LOW-IMPACT HYDROPOWER POWER INSTITUTE CERTIFICATION APPLICATION

CANAAN HYDROELECTRIC PROJECT
(FERC NO. 7528)

Prepared for:

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1.0 FACILITY DESCRIPTION

The Canaan Hydroelectric Project is located on the northern Connecticut River in the towns of Canaan, Vt., and Stewartstown, (West Stewartstown Village) NH. It is located 10 miles below the Murphy Dam at Lake Francis and 82 miles above Moore Dam, at river mile 370. The project consists of a concrete gravity dam located on the Connecticut River in Stewartstown, NH approximately ¼ mile upstream of West Stewartstown Village; a penstock; two surge tanks; and a powerhouse all located in Canaan, Vermont. The Project is a run of river hydroelectric facility operated automatically, on-site via pond level control.

The current minimum flow requirements under the existing license are to release a 165-cfs minimum flow into the bypassed reach year-round. The project utilizes one generating unit with a rated capacity of 1.1 megawatt (MW).

The project boundary encloses the dam, reservoir, penstock, powerhouse, primary transmission line, and tailrace. The project boundary also encloses the following project recreational facilities: (1) a parking area, a viewing and fishing access area located adjacent to the dam gatehouse on the Vermont side of the river that provides access to the impoundment; and (2) a parking area on the Vermont side of the river near the powerhouse with access to bank fishing at the tailrace.

TABLE 1 CANAAN PROJECT FACILITIES AND DESCRIPTIONS

***CANAAN* PROJECT – FERC NO. 7528**	
Description	Number or Fact
GENERAL INFORMATION	
FERC Number	P-7528
License Issued	January 16, 2009
License Expiration Date	July 31, 2039
Licensed Capacity	1,100 kW
Project Location	On Connecticut River in Coos County, New Hampshire.

***CANAAN* PROJECT – FERC NO. 7528**	
Description	Number or Fact
Project Boundary	*Approximately 26.1* acres
RESERVOIR AND DAM	
Surface Area of Reservoir	20 acres
Length of Reservoir	Approximately *4,000* feet *(0.76 miles)*
Gross Storage of Reservoir	200 acre-feet
Elevation Top of Dam	Top of dam: 1051.50 Top of Flashboards: 1055.00
Height	15 feet
Length of Dam	275 feet
Gross head	35 feet
PENSTOCK	
Length	1,360 feet
Width	9-foot diameter
SURGE TANK	
Height	Two 21.3 feet
Width	15.3-foot diameter
POWERHOUSE	
Length (Superstructure)	29’-0”
Width (Superstructure)	50’-6”
TURBINES/GENERATORS	
Number of units	1 Unit, S. Morgan Smith 1550 hp, 164 rpm vertical Francis water wheel
Rated Net Head	35
Total Hydraulic Capacity	1,100 KW
Average Annual Generation	The estimated average annual generation for the Project is 5,565 MWh
TAILRACE	
Length	400 feet
TRANSMISSION LINES	
Type	34.5-kV
Length	1,450 feet

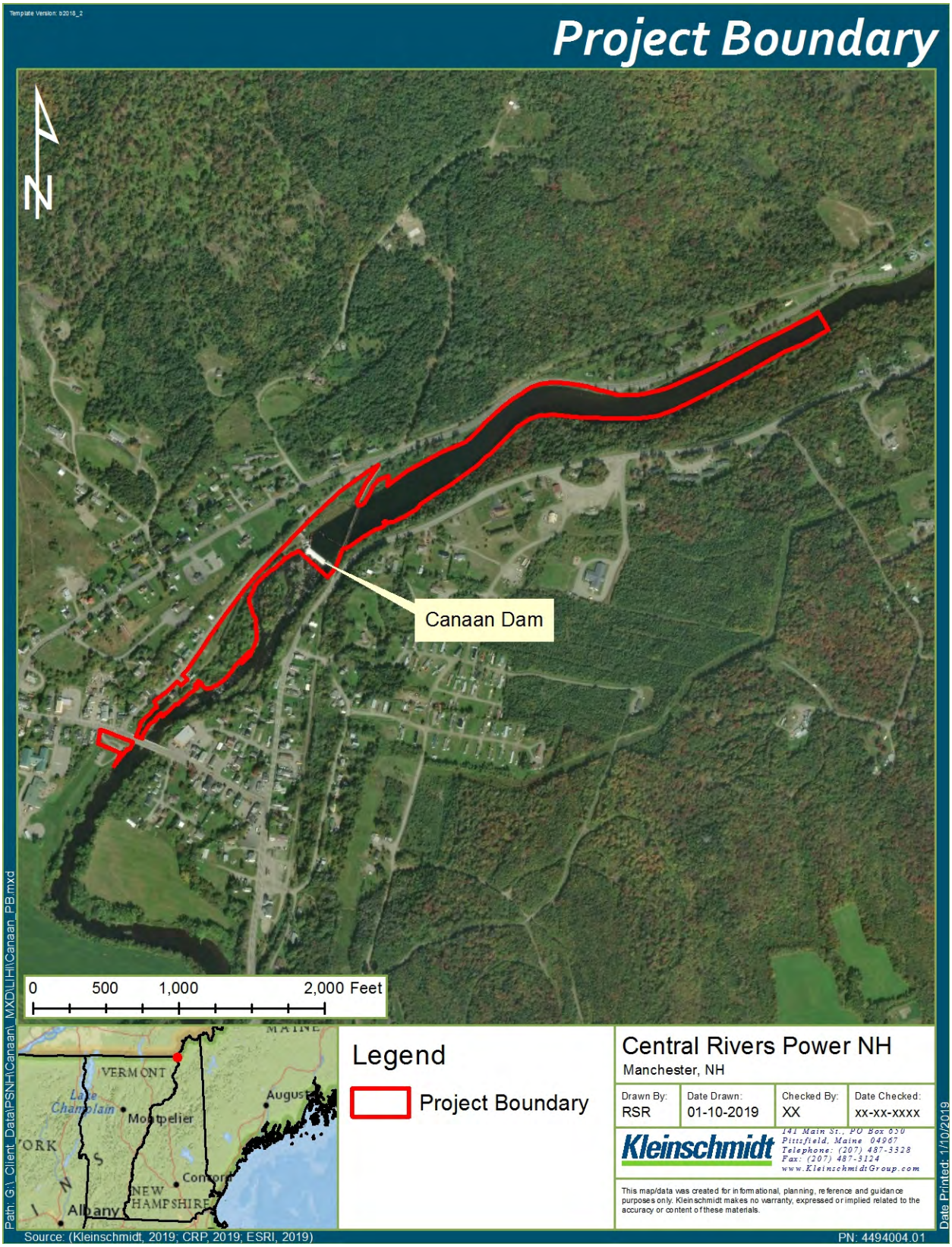


FIGURE 1 PROJECT BOUNDARY MAP

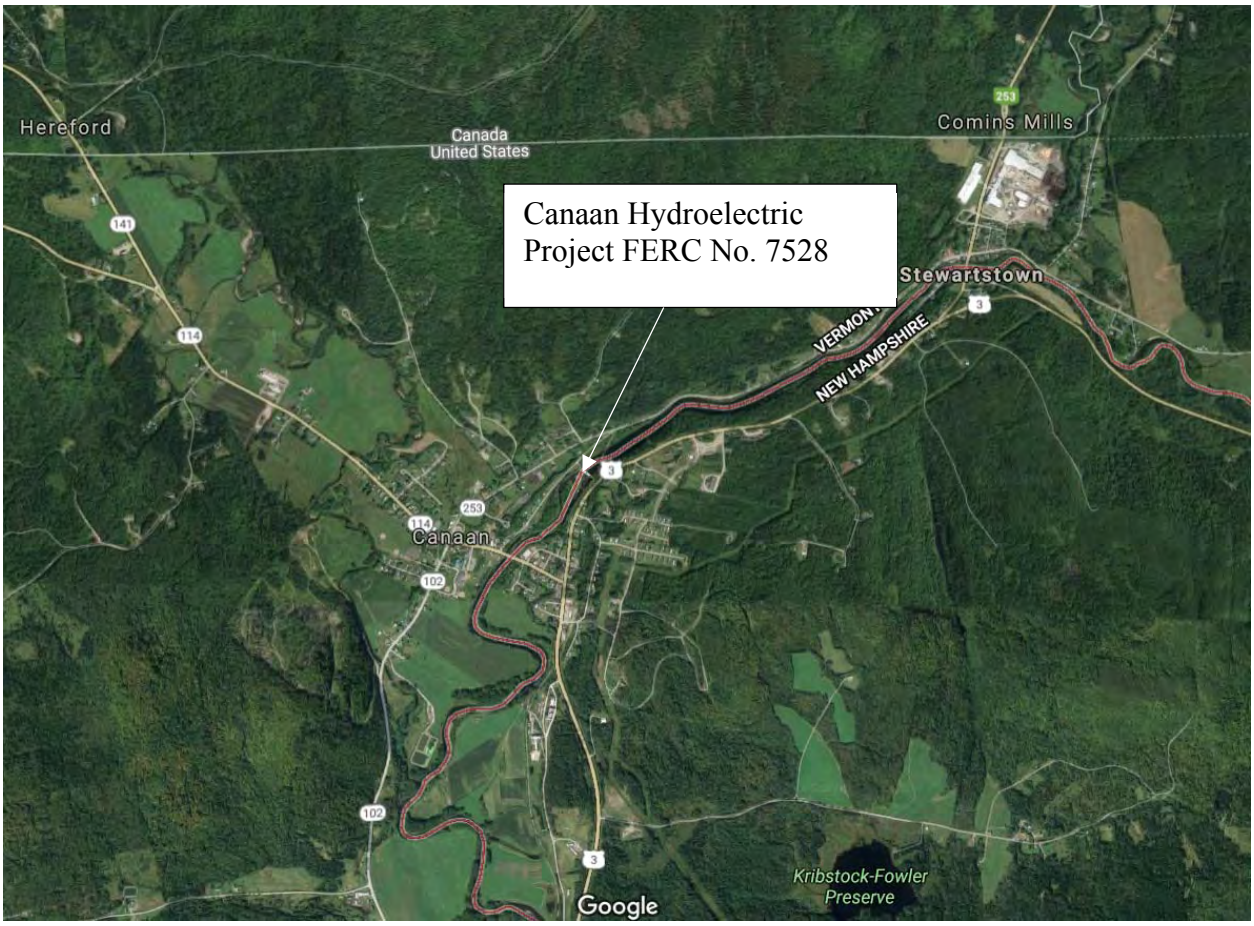


FIGURE 2 GEOGRAPHIC OVERVIEW OF PROJECT LOCATION

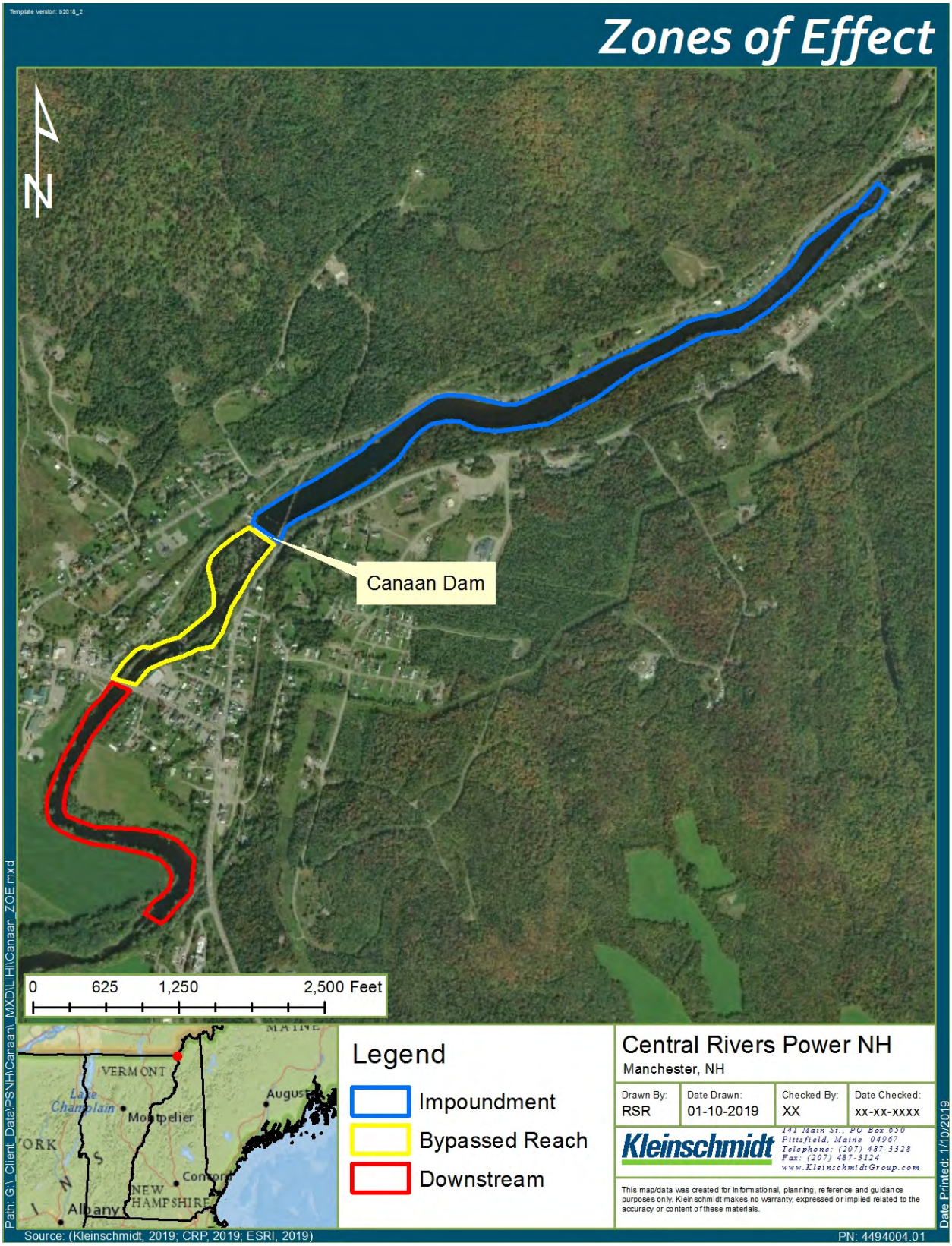


FIGURE 3 ZONES OF EFFECT

1.1 PROJECT DESCRIPTION

The Canaan Project consists of an impoundment, dam, powerhouse, tailrace channel, transmission lines, transformers, and appurtenant facilities, which are described in further detail below. The run-of-river plant is operated automatically as a base load unit generating power whenever adequate river flows are available. The Project is owned and operated by Central Rivers Power NH, LLC (CRP NH).

The Canaan dam is approximately 275 feet long. The height of the dam measured from the lowest elevation of the natural streambed at the downstream toe of the dam to the top of the 3.5 feet high spillway flashboards is 18 feet. A concrete section is located at the south abutment and is 56 feet wide with stoplogs supported by steel stanchions. The crest of the sluiceway is at elevation 1046.0 (USGS) and the stoplogs extend up to elevation 1055.7 (USGS).

The main spillway of the dam is a concrete gravity, ogee-shaped section approximately 150 feet long with a crest elevation of 1051.5 (USGS). This section is equipped with 3.5 feet high pipe-supported flashboards extending to elevation 1055.0 (USGS).

A waste gate is located to the right of the main spillway. It consists of a 20-foot wide concrete sluiceway equipped with an electrically operated 15-foot high steel tainter gate. The crest of the sluiceway is at elevation 1040.75 (USGS).

PHOTO 1 CANAAN DAM

PHOTO 2 CANAAN INTAKE GATE HOUSE

The intake structure is located at the north abutment of the dam. An electrically operated steel gate measuring 12-1/2 feet wide by 12 feet high leads to a steel penstock. The intake racks have a clear spacing of 3 inches.

The penstock leading from the intake structure at the dam to the surge tanks and powerhouse is approximately 1360 feet long with diameter of 9 feet. The invert of the penstock at its upstream end is at elevation 1040.0 (USGS). The penstock is constructed of steel supported by concrete saddles.

Two steel surge tanks are 15' 4" in diameter and 21' 4" in height. The two tanks are supported by a reinforced concrete substructure. The invert elevation of the penstock at the surge tanks is 1033.90 (USGS). The surge tanks sit on the same large concrete block that the penstock passes through and there is an opening from the penstock at the bottom of each tank. Essentially, they serve as one surge tank due to the available footprint and steep riverbank. The opening to the upstream tank is 5 feet in diameter and the opening to the downstream tank is 4 feet.

The powerhouse, located on the north bank of the river approximately 200 feet downstream from the surge tanks, has a substructure of reinforced concrete with a brick superstructure supported by steel framing. The superstructure is approximately 31 feet long by 29 feet wide.

The Canaan Project has a bypass reach which is approximately 1,600 feet long, composed of ledge, cobble and boulders.

Bypass flows and station outflow converge in the tailwater immediately downstream of the powerhouse which has normal water surface elevation of 1031.5 feet (USGS)

The Project related transmission facilities include 2.3-kV generator leads, a 1,350-kVa 2.3/34.5-kV transformer bank; a 34.5-kV and 1,450-foot-long transmission line; and other appurtenances.

PROJECT OPERATIONS

The run-of-river plant is operated automatically as a base load unit generating power whenever adequate river flows are available. CRP NH provides a minimum flow of 165 cfs, in the bypass reach to support aquatic habitat and aesthetics.

TABLE 2 FACILITY DESCRIPTION INFORMATION FOR THE CANAAN HYDROELECTRIC PROJECT (FERC NO. 7528)

INFORMATION TYPE	VARIABLE DESCRIPTION	RESPONSE (AND REFERENCE TO FURTHER DETAILS)
Name of the Facility	Facility name (use FERC project name if possible)	Canaan Hydroelectric Project (FERC No. 7528)
Location	River name (USGS proper name)	Connecticut River
	River basin name	Connecticut River Basin
	Nearest town, county, and state	West Stewartstown Village, Coos County, New Hampshire and Canaan Vermont
	River mile of dam above next major river	RM 307
	Geographic latitude	44°59'57" N
	Geographic longitude	71°31'47" W
Facility Owner	Application contact names (IMPORTANT: you must also complete the Facilities Contact Form):	Curtis R. Mooney Project Manager Central Rivers Power 59 Ayers Island Road Bristol, NH 03222
	- Facility owner (individual and company names)	HSE Hydro NH AC, LLC Todd Wynn, CEO Portfolio Companies
	- Operating affiliate (if different from owner)	Central Rivers Power NH, LLC Brent Sowle, Hydro Manager
	- Representative in LIHI certification	Andy Qua Project Manager Kleinschmidt Associates 141 Main Street P.O. Box 650 Pittsfield, ME 04967
Regulatory Status	FERC Project Number (P-2457), issuance and expiration dates	FERC No. 7528, issued January 16, 2009; expires July 31, 2039.
	FERC License type or special classification (e.g., "qualified conduit")	Minor Project – Existing Dam
	Water Quality Certificate identifier and issuance date, plus source agency name	See Appendix C: Certification issued by the New Hampshire Department of Environmental Services
	Hyperlinks to key electronic records on FERC e-library website (e.g., most recent Commission Orders, WQC, ESA documents, etc.)	Hyperlinks can be found in the footnotes and in Appendix C and D
Power Plant Character-istics	Date of initial operation (past or future for operational applications)	1927
	Total name-plate capacity (MW)	1.1
	Average annual generation (MWh)	7,300 MWH (2007 numbers)

INFORMATION TYPE	VARIABLE DESCRIPTION	RESPONSE (AND REFERENCE TO FURTHER DETAILS)
	Number, type, and size of turbines, including maximum and minimum hydraulic capacity of each unit	1 unit S. Morgan Smith 1550 hp, 164 rpm vertical Francis water wheel. Rated flow - 466 cfs, Max flow- 540 cfs, Min flow-120 cfs.
	Modes of operation (run-of-river, peaking, pulsing, seasonal storage, etc.)	Run-of-river
	Dates and types of major equipment upgrades	The wood stave penstock was replaced with the current 9-foot diameter steel penstock in 2009.
	Dates, purpose, and type of any recent operational changes	None
	Plans, authorization, and regulatory activities for any facility upgrades	None
Character-istics of Dam, Diversion, or Conduit	Date of construction	A dam was originally constructed at the project site in 1927 and was reconstructed in 1943 after the original timber crib dam washed out. A powerhouse was also constructed, and project operation began in 1943.
	Dam height	18 feet high (max.)
	Spillway elevation and hydraulic capacity	The main spillway of the dam is a concrete gravity, ogee-shaped section approximately 150 feet long with a crest elevation of 1051.5 (USGS). This section is equipped with 3.5 feet high pipe-supported flashboards extending to elevation 1055.0 (USGS). The maximum hydraulic capacity of the Project's single generating unit is approximately 466 cfs.
	Tailwater elevation	1031.5 feet mean sea level (msl)
	Length and type of all penstocks and water conveyance structures between reservoir and powerhouse	The penstock leading from the intake structure at the dam to the surge tanks and powerhouse is approximately 1360 feet long with an inside diameter of 9 feet. The invert of the penstock at its upstream end is at elevation 1040.0 (USGS). The penstock is constructed of steel and supported by concrete saddles. Two steel surge tanks are 15' 4" in diameter and 21' 4" in height. The two tanks are supported by a reinforced

INFORMATION TYPE	VARIABLE DESCRIPTION	RESPONSE (AND REFERENCE TO FURTHER DETAILS)
		concrete substructure. The invert elevation of the penstock at the surge tanks is 1033.90 (USGS).
	Dates and types of major, generation-related infrastructure improvements	New Generator Step-up Transformer-2018 New Switchgear and controls-2017
	Designated facility purposes (e.g., power, navigation, flood control, water supply, etc.)	Hydropower
	Water source	Connecticut River
	Water discharge location or facility	Connecticut River
Character-istics of Reservoir and Watershed	Gross volume and surface area at full pool	The Project reservoir has a surface area of 20 acres, and a gross storage capacity of approximately 200 acre-feet.
	Maximum water surface elevation (ft. MSL)	1055.50
	Maximum and minimum volume and water surface elevations for designated power pool, if available	N/A Run of River Project
	Upstream dam(s) by name, ownership, FERC number (if applicable), and river mile	There are 13 dams on the mainstem of the Connecticut River used for flood. storage and/or hydropower generation. The Murphy Dam Project, owned and operated by the New Hampshire DES, is the next upstream dam located about 11 miles upstream of the Canaan Project (RM 359).
	Downstream dam(s) by name, ownership, FERC number (if applicable), and river mile	The Gilman Project owned and operated by Dalton Hydro, LLC, is the next downstream dam located about 80 miles downstream of the Canaan Project (RM 450).
	Operating agreements with upstream or downstream reservoirs that affect water availability, if any, and facility operation	None
	Area inside FERC project boundary, where appropriate	5.9 acres
Hydrologic Setting	Average annual flow at the dam	The average annual flow is 821 cfs.
	Average monthly flows	USGS gage No. 01129200 (Connecticut River below Indian Stream near Pittsburg, NH). See Appendix E for table of average monthly flows.

INFORMATION TYPE	VARIABLE DESCRIPTION	RESPONSE (AND REFERENCE TO FURTHER DETAILS)
	Location and name of relevant stream gauging stations above and below the facility	USGS gage No. 01129200 (Connecticut River below Indian Stream near Pittsburg, NH).
	Watershed area at the dam	The Canaan Project has a drainage area of 381 square miles and includes Hall and Indian Streams, as well as Lake Francis and the Connecticut Lakes.
Designated Zones of Effect	Number of zones of effect	Three Zones of Effect, including, impoundment, bypassed reach and downstream.
	Upstream and downstream locations by river miles	Zone 1: RM 370 to RM 371.*14* Zone 2: RM 369.7 to RM 370 Zone 3: RM 369.1 to RM 369.7
	Type of waterbody (river, impoundment, by-passed reach, etc.)	Zone 1: Impoundment Zone 2: Bypassed reach Zone 2: River
	Delimiting structures	Zone 1: Canaan dam up to Beecher Falls (approximately 1.14 miles upstream) Zone 2: From the Canaan dam down under the Main Street Bridge (Rt 114), approximately 1,800 feet. Zone 3: from the Main Street Bridge (Rt 114) down to the islands approximately 0.55 mile.
	Designated uses by state water quality agency	Class B. Class B waters are acceptable for fishing, swimming and other recreational purposes, and after treatment, for water supply.
Additional Contact Information	Names, addresses, phone numbers, and e-mail for local state and federal resource agencies	See attached LIHI Facility Contact Form
	Names, addresses, phone numbers, and e-mail for local non-governmental stakeholders	See attached LIHI Facility Contact Form
Photographs and Maps	Photographs of key features of the facility and each of the designated zones of effect	See Appendix A
	Maps, aerial photos, and/or plan view diagrams of facility area and river basin	See Appendix A

2.0 STANDARDS MATRICES

2.1 IMPOUNDMENT ZOE

CRITERION		ALTERNATIVE STANDARDS				
		1	*2*	*3*	*4*	*Plus*
A	**Ecological Flow Regimes**		***X***			
B	**Water Quality**		***X***			
C	**Upstream Fish Passage**	***X***				
D	**Downstream Fish Passage**	***X***				
E	**Watershed and Shoreline Protection**		***X***			***X***
F	**Threatened and Endangered Species Protection**	***X***				
G	**Cultural and Historic Resources Protection**		***X***			
H	**Recreational Resources**		***X***			

2.2 BYPASSED REACH ZOE

CRITERION		ALTERNATIVE STANDARDS				
		1	*2*	*3*	*4*	*Plus*
A	**Ecological Flow Regimes**		***X***			
B	**Water Quality**		***X***			
C	**Upstream Fish Passage**	***X***				
D	**Downstream Fish Passage**	***X***				
E	**Watershed and Shoreline Protection**		***X***			***X***
F	**Threatened and Endangered Species Protection**	***X***				
G	**Cultural and Historic Resources Protection**		***X***			
H	**Recreational Resources**		***X***			

2.3 DOWNSTREAM ZOE

CRITERION		ALTERNATIVE STANDARDS				
		1	*2*	*3*	*4*	*Plus*
A	**Ecological Flow Regimes**		***X***			
B	**Water Quality**		***X***			
C	**Upstream Fish Passage**	***X***				
D	**Downstream Fish Passage**	***X***				
E	**Watershed and Shoreline Protection**		***X***			***X***
F	**Threatened and Endangered Species Protection**	***X***				
G	**Cultural and Historic Resources Protection**		***X***			
H	**Recreational Resources**		***X***			

3.0 SUPPORTING INFORMATION

3.1 ECOLOGICAL FLOWS STANDARDS: IMPOUNDMENT ZOE

CRITERION	STANDARD	INSTRUCTIONS
A	2	Agency Recommendation (see Appendix A for definitions): • Identify the proceeding and source, date, and specifics of the agency recommendation applied (NOTE: there may be more than one; identify and explain which is most environmentally stringent). • Explain the scientific or technical basis for the agency recommendation, including methods and data used. This is required regardless of whether the recommendation is or is not part of a Settlement Agreement. • Explain how the recommendation relates to agency management goals and objectives for fish and wildlife. • Explain how the recommendation provides fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow variations).

