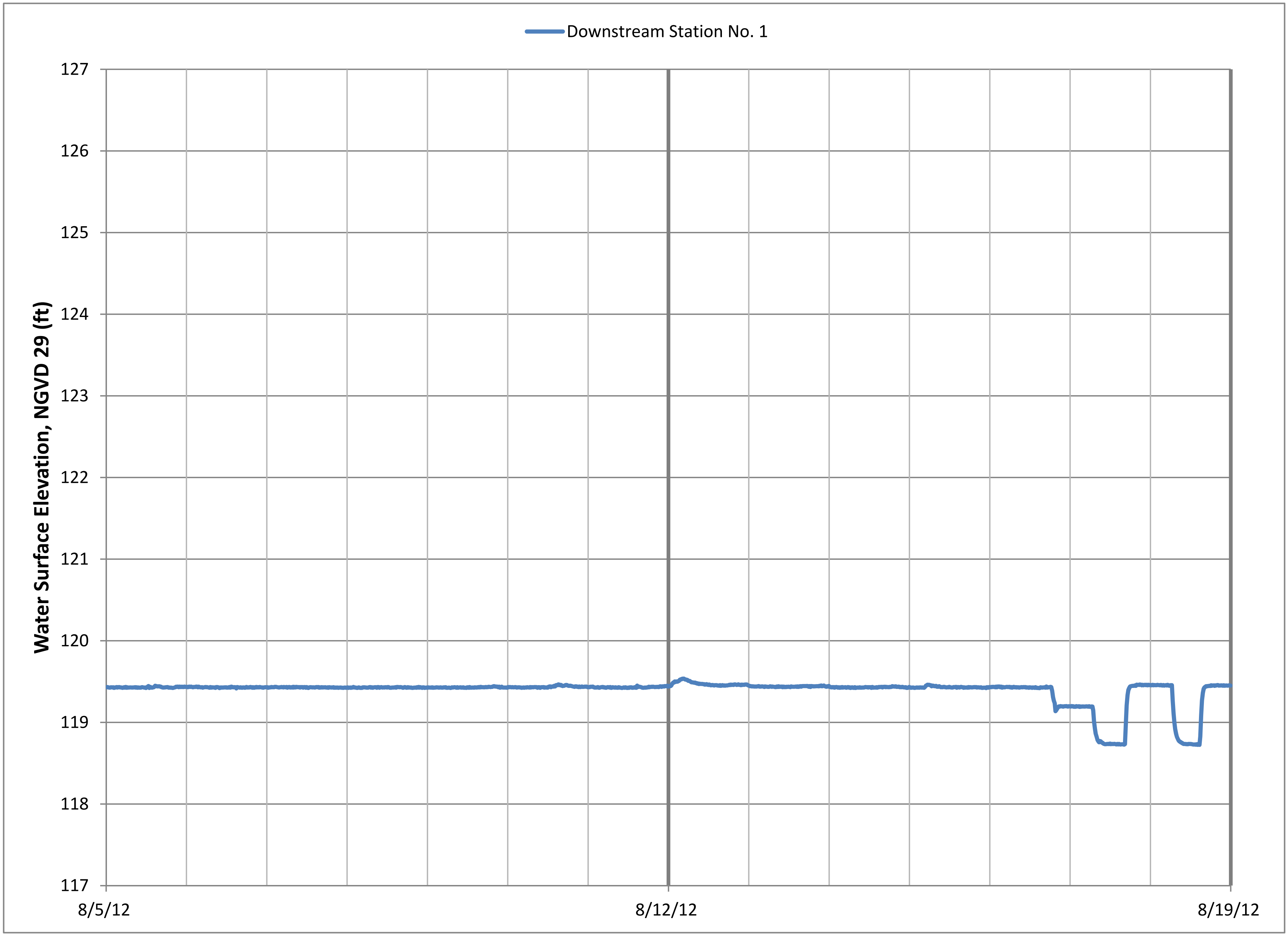
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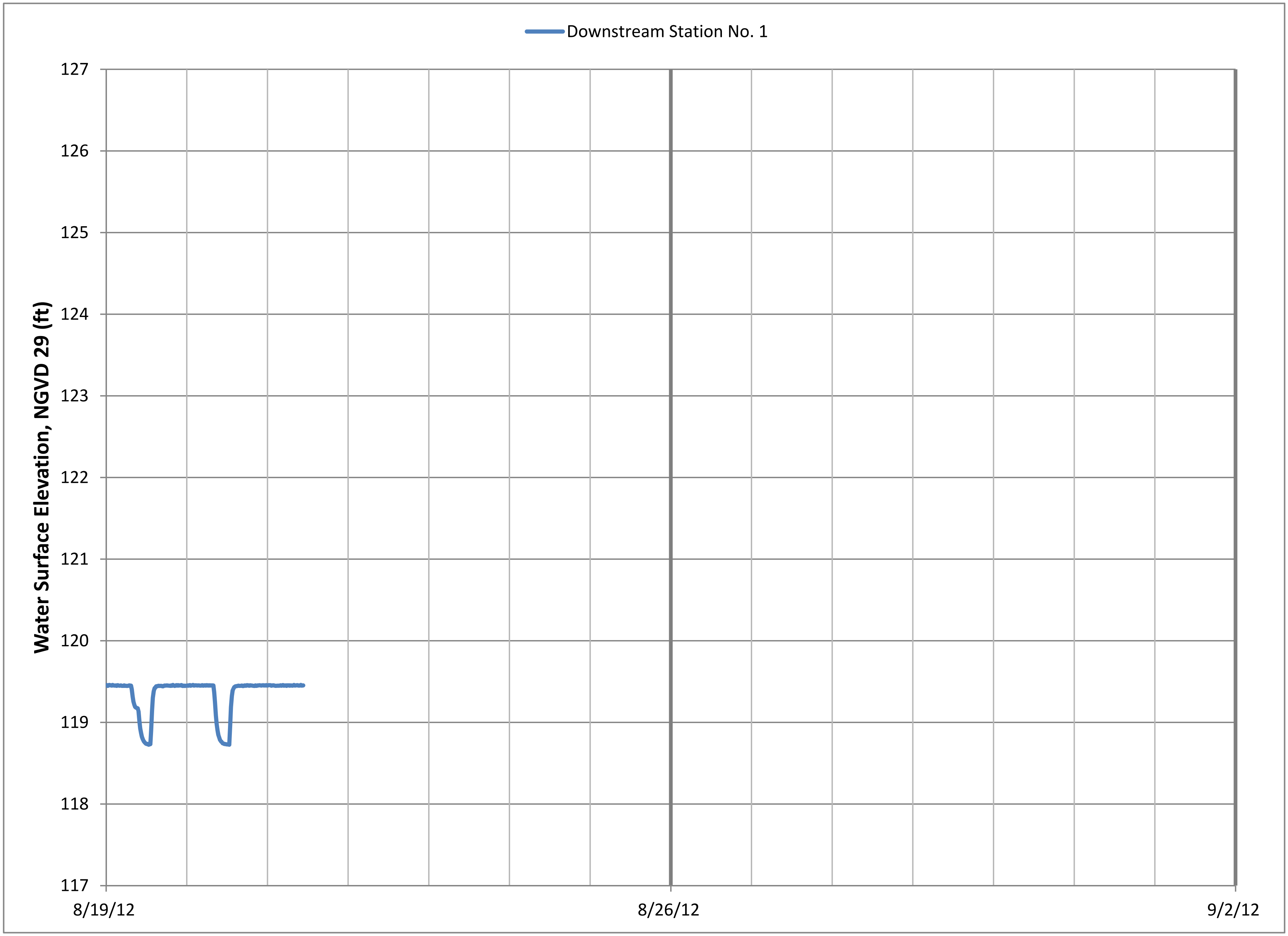
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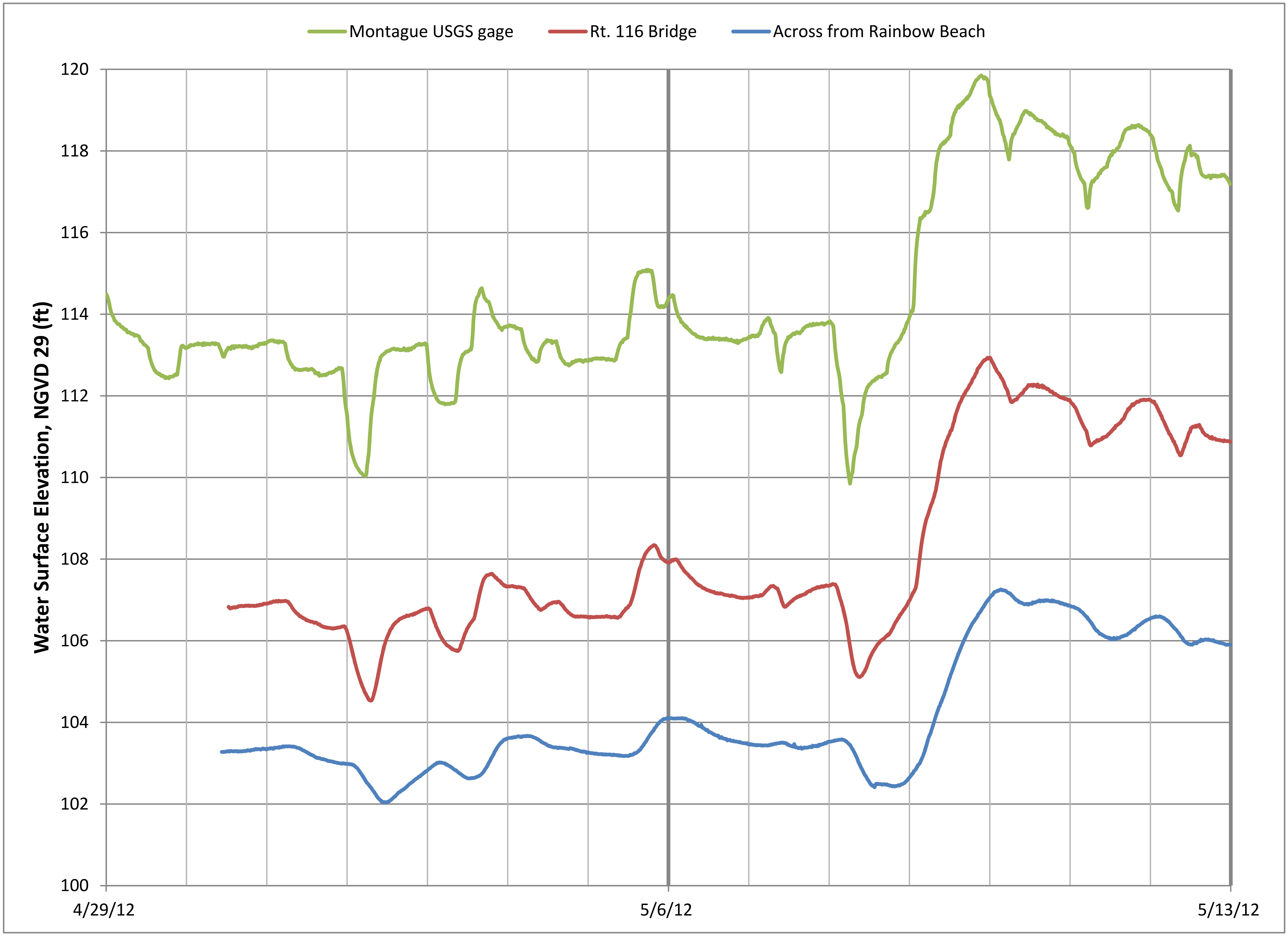
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Rt. 116 Bridge
Across from Rainbow Beach