- The Impoundment ZOE does not have a bypassed reach.
- The Vermont Department of Environmental Conservation (VTDEC)granted the licensee a water quality certification (WQC) for the Project on November 20, 2008 (Appendix C).
- Under WQC condition B (Appendix C), the facility shall be operated in a true run-of-the-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam. In the river reach bypassed by the penstock, a flow of 165 cfs, or instantaneous inflow if less, shall be maintained at all times; the bypass flow shall be provided as full crest spillage unless an alternate method is approved by the VTDEC after review and consultation with the N.H. Department of Environmental Services (NHDES) to assure that aquatic habitat and aesthetics will be supported.
- Under WQC condition E and license article 401[1], a flow management plan was developed with the VTDEC and the NHDES and an impoundment and flow management plan were developed with VTDEC, NHDES, and the U.S. Fish and Wildlife Service (USFWS), were combined and submitted on February 1, 2010[2]. FERC approved the plans on April 6, 2010[3].
- Condition E of the VTDEC water quality certification requires the licensee to develop a flow management plan detailing how the project will be operated to comply with the conservation flow and impoundment fluctuation limitations specified in the VTDEC water quality certification. The plan shall include information on how the project will be

[1] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11906826
[2] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12264023
[3] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12310473

managed to control lag times and avoid related non-compliance with the conservation flow requirements.

- Condition F of the VTDEC water quality certification requires the licensee to develop an impoundment and flow management monitoring plan for continuous monitoring and reporting of flow releases at the project (spillage and turbine discharge), impoundment levels, and inflows. The plan shall include procedures for reporting deviations from prescribed operating requirements to the VDEC, explaining the reasons for those deviations and indicating measures to be taken to avoid recurrences. The licensee shall maintain continuous records of flows and impoundment levels and provide such records on a regular basis as per specifications of the VTDEC.
- The plan states that compliance with the run-of-river operation requirements will be achieved through the use of an impoundment level control, which automatically changes the turbine output as necessary. The impoundment level control will be set to maintain the impoundment at 1055.45 feet (USGS) to ensure compliance with the required minimum bypass flow. The plan states that under limited circumstances, the run-of-river operation may need to be temporarily modified. The licensee will notify the Commission, Vermont Agency of Natural Resources (VANR), NHDES, United State Fish and Wildlife Service (USFWS), and the New Hampshire Fish and Game Department (NHFG) by telephone prior to any temporary modifications. The same agencies will be notified within 24 hours of any deviations from run-of-river operations due to emergencies or equipment failure.
- The plan states that during flood control operations the waste gate will be utilized to pass flows if the impoundment level exceeds 1057.0 feet (USGS). Using the waste gate prevents the loss of the wooden flash boards and the waste gate will be closed when the impoundment level recedes below 1057.0 feet. Should the flashboards fail, once river flows have receded, the licensee will lower the impoundment to one foot below the fixed dam crest to provide maintenance crews access to the top of the spillway to replace the flashboards. After flashboard replacement, which typically requires less than one day, the impoundment will be refilled using the "90 percent rule" as stipulated in Condition D of the VTDEC water quality certificate. To estimate inflow while refilling the impoundment, the licensee will use the Indian Stream gage reading multiplied by 1.5, which is the drainage area ratio. Once the impoundment has reached an elevation of 1055.45 feet, the waste gate will be closed. The "90 percent rule" can be modified after consultation with the VTDEC, NHDES, USFWS, and NHFG.
- The plan includes two types of turbine shutdown events, scheduled events and unscheduled events. During a scheduled event, i.e. maintenance activities or intake cleaning, the licensee will maintain minimum bypassed reach flows by spillage except when flows necessitate flood control operations. Bypassed reach flows will be maintained through increased spillage during unscheduled turbine shutdown events. Specific measures to limit lag time due to turbine shutdown events are not proposed because the associated fluctuations have been shown to be minor and of short duration
- As part of the licensee's plan to maintain the equipment, the sensor levels will be checked and recalibrated annually by operations personnel and a spare sensor will be maintained at the project
- The licensee continuously monitors generation, impoundment levels, and inflows at the project. Additionally, the USGS Indian Stream Gage is used to predict project inflows.

The operations, minimum flow, and water level data are maintained electronically and can be made available, upon request, to the Commission, NHDES, USFWS, NHFG, and VTDEC to verify compliance.

- The licensee will notify VTDEC, NHDES, USFWS, and NHFG within 24 hours and the Commission within ten (10) days of any deviation from the minimum flow requirements. The notifications will discuss reasons for the deviation and the remedial actions taken. Within 45 days of each incident, after consultation with the VTDEC and NHDES, the licensee will file a report containing: the cause, severity, and duration of the incident; observed or reported environmental impacts resulting from the incident; and a description of corrective measures instituted.
- This is not a conduit project
- The Project's run-of-river operations creates a stable impoundment environment.

3.2 ECOLOGICAL FLOWS STANDARDS: BYPASSED REACH ZOE

CRITERION	STANDARD	INSTRUCTIONS
A	2	Agency Recommendation: • Identify the proceeding and source, date, and specifics of the agency recommendation applied (NOTE: there may be more than one; identify and explain which is most environmentally stringent). • Explain the scientific or technical basis for the agency recommendation, including methods and data used. This is required regardless of whether the recommendation is or is not part of a Settlement Agreement. • Explain how the recommendation relates to agency management goals and objectives for fish and wildlife. • Explain how the recommendation provides fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow

- The Vermont Department of Environmental Conservation (VTDEC) granted the licensee a water quality certification (WQC) for the Project on November 20, 2008 (Appendix C).
- Under WQC condition B (Appendix C), the facility shall be operated in a true run-of-the-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam. In the river reach bypassed by the penstock, a flow of 165 cfs, or instantaneous inflow if less, shall be maintained at all times; the bypass flow shall be provided as full crest spillage unless an alternate method is approved by the VTDEC after review and consultation with the N.H. Department of Environmental Services (NHDES) to assure that aquatic habitat and aesthetics will be supported.
- Under WQC condition E and license article 4014, a flow management plan was developed with the VTDEC and the NHDES and an impoundment and flow management plan were developed with VTDEC, NHDES, and the U.S. Fish and Wildlife Service (USFWS), were combined and submitted on February 1, 2010[5]. FERC approved the plans on April 6, 2010[6].
- Condition E of the VTDEC water quality certification requires the licensee to develop a flow management plan detailing how the project will be operated to comply with the conservation flow and impoundment fluctuation limitations specified in the VTDEC water quality certification. The plan shall include information on how the project will be managed to control lag times and avoid related non-compliance with the conservation flow requirements.
- Condition F of the VTDEC water quality certification requires the licensee to develop an impoundment and flow management monitoring plan for continuous monitoring and reporting of flow releases at the project (spillage and turbine discharge), impoundment

[4] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14978694
[5] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12264023
[6] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12310473

levels, and inflows. The plan shall include procedures for reporting deviations from prescribed operating requirements to the VDEC, explaining the reasons for those deviations and indicating measures to be taken to avoid recurrences. The licensee shall maintain continuous records of flows and impoundment levels and provide such records on a regular basis as per specifications of the VTDEC.

- The plan states that compliance with the run-of-river operation requirements will be achieved through the use of an impoundment level control, which automatically changes the turbine output as necessary. The impoundment level control will be set to maintain the impoundment at 1055.45 feet (USGS) to ensure compliance with the required minimum bypass flow. The plan states that under limited circumstances, the run-of-river operation may need to be temporarily modified. The licensee will notify the Commission, Vermont Agency of Natural Resources (VANR), NHDES, United State Fish and Wildlife Service (USFWS), and the New Hampshire Fish and Game Department (NHFG) by telephone prior to any temporary modifications. The same agencies will be notified within 24 hours of any deviations from run-of-river operations due to emergencies or equipment failure.
- The plan states that during flood control operations the waste gate will be utilized to pass flows if the impoundment level exceeds 1057.0 feet (USGS). Using the waste gate prevents the loss of the wooden flash boards and the waste gate will be closed when the impoundment level recedes below 1057.0 feet. Should the flashboards fail, once river flows have receded, the licensee will lower the impoundment to one foot below the fixed dam crest to provide maintenance crews access to the top of the spillway to replace the flashboards. After flashboard replacement, which typically requires less than one day, the impoundment will be refilled using the "90 percent rule" as stipulated in Condition D of the VTDEC water quality certificate. To estimate inflow while refilling the impoundment, the licensee will use the Indian Stream gage reading multiplied by 1.5, which is the drainage area ratio. Once the impoundment has reached an elevation of 1055.45 feet, the waste gate will be closed. The "90 percent rule" can be modified after consultation with the VTDEC, NHDES, USFWS, and NHFG.
- The plan includes two types of turbine shutdown events, scheduled events and unscheduled events. During a scheduled event, i.e. maintenance activities or intake cleaning, the licensee will maintain minimum bypassed reach flows by spillage except when flows necessitate flood control operations. Bypassed reach flows will be maintained through increased spillage during unscheduled turbine shutdown events. Specific measures to limit lag time due to turbine shutdown events are not proposed because the associated fluctuations have been shown to be minor and of short duration
- As part of the licensee's plan to maintain the equipment, the sensor levels will be checked and recalibrated annually by operations personnel and a spare sensor will be maintained at the project
- The licensee continuously monitors generation, impoundment levels, and inflows at the project. Additionally, the USGS Indian Stream Gage is used to predict project inflows. The operations, minimum flow, and water level data are maintained electronically and can be made available, upon request, to the Commission, NHDES, USFWS, NHFG, and VTDEC to verify compliance.
- The licensee will notify VTDEC, NHDES, USFWS, and NHFG within 24 hours and the Commission within ten (10) days of any deviation from the minimum flow requirements.

The notifications will discuss reasons for the deviation and the remedial actions taken. Within 45 days of each incident, after consultation with the VTDEC and NHDES, the licensee will file a report containing: the cause, severity, and duration of the incident; observed or reported environmental impacts resulting from the incident; and a description of corrective measures instituted.

3.3 ECOLOGICAL FLOWS STANDARDS: DOWNSTREAM ZOE

CRITERION	STANDARD	INSTRUCTIONS
A	2	Agency Recommendation: • Identify the proceeding and source, date, and specifics of the agency recommendation applied (NOTE: there may be more than one; identify and explain which is most environmentally stringent). • Explain the scientific or technical basis for the agency recommendation, including methods and data used. This is required regardless of whether the recommendation is or is not part of a Settlement Agreement. • Explain how the recommendation relates to agency management goals and objectives for fish and wildlife. • Explain how the recommendation provides fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow

- The Downstream ZOE does not have a bypassed reach.
- The Vermont Department of Environmental Conservation (VTDEC)granted the licensee a water quality certification (WQC) for the Project on November 20, 2008 (Appendix C).
- Under WQC condition B (Appendix C), the facility shall be operated in a true run-of-the-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam. In the river reach bypassed by the penstock, a flow of 165 cfs, or instantaneous inflow if less, shall be maintained at all times; the bypass flow shall be provided as full crest spillage unless an alternate method is approved by the VTDEC after review and consultation with the N.H. Department of Environmental Services (NHDES) to assure that aquatic habitat and aesthetics will be supported.
- Under WQC condition E and license article 401[7], a flow management plan was developed with the VTDEC and the NHDES and an impoundment and flow management plan were developed with VTDEC, NHDES, and the U.S. Fish and Wildlife Service (USFWS), were combined and submitted on February 1, 2010[8]. FERC approved the plans on April 6, 2010[9].
- Condition E of the VTDEC water quality certification requires the licensee to develop a flow management plan detailing how the project will be operated to comply with the conservation flow and impoundment fluctuation limitations specified in the VTDEC water quality certification. The plan shall include information on how the project will be managed to control lag times and avoid related non-compliance with the conservation flow requirements.

[7] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14978694
[8] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12264023
[9] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12310473

- Condition F of the VTDEC water quality certification requires the licensee to develop an impoundment and flow management monitoring plan for continuous monitoring and reporting of flow releases at the project (spillage and turbine discharge), impoundment levels, and inflows. The plan shall include procedures for reporting deviations from prescribed operating requirements to the VDEC, explaining the reasons for those deviations and indicating measures to be taken to avoid recurrences. The licensee shall maintain continuous records of flows and impoundment levels and provide such records on a regular basis as per specifications of the VTDEC.
- The plan states that compliance with the run-of-river operation requirements will be achieved through the use of an impoundment level control, which automatically changes the turbine output as necessary. The impoundment level control will be set to maintain the impoundment at 1055.45 feet (USGS) to ensure compliance with the required minimum bypass flow. The plan states that under limited circumstances, the run-of-river operation may need to be temporarily modified. The licensee will notify the Commission, Vermont Agency of Natural Resources (VANR), NHDES, United State Fish and Wildlife Service (USFWS), and the New Hampshire Fish and Game Department (NHFG) by telephone prior to any temporary modifications. The same agencies will be notified within 24 hours of any deviations from run-of-river operations due to emergencies or equipment failure.
- The plan states that during flood control operations the waste gate will be utilized to pass flows if the impoundment level exceeds 1057.0 feet (USGS). Using the waste gate prevents the loss of the wooden flash boards and the waste gate will be closed when the impoundment level recedes below 1057.0 feet. Should the flashboards fail, once river flows have receded, the licensee will lower the impoundment to one foot below the fixed dam crest to provide maintenance crews access to the top of the spillway to replace the flashboards. After flashboard replacement, which typically requires less than one day, the impoundment will be refilled using the "90 percent rule" as stipulated in Condition D of the VTDEC water quality certificate. To estimate inflow while refilling the impoundment, the licensee will use the Indian Stream gage reading multiplied by 1.5, which is the drainage area ratio. Once the impoundment has reached an elevation of 1055.45 feet, the waste gate will be closed. The "90 percent rule" can be modified after consultation with the VTDEC, NHDES, USFWS, and NHFG.
- The plan includes two types of turbine shutdown events, scheduled events and unscheduled events. During a scheduled event, i.e. maintenance activities or intake cleaning, the licensee will maintain minimum bypassed reach flows by spillage except when flows necessitate flood control operations. Bypassed reach flows will be maintained through increased spillage during unscheduled turbine shutdown events. Specific measures to limit lag time due to turbine shutdown events are not proposed because the associated fluctuations have been shown to be minor and of short duration
- As part of the licensee's plan to maintain the equipment, the sensor levels will be checked and recalibrated annually by operations personnel and a spare sensor will be maintained at the project
- The licensee continuously monitors generation, impoundment levels, and inflows at the project. Additionally, the USGS Indian Stream Gage is used to predict project inflows. The operations, minimum flow, and water level data are maintained electronically and

can be made available, upon request, to the Commission, NHDES, USFWS, NHFG, and VTDEC to verify compliance.

- The licensee will notify VTDEC, NHDES, USFWS, and NHFG within 24 hours and the Commission within ten (10) days of any deviation from the minimum flow requirements. The notifications will discuss reasons for the deviation and the remedial actions taken. Within 45 days of each incident, after consultation with the VTDEC and NHDES, the licensee will file a report containing: the cause, severity, and duration of the incident; observed or reported environmental impacts resulting from the incident; and a description of corrective measures instituted.
- This is not a conduit project.

3.4 WATER QUALITY STANDARDS: IMPOUNDMENT ZOE

CRITERION	STANDARD	INSTRUCTIONS
B	2	Agency Recommendation: • If facility is located on a Water Quality Limited river reach, provide an agency letter stating that the facility is not a cause of such limitation. • Provide a copy of the most recent Water Quality Certificate, including the date of issuance. • Identify any other agency recommendations related to water quality and explain their scientific or technical basis. • Describe all compliance activities related to the water quality related agency recommendations for the facility, including on-going monitoring, and how those are integrated into facility operations.

- The Connecticut River in the project area has been classified by Vermont and New Hampshire as a Class B water (FERC Environmental Assessment[10]). For both states, Class B waters are acceptable for fishing, swimming and other recreational purposes, and after treatment, for water supply.
- New Hampshire standards for DO are 75 percent saturation or an instantaneous minimum of 5 mg/l, temperature not to affect designated uses, pH in the 6.5-8.0 range, and turbidity of 10 Nephelometric Turbidity Units (NTUs) or less. Vermont standards for DO are a minimum of 7.0 milligrams per liter (mg/l) and 75 percent saturation, temperature increase of no more than 1.0 ºF, pH in the 6.5-8.5 range, and turbidity of 10NTUs or less.
- According to NHDES, although PCBs have been detected in some fish taken from the Connecticut River, the concentrations, according to staff in the NHDES Environmental Health Program do not warrant a fish consumption advisory for PCBs. Consequently, since there is no fish consumption advisory for PCBs in the Connecticut River, the the Connecticut River at the Canaan Project has been removed from the 303(d) List for fish consumption due to PCBs and placed in Category 3 (Insufficient Information)[11].
- The Vermont Department of Environmental Conservation (VTDEC)granted the licensee a water quality certification (WQC) for the Project on November 20, 2008 (Appendix C).
- Aquatic habitat in the impoundment is considered steep, narrow, and fast.
- The 2016 list of threatened or impaired waters list show that 1.83 miles of the Connecticut River in Stewartstown is impaired due to pH levels[12]. The same segment is contained in the draft 2018 listing[13]. The segment starts approximately two miles

[10] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11624076

[11] https://www.des.nh.gov/organization/divisions/water/wmb/swqa/2008/documents/appendix_10_removed_from_303d.pdf

[12] https://www.des.nh.gov/organization/divisions/water/wmb/swqa/2016/documents/r-wd-17-09-app-a1.pdf

[13] https://www.des.nh.gov/organization/divisions/water/wmb/swqa/2018/documents/2018-draft-303d.xlsx

upstream of the Canaan impoundment. The Canaan impoundment itself is classified on NHDES mapping as "Good" in full support of designated uses[14].

- Under WQC condition G and license article 401[15], a dissolved oxygen study following the protocol agreed upon with the VTDEC and the NHDES will be conducted. CRP NH annually sends a letter to VTANR stating if the trigger conditions did or did not occur. Copies of the recent letters to VTANR can be found in Appendix D.
    - Per email dated January 15, 2019 (Appendix D), CRP NH requested that the NHDES verify the continued operations of the project will not contribute to water quality limitations. No response has been received.

[14] http://nhdes.maps.arcgis.com/apps/webappviewer/index.html?id=aa5a11f8b8c341058fc031701a2fb3c9
[15] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14978694

3.5 WATER QUALITY STANDARDS: BYPASSED REACH ZOE

CRITERION	STANDARD	INSTRUCTIONS
B	2	Agency Recommendation: • If facility is located on a Water Quality Limited river reach, provide an agency letter stating that the facility is not a cause of such limitation. • Provide a copy of the most recent Water Quality Certificate, including the date of issuance. • Identify any other agency recommendations related to water quality and explain their scientific or technical basis. • Describe all compliance activities related to the water quality related agency recommendations for the facility, including on-going monitoring, and how those are integrated into facility operations.

- Please see answer to Impoundment ZOE above.
- The bypassed reach is 1,800 feet long and is irregular and composed of ledge, cobble, and boulders. According to the Environmental Assessment[16], Rapid and run habitats were the most abundant and represented 70 percent of the habitat.
- NHDES's draft 2018 303(d) mapping[17] for Canaan Hydro identifies the bypass reach as "Likely Good" and "Insufficient Information – Potentially Full Supporting" relative to designated uses.

[16] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11624076
[17] http://nhdes.maps.arcgis.com/apps/webappviewer/index.html?id=aa5a11f8b8c341058fc031701a2fb3c9

3.6 WATER QUALITY STANDARDS: DOWNSTREAM ZOE

CRITERION	STANDARD	INSTRUCTIONS
B	2	Agency Recommendation: • If facility is located on a Water Quality Limited river reach, provide an agency letter stating that the facility is not a cause of such limitation. • Provide a copy of the most recent Water Quality Certificate, including the date of issuance. • Identify any other agency recommendations related to water quality and explain their scientific or technical basis. • Describe all compliance activities related to the water quality related agency recommendations for the facility, including on-going monitoring, and how those are integrated into facility operations.

- Please see answer to Impoundment ZOE above.
- NHDES's draft 2018 303(d) mapping for Canaan Hydro identifies the reach downstream of the Project as "Likely Good" and "Insufficient Information – Potentially Full Supporting" relative to designated uses.
- Aquatic habitat in the downstream reach, below the confluence of the bypass and tailwater, has a wider river reach and is slower.

3.7 UPSTREAM FISH PASSAGE STANDARDS: ALL ZOES

CRITERION	STANDARD	INSTRUCTIONS
C	1	Not Applicable / De Minimis Effect: • Explain why the facility does not impose a barrier to upstream fish passage in the designated zone. Typically, impoundment zones will qualify for this standard since once above a dam and in an impoundment, there is no facility barrier to further upstream movement. • Document available fish distribution data and the lack of migratory fish species in the vicinity. • If migratory fish species have been extirpated from the area, explain why the facility is or was not the cause of this.

- The facility does not pose a barrier to upstream anadromous fish passage, because there are several dams downstream do not have upstream fish passage facilities, including the Gilman Falls project (FERC No. 2392 and LIHI 108), and the three dams associated with the Fifteen Miles Falls project (FERC No. 2077 and LIHI No. 39). Gilman dam is nearly 75 miles downstream of Canaan Dam. A map showing the dams in located in Appendix B.
- As requested during the relicensing process, an evaluation of the technical and economic feasibility of both upstream and downstream passage for resident species and trout has been completed (Appendix F). The feasibility study was including in the Exhibit E of the license application, no specific comments were derived. Considering that the fisheries resource consists of stock supplemented populations of trout with suitable habitat for spawning, overwintering, feeding, resting, and breeding found above and below the dam, CRP NH did not believe that upstream or downstream passage facilities at the project were justified.
- Under WQC condition I and license article 401, within two years of a request by the VTDEC, the licensee shall institute upstream fish passage, subject to plan approval by the VTDEC. Said request shall only occur after the NHFG adopts a management plan emphasizing self-sustaining wild trout populations and provides the VTDEC with a plan for reducing or eliminating stocking and/or harvest in the towns of Stewartstown, Colebrook, and Columbia after implementation of passage. Any request shall be made based on a written evaluation by the Vermont Department of Fish and Wildlife (VTFW) of the need for upstream fish passage, said evaluation to be done in consultation with the NHDES, the NHFG, the USFWS, the Connecticut River Watershed Council, Connecticut River Joint Commissions, Trout Unlimited, and CRP NH. The applicant shall consult the VTDEC, the VTFW, the NHDES, NHFG, and the USFWS during plan development.
- FERC Environmental Assessment (2008) (Appendix G) concluded that eels are not present at the Project. Further, it is likely that few or no eels are present at Canaan based on more recent information from downstream studies. The 2017 license application for the Wilder Project[18] indicates that three were found in the throughout the three Fifteen

[18] https://elibrary-backup.ferc.gov/idmws/common/OpenNat.asp?fileID=14580677

Mile Falls developments. Of those the Wilder Project is over 100 miles downstream of Canaan and downstream of the Fifteen Mile Falls Project. The potential benefits of fish passage depend on the species in the project area, the resource management goals of the resource agencies, and the limiting factors of existing conditions. Atlantic salmon juveniles are not stocked above the project. Therefore, adults do not return below Canaan dam and juveniles do not need to get around Canaan dam on their way back to the ocean. However, brook, brown, and rainbow trout are stocked in the river above and below the project and brook trout as a put and take program managed at the state level.

The USFWS did not prescribe fish passage for resident species and VTANR initially recommended passage, but subsequently reserved authority, therefore FERC did not include fish passage in the license.

- CRP NH continues to operate the Canaan Project as a run-of-river development with minimal impoundment drawdowns (except to replace missing/damaged flashboards due to spring runoff and/or high flows) and to provide a minimum bypass and downstream flow of 165 cfs for aquatic and aesthetic enhancement purposes.

3.8 DOWNSTREAM FISH PASSAGE AND PROTECTION STANDARDS: ALL ZOES

CRITERION	STANDARD	INSTRUCTIONS
D	*1*	***Not Applicable/De Minimis Effect:*** • *the facility does not create a barrier to downstream passage, or there are no migratory fish in the vicinity of the facility* • *if migratory fish were present historically, the facility did not contribute to the extirpation of such species* • *the facility does not contribute adversely to the sustainability of riverine fish populations or to their access to habitat necessary for the completion of their life cycles*

- As addressed in the license application (2007), the Connecticut River in the Project vicinity supports a cold-water fish community. While the database of fish species present within the vicinity of the Project is limited, the fishes observed, caught, or stocked within the Project vicinity have been consistent with nearby NHFG fish surveys and are expected to be similar in species composition.