Water Surface Elevation, NGVD 29 (ft)
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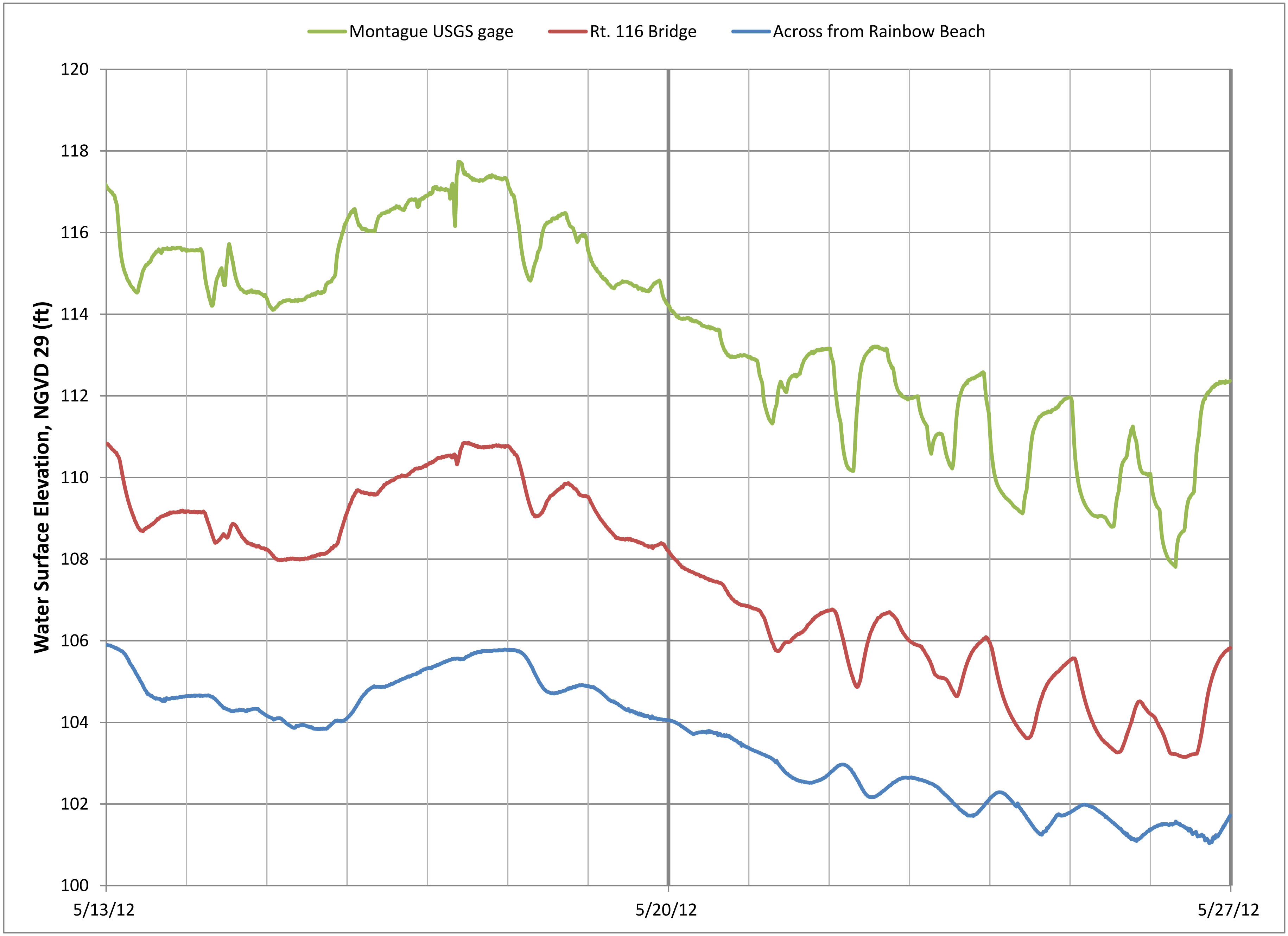
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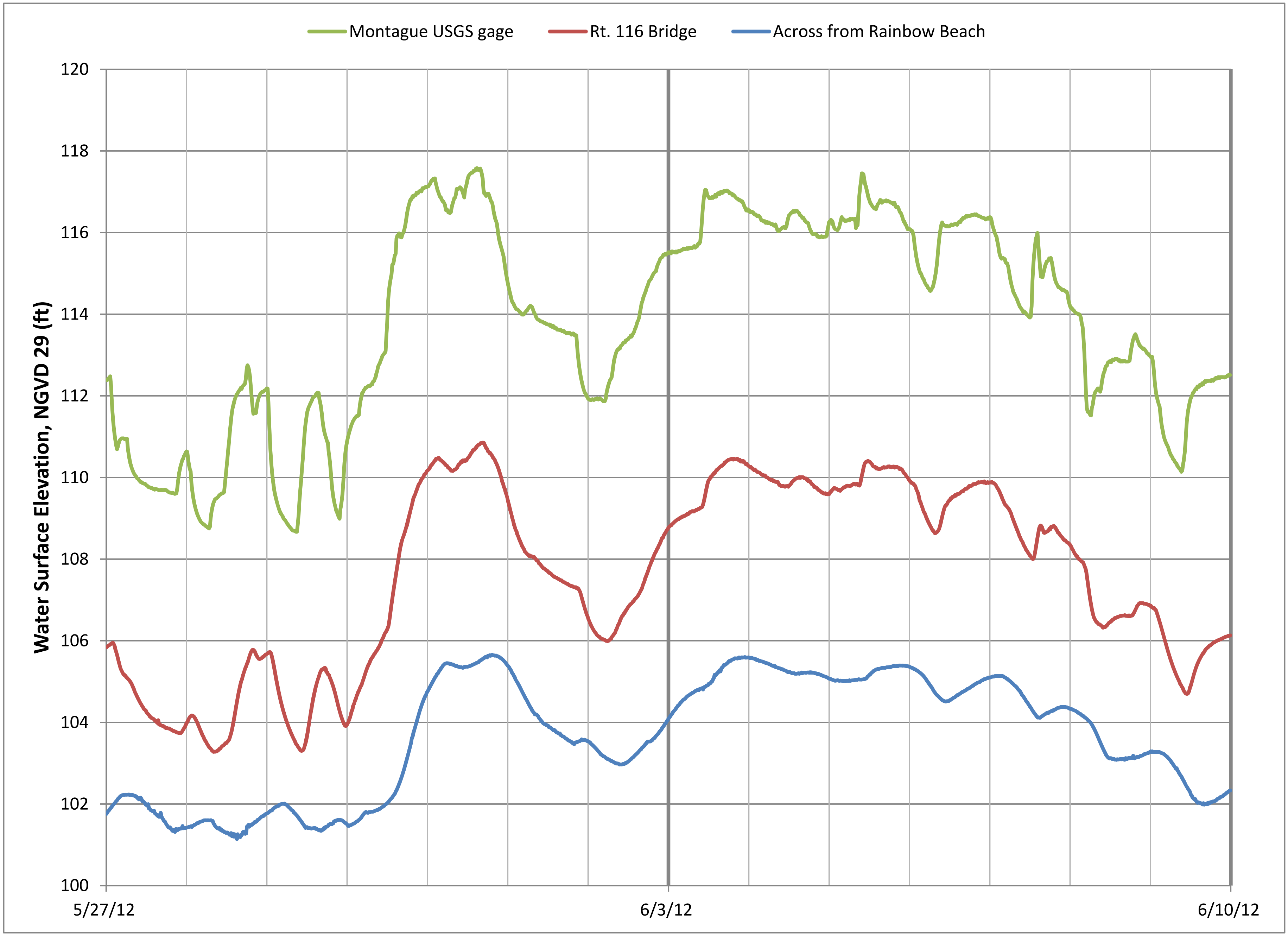
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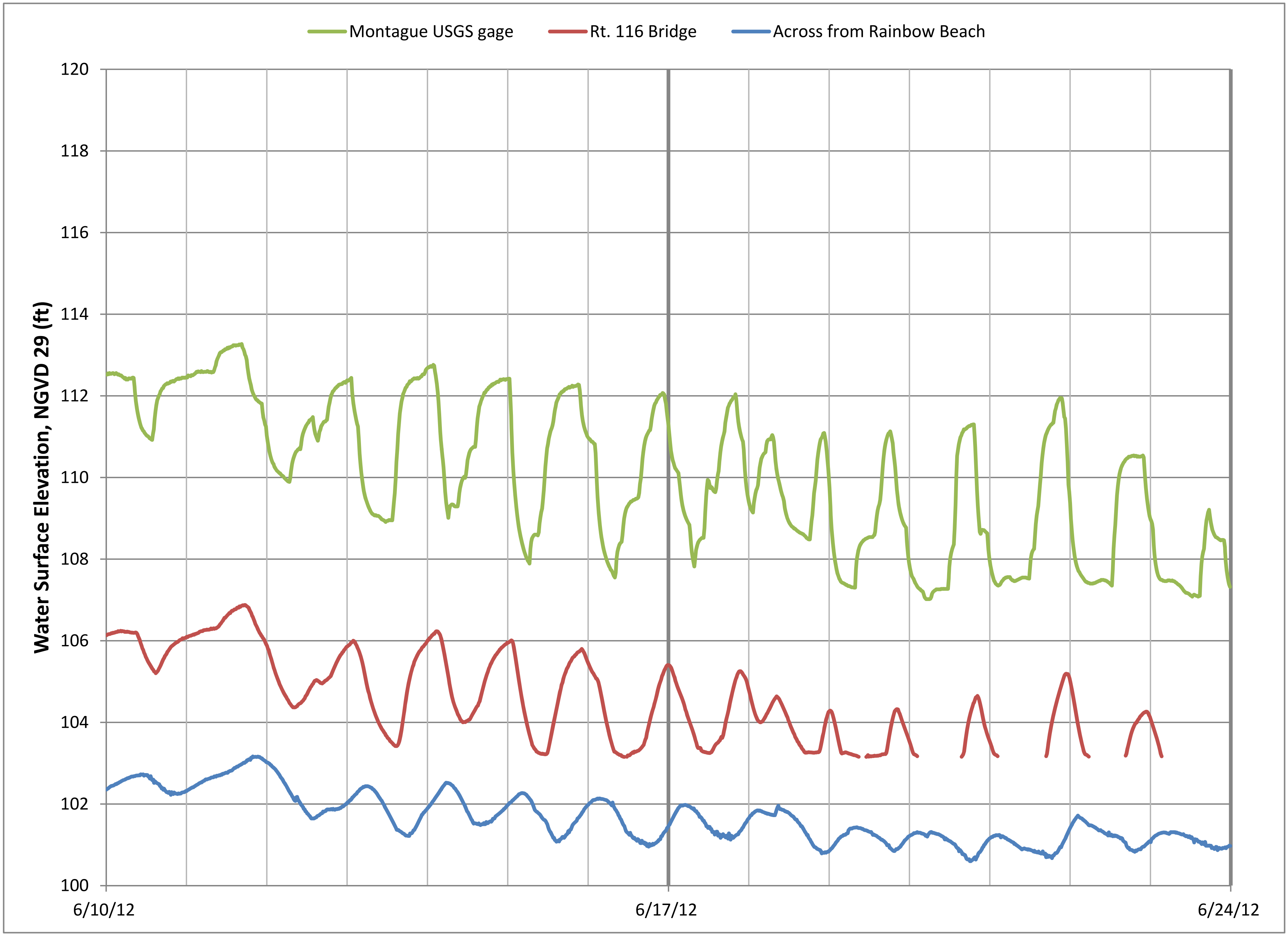