  Sport and recreational fisheries in the Project area (Murphy Dam through the Canaan - Stewartstown area) are provided primarily by populations of rainbow (*Salmo gairdneri*), brown (*Salmo trutta*), and brook trout (*Salvelinas fontinalis*), and white sucker (*Catostomus commersoni*) and dwarf longnose sucker (*C. commersoni nannomyzon*). Populations of rainbow, brown trout and brook trout are supplemented by stocking. Annual stocking of trout in the upper reach is concentrated primarily above the Project, in the Pittsburg -Clarksville, NH, river reach below Murphy Dam. The Canaan impoundment also receives an annual allotment of stocked trout. The extensive reach below the Project (Stewartstown to Stratford) is the subject of a somewhat less intensive stocking effort. The stocking program occurs because while the naturally reproducing populations are currently sustaining themselves, the levels are not adequate to meet the high level of angling pressure experienced in this area of the Connecticut River.

  Chain pickerel (*Esox niger*), yellow perch (*Perca flavescens*), smallmouth (*Micropterus dolomieui*) and largemouth bass (*M. salmoides*), rock bass (*Ambloplites rupestris*), suckers (*Catostomus spp*.), and the stocked salmonids (*Salmo spp*.) are the primary components of the sport and recreational fishery in the extensive lower reach below the Project[19].

- As requested during the relicensing process, an evaluation of the technical and economic feasibility of both upstream and downstream passage for resident species and trout has been completed. Considering that the fisheries resource consists of stock supplemented populations of trout with suitable habitat for spawning, overwintering, feeding, resting, and breeding found above and below the dam, CRP NH did not believe that upstream or downstream passage facilities at the project were justified.

- Under WQC condition H and license article 401, The licensee shall implement permanent downstream fish passage within two years of a request by the VTDEC, which request shall only occur after the NHFG adopts a management plan emphasizing self-sustaining

[19] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11414155

wild trout populations and provides the VTDEC with a plan for reducing or eliminating stocking and/or harvest in the towns of Stewartstown, Colebrook, and Columbia after implementation of passage. Any request shall be made based on a written evaluation by the VTDFW of the need for downstream fish passage, said evaluation to be done in consultation with the NHDES, the NHFG, the USFWS, the Connecticut River Watershed Council, Connecticut River Joint Commissions, Trout Unlimited, and CRP NH. The design shall include provisions to prevent entrainment and impingement and shall be functional at all normal impoundment levels (e.g., with and without flashboards). The VTDFW evaluation shall address whether the facility should be operated year-round or for an alternate schedule, and the VTDEC shall specify the operating schedule in its request. The VTDEC may authorize or order an adjustment of the operating schedule based on experience or specific conditions during a given year, either at the CRP NH's request, after consultation with the state fisheries resource departments, or pursuant to a mutual request by the state fisheries resource departments. The applicant shall develop the design in consultation with the VTDEC, the VTDFW, the NHFG, and the USFWS, and it shall be subject to VTDEC approval prior to implementation.

- The USFWS did not prescribe fish passage for resident species and VTANR initially recommended passage, but subsequently reserved authority, therefore FERC did not include fish passage in the license.
- CRP NH continues to operate the Canaan Project as a run-of-river development with minimal impoundment drawdowns (except during brief periods of maintenance or emergency operations) and to provides a minimum bypass and downstream flow of 165 cfs for aquatic and aesthetic enhancement purposes.

3.9 SHORELINE AND WATERSHED PROTECTION STANDARDS: ALL ZOES

CRITERION	STANDARD	INSTRUCTIONS
E	2	Agency Recommendation: • Provide copies or links to any agency recommendations or management plans that are in effect related to protection, mitigation, or enhancement of shoreline surrounding the facility (e.g., Shoreline Management Plans). • Provide documentation that indicates the facility is in full compliance with any agency recommendations or management plans that are in effect.

- The area surrounding the Impoundment, Bypassed Reach, and Downstream ZOEs consists mostly of industrial, and commercial buildings, rural residential housing are spaced evenly on both sides of the river and increase in population downstream to the City of Canaan. Further out from the project boundary there are forested stretches along both sides of the river. Land cover units identified in the vicinity of the project can be found in the Land Cover map below as identified within the National Land Cover Database, 2011 (http://www.mrlc.gov/nlcd11_leg.php).

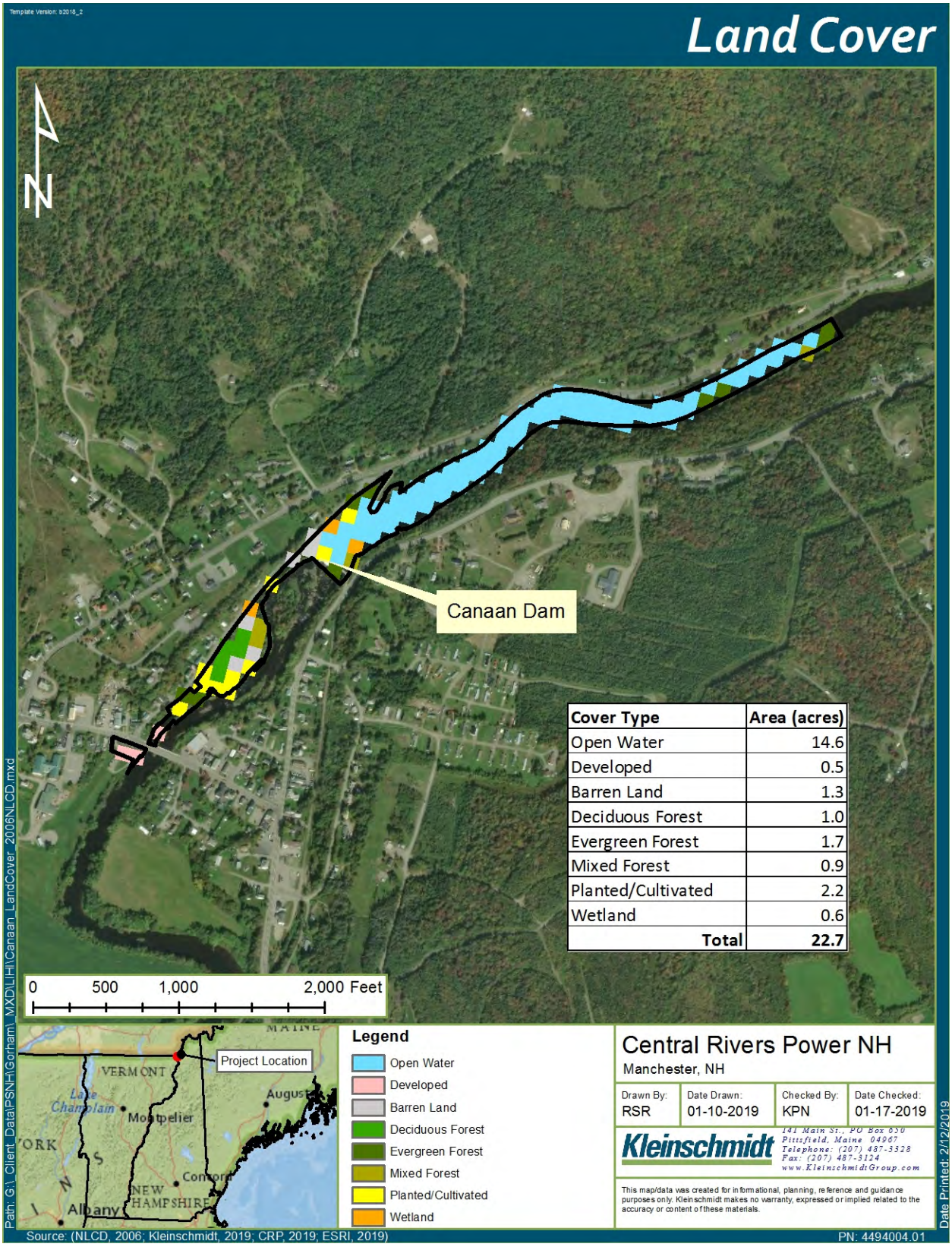


FIGURE 4 PROJECT COVER CLASSIFICATION

- Condition L of the WQC, requests the licensee to develop a plan for proper disposal of debris associated with project operation, including trashrack debris. The plan shall be developed in consultation with the VTDEC and shall be subject to VTDEC review and approval. A plan was submitted on April 29, 2010[20], supplemented on October 4, 2011[21], and approved by FERC on November 3, 2011[22].
- Condition O of the WQC, licensee shall develop, and file for Department approval within six months of the effective date of the license, a riparian zone management plan that establishes and maintains an undisturbed, naturally vegetated riparian zone along the river. The applicant shall prepare the plan in consultation with the Department, the N.H. Department of Environmental Services, the Connecticut River Watershed Council, the towns of Canaan and Stewartstown, Connecticut River Joint Commissions, Trout Unlimited, and either or both of the state highway agencies, if interested. Documentation of consultation will be included in the plan and a specific explanation of how the comments have been addressed. A plan was submitted on April 30, 2010[23]. On July 28, 2010 a meeting was held with agencies to discuss the plan[24]. FERC approved the plan on December 6, 2010[25].
- Condition R of the WQC, upon a written request by the Department or the N.H. Department of Environmental Services, the applicant shall design and implement erosion prevention and sediment control measures as necessary to address erosion occurring as a result of project operation or use of the project lands for recreation. Any work that exceeds minor maintenance shall be subject to prior approval by the Department, which shall consult with the N.H. Department of Environmental Services where appropriate.
- A shoreline Erosion Study was conducted by Field Geology Services and filed with FERC on November 2, 2006[26]. The study area extended from the first bridge upstream of the impoundment in Beecher Falls, VT to the first meander bend approximately 3,000 feet downstream of the dam. The study identified erosion in reaches upstream and downstream of the dam. Upstream, slump features emanating from the upper slopes of high banks of glacial deposits are the result of concentrated runoff from Route 3 on top of the bank and are unrelated to pool fluctuations in the impoundment below. Sediment storage in the impoundment creates a sediment deficit responsible for the scour of low banks and bars downstream of the dam. The sediment generated by this erosion offsets the sediment stored in the impoundment such that the impacts of the dam do not extend downstream of the Canaan-West Stewartstown Bridge. It was determined that at the time of the study, current project operations had a minimal impact on the extent or severity of the erosion.

[20] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12334638
[21] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12784040
[22] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12810432
[23] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12338862
[24] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12416124
[25] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12503317
[26] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11177369

Bonus:

E	PLUS	Bonus Activities: • Provide documentation that the facility has a formal conservation plan protecting a buffer zone of 50% or more of the undeveloped shoreline that the facility owns around its reservoirs and river corridors. • In lieu of a formal conservation plan, provide documentation that the facility has established a watershed enhancement fund for ecological land management that will achieve the equivalent land protection value of an ecologically effective buffer zone of 50% or more around undeveloped shoreline.

- As previously discussed, the Project has a FERC approved Riparian Zone Management Plan. The purpose of the plan is to maintain an undisturbed vegetated riparian zone along the river, including narrow strips of land along the impoundment and bypass reach. The Plan identifies these areas as consisting primarily of woody and herbaceous vegetation, providing habitat opportunities for wildlife.
- CRP NH actively mows project access (i.e., along the penstock and areas immediately adjacent to project structures) and recreation sites but allows grasses and shrubs of remaining areas of shoreline to grow to maturity.
- CRP NH periodically (about every four years) surveys for invasive plant species within the riparian zones. Should invasive plant species be identified, CRP NH will consult with agencies regarding eradication and control measures. No formal reporting requirements exist for this monitoring.
- Based upon calculation within GIS of the shoreline boundary and shoreline development information illustrated in Figure 4 above, approximately 89% of the shoreline within the project boundary and subject to the Riparian Zone Management Plan is undeveloped.

3.10 THREATENED AND ENDANGERED SPECIES STANDARDS: IMPOUNDMENT ZOE

CRITERION	STANDARD	INSTRUCTIONS
F	1	Finding of No Negative Effects: • Identify all listed species in the facility area based on current data from the appropriate state and federal natural resource management agencies. • Provide documentation of a finding of no negative effect of the facility on any listed species in the area from an appropriate natural resource management agency.

- Limited wildlife habitat exists within the project area. While the habitat that does exist around the impoundment can be classified as good to high quality and large tracts of forested and open habitat surround the project area beyond the roads that border the project, wildlife access is limited by surrounding commercial and residential development and paved roadways. Habitat immediately downstream of the dam is characterized as generally poor quality.
- Per email dated January 15, 2019 (Appendix D), CRP NH requested that the VTANR verify the list of possible rare, threatened, and endangered species and determine if the Project continued to operate in compliance with Water Quality Certification conditions, the Project would not be expected to negatively affect listed species located in the vicinity of the Project. No response has been received.
- Per request through the Natural Heritage Bureau (NHB) Datacheck Tool on January 3, 2019, CRP NH requested that the NHB verify the list of possible rare, threatened, and endangered species and determine if the Project continued to operate in compliance with Water Quality Certification conditions, the Project would not be expected to negatively affect listed species located in or within the vicinity of the Project.
- On January 24, 2019, additional information was submitted to NHB and NHFG including project description, project operations, and date of construction for the dam (Appendix D).
- On January 29, 2019 (Appendix D), the NHB responded that there is a record in the NHB database for an acidic riverbank outcrop natural community immediately below the dam. The records indicate that it is relatively weedy with low botanical diversity.
- Also, at/near this location is a record for satiny willow (Salix pellita). According to the records it is growing at the edge of an agricultural field somewhere north of the dam.
- NHB does not have pre- and post-dam data for the plant at this location, so it is difficult to know what the effects of the dam may be on this species and natural community. The dam was originally constructed at the project site in 1927 and was reconstructed in 1943 after the original timber crib dam washed out. A powerhouse was also constructed, and project operation began in 1943. The run-of-river plant is operated automatically as a base load unit generating power whenever adequate river flows are available. CRP NH provides a minimum flow of 165 cfs, in the bypass reach to support aquatic habitat and aesthetics. It is the applicant's opinion that the continued use of the Project will not significantly affect the satiny willow.

- The protection of birds is regulated by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)).

  Bald eagles are no longer listed under the ESA but maintain federal protection under the Bald and Golden Eagle Protection Act and legally protected in New Hampshire. The species have been recorded in/near the project area; however, if is not certain if there are residents near the project area. There are no anticipated changes to the project. The project will continue to be run-of-river and operations will stay the same. If effects would occur, they should be insignificant.

- Based on an official USFWS Species List populated on February 1, 2019, (Appendix D), the northern long-eared bat (*Myotis septentrionalis*) and the Canada lynx (*Lynx canadenis*) may occur in the Project Area.

- It is unlikely that the northern long-eared bat or Canada lynx would use the Project area for breeding or hibernating due to the urbanized development located around the Project. However, the species could use the area for feeding and transit place. For brief occurrences such as these it is unlikely that the species would be affected long term be the existing project operations.

- CRP NH does not plan on cutting any trees or shrubs for project use or maintenance. If CRP NH finds it necessary to cut, they will consult with the agencies to make sure the cutting is done in compliance with the species needs (i.e. time of year restrictions).

3.11 THREATENED AND ENDANGERED SPECIES STANDARDS: BYPASSED REACH ZOE

CRITERION	STANDARD	INSTRUCTIONS
F	1	Finding of No Negative Effects: • Identify all listed species in the facility area based on current data from the appropriate state and federal natural resource management agencies. • Provide documentation of a finding of no negative effect of the facility on any listed species in the area from an appropriate natural resource management agency.

- Please see answer to Impoundment ZOE above.

3.12 THREATENED AND ENDANGERED SPECIES STANDARDS: DOWNSTREAM ZOE

CRITERION	STANDARD	INSTRUCTIONS
F	1	Finding of No Negative Effects: • Identify all listed species in the facility area based on current data from the appropriate state and federal natural resource management agencies. • Provide documentation of a finding of no negative effect of the facility on any listed species in the area from an appropriate natural resource management agency.

- Please see answer to Impoundment ZOE above.

3.13 CULTURAL AND HISTORIC RESOURCES STANDARDS: ALL ZOES

CRITERION	STANDARD	INSTRUCTIONS
G	2	Approved Plan: • Provide documentation of all approved state, provincial, federal, and recognized tribal plans for the protection, enhancement, and mitigation of impacts to cultural and historic resources affected by the facility. • Document that the facility is in compliance with all such plans.

- In association with its relicensing efforts, a Phase IA archaeological assessment of the project was conducted. The study, developed in consultation with the SHPOs and Alnobak Heritage Preservation Center, consisted of a literature search and reconnaissance-level field inspection. The archaeological consultants identified four historic-period archaeological sites and five shoreline segments that are sensitive for prehistoric archaeological resources. The historic archaeological sites consist of a stone-lined foundation with associated 19th-to 20th century debris; remnants of a wooden structure of unknown origin partly submerged in the project pond; structural remains of the Allen Electric Light Plant (precursor to the Canaan project); and the possible location of a 19th century building. The archaeologically-sensitive segments exhibited minimal active erosion, attributed chiefly to ice scouring and bank undercutting.
- Article 404 of the license required the licensee to implement the Programmatic Agreement Among the FERC and the Vermont and New Hampshire State Historic Preservation Officers for Managing Historic Properties (SHPO) that may be Affected by Issuing a License for the Continued Operation of the Canaan Hydroelectric Project in Essex County, Vermont and Coos County, New Hampshire (FERC No. 7528), executed on December 8, 2008[27], including but not limited to the Historic Properties Management Plan (HPMP) for the project (filed November 24, 2008[28]).

[27] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11862872
[28] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11865279

Annual Historical Reports:

Submitted
July 18, 2013[29]
July 30, 2014[30]
July 31, 2015[31]
July 21, 2016[32]
July 26, 2017[33]
July 26, 2018[34]

[29] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13309228
[30] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13604028
[31] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13945410
[32] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14313365
[33] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14643607
[34] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14984533

3.14 RECREATIONAL RESOURCES STANDARDS: ALL ZOES

CRITERION	STANDARD	INSTRUCTIONS
H	2	Agency Recommendation: • Document any comprehensive resource agency recommendations and enforceable recreation plan that is in place for recreational access or accommodations. • Document that the facility is in compliance with all such recommendations and plans.

- License article 403 and WQC condition P, require a recreation plan. The plan was prepared in consultation with the Department, the N.H. Department of Environmental Services, the Connecticut River Watershed Council, the towns of Canaan and Stewartstown, the Connecticut River Joint Commissions, and Trout Unlimited.
- On October 25, 2010, the Recreation Plan was submitted including the VTDEC letter of approval[35]. FERC modified and approved the plan on December 21, 2010[36].
- On December 15, 2011[37], as-built drawings for the recreation facilities were submitted and approved by FERC on February 28, 2012[38].
- Revised drawings where submitted from February to May 2012[39], FERC approved drawings on June 14, 2012[40]. Drawings can be found in Appendix A.
- Impoundment recreation items
    - Boat Barrier
    - Portage route
    - Information kiosk
    - Portage take-out signage
    - Portage take-out
    - Dam gatehouse parking and angler access area
- Bypassed Reach recreation items
    - Day use parking area with interpretive signage
    - Picnic tables
    - Site historical information sign
    - Powerhouse parking and angler access area
- Downstream recreation items

[35] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12472301
[36] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12515951
[37] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12841306
[38] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12903819
[39] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12995234
[40] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13007667

    - Portage route sign
    - Portage put-in below dam
    - Portage put-in sign
- Recreation Reports (Form 80)
    - March 16, 2015[41]
- An environmental inspection was completed on August 9, 2018. FERC issued a follow-up letter on August 30, 2018[42], identifying a need for a plan and schedule to address the lack of secondary containment for turbine wheel pit oil. HSE NH provided a plan and schedule to address the issue on September 26, 2018[43], followed by a proposed design for a new containment system on January 31, 2019[44], to which FERC has not responded.

[41] https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13801790
[42] https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=14943928
[43] https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=15051427
[44] https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=15153082

4.0 CONTACTS FORMS

1. **All applications for LIHI Certification must include complete contact information to be reviewed.**

Project Owner:	
Name and Title	Todd, Wynn; CEO Portfolio Companies
Company	Hull Street Energy
Phone	301-664-7701
Email Address	twynn@hullstreetenergy.com
Mailing Address	4920 Elm Street, Suite 205 Bethesda, MD 20814
Consulting Firm / Agent for LIHI Program (if different from above):	
Name and Title	Andy Qua
Company	Kleinschmidt Associates
Phone	207-416-1246
Email Address	Andy.Qua@kleinschmidtgroup.com
Mailing Address	141 Main Street P.O. Box 650 Pittsfield, Maine 04967
Compliance Contact (responsible for LIHI Program requirements):	
Name and Title	Curtis R. Mooney; Manager, Regulatory Affairs
Company	Central Rivers Power
Phone	(603)744-0846
Email Address	cmooney@centralriverspower.com
Mailing Address	59 Ayers Island Road Bristol, NH 03222
Party responsible for accounts payable:	
Name and Title	Ryan McQueeney; CFO, Portfolio Companies
Company	Hull Street Energy, LLC
Phone	(301)664-7702
Email Address	accounting@centralriverspower.com
Mailing Address	4920 Elm Street, Suite 205 Bethesda, MD 20814

2. Applicant must identify the most current and relevant state, federal, provincial, and tribal resource agency contacts (copy and repeat the following table as needed).

Agency Contact (Check area of responsibility: Flows_**X**_, Water Quality __, Fish/Wildlife Resources _**X**_, Watersheds _**X**_, T/E Spp. __, Cultural/Historic Resources __, Recreation _ _):	
Agency Name	United States Fish and Wildlife Service (USFWS)
Name and Title	Julianne Rosset; Fish & Wildlife Biologist
Phone	603-227-6436
Email address	julianne_rosset@fws.gov
Mailing Address	USFWS New England Field Office 70 Commercial Street, Suite 300 Concord, NH 03301
Agency Contact (Check area of responsibility: Flows_**X**_, Water Quality _**X**_, Fish/Wildlife Resources __, Watersheds _X_, T/E Spp. __, Cultural/Historic Resources __, Recreation _ _):	
Agency Name	New Hampshire Department of Environmental Services (NHDES)
Name and Title	Gregg Comstock, P.E.; Supervisor, Water Quality Planning Section
Phone	603-271-2983
Email address	gregg.comstock@des.nh.gov
Mailing Address	NH Department of Environmental Services 29 Hazen Drive, P.O. Box 95 Concord, NH 03302-0095

Agency Contact (Check area of responsibility: Flows_X_, Water Quality _X_, Fish/Wildlife Resources X__, Watersheds __, T/E Spp. _X_, Cultural/Historic Resources __, Recreation _X_):	
Agency Name	New Hampshire Fish and Game Department (NHFGD)
Name and Title	Carol Henderson; Environmental Review Coordinator
Phone	603-271-1138
Email address	Carol.Henderson@wildlife.nh.gov
Mailing Address	New Hampshire Fish and Game Department 11 Hazen Drive Concord, NH 03301

Agency Contact (Check area of responsibility: Flows__, Water Quality __, Fish/Wildlife Resources __, Watersheds __, T/E Spp. __, Cultural/Historic Resources _**X**_, Recreation __):	
Agency Name	New Hampshire Division of Historical Resources
Name and Title	Nadine Miller; Deputy State Historic Preservation Officer
Phone	603-271-6628
Email address	Nadine.Miller@dcr.nh.gov
Mailing Address	NH Division of Historical Resources 19 Pillsbury Street – 2nd Floor Concord, NH 03301-3570

Agency Contact (Check area of responsibility: Flows_X_, Water Quality __, Fish/Wildlife Resources __, Watersheds __, T/E Spp. __, Cultural/Historic Resources __, Recreation __):	
Agency Name	Federal Energy Regulatory Commission
Name and Title	John Spain; Regional Engineer
Phone	212-273-5900
Email address	John.Spain@ferc.gov
Mailing Address	19West 34th Street Suite 400 New York, NY 1001-3006

B.3 Sworn Statement and Waiver Form

All applications for LIHI Certification must include the following sworn statement before they can be reviewed by LIHI:

SWORN STATEMENT

*As an Authorized Representative of **Central Rivers Power NH Canaan, LLC**, the Undersigned attests that the material presented in the application is true and complete.*

The Undersigned acknowledges that the primary goal of the Low Impact Hydropower Institute's certification program is public benefit, and that the LIHI Governing Board and its agents are not responsible for financial or other private consequences of its certification decisions.

The Undersigned further acknowledges that if LIHI Certification of the applying facility is granted, the LIHI Certification Mark License Agreement must be executed prior to marketing the electricity product as LIHI Certified®.

The Undersigned further agrees to hold the Low Impact Hydropower Institute, the Governing Board and its agents harmless for any decision rendered on this or other applications, from any consequences of disclosing or publishing any submitted certification application materials to the public, or on any other action pursuant to the Low Impact Hydropower Institute's certification program.

PLEASE INSERT FOR PRE-OPERATIONAL CERTIFICATIONS (see Section 4.5.3)**:**

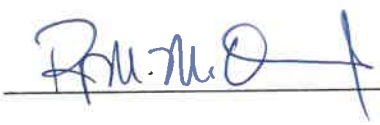
The Undersigned acknowledges that LIHI may suspend or revoke the LIHI Certification should the impacts of the facility, once operational, fail to comply with the LIHI program requirements.