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Across from Rainbow Beach
Water Surface Elevation, NGVD 29 (ft)
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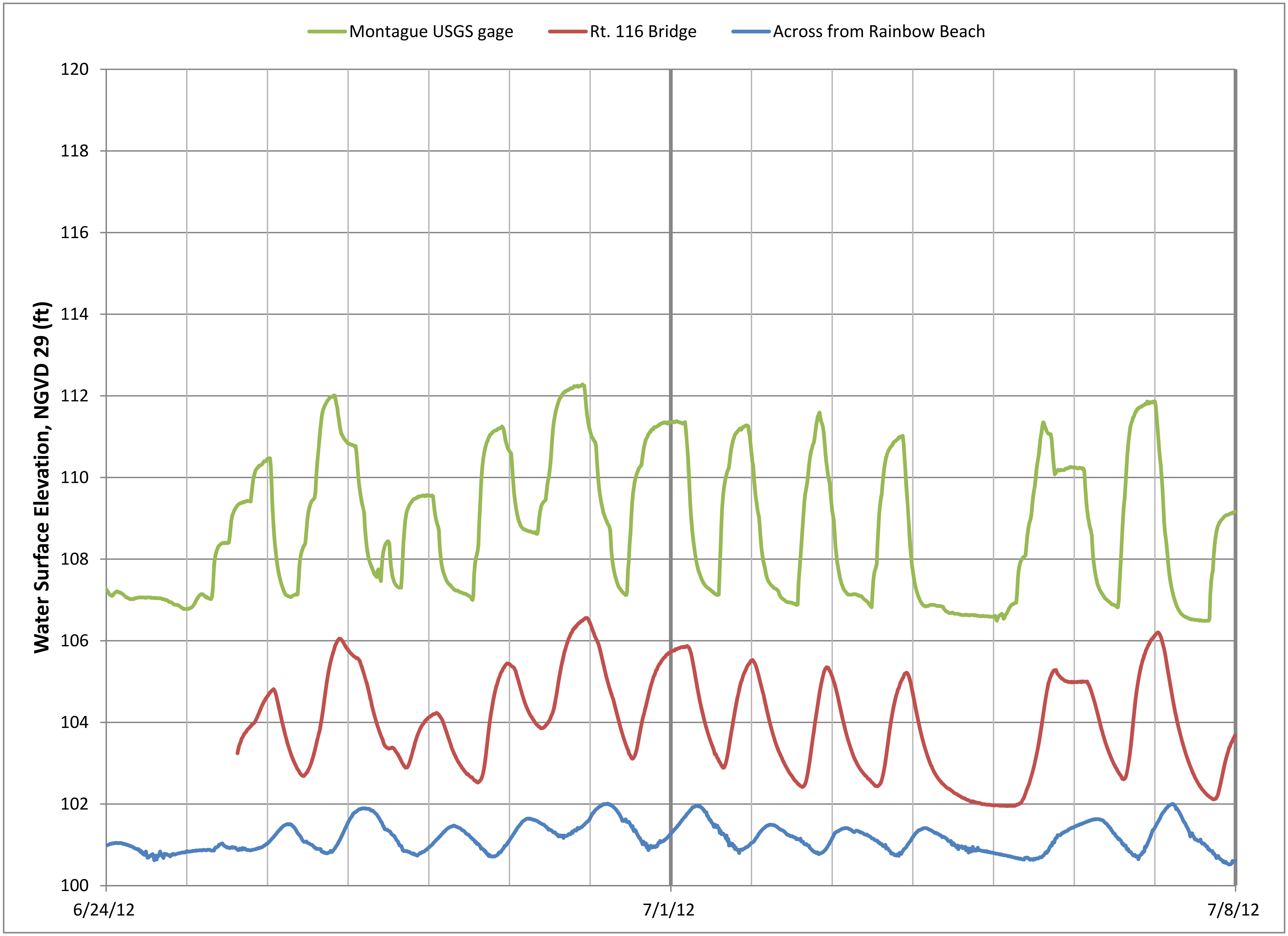