Company Name: CRP NH Canaan, LLC

Authorized Representative:

Name: Ryan McQueeney

Title: CFO

Authorized Signature: 

Date: April 26, 2019

APPENDIX A

PROJECT ZOE, DRAWINGS, AND PHOTOS

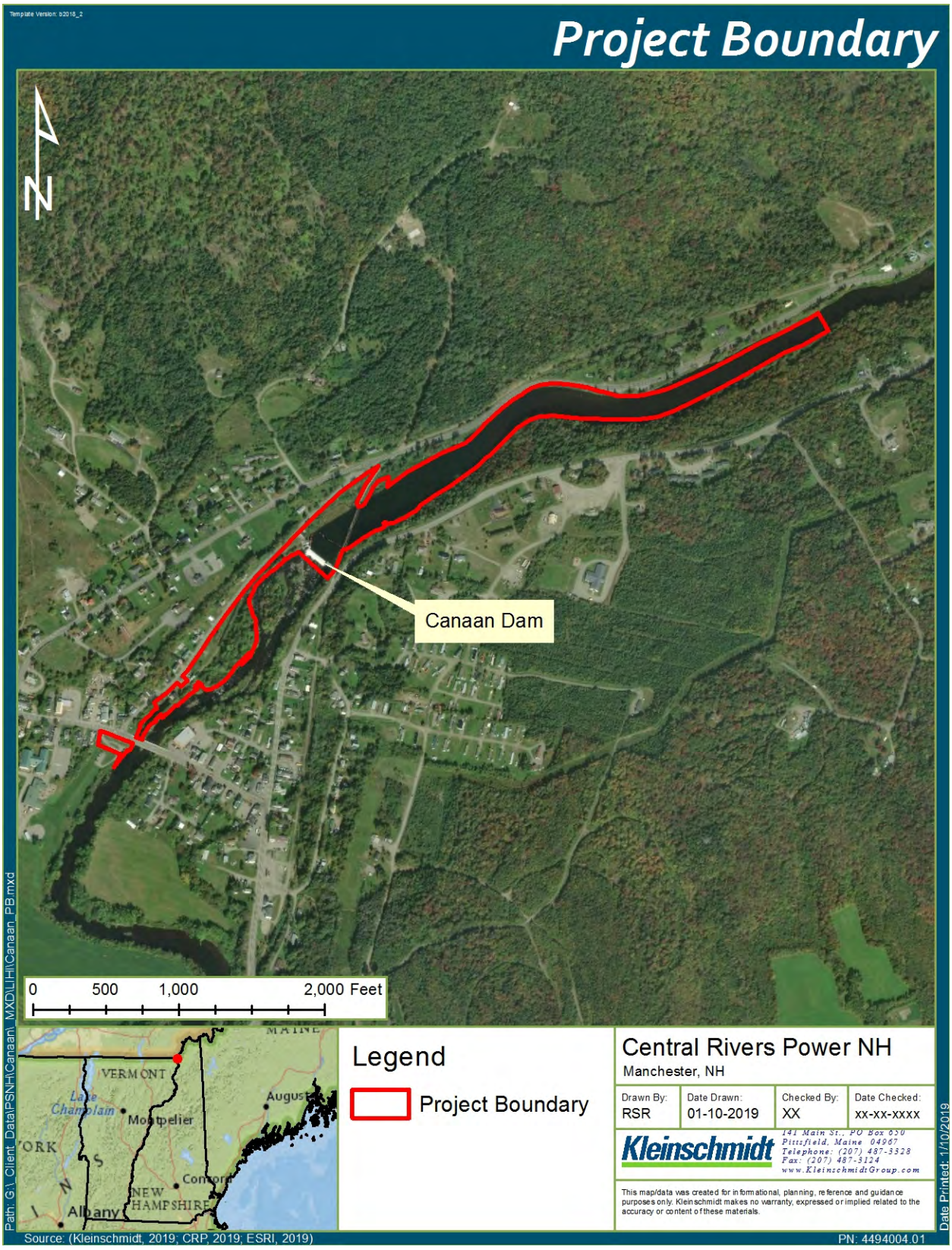


FIGURE 5 PROJECT BOUNDARY

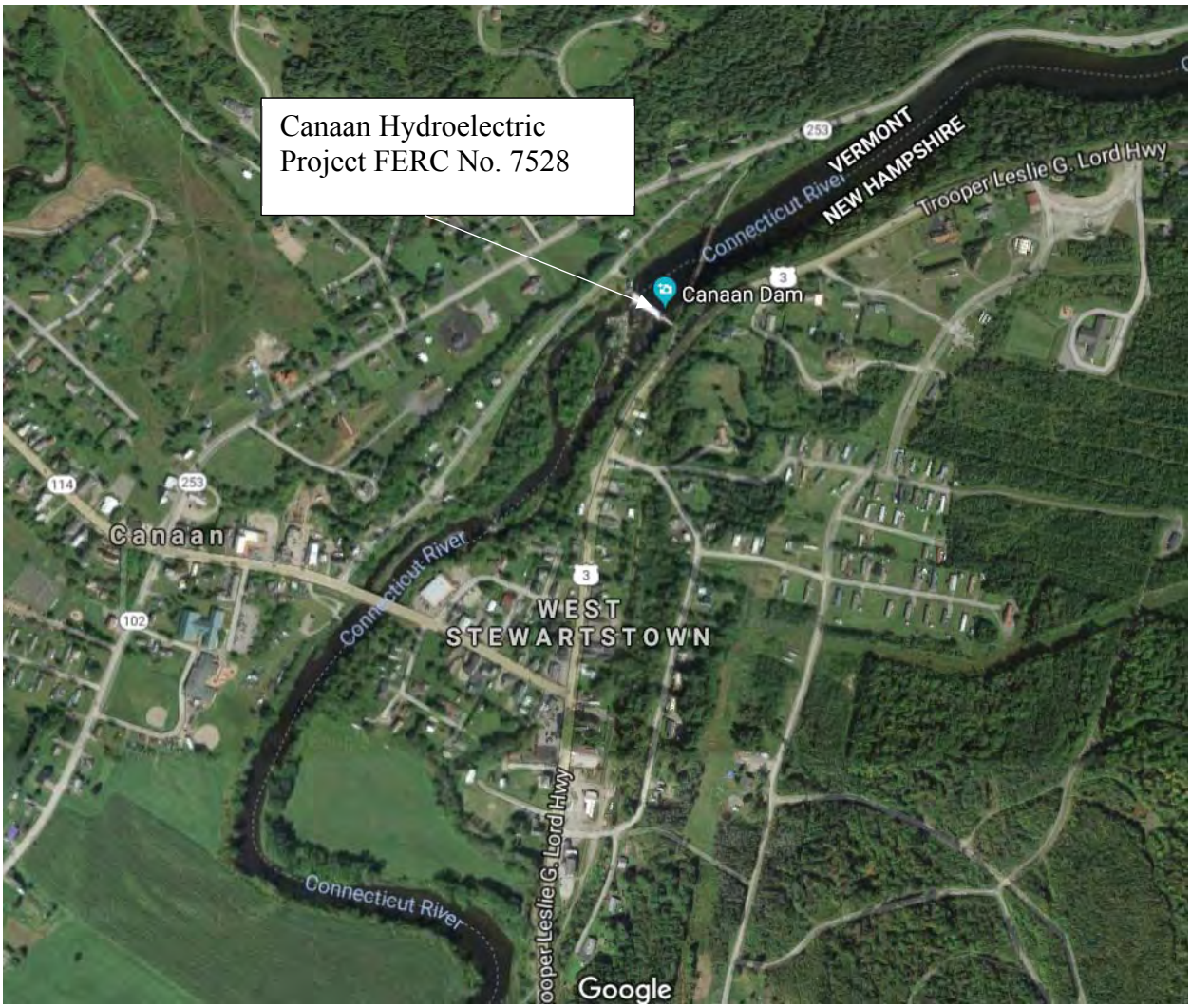


FIGURE 6 GEOGRAPHIC OVERVIEW OF PROJECT LOCATION

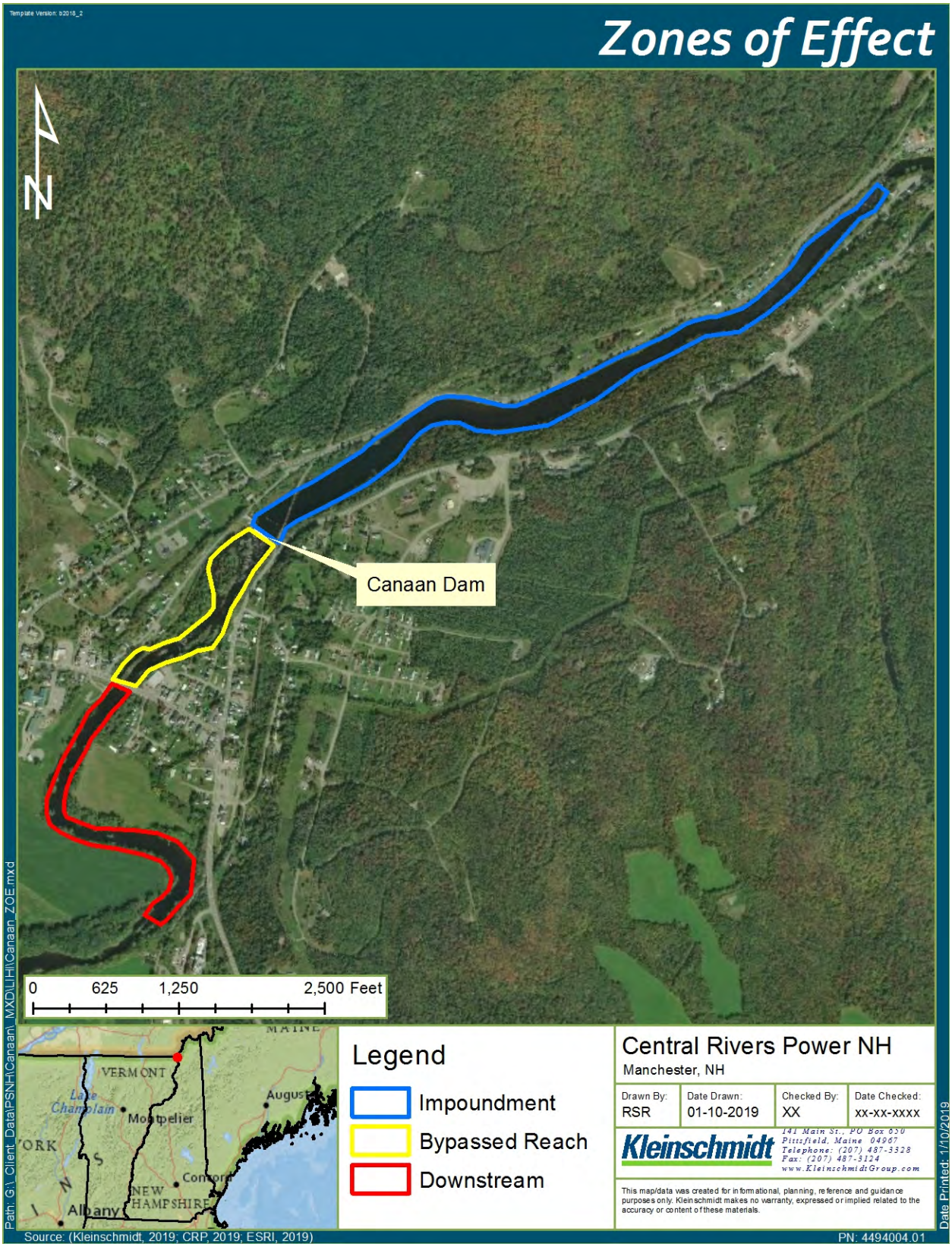


FIGURE 7 ZONES OF EFFECT

PHOTO *3* **INTERPRETIVE SIGN LOCATED IN THE DAY USE AREA/PICNIC AREA**

PHOTO *4* **UPDATED POSITIVE RESTRAINT**

PHOTO *5* **CANAAN PORTAGE INFORMATION SIGN**

PHOTO *6* **CANAAN DAM**

PHOTO *7* CANAAN INTAKE GATE HOUSE

PHOTO *8* SURGE TANKS

PHOTO *9* **CANAAN POWERHOUSE**

PHOTO *10* **BYPASSED REACH**

PHOTO *11* **LOOKING FROM DAM TO TAKE-OUT AREA**

PHOTO *12* DOWNSTREAM PUT-IN AREA

PROJECT DRAWINGS

Public Service
of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000
www.psnh.com

The Northeast Utilities System

December 15, 2011

D30811

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

Re: Canaan Hydroelectric Project, FERC Project No. 7528
"As-Built Recreation Facility Drawings"

Dear Ms. Bose,

On December 1, 2010, the Commission issued its *Order Modifying and Approving Recreation Plan Pursuant to License Articles 401 and 403 and Water Quality Certificate Condition P* for Public Service Company of New Hampshire's ("PSNH") Canaan Hydroelectric Project. Ordering Paragraph (A) approved PSNH's recreation plan and proposed construction of facilities, filed with the Commission on October 25, 2010. Paragraph (B) stipulates that construction of the facilities but be completed on or before December 1, 2011 and Paragraph (C) requires filing of "as-built" drawings showing the facility locations in relation to the project boundary.

Construction of the facilities was completed during the summer of 2011 and occurred as outlined in the Commission approved recreation plan. Therefore, PSNH hereby files "as-built" drawings, revised Recreation Plan Figures 1, 2A, and 2B as required by Ordering Paragraph (C), in .pdf format for Commission review and approval. Please note that Recreation Plan Figure 3 was included in the Recreation Plan to specifically show the proposed relocation of the boat barrier. Because the relocated boat barrier is shown as constructed on Figure 2B, Figure 3 is no longer applicable and therefore is not being provided as part of this "as-built" filing.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 5841 or by e-mail at mooneCR@nu.com .

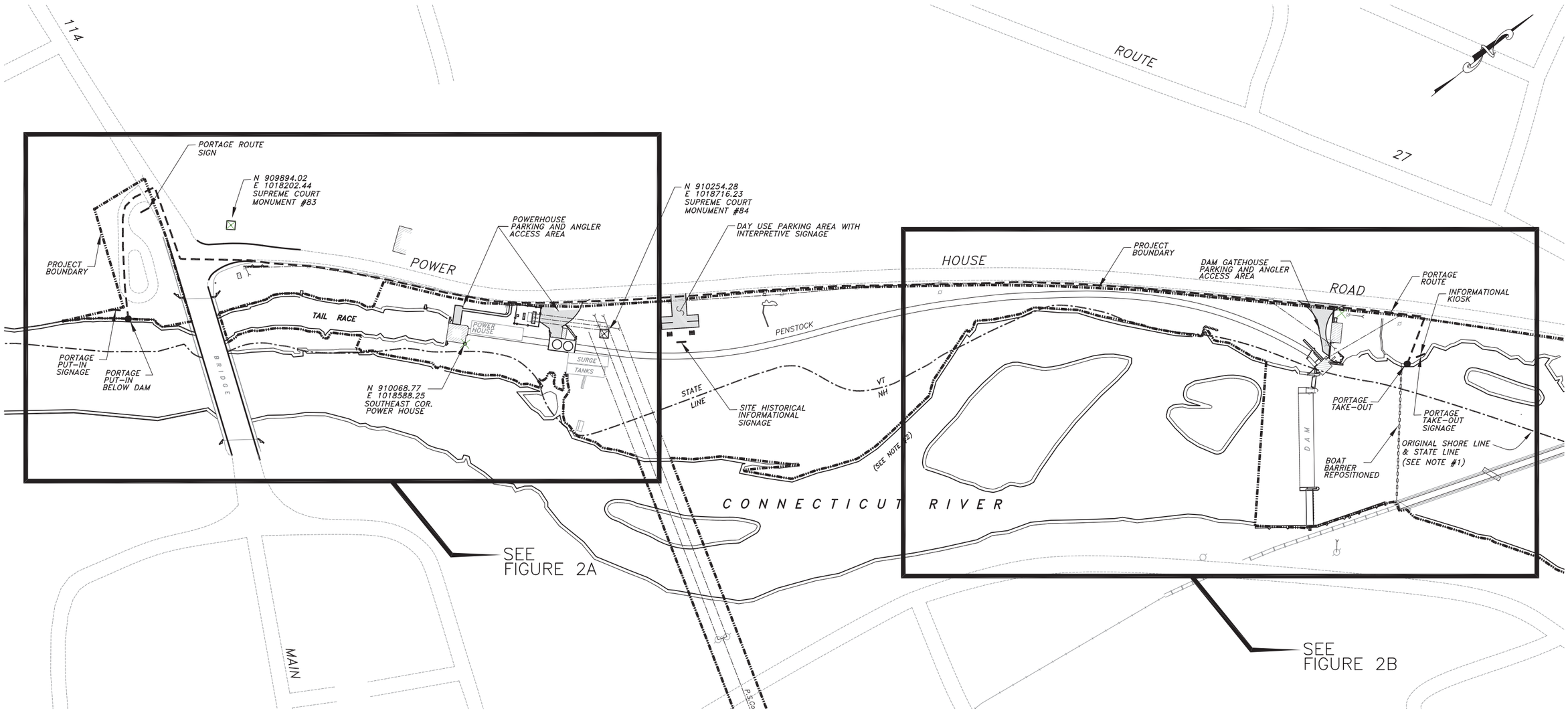
Very truly yours,

Public Service Company of New Hampshire

Robert Gundersen CRM

Robert Gundersen
PSNH Hydro Manager

Enclosure



0 75 150 225

GRAPHIC SCALE
1" = 75'

NOTES:
1. COORDINATES ARE BASED ON NAD83 NEW HAMPSHIRE STATE PLANE, US FOOT

FIGURE 1

CANAAN HYDRO ELECTRIC PROJECT
PROJECT NO. 7528–VT
RECREATION PLAN "AS–BUILT"

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, N.H.

REVISED:
12–12–11

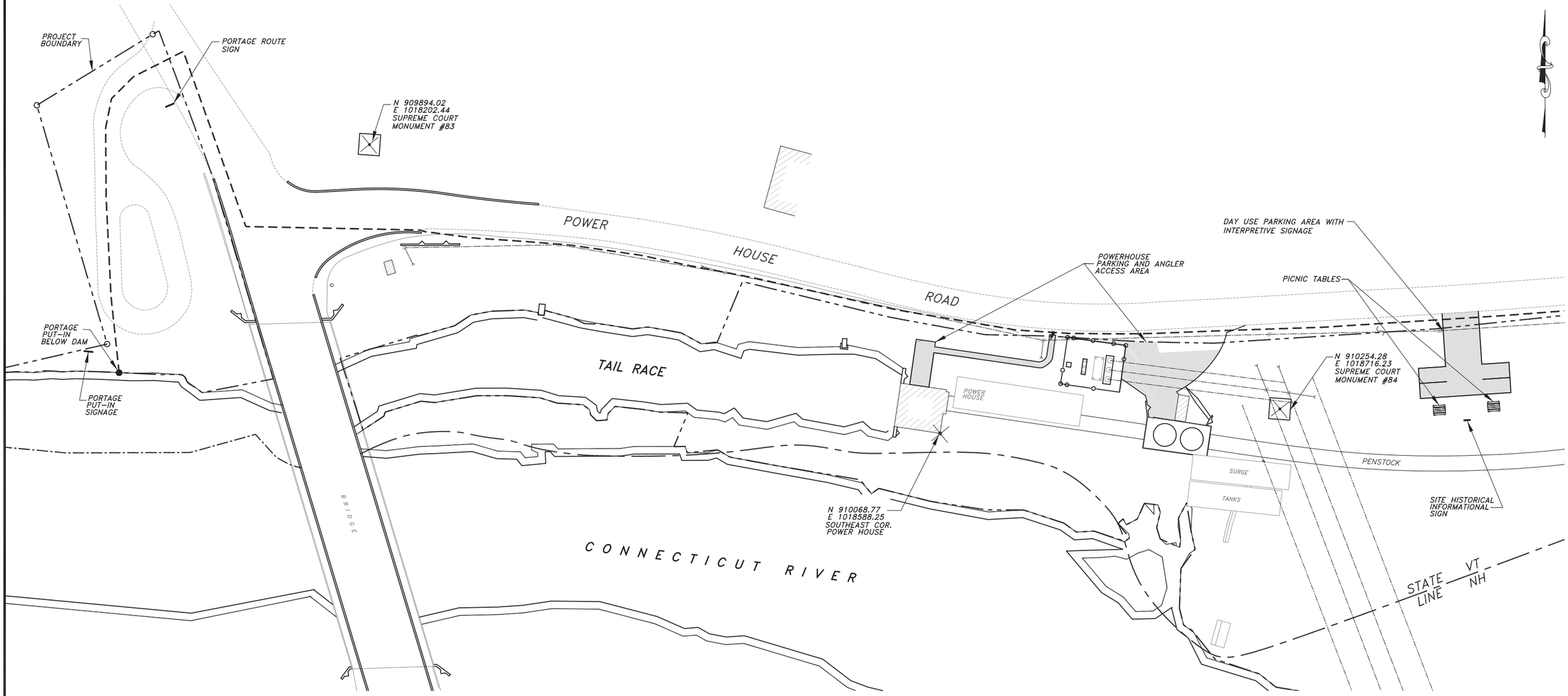


FIGURE 2A

CANAAN HYDRO ELECTRIC PROJECT
PROJECT NO. 7528-VT
RECREATION PLAN "AS BUILT"

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, N.H.

REVISED:
12-12-11

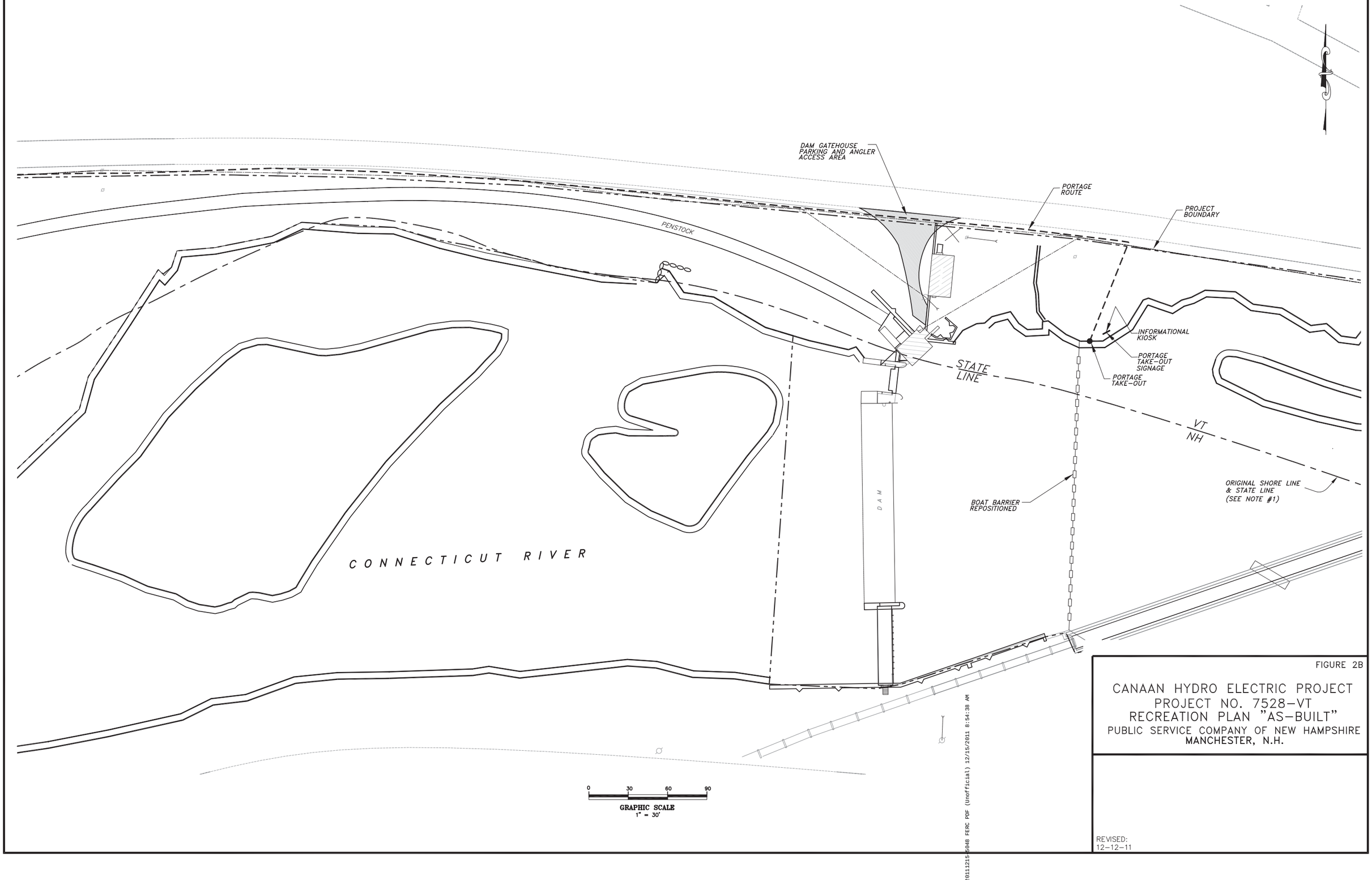


FIGURE 2B

CANAAN HYDRO ELECTRIC PROJECT
PROJECT NO. 7528-VT
RECREATION PLAN "AS-BUILT"
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, N.H.

REVISED:
12-12-11

Document Content(s)

Public Service of New Hampshire

780 N. Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P. O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

May 29, 2012
D-31342

VIA ELECTRONIC FILING

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Office of Hydropower Licensing
888 First Street, N.E.
Washington, D.C. 20426

Re: Canaan Hydroelectric Project, FERC Project No. 7528-019
Revised Exhibit G Drawing

Dear Secretary Bose:

The Commission issued an Order Approving As-Built Recreational Drawings and Requiring the Filing of Exhibit G Drawings on February 28, 2012 for Public Service of New Hampshire's (PSNH) Canaan Hydroelectric Project. The order requires PSNH to file for Commission approval, revised Exhibit G drawings enclosing within the project boundary all principal project works necessary for operation and maintenance of the project including the recreation enhancements at the project. The attached revised Exhibit G incorporates all recreation facilities included in the approved As-Built Recreation Drawing.

PSNH hereby electronically files for Commission review and approval the revised Exhibit G-1 for the Canaan Hydroelectric Project, in compliance with the format requirements of 18 CFR 4.39 and 4.41 of the Commission's regulations. We anticipate that upon Commission approval, PSNH will be required to file aperture cards and electronic format versions of the Exhibit G drawings.

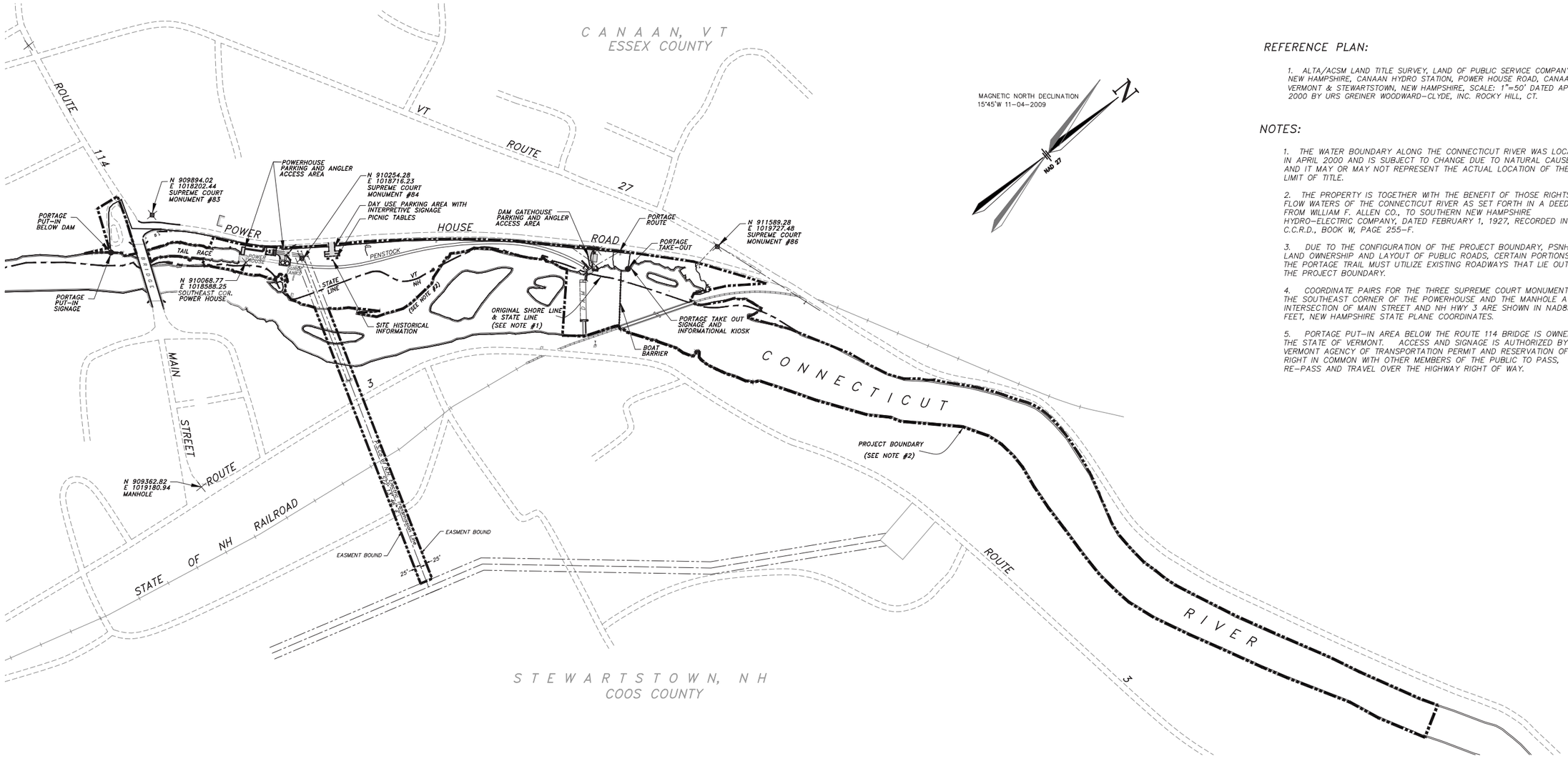
If you have any questions regarding the above, please contact Mr. Curtis R. Mooney by phone at (603) 744-8855 Ext. 5841 or by e-mail at curtis.mooney@nu.com.

Very truly yours,

Public Service Company of New Hampshire

Andrew Qua
Kleinschmidt Project Manager for PSNH

Enclosures
cc: Curt Mooney, PSNH



REFERENCE PLAN:

1. ALTA/ACSM LAND TITLE SURVEY, LAND OF PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE, CANAAN HYDRO STATION, POWER HOUSE ROAD, CANAAN, VERMONT & STEWARTSTOWN, NEW HAMPSHIRE, SCALE: 1"=50' DATED APRIL 2000 BY URS GREINER WOODWARD-CLYDE, INC. ROCKY HILL, CT.

NOTES:

1. THE WATER BOUNDARY ALONG THE CONNECTICUT RIVER WAS LOCATED IN APRIL 2000 AND IS SUBJECT TO CHANGE DUE TO NATURAL CAUSES AND IT MAY OR MAY NOT REPRESENT THE ACTUAL LOCATION OF THE LIMIT OF TITLE.

2. THE PROPERTY IS TOGETHER WITH THE BENEFIT OF THOSE RIGHTS TO FLOW WATERS OF THE CONNECTICUT RIVER AS SET FORTH IN A DEED FROM WILLIAM F. ALLEN CO., TO SOUTHERN NEW HAMPSHIRE HYDRO-ELECTRIC COMPANY, DATED FEBRUARY 1, 1927, RECORDED IN THE C.C.R.D., BOOK W, PAGE 255-F.

3. DUE TO THE CONFIGURATION OF THE PROJECT BOUNDARY, PSNH LAND OWNERSHIP AND LAYOUT OF PUBLIC ROADS, CERTAIN PORTIONS OF THE PORTAGE TRAIL MUST UTILIZE EXISTING ROADWAYS THAT LIE OUTSIDE THE PROJECT BOUNDARY.

4. COORDINATE PAIRS FOR THE THREE SUPREME COURT MONUMENTS, THE SOUTHEAST CORNER OF THE POWERHOUSE AND THE MANHOLE AT THE INTERSECTION OF MAIN STREET AND NH HWY 3 ARE SHOWN IN NAD83 FEET, NEW HAMPSHIRE STATE PLANE COORDINATES.

5. PORTAGE PUT-IN AREA BELOW THE ROUTE 114 BRIDGE IS OWNED BY THE STATE OF VERMONT. ACCESS AND SIGNAGE IS AUTHORIZED BY VERMONT AGENCY OF TRANSPORTATION PERMIT AND RESERVATION OF RIGHT IN COMMON WITH OTHER MEMBERS OF THE PUBLIC TO PASS, RE-PASS AND TRAVEL OVER THE HIGHWAY RIGHT OF WAY.

200 100 0 200 400 600

GRAPHIC SCALE
1" = 200'

Exhibit G, Sheet 1, KA 1203-034 11/09
Revised 5/12

THE PURPOSE OF THIS MAP IS TO PROVIDE A GEOREFERENCED VISUAL DEPICTION (+/- 40') OF THE LOCATION OF PROJECT FEATURES. BOUNDARIES ARE BASED ON THE BEST AVAILABLE HISTORICAL DRAWINGS AND HAVE NOT BEEN COMPLETELY VERIFIED BY PHYSICAL FIELD SURVEYS. THIS DRAWING SHOULD NOT BE USED FOR PURPOSES OF DEVELOPING PROPERTY BOUNDARY DESCRIPTIONS. THIS DRAWING IS FOR EXCLUSIVE USE OF FERC AND NO OTHER THIRD-PARTIES.

By: _____
Norbert A. Blais, VT R.L.S. #409

EXHIBIT G SHEET 1

CANAAN HYDRO ELECTRIC PROJECT
PROJECT NO. 7528-VT
MAP OF PROJECT AREA
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, N.H.

KA 1203-024 3/10

Kleinschmidt
Energy & Water Resource Consultants

SHEET NO. OF	Drawn By: Date: / Checked By: Date: / Approved By: Date:	Date	Chkd.	Revision

Document Content(s)

APPENDIX B

FACILITY AREA AND RIVER BASIN

PHOTO 14 OVERVIEW OF GORHAM PROJECT

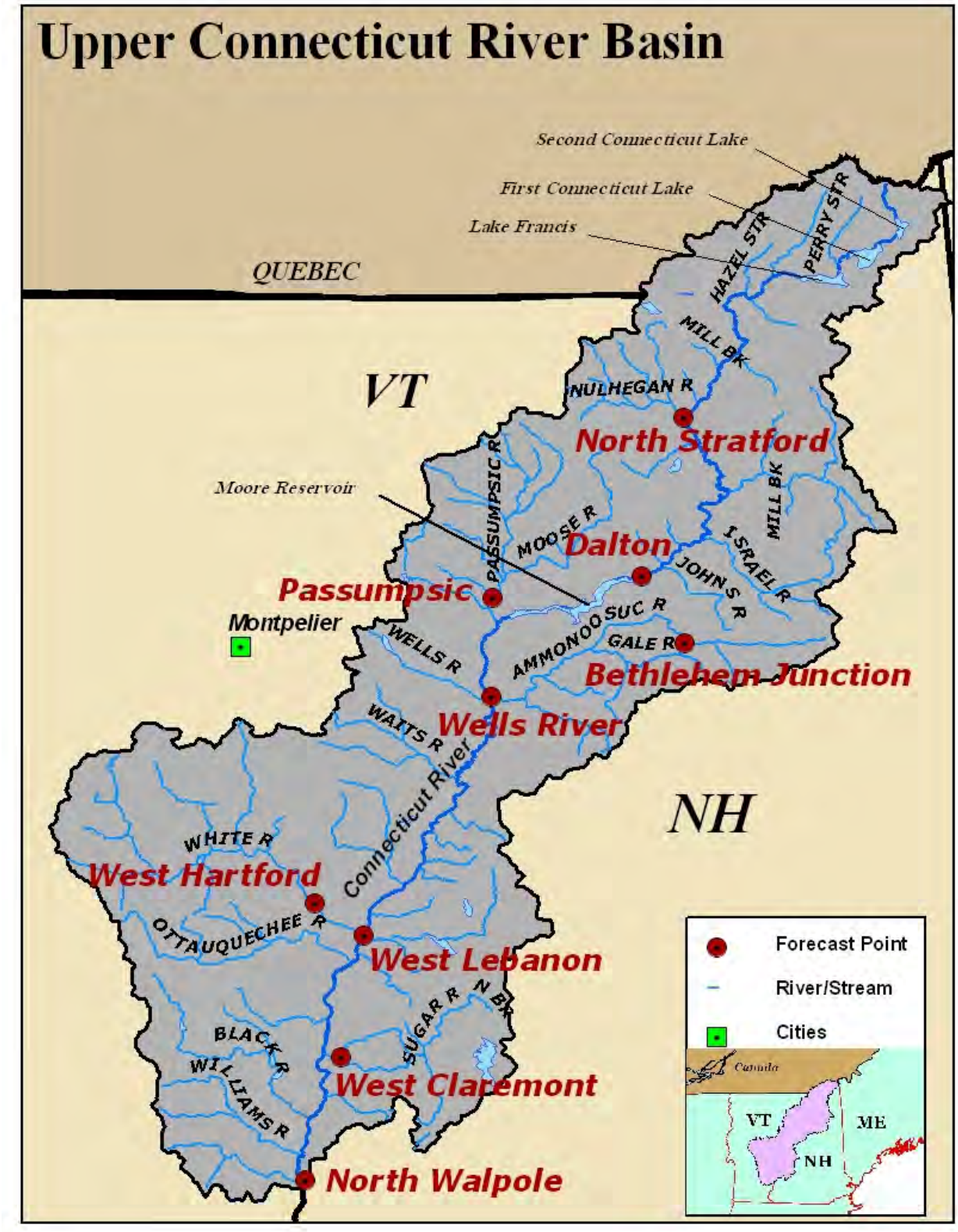
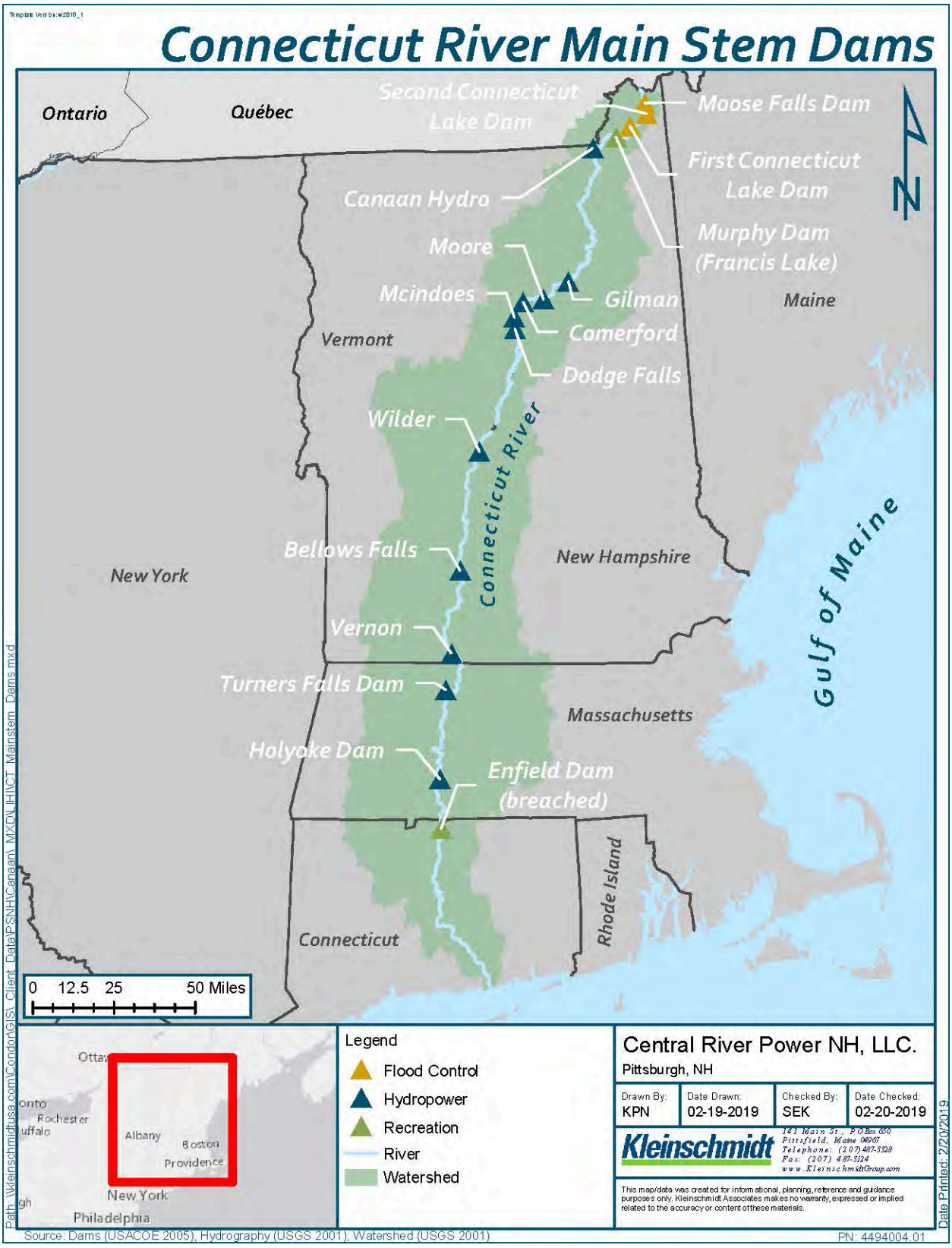


FIGURE 8 UPPER CONNECTICUT RIVER BASIN[45]

[45] https://www.weather.gov/nerfc/ct_photos


Connecticut River Main Stem Dams
Ontario
Québec
Second Connecticut Lake Dam
Moose Falls Dam
First Connecticut Lake Dam
Canaan Hydro
Murphy Dam (Francis Lake)
Moore
Mcindoes
Gilman
Comerford
Dodge Falls
Wilder
Vermont
Maine
Connecticut River
Bellows Falls
New Hampshire
New York
Vernon
Turners Falls Dam
Massachusetts
Holyoke Dam
Enfield Dam (breached)
Gulf of Maine
Rhode Island
Connecticut
N
0 12.5 25 50 Miles
Albany
Boston
Providence
New York
Philadelphia
Legend
Flood Control
Hydropower
Recreation
River
Watershed
Central River Power NH, LLC.
Pittsburgh, NH
Drawn By: KPN
Date Drawn: 02-19-2019
Checked By: SEK
Date Checked: 02-20-2019
Kleinschmidt
141 Main St., PO Box 650
Pittsfield, Maine 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtGroup.com
This map/data was created for informational, planning, reference and guidance purposes only. Kleinschmidt Associates makes no warranty, expressed or implied related to the accuracy or content of these materials.
Date Printed: 2/20/2019
Path: \\kleinschmidtusa.com\Condor\GIS\Client_Data\PSNH\Canaan\MXD\LIHI\CT_Mainstem_Dams.mxd
Source: Dams (USACOE 2005), Hydrography (USGS 2001), Watershed (USGS 2001)
PN: 4494004.01

APPENDIX C

WATER QUALITY CERTIFICATION

APPENDIX A

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION WATER QUALITY CERTIFICATION CONDITIONS ISSUED NOVEMBER 20, 2008

A. **Compliance with Conditions.** The applicant shall operate and maintain this project consistent with the findings and conditions of this certification, where those findings and conditions relate to protection of water quality and support of designated and existing uses under Vermont Water Quality Standards and other appropriate requirements of state law and New Hampshire Water Quality Standards where applicable.

B. **Flow Management.** Except as allowed in Condition C below, the facility shall be operated in a true run-of-the-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam. In the river reach bypassed by the penstock, a flow of 165 cfs, or instantaneous inflow if less, shall be maintained at all times; the bypass flow shall be provided as full crest spillage unless an alternate method is approved by the Department after review and consultation with the N.H. Department of Environmental Services to assure that aquatic habitat and aesthetics will be supported.

C. **Impoundment Water Level Management.** The conservation flow shall be maintained as full crest spillage unless an alternative method combining spillage with a gate discharge and/or fishway flows is approved by the Department after the Department's consultation with the N.H. Department of Environmental Services, and a determination that aesthetics will continue to be fully supported. During maintenance drawdowns, the water level will be maintained at or above twelve inches below the fixed dam crest (at or above elevation 1050.5 feet msl), unless special approval is granted by the Department under Condition M below. Any drawdown for maintenance or repair work shall be done at a controlled rate so as to limit the impact on public safety and on aquatic habitat in the impoundment and downstream of the dam.

D. **Flow Management during Impoundment Refill.** During refilling of the project impoundment after flashboard replacement, an approved dam maintenance operation or an emergency drawdown, the applicant shall release at least 90 percent of instantaneous inflow below the project. While the impoundment is being refilled, bypass flow requirements shall be met at all times.

E. **Flow Management Plan.** The applicant shall develop and file with the Department and the N.H. Department of Environmental Services a flow management plan detailing how the project will be operated to comply with the conservation flow and impoundment fluctuation limitations described above. The plan shall include information on how the project will be managed to control lag times and avoid related non-compliance with the conservation flow requirements. The plan shall be subject to Department review and approval after consultation with the N.H. Department of Environmental Services. The Department reserves the right of review and approval of any material changes made to the plan.

F. **Monitoring Plan for Impoundment and Flow Management.** The applicant shall develop a plan for continuous monitoring and reporting of flow releases at the project (spillage and turbine discharge), impoundment levels, and inflows. The plan shall include procedures for reporting deviations from prescribed operating requirements to the Department, explaining the reasons for those deviations and indicating measures to be taken to avoid recurrences. The applicant shall maintain continuous records of flows and impoundment levels and provide such records on a regular basis as per specifications of the Department. The plan shall be developed in consultation with the Department, the N.H. Department of Environmental Services, and the U.S. Fish and Wildlife Service. The plan shall be subject to Department review and approval. The Department reserves the right of review and approval of any material changes made to the plan.

G. **Dissolved Oxygen Sampling Study.** When technically feasible based on critical river flow and water temperature conditions, the licensee shall complete the dissolved oxygen study following the protocol agreed upon with the Department and the New Hampshire Department of Environmental Services. The study report shall be filed by the December following the season of sampling and shall include proposed remediation to address substandard conditions, if identified, and an implementation schedule, both subject to Department approval. The Department, after consultation with the N.H. Department of Environmental Services, may require additional sampling, if needed, or post-remediation sampling to determine effectiveness. The licensee shall notify the Department by October 1 of each year as to whether it was successful in completing the sampling effort.

H. **Downstream Fish Passage.** The licensee shall implement permanent downstream fish passage within two years of a request by the Department, which request shall only occur after the N.H. Department of Fish and Game adopts a management plan emphasizing self-sustaining wild trout populations and provides the Department with a plan for reducing or eliminating stocking and/or harvest in the towns of Stewartstown, Colebrook, and Columbia after implementation of passage. Any request shall be made based on a written evaluation by the Vermont Department of

Fish and Wildlife of the need for downstream fish passage, said evaluation to be done in consultation with the N.H. Department of Environmental Services, the N.H. Department of Fish and Game, the U.S. Fish and Wildlife Service, the Connecticut River Watershed Council, Connecticut River Joint Commissions, Trout Unlimited, and PSNH. The design shall include provisions to prevent entrainment and impingement, and shall be functional at all normal impoundment levels (e.g., with and without flashboards). The Vermont Department of Fish and Wildlife evaluation shall address whether the facility should be operated year-round or for an alternate schedule, and the Department shall specify the operating schedule in its request. The Department may authorize or order an adjustment of the operating schedule based on experience or specific conditions during a given year, either at the PSNH's request, after consultation with the state fisheries resource departments, or pursuant to a mutual request by the state fisheries resource departments. The applicant shall develop the design in consultation with the Department, the Vermont Department of Fish and Wildlife, the N.H. Department of Fish and Game, and the U.S. Fish and Wildlife Service, and it shall be subject to Department approval prior to implementation.

The design for any trashrack replacement is subject to prior approval by the Department, after consultation with the Vermont Department of Fish and Wildlife, the N.H. Department of Environmental Services, the N.H. Department of Fish and Game, and the U.S. Fish and Wildlife Service.

I. **Upstream Fish Passage.** Within two years of a request by the Department, the licensee shall institute upstream fish passage, subject to plan approval by the Department. Said request shall only occur after the N.H. Department of Fish and Game adopts a management plan emphasizing self-sustaining wild trout populations and provides the Department with a plan for reducing or eliminating stocking and/or harvest in the towns of Stewartstown, Colebrook, and Columbia after implementation of passage. Any request shall be made based on a written evaluation by the Vermont Department of Fish and Wildlife of the need for upstream fish passage, said evaluation to be done in consultation with the N.H. Department of Environmental Services, the N.H. Department of Fish and Game, the U.S. Fish and Wildlife Service, the Connecticut River Watershed Council, Connecticut River Joint Commissions, Trout Unlimited, and PSNH. The applicant shall consult the Department, the Vermont Department of Fish and Wildlife, the N.H. Department of Environmental Services, the N.H. Department of Fish and Game, and the U.S. Fish and Wildlife Service during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction. The facility shall be operated from April 1 through June 30 and September 1 through December 15. The Department may authorize or order an

adjustment of the operating schedule based on experience or specific conditions during a given year, either at the PSNH's request, after consultation with the state fisheries resource departments, or pursuant to a mutual request by the state fisheries resource departments.

J. **Passage Effectiveness Study.** Upon a request by the Vermont Agency of Natural Resources, the applicant shall complete a passage effectiveness study, or studies, based on a study plan(s) and schedule(s) approved by the Department after consultation with the U.S. Fish and Wildlife Service, the Vermont Department of Fish and Wildlife, the N.H. Department of Environmental Services, and the N.H. Department of Fish and Game. Any study shall be limited to monitoring utilization of the fishway(s) during applicable operating periods and shall not include studies of fish behavior and movement. The results of such effectiveness studies may serve as the basis for the Department to require modifications of any facilities required under conditions H and I above.

K. **Turbine Rating Curves.** The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within one year of the effective date of the license.

L. **Debris Disposal Plan.** The applicant shall develop a plan for proper disposal of debris associated with project operation, including trashrack debris. The plan shall be developed in consultation with the Department and shall be subject to Department review and approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

M. **Maintenance and Repair Work.** Any proposals for project maintenance or repair work, including drawdowns lower than six inches below the fixed dam crest to facilitate repair/maintenance work, shall be filed with the Department for prior review and approval, if said work may have a material adverse effect on water quality or cause less-than-full support of an existing use or a beneficial value or use of the waters. The applicant shall file any proposals concurrently with the N.H. Department of Environmental Services to facilitate the Department's consultation with the N.H. Department of Environmental Services.

N. **Public Access.** The applicant shall allow public access to the project lands for utilization of public resources, subject to reasonable safety and liability limitations. Such access should be prominently and permanently posted so that its availability is made known to the public. Any proposed limitations of access to the waters to be imposed by the applicant shall first be subject to written approval by either the Department or the N.H. Department of Environmental Services, depending on which bank of the river is involved. In cases where an immediate threat to public safety

exists, access may be restricted without prior approval; the applicant shall so notify the appropriate department and shall file a request for approval, if the restriction is to be permanent or long term, within 14 days of the restriction of access.

O. **Riparian Zone Management Plan.** The applicant shall develop, and file for Department approval within six months of the effective date of the license, a riparian zone management plan that establishes and maintains an undisturbed, naturally vegetated riparian zone along the river. The applicant shall prepare the plan in consultation with the Department, the N.H. Department of Environmental Services, the Connecticut River Watershed Council, the towns of Canaan and Stewartstown, Connecticut River Joint Commissions, Trout Unlimited, and either or both of the state highway agencies, if interested. Documentation of consultation will be included in the plan and a specific explanation of how the comments have been addressed. The applicant shall provide a minimum of 30 days for the entities to comment and make recommendations before the plan is finalized.