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Across from Rainbow Beach
Water Surface Elevation, NGVD 29 (ft)
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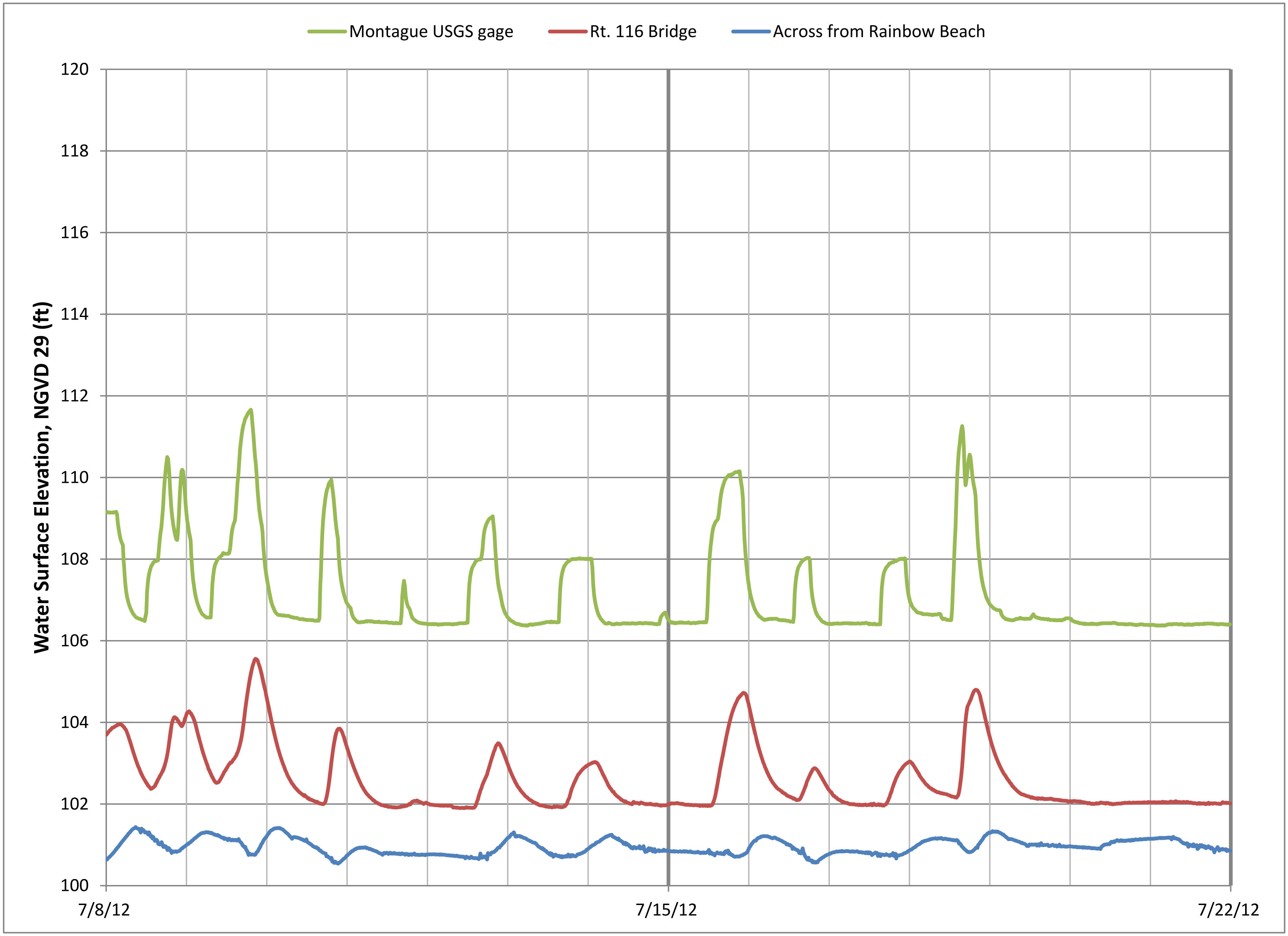
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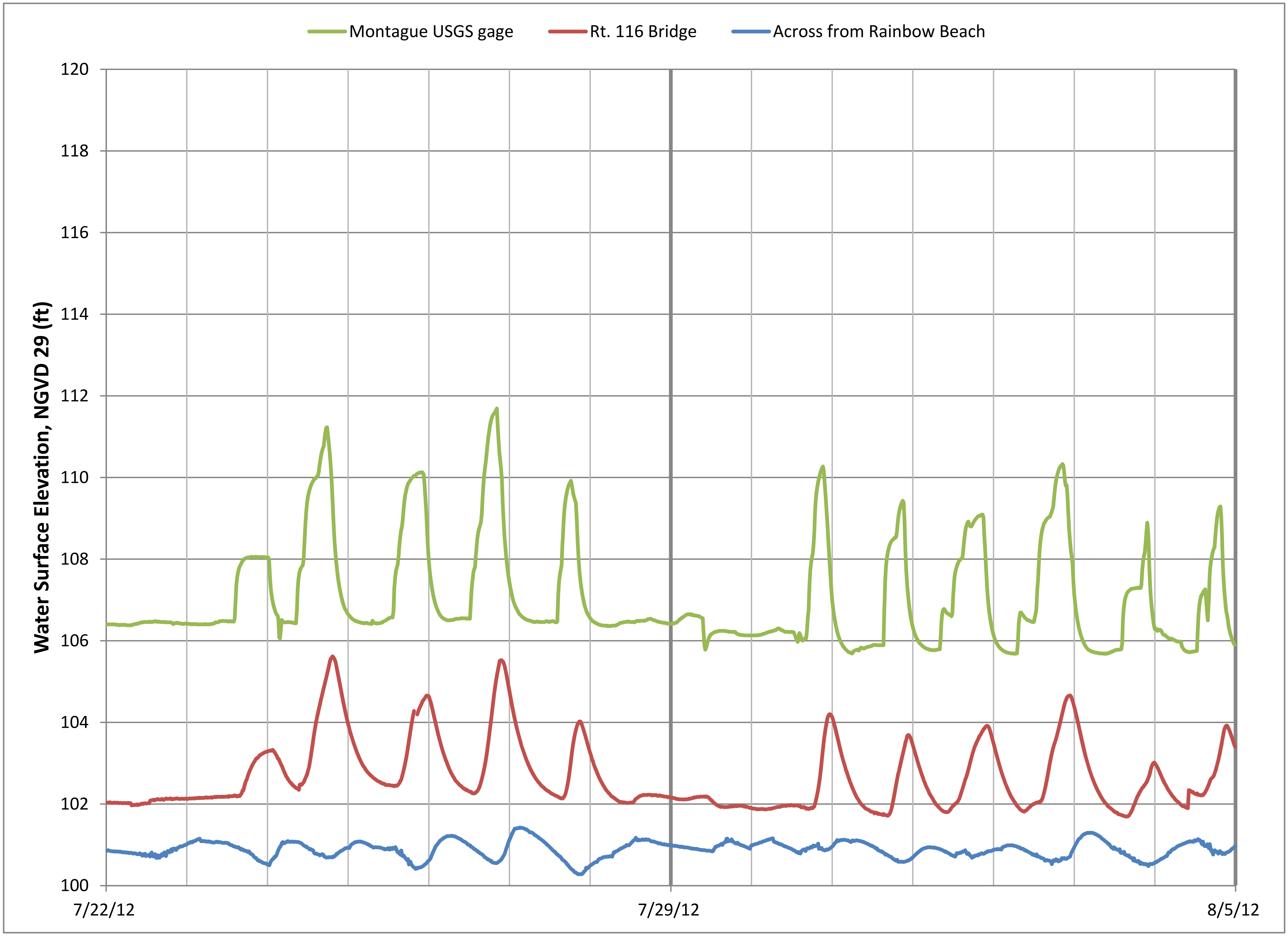