P. **Recreational Facilities.** Recreational facilities shall be constructed and maintained consistent with a recreation plan approved by the Department after consultation with the N.H. Department of Environmental Services. The plan shall include interpretive and directional signs. The plan shall be filed with the Department within one year of the effective date of the license and shall include an implementation schedule. Where appropriate, the recreation plan shall include details on erosion control. The applicant shall prepare the plan in consultation with the Department, the N.H. Department of Environmental Services, the Connecticut River Watershed Council, the towns of Canaan and Stewartstown, the Connecticut River Joint Commissions, and Trout Unlimited. The plan shall be updated at the end of each subsequent five-year period. Modifications to the recreation plan shall also be subject to Department approval over the term of the license. If the applicant determines that the plan does not need to be updated, a statement stating such shall be filed with the two departments.

Q. **Boat Put-in at Vermont Route 114 Bridge.** The applicant shall evaluate the feasibility of including the existing boat access at the Vermont Route 114 bridge within the project boundary and report its findings, and a schedule if found feasible, to the Department within one year of the effective date of the license.

R. **Erosion Prevention and Sediment Control.** Upon a written request by the Department or the N.H. Department of Environmental Services, the applicant shall design and implement erosion prevention and sediment control measures as necessary to address erosion occurring as a result of project operation or use of the project lands for recreation. Any work that exceeds minor maintenance shall be subject to prior approval by the Department, which shall consult with the N.H. Department of Environmental Services where appropriate.

The applicant shall collect data on shoreline erosion during the first and fifth summers following the effective date of the license and following any flood event exceeding a flow of 5,000 cfs. The scope and type of data collected shall be consistent with the recommendations in Shoreline Erosion Study for the Canaan Hydroelectric Project, October 2006. The data shall be compared to the reference data collected for that study report to determine where active erosion is occurring, how that may affect water quality, and what, if any, risk the erosion presents to project works and roadways and other public infrastructure. A report shall be filed with the Department by the first December 1 following the fifth summer. The report shall provide the comparative evaluation, impact/risk assessment, a remediation proposal based on the assessment, and recommendations on subsequent monitoring. After consultant with the N.H. Department of Environmental Services, the Department may require continued monitoring and/or remediation.

S. **Compliance Inspection by Department.** The applicant shall allow the Department and N.H. Department of Environmental Services to inspect the project area at any time to monitor compliance with certification conditions.

T. **Posting of Certification.** A copy of this certification shall be prominently posted within the project powerhouse.

U. **Approval of Project Changes.** Any change to the project that would have a significant or material effect on the findings, conclusions or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval where appropriate and authorized by law and only as related to the change proposed after consultation with the N.H. Department of Environmental Services.

V. **Reopening of License.** The Department may request, at anytime, that FERC reopen the license to consider modifications to the license as necessary to assure compliance with Vermont and/or New Hampshire Water Quality Standards.

W. **Continuing Jurisdiction.** The Department reserves the right to add and alter the terms and conditions of this certification, when authorized by law and as appropriate to carry out its responsibilities with respect to water quality during the life of the project.

APPENDIX D

CONSULTATION

Public Service
of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000
www.psnh.com

The Northeast Utilities System

September 28, 2011

D30615

Mr. Brian Fitzgerald
Vermont Agency of Natural Resources
Department of Environmental Conservation
103 South Main Street, 10 North
Waterbury, VT 05671-0408

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Fitzgerald:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Public Service Company of New Hampshire (PSNH) to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

The **Surface Water Quality Assessment Study Plan** outlined the following sampling criteria:

> Monitoring will occur during low flow conditions, defined as when river flow at the project is less than 200 cfs. The USGS real-time flow gage upstream, Connecticut River below Indian Stream near Pittsburg, NH (USGS 01129200) will be used to determine the flows at the Project. Upon review of the flow duration curves for Canaan Hydroelectric Project, drainage areas at the gage and the project, and actual flow data, it was determined that a flow of 133 cfs at the gage (USGS 01129200) equals approximately 200 cfs at the Project.
>
> Real-time flow at the Pittsburg gage will be monitored to determine when to mobilize to the site for the water quality sampling. When the Pittsburg gage is at or near 133 cfs, water temperatures are at least 15° C, and if weather conditions are favorable, preparations will be made to begin monitoring the next day.

No sampling was conducted during 2011 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 5841 or by e-mail at mooneer@nu.com .

Very truly yours,

Public Service Company of New Hampshire

Robert Gundersen

Robert Gundersen
PSNH Hydro Manager

Public Service
of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000
www.psnh.com

The Northeast Utilities System

September 7, 2012

D31601

Mr. Brian Fitzgerald
Vermont Agency of Natural Resources
Department of Environmental Conservation
103 South Main Street, 10 North
Waterbury, VT 05671-0408

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Fitzgerald:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Public Service Company of New Hampshire (PSNH) to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

The **Surface Water Quality Assessment Study Plan** outlined the following sampling criteria:

> Monitoring will occur during low flow conditions, defined as when river flow at the project is less than 200 cfs. The USGS real-time flow gage upstream, Connecticut River below Indian Stream near Pittsburg, NH (USGS 01129200) will be used to determine the flows at the Project. Upon review of the flow duration curves for Canaan Hydroelectric Project, drainage areas at the gage and the project, and actual flow data, it was determined that a flow of 133 cfs at the gage (USGS 01129200) equals approximately 200 cfs at the Project.
>
> Real-time flow at the Pittsburg gage will be monitored to determine when to mobilize to the site for the water quality sampling. When the Pittsburg gage is at or near 133 cfs, water temperatures are at least 15° C, and if weather conditions are favorable, preparations will be made to begin monitoring the next day.

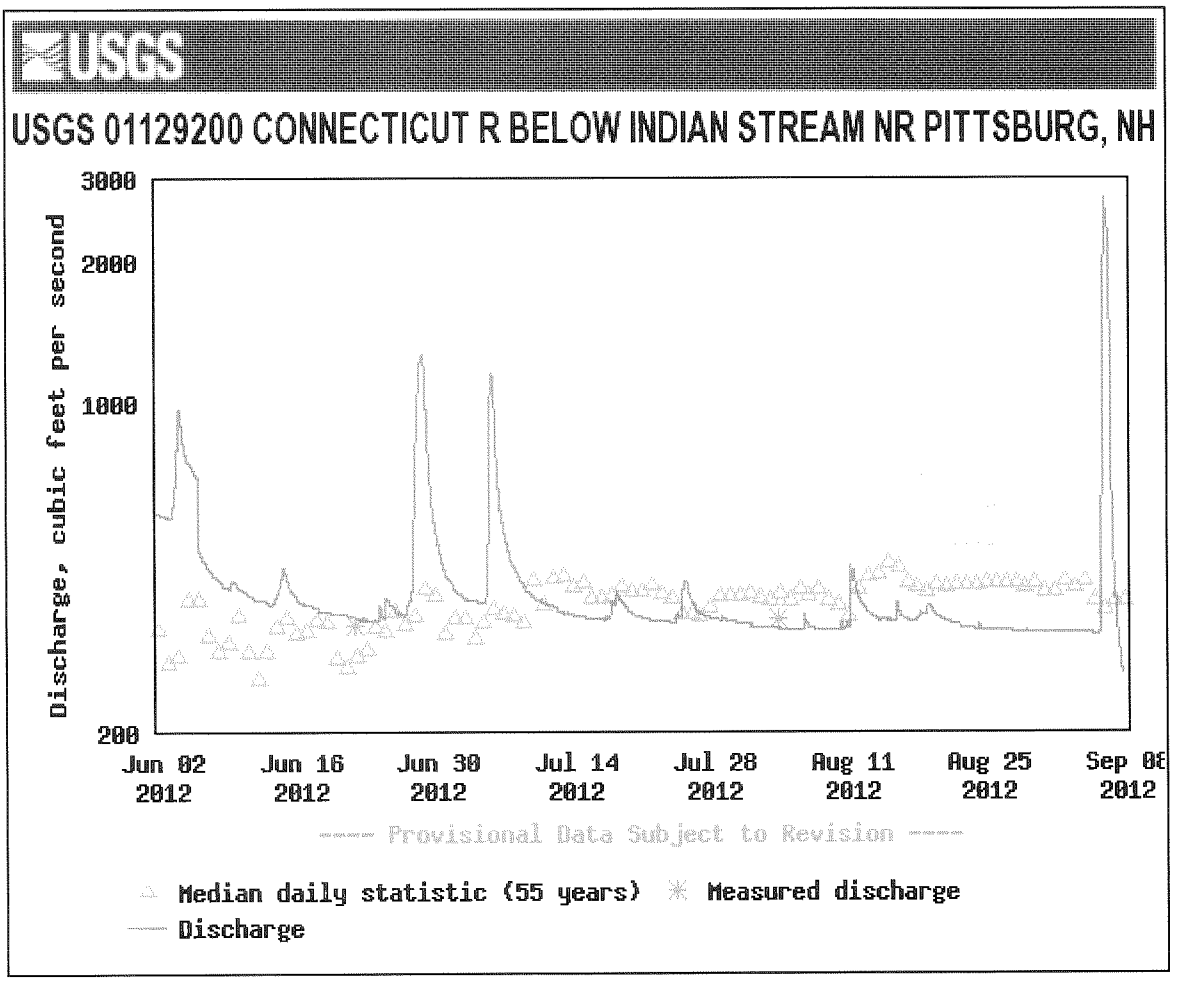
No sampling was conducted during 2012 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs. Attached is a USGS graph of river flow at the Pittsburg gage during the summer of 2012.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 5841 or by e-mail at moonecr@nu.com .

Very truly yours,

Public Service Company of New Hampshire

Michael Hitchko
PSNH Hydro Manager



Public Service of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

September 3, 2013

D32467

Mr. Brian Fitzgerald
Vermont Agency of Natural Resources
Department of Environmental Conservation
103 South Main Street, 10 North
Waterbury, VT 05671-0408

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Fitzgerald:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Public Service Company of New Hampshire (PSNH) to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

The **Surface Water Quality Assessment Study Plan** outlined the following sampling criteria:

> Monitoring will occur during low flow conditions, defined as when river flow at the project is less than 200 cfs. The USGS real-time flow gage upstream, Connecticut River below Indian Stream near Pittsburg, NH (USGS 01129200) will be used to determine the flows at the Project. Upon review of the flow duration curves for Canaan Hydroelectric Project, drainage areas at the gage and the project, and actual flow data, it was determined that a flow of 133 cfs at the gage (USGS 01129200) equals approximately 200 cfs at the Project.
>
> Real-time flow at the Pittsburg gage will be monitored to determine when to mobilize to the site for the water quality sampling. When the Pittsburg gage is at or near 133 cfs, water temperatures are at least 15° C, and if weather conditions are favorable, preparations will be made to begin monitoring the next day.

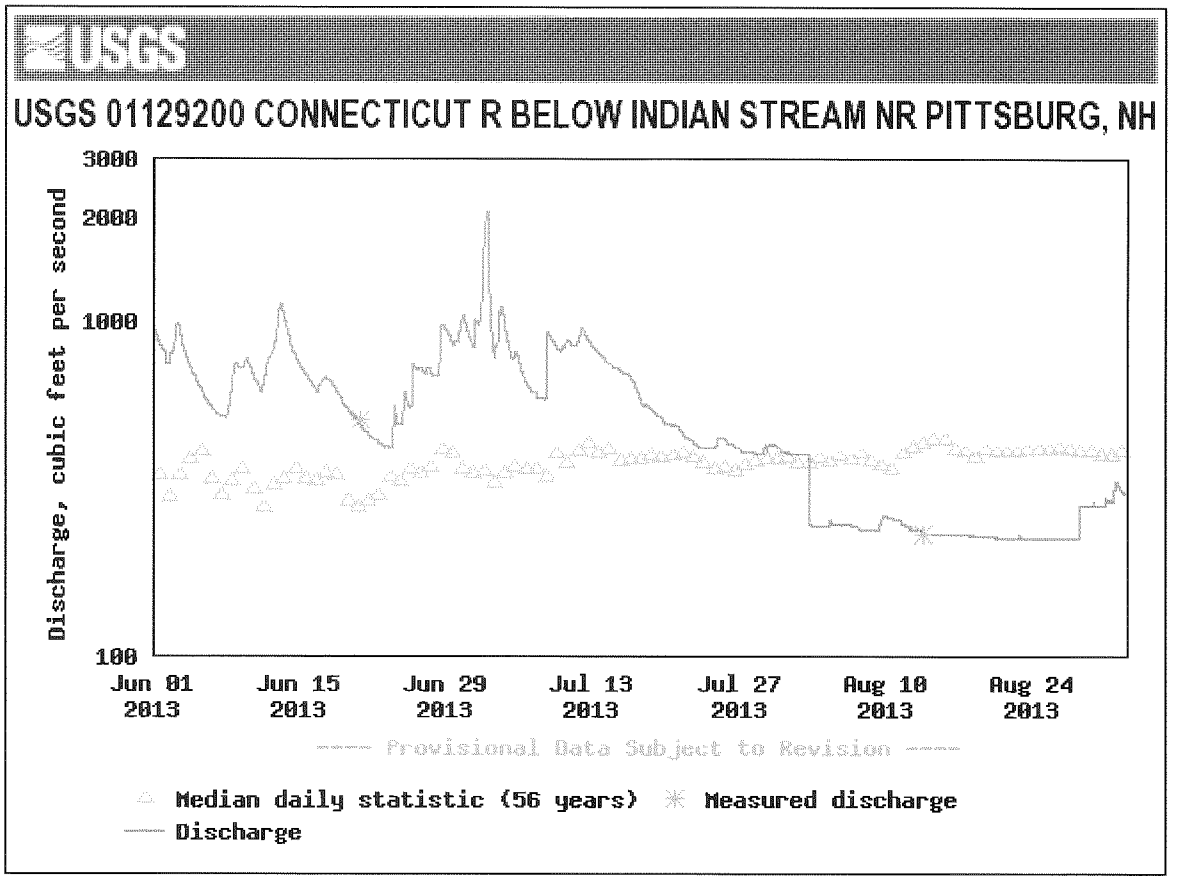
No sampling was conducted during 2013 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs. Attached is a USGS graph of river flow at the Pittsburg gage during the summer of 2013.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 5841 or by e-mail at moonecr@nu.com .

Very truly yours,

Public Service Company of New Hampshire

Michael Hitchko
PSNH Hydro Manager



Public Service
of New Hampshire
A Northeast Utilities Company

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000
www.psnh.com

September 10, 2014

D32994

Mr. Brian Fitzgerald
Vermont Agency of Natural Resources
Department of Environmental Conservation
103 South Main Street, 10 North
Waterbury, VT 05671-0408

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Fitzgerald:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Public Service Company of New Hampshire (PSNH) to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

The **Surface Water Quality Assessment Study Plan** outlined the following sampling criteria:

> Monitoring will occur during low flow conditions, defined as when river flow at the project is less than 200 cfs. The USGS real-time flow gage upstream, Connecticut River below Indian Stream near Pittsburg, NH (USGS 01129200) will be used to determine the flows at the Project. Upon review of the flow duration curves for Canaan Hydroelectric Project, drainage areas at the gage and the project, and actual flow data, it was determined that a flow of 133 cfs at the gage (USGS 01129200) equals approximately 200 cfs at the Project.
>
> Real-time flow at the Pittsburg gage will be monitored to determine when to mobilize to the site for the water quality sampling. When the Pittsburg gage is at or near 133 cfs, water temperatures are at least 15° C, and if weather conditions are favorable, preparations will be made to begin monitoring the next day.

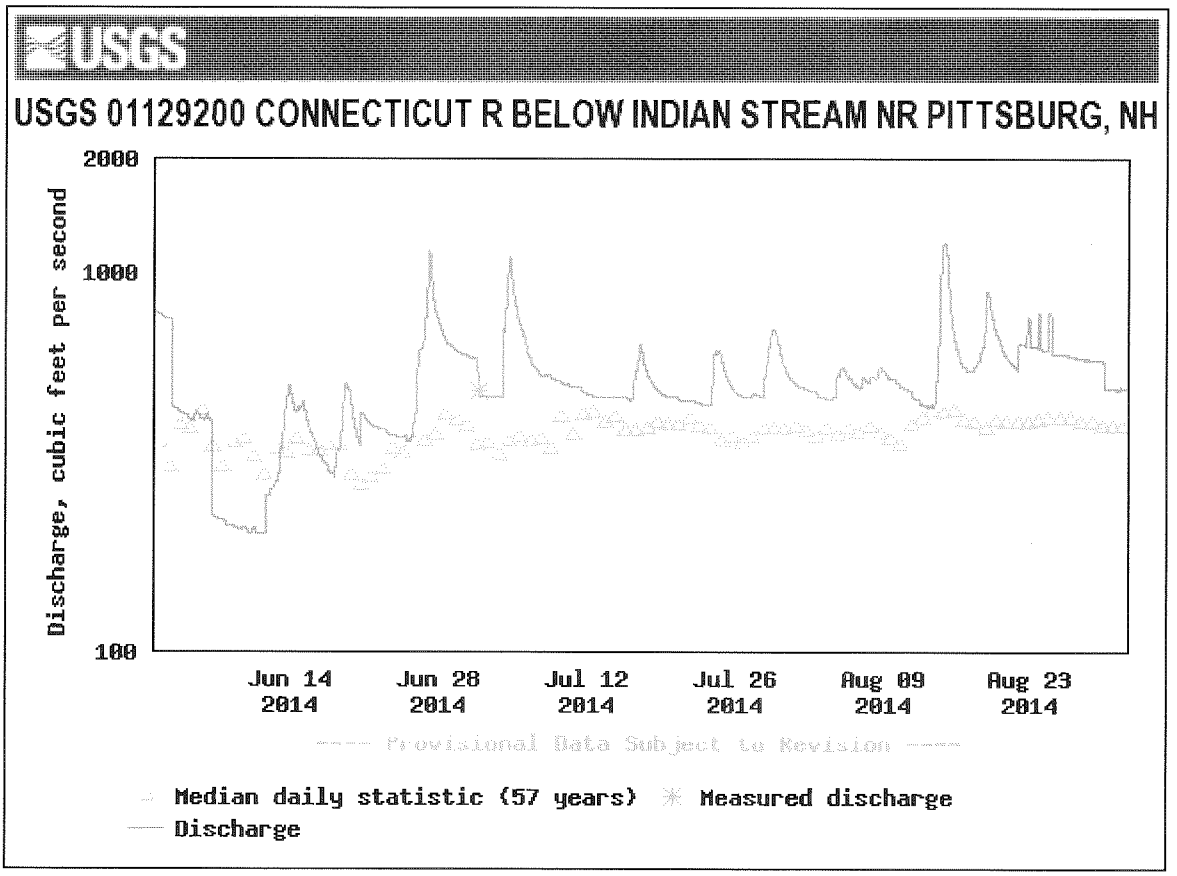
No sampling was conducted during 2014 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs. Attached is a USGS graph of river flow at the Pittsburg gage during the summer of 2014.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 555 5841 or by e-mail at mooneCr@nu.com .

Very truly yours,

Public Service Company of New Hampshire

Michael Hitchko
PSNH Hydro Manager



EVERSOURCE ENERGY

780 North Commercial Street
Manchester, NH 03101-1134

September 23, 2015

D33331

Mr. Jeff Crocker
River Ecologist
1 National Life Drive, Main 2
Montpelier, VT 05620-3522

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Crocker:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Public Service Company of New Hampshire (PSNH) d/b/a Eversource to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

The **Surface Water Quality Assessment Study Plan** outlined the following sampling criteria:

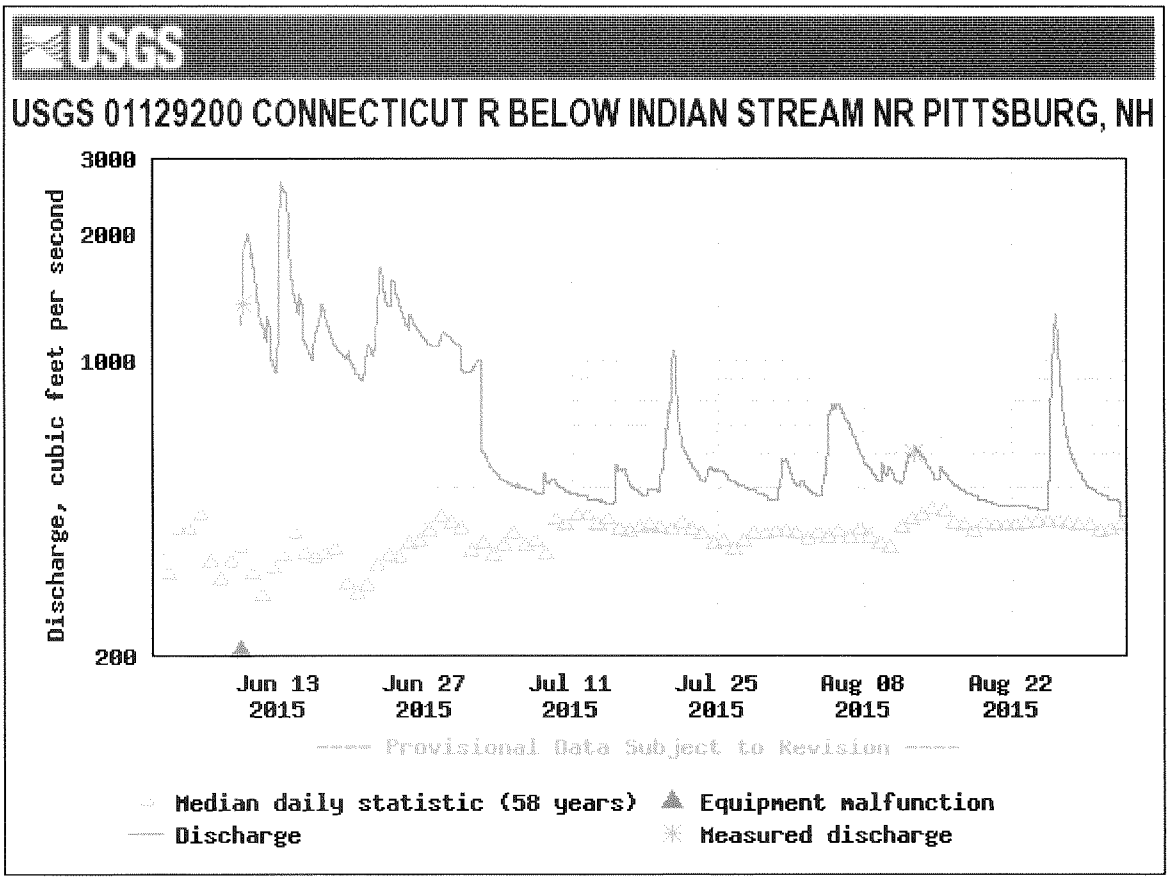
> Monitoring will occur during low flow conditions, defined as when river flow at the project is less than 200 cfs. The USGS real-time flow gage upstream, Connecticut River below Indian Stream near Pittsburg, NH (USGS 01129200) will be used to determine the flows at the Project. Upon review of the flow duration curves for Canaan Hydroelectric Project, drainage areas at the gage and the project, and actual flow data, it was determined that a flow of 133 cfs at the gage (USGS 01129200) equals approximately 200 cfs at the Project.
>
> Real-time flow at the Pittsburg gage will be monitored to determine when to mobilize to the site for the water quality sampling. When the Pittsburg gage is at or near 133 cfs, water temperatures are at least 15° C, and if weather conditions are favorable, preparations will be made to begin monitoring the next day.

No sampling was conducted during 2015 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs. Attached is a USGS graph of river flow at the Pittsburg gage during the summer of 2015.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 2 or by e-mail at curtis.mooney@eversource.com .

Very truly yours,

Michael Hitchko
Eversource Hydro Manager



EVERSOURCE ENERGY

780 North Commercial Street
Manchester, NH 03101-1134

September 14, 2016

D33680

Mr. Jeff Crocker
River Ecologist
1 National Life Drive, Main 2
Montpelier, VT 05620-3522

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Crocker:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Public Service Company of New Hampshire (PSNH) d/b/a Eversource to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

The **Surface Water Quality Assessment Study Plan** outlined the following sampling criteria:

> Monitoring will occur during low flow conditions, defined as when river flow at the project is less than 200 cfs. The USGS real-time flow gage upstream, Connecticut River below Indian Stream near Pittsburg, NH (USGS 01129200) will be used to determine the flows at the Project. Upon review of the flow duration curves for Canaan Hydroelectric Project, drainage areas at the gage and the project, and actual flow data, it was determined that a flow of 133 cfs at the gage (USGS 01129200) equals approximately 200 cfs at the Project.
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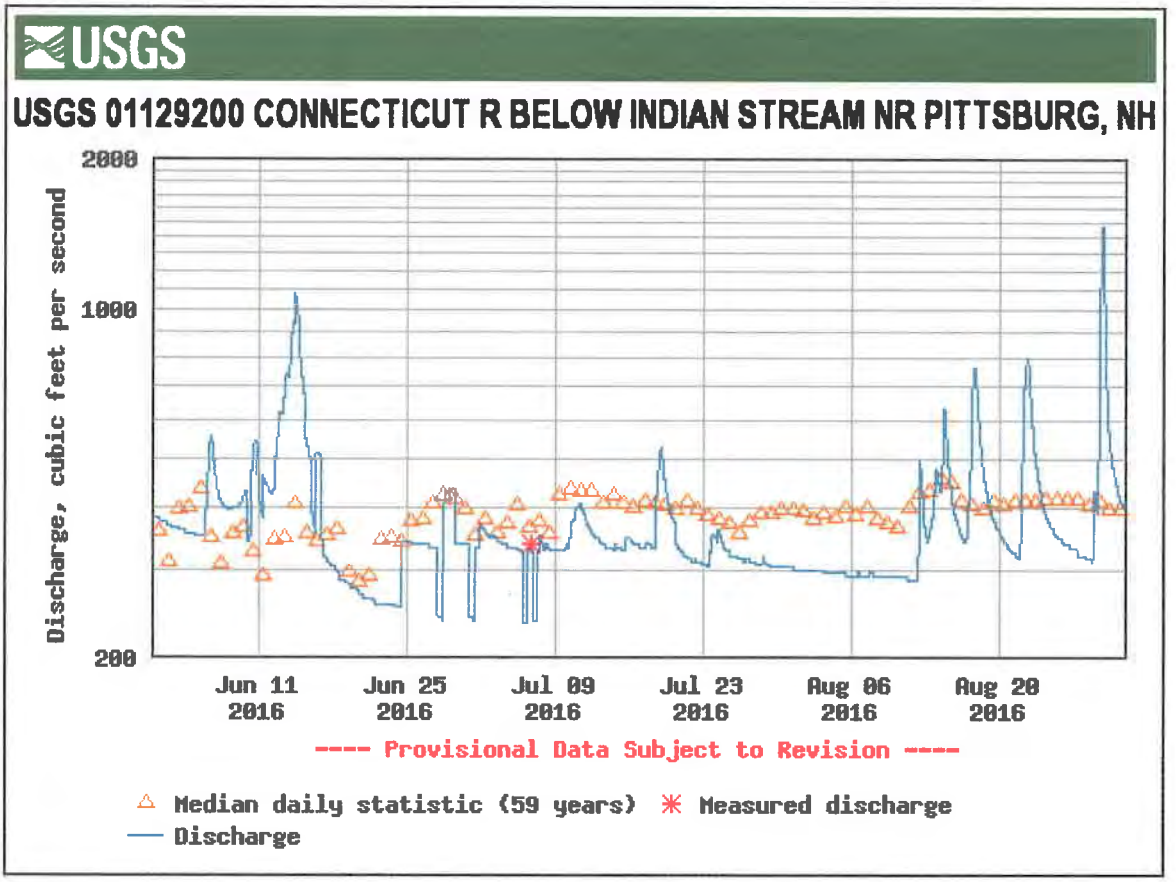
> Real-time flow at the Pittsburg gage will be monitored to determine when to mobilize to the site for the water quality sampling. When the Pittsburg gage is at or near 133 cfs, water temperatures are at least 15° C, and if weather conditions are favorable, preparations will be made to begin monitoring the next day.

No sampling was conducted during 2016 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs. Attached is a USGS graph of river flow at the Pittsburg gage during the summer of 2016.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 2 or by e-mail at curtis.mooney@eversource.com .

Very truly yours,

Michael Hitchko
Eversource Hydro Manager



Public Service of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000
www.psnh.com

The Northeast Utilities System

September 8, 2017

D33988

Mr. Jeff Crocker
River Ecologist
1 National Life Drive, Main 2
Montpelier, VT 05620-3522

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Crocker:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Public Service Company of New Hampshire (PSNH) d/b/a Eversource to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

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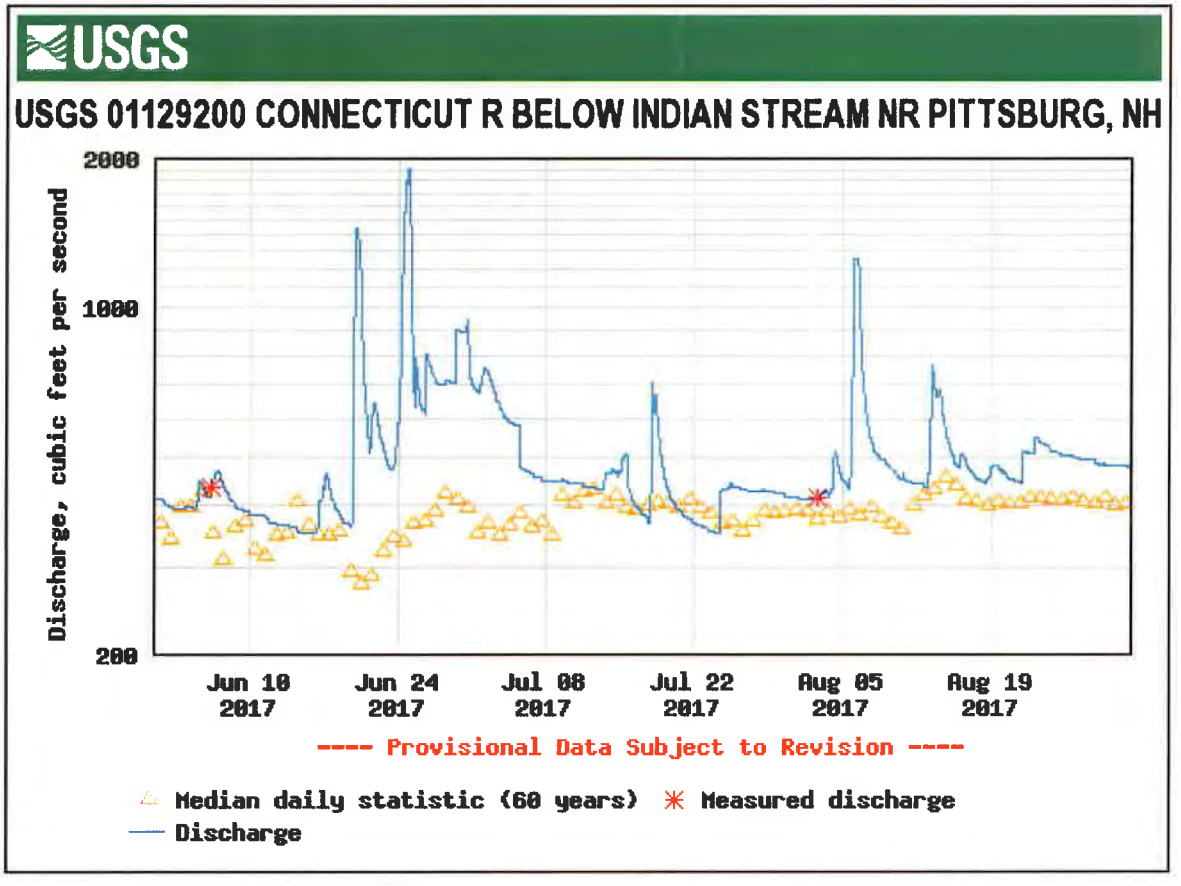
No sampling was conducted during 2017 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs. Attached is a USGS graph of river flow at the Pittsburg gage during the summer of 2017.

If you have any questions regarding the above, please contact Mr. Curt Mooney by phone at (603) 744-8855 Ext. 2 or by e-mail at curtis.mooney@eversource.com .

Very truly yours,

Michael Hitchko
Eversource Hydro Manager



Central Rivers Power
59 Ayers Island Road
Bristol, NH 03222

September 11, 2018

Mr. Jeff Crocker
River Ecologist
1 National Life Drive, Main 2
Montpelier, VT 05620-3522

Re: Canaan Hydroelectric Project, FERC Project No. 7528
Dissolved Oxygen Sampling Study

Dear Mr. Crocker:

Condition G of the Canaan Hydroelectric Project Water Quality Certification requires Central Rivers Power to notify the VT Department of Environmental Conservation by October 1 of each year as to whether it was successful in completing the dissolved oxygen sampling effort.

The **Surface Water Quality Assessment Study Plan** outlined the following sampling criteria:

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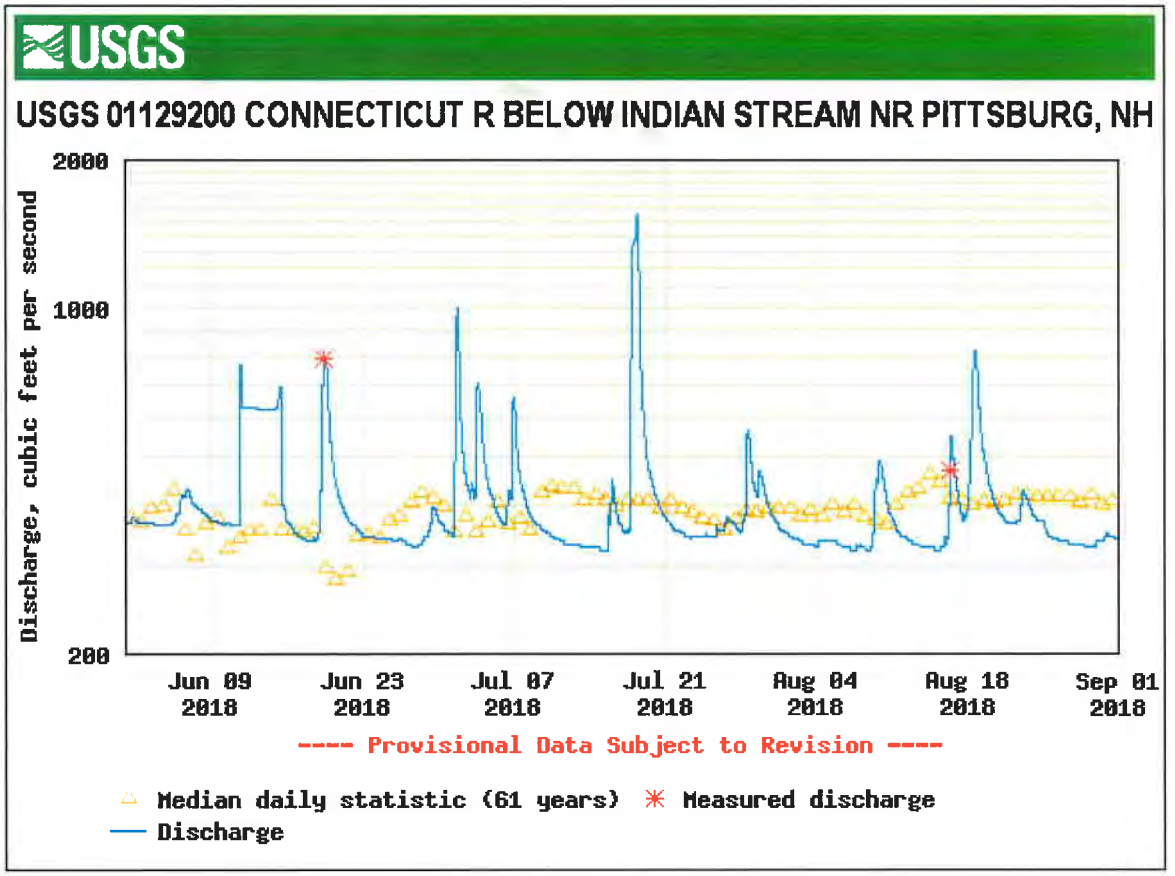
> Real-time flow at the Pittsburg gage will be monitored to determine when to mobilize to the site for the water quality sampling. When the Pittsburg gage is at or near 133 cfs, water temperatures are at least 15° C, and if weather conditions are favorable, preparations will be made to begin monitoring the next day.

No sampling was conducted during 2018 since river flow at the Pittsburg gage did not reach the trigger flow of 133 cfs. Attached is a USGS graph of river flow at the Pittsburg gage during the summer of 2018.

If you have any questions regarding the above, please contact me by phone at (603) 744-8855 Ext. 2 or by e-mail at cmooney@centralriverspower.com .

Very truly yours,

Curtis Mooney
Central Rivers Power
Manager, Regulatory Affairs



Request for NHB Review of "Potential Impacts" from the NHB DataCheck Tool

NHB File Number: NHB19-0070
Data Requested: 1/3/2019

Requested By:

Name: Kayla Easler
141 Main Street, P.O. Box 650
Pittsfield, ME 04967
E-mail: kayla.easler@kleinschmidtgroup.com
Phone: 207-416-1271

Project Location:

Town: Stewartstown
Description: 344 Powerhouse Road

Payment Information. These fields MUST be filled out.

Check Number: _____

Name of Account: _____

(as printed on the check)

Enclose this completed form with a check in the amount of $25, made out to "Treasurer, State of NH".

Send the check and the completed form to the following address:

DRED - NHB
NHB Reviews
172 Pembroke Road
Concord, NH 03301

Kleinschmidt

January 9, 2018

VIA-EMAIL

Gregg Comstock
Supervisor, Water Quality Planning Section
NH Department of Environmental Services
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095
Gregg.Comstock@des.nh.gov

Canaan Hydroelectric Project (FERC No. 7528)
LIHI application Project Review of Continued Use

Dear Gregg:

The following is a request for review of water quality resources for the Low Impact Hydropower Institute (LIHI) certification application for Central Rivers Power: Canaan Hydroelectric Project (FERC No. 7528) located on the Connecticut River in Coos County, New Hampshire and Essex County, Vermont.

Part of the LIHI application process requires the applicant to receive conformation from the state water resource agency that the continued operation of the project does not and will not contribute to the impaired waters of the state.

We ask that you please confirm, to your best abilities, that this is still true for the project and that the continued operations of the project do not contribute to water quality limitations.

If you have any questions, please contact me at (207) 416-1271 or by email at Kayla.Easler@KleinschmidtGroup.com.

Sincerely,

KLEINSCHMIDT ASSOCIATES

Kayla A. Easler
Regulatory Coordinator

KAE:TMJ
cc: Curt Mooney, Central Rivers Power
Andy Qua, Kleinschmidt

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Kleinschmidt

January 9, 2018

VIA-EMAIL

Eric Davis, River Ecologist
Vermont Department of Environmental Conservation
1 National Life Drive, Main 2
Montpelier, VT 05620-3522

Canaan Hydroelectric Project (FERC No. 7528)
LIHI application Project Review of Continued Use

Dear Eric:

The following is a request for review of water quality resources and rare, threatened, and endangered species for the Low Impact Hydropower Institute (LIHI) certification application for Central Rivers Power: Canaan Hydroelectric Project (FERC No. 7528) located on the Connecticut River in Coos County, New Hampshire and Essex County, Vermont.

Part of the LIHI application process requires the applicant to receive conformation from the state water resource agency that the continued operation of the project does not and will not contribute to the impaired waters of the state.

We ask that you please confirm, to your best abilities, that this is still true for the project and that the continued operations of the project do not contribute to water quality limitations.

In addition, the LIHI application process requires the applicant to receive conformation that there are no negative impacts to rare, threatened, and endangered species by the continued operation of the project.

Due to the partial government shutdown (at the time of writing this letter) an official species list from the U.S. Fish and Wildlife Service cannot be conducted do to the furlough. However, we are requesting a species list for both flora and fauna from the state agencies at this time.

If you have any questions, please contact me at (207) 416-1271 or by email at Kayla.Easler@KleinschmidtGroup.com.

Sincerely,

KLEINSCHMIDT ASSOCIATES

Kayla A. Easler

Kayla A. Easler
Regulatory Coordinator

KAE:TMJ
cc: Curt Mooney, Central Rivers Power
Andy Qua, Kleinschmidt

From: Kayla Easler
To: "Carol.Henderson@wildlife.nh.gov"
Subject: Additional species review for LIHI certification
Date: Thursday, January 24, 2019 9:35:00 AM
Attachments: NHB18-3938_Easler (002).pdf
NHB19-0070_Easler (002).pdf
NHB19-0097_Easler.pdf
image001.png

Good morning Carol,

I have three projects Gorham, Canaan, and Hooksett (attached) that are going through the application process for LIHI certification.

Kim Tuttle directed me to you for the additional review of the projects. Please let me know what additional information you need for review. As part of the LIHI process they require written responses from the agencies, showing the continued operation of the project will not contribute to the status of the species and that no significant affect is expected.

Thank you,

Kayla A. Easler
Regulatory Coordinator
Kleinschmidt
Direct: (207) 416-1271
www.KleinschmidtGroup.com
*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From:	Kayla Easler
To:	"Lamb, Amy"
Cc:	Tuttle, Kim; "Carol.Henderson@wildlife.nh.gov"; Andy Qua
Subject:	RE: NHB review: NHB19-0070
Date:	Thursday, January 24, 2019 10:51:00 AM
Attachments:	Project Description Canann for NHB.docx Canaan_PB.jpg Project Location.png Project Description Gorham for NHB.docx

Amy,

Attached are the project description and operations for the Gorham (NHB18-3938) and Canaan (NHB19-0070) project.

The first part of the existing Gorham powerhouse was built in 1909. Additional parts of the Gorham Project were built from 1917 to 1923 in stages by the Twin State Gas and Electric Company. In addition, the dam was enlarged several times, in 1903, 1927-1928, and 1958-1959. The Gorham Project was acquired by PSNH in 1943.

The first part of the existing Canaan dam was originally constructed at the project site in 1927 and was reconstructed in 1943 after the original timber crib dam washed out. A powerhouse was also constructed, and project operation began in 1943.

Thank you,

Kayla A. Easler
Regulatory Coordinator
Kleinschmidt
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From: Lamb, Amy <Amy.Lamb@dncr.nh.gov>
Sent: Thursday, January 24, 2019 10:15 AM
To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>
Cc: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Subject: RE: NHB review: NHB19-0070

Kayla,

We do not have current information about the natural community or rare plant species within the project area, nor a set of historic data to compare with existing conditions. Therefore, we can't comment on any effects the dam might be having on these resources. How long has the dam been present at this location?

Amy Lamb
Ecological Information Specialist

(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301

From: Kayla Easler [mailto:Kayla.Easler@KleinschmidtGroup.com]
Sent: Thursday, January 24, 2019 8:56 AM
To: Lamb, Amy
Cc: Tuttle, Kim
Subject: RE: NHB review: NHB19-0070

Amy and Kim,

Like my email for the Hooksett Development I am looking to what additional information would like on the project? As I put in the project description, Central Rivers Power (CRP) is applying for Low Impact Hydropower Institute (LIHI)Certification and as part of the process, CRP needs to reach out to agencies and update their project information with the most up-to-date information. No changes to the Project are expected at this time.

Along with getting the most up-to-date information on listed species, LIHI is looking for a written response from the agencies, showing the continued operation of the project will not contribute to the status of the species and that no significant affect is expected. We ill need a response for all three project, Gorham, Canaan, and Hooksett.

If you have questions, feel free to call me at 207-416-1271

Kayla A. Easler
Regulatory Coordinator
Kleinschmidt
Direct: (207) 416-1271
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*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Lamb, Amy <Amy.Lamb@dncr.nh.gov>
Sent: Friday, January 18, 2019 12:29 PM
To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>
Cc: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Subject: NHB review: NHB19-0070

Attached, please find the review we have completed. If your review memo includes potential impacts to plants or natural communities please contact me for further information. If your project had potential impacts to wildlife, please contact NH Fish and Game at the phone

number listed on the review.

Best,
Amy

Amy Lamb
Ecological Information Specialist

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301
603-271-2834

PROJECT DESCRIPTION

The Canaan Project consists of an impoundment, dam, powerhouse, tailrace channel, transmission lines, transformers, and appurtenant facilities, which are described in further detail below. The run-of-river plant is operated automatically as a base load unit generating power whenever adequate river flows are available.

The Canaan dam is approximately 275 feet long. The height of the dam measured from the lowest elevation of the natural streambed at the downstream toe of the dam to the top of the 3.5 feet high spillway flashboards is 18 feet. A concrete section is located at the south abutment and is 56 feet wide with stoplogs supported by steel stanchions. The crest of the sluiceway is at elevation 1046.0 (USGS) and the stoplogs extend up to elevation 1055.7 (USGS).

The main spillway of the dam is a concrete gravity, ogee-shaped section approximately 150 feet long with a crest elevation of 1051.5 (USGS). This section is equipped with 3.5 feet high pipe-supported flashboards extending to elevation 1055.0 (USGS).

A waste gate is located to the right of the main spillway. It consists of a 20-foot wide concrete sluiceway equipped with an electrically operated 15-foot high steel tainter gate. The crest of the sluiceway is at elevation 1040.75 (USGS).

The intake structure is located at the north abutment of the dam. An electrically operated steel gate measuring 12-1/2 feet wide by 12 feet high leads to a steel penstock. The intake racks have a clear spacing of 3 inches.

The penstock leading from the intake structure at the dam to the surge tanks and powerhouse is approximately 1360 feet long with diameter of 9 feet. The invert of the penstock at its upstream end is at elevation 1040.0 (USGS). The penstock is constructed of steel supported by concrete saddles.

Two steel surge tanks are 15' 4" in diameter and 21' 4" in height. The two tanks are supported by a reinforced concrete substructure. The invert elevation of the penstock at the surge tanks is 1033.90 (USGS).

The powerhouse, located on the north bank of the river approximately 200 feet downstream from the surge tanks, has a substructure of reinforced concrete with a brick superstructure supported by steel framing. The superstructure is approximately 31 feet long by 29 feet wide.

The Canaan Project has a bypass reach which is approximately 1,600 feet long, composed of ledge, cobble and boulders.

Bypass flows and station outflow converge in the tailwater immediately downstream of the powerhouse which has normal water surface elevation of 1031.5 feet (USGS)

The Project related transmission facilities include 2.3-kV generator leads, a 1,350-kVa 2.3/34.5-kV transformer bank; a 34.5-kV and 1,450-foot-long transmission line; and other appurtenances.

PROJECT OPERATIONS

The run-of-river plant is operated automatically as a base load unit generating power whenever adequate river flows are available. CRP provides a minimum flow of 165 cfs, in the bypass reach to support aquatic habitat and aesthetics.

PROJECT DESCRIPTION

The Gorham Project consists of an impoundment, dam, powerhouse, tailrace channel, transmission lines, transformers, and appurtenant facilities, which are described in further detail below. The project operates as an un-manned, run-of-river facility. Photo 1 provides a summary of the installed equipment.

The Project dam is a timber crib, L-shaped dam, 417 feet long and about 20 feet high, with three sections: (1) a 90-foot-long spillway section, with a steel sheet pile facing, having a crest elevation of 772.23 feet (USGS), topped with wooden flashboards, about 1.7 feet high, (2) a 252-foot-long spillway section, with two layers of 3-inch wooden plank facing, having a crest elevation of 768.12 feet (USGS), topped with hinged wooden flashboards, about 5.4 feet high, and (3) a 75-foot-long reinforced-concrete sluiceway section, with a crest elevation of 768.20 feet (USGS), topped with 5.33-foot-high hinged wooden flashboards, having one 15-foot-wide sluice gate.

The Project has an earthen power canal which is approximately 415-feet-long by 60-feet-wide by 20-feet-deep.

The powerhouse contains two 400-kW Allis-Chalmers generators driven by two 583-horsepower (hp) S. Morgan Smith vertical, Francis-type turbines, and two 675-kW Allis-Chalmers generators driven by two 1,000-hp Allis-Chalmers vertical, propeller-type turbines, totaling a maximum hydraulic capacity of about 2,800 cfs, at an operating head of approximately 18 feet.

The Project has a 33 kV, 200-foot-long transmission line, and appurtenant facilities.

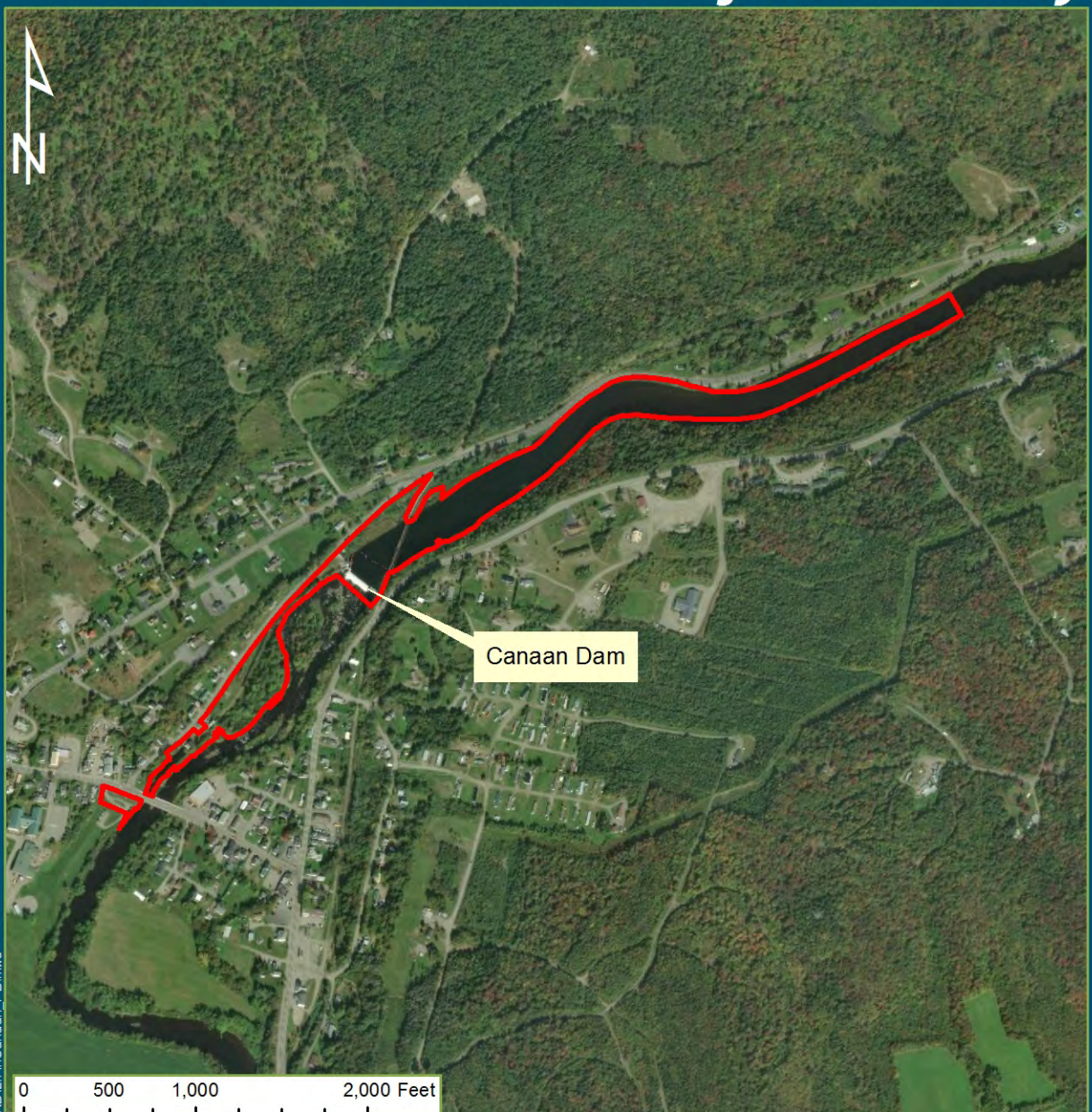
PROJECT OPERATIONS

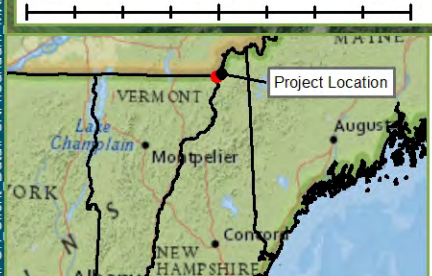
The Project is operated as run-of-river with no impoundment fluctuations. Article 402 of the existing license requires there be a minimum flow release of 200 cfs from the Gorham dam at all times. The minimum flow is released through a lowered flashboard near the middle of the dam. The generating units are normally operated remotely from CRPNH's Control Center Customized Energy Solutions (CES) located in Philadelphia, Pennsylvania, although the units are also capable of local operation. Manual operations and maintenance of the Gorham Project are performed by the Upper Hydro Group, which is also responsible for CRPNH's J. Brodie Smith

Project (FERC No. 2287) and Canaan Project (FERC No. 7528) located in northern New Hampshire. Daily logs of pond level, flow, and outages are maintained electronically for the Project. Minimum bypass flows are assured by maintaining the headpond at elevation 96.75 feet MSL, monitored at the licensee's dispatch center. Minimum flows are recorded on a computer.