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Across from Rainbow Beach
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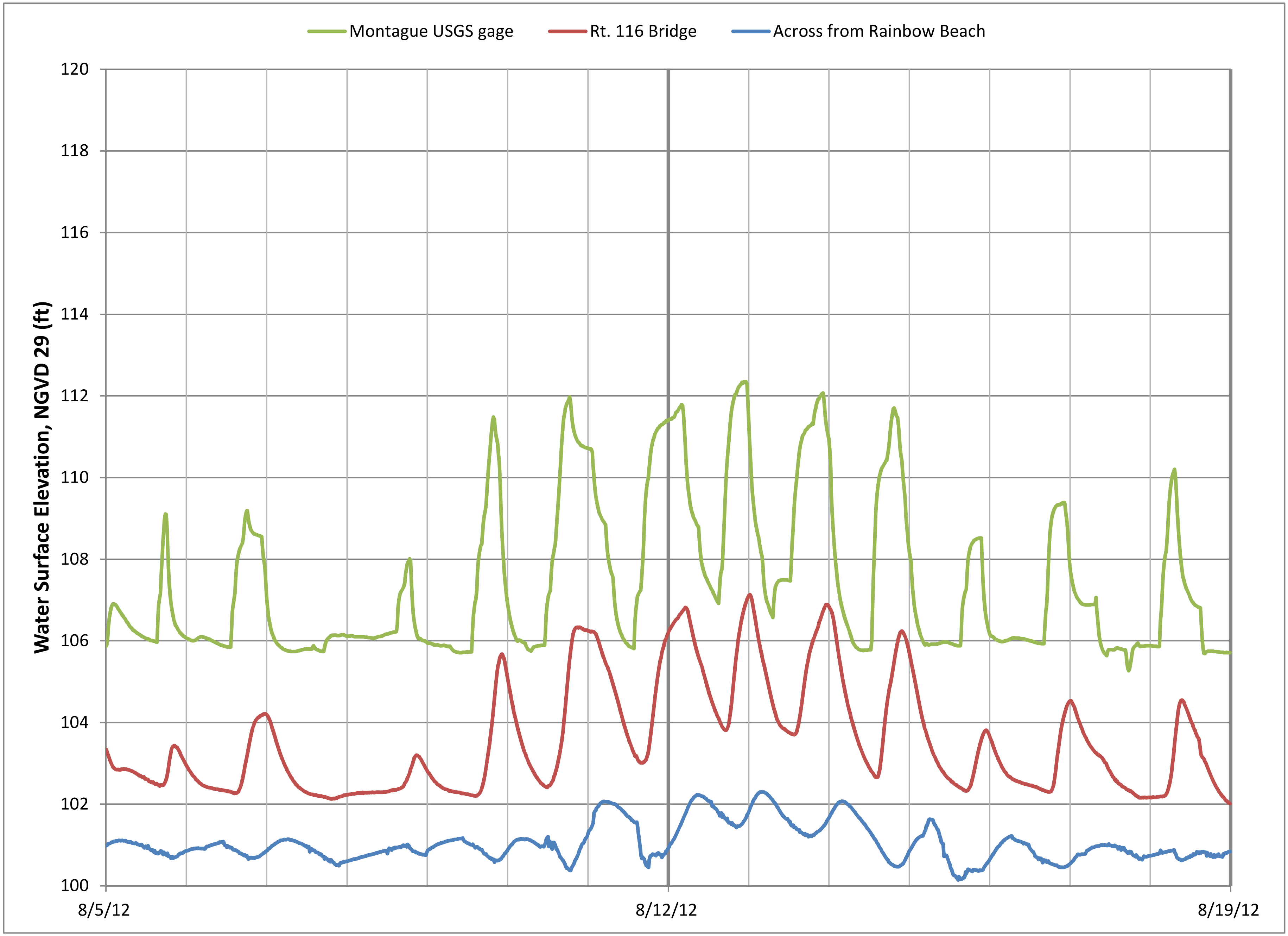

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Across from Rainbow Beach
Water Surface Elevation, NGVD 29 (ft)
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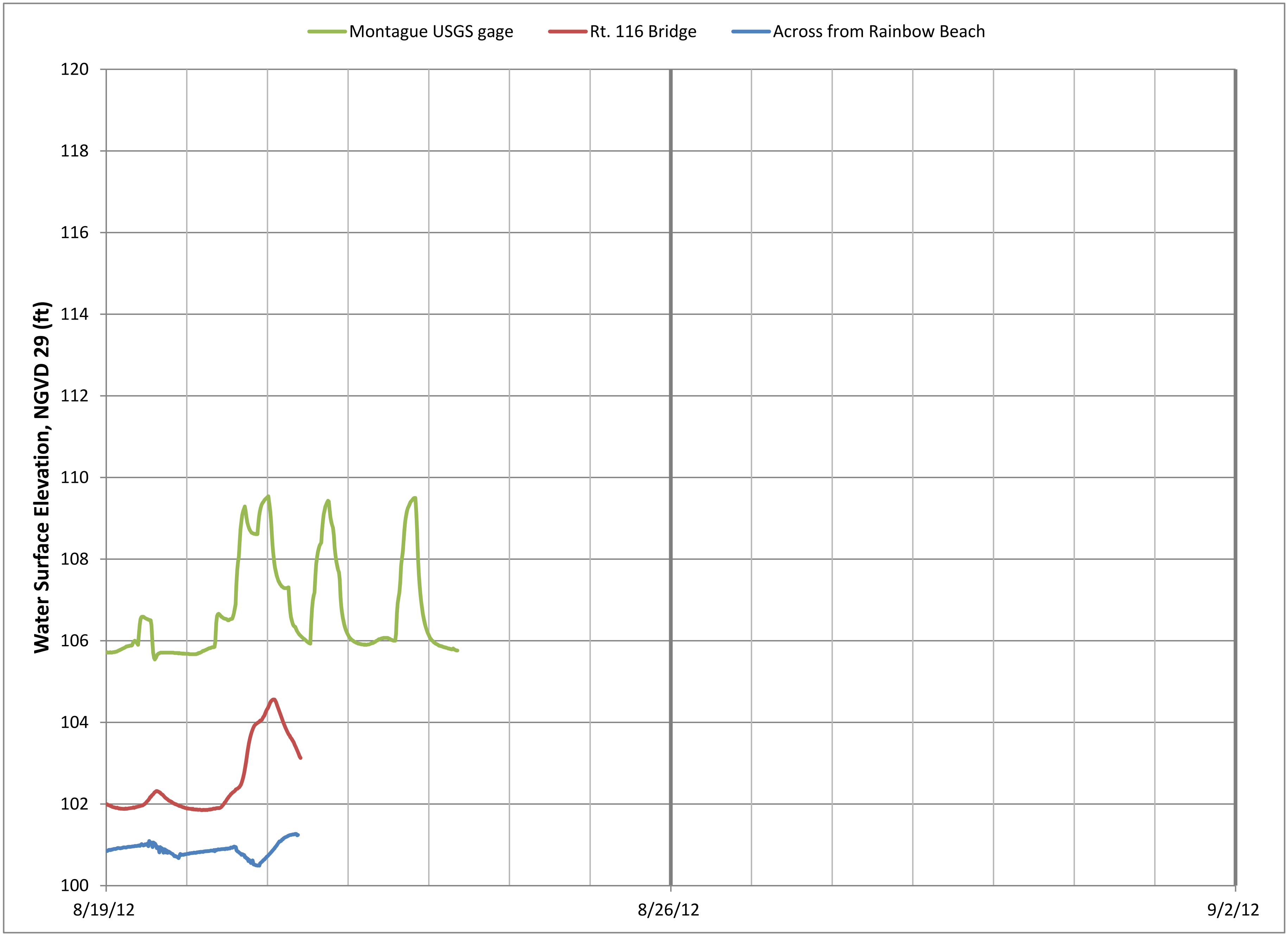
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Rt. 116 Bridge
Across from Rainbow Beach
Water Surface Elevation, NGVD 29 (ft)
120
118
116
114
112
110
108
106
104
102
100
8/19/12
8/26/12
9/2/12

APPENDIX F – List of Mammals and Bird Species Likely to Occur in the Northfield Mountain Pumped Storage Project and Turners Falls Hydroelectric Project Area

Mammals

Common Name	Scientific name
Virginia oppossum	*Didelphis virginiana*
Masked shrew	*Sorex cinereus*
Water shew	*Sorex palustris*
Smoky shrew	*Sorex fumeus*
Long-tailed shew	*Sorex dispar*
Northern short-tailed shrew	*Blarina brevicauda*
Hairy-tailed mole	*Parascalops breweri*
Eastern mole	*Scalopus aquaticus*
Star-nosed mole	*Condylura cristata*
Little brown bat	*Myotis lucifugus*
Keen’s myotis	*Myotis keenii*
Indiana myotis	*Myotis sodalis*
Silver-haired bat	*Lasionycteris noctivagans*
Eastern pipistrelle	*Pipistrellus subflavus*
Big brown bat	*Eptesicus fuscus*
Red bat	*Lasiurus borealis*
Hoary bat	*Lasiurus cinereus*
New England cottontail	*Sylvilagus transitionalis*
Snowshoe hare	*Lepus americanus*
Eastern chipmunk	*Tamias striatus*
Woodchuck	*Marmota monax*
Gray squirrel	*Sciurus carolinensis*
Red squirrel	*Tamiasciurus hudsonicus*
Southern flying squirrel	*Glaucomys volans*
Northern flying squirrel	*Glaucomys sabrinus*
Beaver	*Castor canadensis*
Deer mouse	*Peromyscus maniculatus*
White-footed mouse	*Peromyscus leucopus*
Southern red-backed vole	*Clethrionomys gapperi*
Meadow vole	*Microtus pennsylvanicus*
Woodland vole	*Microtus pinetorum*
Muskrat	*Ondatra zibethicus*
Southern bog lemming	*Synaptomys cooperi*
Norway rat	*Rattus norvegicus*
House mouse	*Mus musculus*
Meadow jumping mouse	*Zapus hudsonius*
Woodland jumping mouse	*Napaeozapus insignis*
Coyote	*Canis latrans*
Red fox	*Vulpes vulpes*
Gray fox	*Urocyon cinereoargenteus*
Black bear	*Ursus americanus*
Raccoon	*Procyon lotor*

Common Name	Scientific name
Fisher	*Martes pennanti*
Ermine	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
Mink	*Mustela vison*
Striped skunk	*Mephitis mephitis*
River otter	*Lutra canadensis*
Bobcat	*Felix rufus*
White-tailed deer	*Odocoileus virginianus*

Birds

Common Name	Scientific Name
Waterfowl	
Canada goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
American black duck	*Anas rubripes*
Gadwall	*Anas strepera*
Common goldeneye	*Bucephala clangula*
Common merganser	*Mergus merganser*
Hooded merganser	*Lophodytes cucullatus*
Other Water-dependent birds	
Common loon	*Gavia immer*
Red-necked grebe	*Podiceps grisegena*
Pied-billed grebe	*Podilymbus podiceps*
Double-creasted cormorant	*Phalacrocorax auritus*
Least bittern	*Ixobrychus exilis*
American bittern	*Botaurus lentiginosus*
Black-crowned night-heron	*Nycticorax nycticorax*
Green-backed heron	*Butorides striatu*
Great blue heron	*Ardea herodias*
American coot	*Fulica americana*
Herring gull	*Larus argentatus*
Bald eagle	*Haliaeetus leucocephalus*
Northern harrier	*Circus cyaneus*
Belted kingfisher	*Megaceryle alcyon*
Passerines and raptors (seasonal breeders that do not winter in the watershed)	
Turkey vulture	*Cathartes aura*
Broad-winged hawk	*Buteo platypterus*
American woodcock	*Philohela minor*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Yellow-billed cuckoo	*Coccyzus americanus*
Common nighthawk	*Chordeiles minor*
Whip-poor-will	*Caprimulgus vociferus*
Chimmey swift	*Chaetura pelagica*
Ruby-throated hummingbird	*Archilochus colubris*

Common Name	Scientific Name
Red-headed woodpecker	*Melanerpes erythrocephalus*
Red-bellied woodpecker	*Melanerpes carolinus*
Olive-sided flycatcher	*Nuttallornis borealis*
Eastern wood-pewee	*Contopus virens*
Alder flycatcher	*Empidonax alnorum*
Willow flycatcher	*Empidonax traillii*
Least flycatcher	*Emidonax minimus*
Eastern Phoebe	*Sayornis phoebe*
Great Crested flycatcher	*Myiarchus crinitus*
Eastern kingbird	*Tyrannus tyrannus*
Purple martin	*Progne subis*
Tree shallow	*Iridoprocne bicolor*
Northern rough-winged swallow	*Stegidopteryx ruficollis*
Bank swallow	*Riparia riparia*
Cliff swallow	*Petrochelidon pyrrhonota*
Barn swallow	*Hirundo rustica*
House wren	*Troglodytes aedon*
Sedge wren	*Cistothorus platensis*
Marsh wren	*Cistothorus palustris*
Blue-grey gnatcatcher	*Polioptila caerulea*
Veery	*Catharus fuscescens*
Wood thrush	*Hylocichla mustelina*
Gray catbird	*Dumetella carolinensis*
Brown thrasher	*Toxostoma rufum*
Solitary vireo	*Vireo solitarius*
Yellow-throated vireo	*Vireo flavifrons*
Warbling vireo	*Vireo gilvus*
Red-eyed vireo	*Vireo olivaceus*
Blue-winged warbler	*Vermiivora pinus*
Golden-winged warbler	*Vermivora chrysoptera*
Nashville warbler	*Vermivora ruficapilla*
Northern Parula	*Parula americana*
Yellow warbler	*Dendroica petechia*
Chestnut-sided warbler	*Dendroica pensylvanica*
Black-throated blue warbler	*Dendroica caerulescens*
Yellow-rumped warbler	*Dendroica coronata*
Black-throated green warbler	*Dendroica virens*
Blackburnian warbler	*Dendroica fusca*
Pine warbler	*Dendroica pinus*
Prairie warbler	*Dendroica discolor*
Black-and-white warbler	*Mniotilta varia*
American redstart	*Setophaga ruticilla*
Ovenbird	*Seiurus aurocapillus*
Northern waterthrush	*Seiurus noveboracensis*

Common Name	Scientific Name
Louisiana waterthrush	*Seiurus motacilla*
Mourning warbler	*Oporornis philadelphia*
Common yellowthroat	*Geothlypis trichas*
Scarlet tanager	*Piranga olivacea*
Rose-brested grosbeak	*Pheucticus ludovicianus*
Indigo bunting	*Passerina cyanea*
Chipping sparrow	*Spizella passerina*
Grasshopper sparrow	*Ammodramus savannarum*
Bobolink	*Dolichonyx oryzivorus*
Red-winged blackbird	*Agelaius phoeniceus*
Orchard oriole	*Icterus spurius*
Northern oriole	*Icterus galbula*
Passerines and raptors (residents that breed and winter within the watershed)	
Bald Eagle	*Haliaeetus leucocephalus*
Northern harrier	*Circus cyaneus*
Northern goshawk	*Accipiter gentilis*
Sharp-shinned hawk	*Accipiter striatus*
Cooper’s hawk	*Accipiter cooperii*
Red-shouldered hawk	*Buteo lineatus*
Red-tailed hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
Peregrine falcon	*Falco peregrinus*
Ring-necked pheasant	*Phasianus colchicus*
Ruffed grouse	*Bonasa umbellus*
Wild turkey	*Meleagris gallopavo*
Northern bobwhite	*Colinus virginianus*
Killdeer	*Charadrius vociiferous*
Rock dove	*Columba livia*
Mourning dove	*Zenaida macroura*
Common barn owl	*Tyto alba*
Eastern screech owl	*Otus asio*
Great horned owl	*Bubo virginianus*
Barred owl	*Strix varia*
Long-eared owl	*Asio otus*
Northern saw-whet owl	*Aegolius acadicus*
Belted Kingfisher	*Megaceryle alcyon*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Pileated woodpecker	*Dryocopus pileatus*
Horned lark	*Eremophila alpestris*
Blue jay	*Cyanocitta cristata*
American crow	*Corvus brachyrhynchos*
Black-capped chickadee	*Parus atricapillus*

Common Name	**Scientific Name**
Tufted titmouse	*Parus bicolor*
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Brown creeper	*Certhia familiaris*
Winter wren	*Troglodytes troglodytes*
Golden-crowned kinglet	*Regulus satrapa*
Eastern bluebird	*Sialia sialis*
Hermit thrush	*Catharus guttatus*
American robin	*Turdus migratorius*
Northern mockingbird	*Mimus polyglottos*
Cedar waxwing	*Bombycilla cedrorum*
European starling	*Sturnus vulgaris*
Yellow-breasted chat	*Icteria virens*
Northern cardinal	*Cardinalis cardinalis*
Rufous-sided towhee	*Pipilo erythrophthalmus*
Field sparrow	*Spizella pusilla*
Vesper sparrow	*Pooecetes gramineus*
Savannah sparrow	*Passerculus sandwichensis*
Song sparrow	*Melospiza melodia*
Swamp sparrow	*Melospiza georgiana*
White-throated sparrow	*Zonotrichia albicollis*
Dark-eyed junco	*Junco hyemalis*
Eastern meadowlark	*Sturnella magna*
Common grackle	*Quiscalus quiscula*
Brown-headed cowbird	*Molothrus ater*
Purple finch	*Carpodacus purpureus*
House finch	*Carpodacus mexicanus*
Pine siskin	*Carduelis pinus*
American goldfinch	*Carduelis tristis*
Evening grosbeak	*Hesperiphona vespertina*
House sparrow	*Passer domesticus*
Passerines and raptors (residents that do not breed within the watershed)	
Golden eagle	*Aquila chrysaetos*
Rough legged hawk	*Buteo lagopus*
Snowy owl	*Nyctea scandiaca*
Great gray owl	*Strix nebulosa*
Short-eared owl	*Asio flammeus*
Northern shrike	*Lanius excubitor*
American tree sparrow	*Spizella arborea*
Lapland longspur	*Calcarius lapponicus*
Snow bunting	*Plectrophenax nivalis*
Pine grosbeak	*Pinicola enucleator*
Common redpoll	*Carduelis flammea*
Hoary redpoll	*Carduelis hornemanni*

APPENDIX G – List of Reports of Studies Conducted at the Turners Falls Fishway Complex to Investigate Upstream Passage of Adult American Shad and Downstream Passage of Atlantic Salmon Smolts and Juvenile Clupeids, and at the Northfield Mountain Project to Investigate Upstream Passage of Adult American Shad and Emigrating Atlantic Salmon Smolts

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