Template Version: b2018_2

Project Boundary





Legend

Project Boundary

Central Rivers Power NH

Manchester, NH

Drawn By:	Date Drawn:	Checked By:	Date Checked:
RSR	01-10-2019	KPN	01-17-2019

Kleinschmidt
141 Main St., PO Box 630
Pittsfield, Maine 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtGroup.com

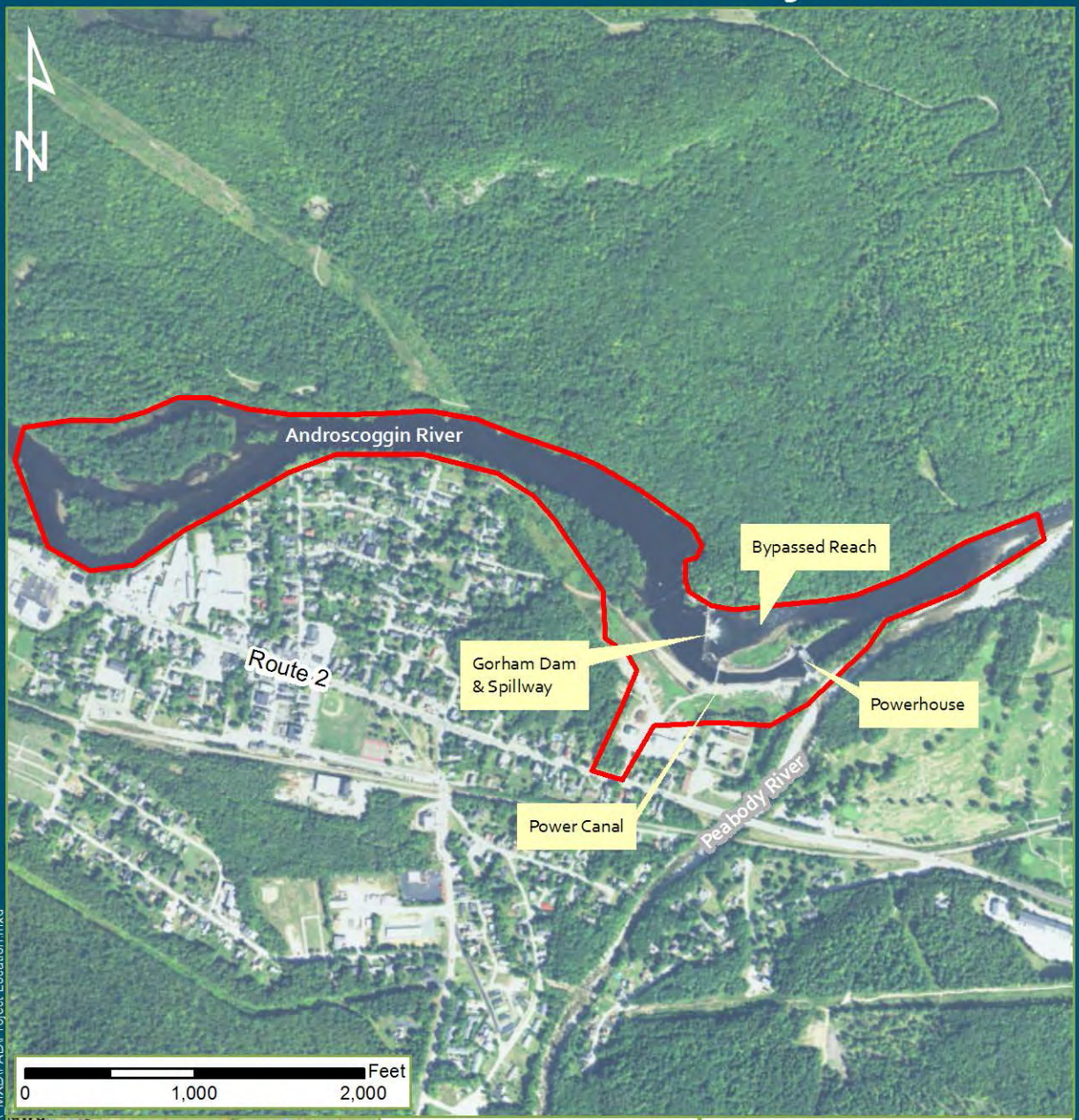
Path: G:_Client_Data\PSNH\Canaan_MXD\LIHI\Canaan_PB.mxd

Date Printed: 1/18/2019

Source: (Kleinschmidt, 2019; CRP, 2019; ESRI, 2019)

PN: 4494004.01

Project Location



Legend

Project Boundary

Public Service Company of New Hampshire
Manchester, NH

Gorham Hydroelectric Project
FERC No. 2288

Drawn By:	Date Drawn:	Checked By:	Date Checked:
RSR	05-30-2018	KPN	00-00-0000

Kleinschmidt
141 Main St., PO Box 650
Pittsfield, Maine 04967
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Fax: (207) 487-3124
www.KleinschmidtGroup.com

Path: G:_Client_Data\PSNH\Gorham_MXD\PAD\Project_Location.mxd

Source: (Kleinschmidt, 2018; PSNH, 2018; ESRI, 2018)

PN: 1203103.01

From: Lamb, Amy
To: Kayla Easler
Cc: Tuttle, Kim
Subject: NHB review: NHB19-0070
Date: Friday, January 18, 2019 12:28:58 PM
Attachments: NHB18-3938_Easler.pdf
NHB19-0070_Easler.pdf

Attached, please find the review we have completed. If your review memo includes potential impacts to plants or natural communities please contact me for further information. If your project had potential impacts to wildlife, please contact NH Fish and Game at the phone number listed on the review.

Best,
Amy

Amy Lamb
Ecological Information Specialist

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301
603-271-2834

APPENDIX E

AVERAGE MONTHLY FLOWS TABLE

Year	MONTHLY MEAN IN CFS											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**June**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
2013	622	512	318	736	880	700	665	249	438	513	399	372
2014	563	648	462	1,014	1,021	432	527	574	423	446	375	499
2015	659	357	268	799	612	1,098	547	551	334	453	434	562
2016	713	560	724	824	451	395	334	390	381	337	367	717
2017	611	527	577	1,214	1,143	545	463	507	426	644	542	591
2018	622	486	368	849	1,242	411	427	371	439			
Mean of monthly Discharge	631.7	515.2	452.5	906.0	891.4	596.8	493.6	440.3	406.8	398.8	352.8	456.8

APPENDIX F

FEASIBILITY STUDY

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

MANCHESTER, NEW HAMPSHIRE

CANAAN HYDROELECTRIC PROJECT

(FERC No. 7528)

EVALUATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF UPSTREAM FISH PASSAGE

APRIL 2006

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, NEW HAMPSHIRE

CANAAN HYDROELECTRIC PROJECT
(FERC No. 7528)

EVALUATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF UPSTREAM FISH PASSAGE

APRIL 2006

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PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, NEW HAMPSHIRE

CANAAN HYDROELECTRIC PROJECT
(FERC NO. 7528)

EVALUATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF UPSTREAM FISH PASSAGE

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LIST OF APPENDICES

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
MANCHESTER, NEW HAMPSHIRE

CANAAN HYDROELECTRIC PROJECT
(FERC NO. 7528)

EVALUATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF UPSTREAM FISH PASSAGE

1.0 INTRODUCTION

The Canaan Hydroelectric Project (Project) (FERC No. 7528) on the Connecticut River is owned by Public Service Company of New Hampshire (PSNH). PSNH has initiated the process of relicensing the Project with the Federal Energy Regulatory Commission (FERC). PSNH is applying for a new license using FERC's Integrated Licensing Process (ILP). The current license will expire on July 31, 2009. During the relicensing process, PSNH will be collecting information on the resources in the Project area. FERC requires a discussion of fish, wildlife, and botanical resources in the vicinity of the Project and to identify the potential effects of the Project on these resources, including a description of any anticipated continuing effect for on-going and future operations.

As part of the ILP, PSNH has conducted a public scoping process during which various resource issues were identified. The Connecticut River Watershed Council recommended that there be a study of the value of upstream passage for resident fish species at the Project in their comment letter dated October 13, 2004. The Northeast Kingdom Chapter of Trout Unlimited also requested a study of upstream fish passage at the Project in their comment letter dated October 9, 2004. Then during the January 24, 2005 Canaan relicensing study plan meeting, the Vermont Agency of Natural Resources verbally requested that an upstream fish passage plan for trout be added to their list of previously identified study requests. Also, during this meeting the resource agencies from New Hampshire and Vermont decided that the management objective for the bypass reach at the Project should be to foster the health of the resident fish populations and to promote the coldwater fishery for resident trout species.

This study will fulfill the above mentioned FERC requirements in part and the above mentioned agency requests in full. The objective of this study is to evaluate the technical and

economic feasibility of installing upstream fish passage facilities for brook trout, brown trout and rainbow trout and not to determine whether or not fish passage is necessary for the perpetuation of trout populations at the Project.

Fish passage design is typically based on the known behavioral characteristics of the target species. The target species for most upstream fish passage projects are highly motivated to move upstream, driven by their migratory instinct. It is recognized that the trout species existing at the Project are resident populations that are not obligatory migrants. Although individuals of populations such as these often move upstream and downstream as adults and juveniles, these movements are not necessarily required to perpetuate the population. This is particularly true of populations that are managed on a "Put and Take" basis by stocking, such as those in the Connecticut River at the Project. The Project is located in a reach of the Connecticut River that is managed by the New Hampshire Fish and Game Department as a coldwater fishery for brook trout, brown trout, and rainbow trout. The fishery is supported by natural reproduction and annual stocking of all three species, both upstream and downstream of the Project.

Spawning season for the target species varies. Brook trout and brown trout are both fall spawners, typically spawning when the water temperature range is between 45°-50° F for brook trout and 44°-48° F for brown trout. Rainbow trout are spring spawners and usually spawn at water temperatures of 50°-60° F (Scott and Crossman, 1973). For the purposes of this report a potential upstream migration period of September to mid-November has been identified for brook trout and brown trout and March to the end of April for rainbow trout.

2.0 SITE DESCRIPTION

The Project is located on the Connecticut River in the towns of Canaan, Vermont and Stewartstown, New Hampshire. The Project structures include a concrete gravity dam, a penstock, two surge tanks, a powerhouse, and a tailrace as shown on the site plan included in Appendix A. The dam impounds a reservoir of approximately 20 acres with a gross storage capacity of approximately 200 acre-feet. The majority of the river flow passes through the hydroelectric unit in the powerhouse and then into a man-made tailrace channel, which rejoins the natural river channel about 1600 feet (ft) downstream of the dam. Flow that passes over the spillway runs into the natural river channel, known as the bypass reach.

The dam is approximately 275 ft long and 18 ft high and consists of a stanchion section with stop logs, a concrete spillway, a waste gate, and an intake structure. The stanchion section (Appendix B, Photo # 1), located at the south end of the dam (Appendix B, Photo # 2), is 56 ft wide with a concrete crest at 1046.0[1] and stoplogs extending up to elevation 1055.7. Adjacent to the stanchion section is the ogee-shaped concrete spillway (Appendix B, Photo # 3), which is 150 ft long with a crest elevation of 1051.5. The spillway is equipped with 3.5 ft high pipe supported wooden flashboards (Appendix B, Photo # 4) extending up to elevation 1055.0. The waste gate (Appendix B, Photo # 5), located on the north side of the spillway, is a 20 ft wide by 15 ft tall tainter gate with a sill elevation of 1040.75. The intake structure (Appendix B, Photo # 6) is located at the north end of the dam adjacent to the waste gate. The hydraulic opening at the upstream face of the intake is 18 ft wide with a sill elevation of 1037.0 and has a steel trashrack with a clear spacing of 2.41 inches between bars. Downstream of the trashrack is a 12.5 ft wide by 12 ft high timber head gate which leads to the 9 ft diameter wood stave penstock. The length of the penstock from the intake structure to the surge tanks and powerhouse is approximately 1360 ft. The penstock's two surge tanks are located approximately 200 ft upstream of the powerhouse and measure 15.33 ft in diameter and 21.33 ft in height. The powerhouse (Appendix B, Photo # 7) is located on the north side of the river and contains one hydroelectric unit with a vertical Francis style runner. The unit produces 1,100 KW with a gross head of 35 ft and discharge of 466 cubic feet per second (cfs). The unit has a maximum hydraulic capacity of 540 cfs, but is most efficient when running at 86% capacity (466 cfs). The discharge from the powerhouse (Appendix B, Photo # 8) travels about 200 ft through a man-made tailrace channel before rejoining the natural river channel (Appendix B, Photo # 9).

The Project is operated in a run-of-river mode and has a drainage area of approximately 381 square miles. Monthly and annual flow duration curves for the Project were taken from the Pre-Application Document and are included in Appendix C. The flow duration curves were derived using USGS gage data from the Connecticut River gage below Pittsburgh (Gage No. 01129200) and the Hall Stream gage (Gage No. 01129300). The annual mean river flow at the Project is 821 cfs. The annual flow duration curve shows that a 466 cfs station discharge is exceeded about 70% of the time at the Project. The minimum flow requirement of 136 cfs under

[1] All elevations included in this document refer to USGS datum.

the existing license is broken into 50 cfs into the bypass reach and 86 cfs (or inflow if less) through the hydroelectric unit. Some or all of the flashboards are typically lost during winter or spring run-off, and are replaced when water levels stabilize. Flashboard outages do not normally occur during other times of the year.

3.0 SITE INSPECTION

Mr. Jesse Waldrip and Mrs. Christine Tomichek of Kleinschmidt Associates (Kleinschmidt) visited the Project with Curt Mooney of PSNH on September 13, 2005. The site visit provided valuable insight for the evaluation of layout and practicality of the various potential upstream fish passage options. Photographs 1 through 9 in Appendix B were taken during the site visit. It appears that access to the Project structures for the purpose of constructing a potential upstream passage facility would be adequate. The tailrace rejoins the natural river channel just downstream of the VT Route 114 bridge. There is a boat launch located immediately downstream of this confluence, making the end of the tailrace accessible. The north bank of the upstream end of the tailrace at the powerhouse is accessible from Power House Road. However, access to the south bank of the tailrace requires crossing over the 9 ft diameter penstock upstream of the powerhouse. The north end of Canaan Dam, where the intake is located, is also accessible from Power House Road with available parking, workspace, and laydown area. The south end of the dam is also accessible with some space available for parking and equipment storage where the abandoned railroad intersects U.S. Route 3.

4.0 EVALUATION OF UPSTREAM FISH PASSAGE OPTIONS

Upstream fish passage at the Project should be focused on providing a means for fish that are moving upstream to bypass the Project dam. The two categories that have been addressed in order to evaluate the options for downstream fish passage are technical feasibility and economic feasibility.

4.1 Upstream Fish Passage at Technical Feasibility

Several different upstream passage systems were evaluated for the Project Dam. These included fish ladders, a nature-like bypass channel, a fish ramp, a fish lift and a

fish lock. Some of these systems were eliminated from further considerations by a preliminary review. For instance, fish lifts and fish locks (Appendix D, Figures # 1 and # 2) have similar efficiency for passing fish at relatively low head barriers, such as the Project dam, as other types of upstream fish passage systems. However, they are typically more complex and costly than other systems because of their various mechanical components which also necessitate diligent maintenance. For this reason they are typically only considered for projects where relatively high head differential causes excessive length and therefore reduced fish passage efficiency in systems such as ladders and bypass channels. For these reasons neither a fish lift nor a fish lock will be considered for the Project dam.

A fish ramp consists of a portion of the river channel that is built up into a roughened slope (usually 1:20 or shallower) that passes over or around the dam or other fish passage obstruction. For this site, a fish ramp with a length of 360 ft or more would be required. In order to prevent the only entrance to the ramp from being at its downstream end, 360 ft away from the dam, a slope up along the face of the dam to the top of the ramp would also be desired (Appendix D, Figure # 3). This would cause the width of the ramp to be similar to its length (360 ft). Because of the significant foot print required there is no room for this type of structure to be built around either end of the dam due to adjacent roads, railroad, penstock, maintenance building, and intake access road. A ramp could be placed over the spillway, but this would reduce the spillway discharge capacity. Fish ramps also have a tendency to dry out at low river flows and are not typically used for head differentials greater than 10 ft. For these reasons a fish ramp will not be considered for the Project dam.

A nature-like bypass channel (Appendix D, Figure # 4) offers a route around a dam that is constructed like a natural stream. Similar to fish ramps, bypass channels typically have a slope of 1:20 or shallower. They are suitable for any head differential if adequate space is available. For this site, a bypass channel with a length of 360 ft or more would be required. Though bypass channels are typically not as wide as fish ramps, the construction of a bypass channel around the south end of the dam is not feasible because of the close proximity of U.S. Route 3 and the interference of the existing railroad bed and bridge. Likewise, there are spatial constraints and interferences around

the north end of the dam. A bypass channel around the north end would first have to pass beneath the existing penstock and then through a narrow area between the intake structure and Power House Road. Passage beneath the penstock would require significant rock excavation and a new penstock support structure. Then there is a retaining wall behind the intake structure that supports a steep slope up to the road. A deep cut with almost vertical walls would be required to construct a channel through this route. This would require significant soil and potentially rock excavation and would necessitate construction of a bridge across the bypass channel for maintenance access to the dam and intake. Excessive flows in the bypass channel during times of high river flow could cause damage to the channel itself or surrounding structures such as the penstock. Therefore, a flow control gate would be required at the upstream end of the bypass channel. Because of all of these factors, the direct construction cost for installing a bypass channel around the north side of the dam would be two or three time greater than the cost for installing a fish ladder. Because of these constraints on available area and layout and the resulting excessive construction costs a nature-like bypass channel will not be considered for the Project dam.

There are three basic categories of fish ladders: pool passes (Appendix D, Figure # 5), which consist of a sloped channel containing a series of connected pools of increasing elevation separated by weirs with notches at the top and/or submerged orifices to allow passage between pools; vertical slot passes (Appendix D, Figure # 6), which are similar in nature to pool passes except that the weirs have one or more vertical slots that extend the entire height of the wall; and Denil passes (Appendix D, Figure # 7), which consist of a sloped channel containing slotted baffles angled upstream to reduce the velocity of the flow as it passes down the declining waterway. Of these three categories of fish ladders a Denil pass would be the most appropriate for placement at the Project dam because it requires the least amount of space, it is the least expensive and it can tolerate the amount of head pond fluctuation that is seen at the site. Pool passes are sensitive to fluctuating head pond levels, are susceptible to debris clogging and are typically larger and more expensive to construct than Denil passes. Vertical slot passes are the most suited for varying head pond levels and they are no more susceptible to debris clogging than Denil passes; however, vertical slot passes are larger and therefore

more expensive to construct than Denil passes and do not add any advantage over a Denil pass.

Denil passes are usually constructed in two distinct styles, a Standard Denil and an Alaska Steeppass. A Standard Denil fishway typically consists of a concrete channel with a slope of 10-20% containing slotted baffles angled upstream. With a width of 3 ft the conveyance flow through the fishway would be 8.5 cfs. Typically the minimum requirement for upstream fish passage attraction flow at hydroelectric projects is 3% of the station hydraulic capacity (3% x 540cfs = 16.2cfs). This would be greater than the conveyance flow through the fishway, so a pipe would be required to transport the additional attraction flow from the head pond to the fishway entrance. A Standard Denil fishway would have a minimum length of 110 ft, including two resting pools, to ascend the 18 ft head differential at the dam. If the fishway was laid out as a straight channel the entrance would be located approximately 80 ft downstream of the apron of the dam. In most cases, it is preferable to keep the fishway entrance as far upstream as possible, which in this case would be the downstream edge of the dam apron. This could be done by installing two 180 degree turnpools in the fishway. Adding in these turnpools increases the complexity of the structure and therefore increases the construction costs. Adding turnpools to the fishway also increases the width of the structure, thus increasing its exposure to river flow, debris and ice. Standard Denil fishways can tolerate head pond fluctuations up to 3 ft without significant effect to passage conditions. The waste gate is used during periods of high river flow to maintain the head pond near the top of the flashboards. The waste gate has a hydraulic capacity of about 3,500 cfs. According to the monthly duration curves (Appendix C) the river flow is less than 3,500 cfs more than 95% of the months of March, September, October, and November and approximately 94% of the month of April. Therefore, a Standard Denil fishway would be operational more than 95% of the time during the upstream fish passage season.

The other style of Denil fishway that needs to be considered is the Alaska Steeppass, which is a specific variation designed to be smaller, require less flow and be operable at steeper slopes (20-30%) while maintaining the same flow velocities as the Standard Denil fishway. The conveyance flow through this type of fishway would be 3.5 cfs. As noted above the minimum requirement for upstream fish passage attraction flow

at hydroelectric projects is typically 3% of the station hydraulic capacity (3% x 540cfs = 16.2cfs). This would be greater than the conveyance flow through the fishway, so a pipe would be required to transport the additional attraction flow from the head pond to the fishway entrance. Alaska Steeppass fishways are typically prefabricated as aluminum modular systems and were originally intended for installation at remote sites. One disadvantage of this type of fishway is that they can not tolerate head pond fluctuation greater than 1 ft. So, they can be used as a low cost alternative for sites where the head pond fluctuation can be kept within 1 ft. As noted above the waste gate is used during periods of high river flow to maintain the head pond near the top of the flashboards. With a hydraulic capacity of about 3,500 cfs the waste gate would be sufficient for keeping the head pond within the operational range of an Alaska Steeppass more than 95% of the time during the upstream fish passage season. The minimum length of an Alaska Steeppass fishway at this site would be about 80 ft including one resting pool, thus positioning the entrance about 50 ft downstream of the apron of the dam. As mentioned above, the entrance could be located closer to the dam apron by installing two 180 degree turnpools in the fishway. Adding in these turnpools increases the complexity of the structure and therefore increases the construction costs. Adding turnpools to the fishway also increases the width of the structure, thus increasing its exposure to river flow, debris and ice.

There are two practical locations for placement of an upstream fish passage structure at the Project dam. The first is along the concrete abutment at the south end of the dam (Appendix B, Photo # 2). One or two stoplog stanchion sections would be removed to allow the fishway exit to pass into the head pond. There is access to this location for installation and future maintenance. The disadvantage of this location is that it is on the opposite side of the dam from the potential location for downstream passage. One option for downstream passage is to remove or notch the section of flashboards closest to the intake where downstream passing fish will likely be attracted. This notch would also have the potential to serve as the means for releasing the minimum bypass reach flow requirement during downstream fish passage season (months of March, April and May). This could potentially attract fish that are trying to pass upstream away from the entrance to the upstream fishway which would be operating at the same time. The other feasible upstream fish passage location is at the north end of the spillway adjacent

to the waste gate (Appendix B, Photos # 3 and # 4). Though this location is not quite as accessible, it can be reached by way of ladder from the maintenance deck of the waste gate structure. The advantage of this location is that it is also the most practical location for downstream passage structure as mentioned above. Both the Standard Denil fishway and the Alaska Steeppass fishway could also be used as a downstream fish passage channel at this location. An arrangement similar to this is used at the South Berwick Hydroelectric Project, located on the Salmon Falls River in the towns of South Berwick, Maine and Rollinsford, New Hampshire. At the South Berwick Project the upstream and downstream fish passage seasons do not overlap, so the baffles are removed from the Standard Denil fishway during the downstream fish passage season to create an open channel. It should be noted that there would be some concern for potential damage if an Alaska Steeppass were chosen for this location. Locating the fishway in the spillway makes it more susceptible to damage caused by high flows, debris and ice. A sturdy concrete structure like a Standard Denil fishway would be required to withstand this loading at this location.

4.2 Upstream Fish Passage Economic Feasibility

Based on the technical feasibility of upstream fish passage discussed above, two options were selected for economic evaluation. The options that have been considered are:

1) Installation of a Standard Denil fishway at the dam.
2) Installation of an Alaska Steeppass fishway at the dam.

All costs are based on our professional judgment and recent unit construction prices from similar upstream passage facilities. Below is a table which summarizes the detailed Opinion of Probable Construction Cost tables that can be found in Appendix E. Included in the totals for these probable construction costs are the direct expenses for the installation contractor's labor and materials and the following indirect expenses: permitting, conceptual design, engineering, construction monitoring and effectiveness testing. Also included in these totals is a 25% contingency to account for unforeseen costs. Also, there were no viewing windows or other ancillary features included in the

costs for the fishways. Option 2 is less expensive because an Alaska Steeppass fishway is smaller and easier to install than a Standard Denil fishway.

OPINION OF PROBABLE CONSTRUCTION COSTS SUMMARY TABLE		
OPTION		TOTAL COST
1	Installation of a Standard Denil fishway at the dam.	$686,000
2	Installation of an Alaska Steeppass fishway at the dam.	$550,000

5.0 SUMMARY

Based on our site visit and evaluation there are two potential options for upstream fish passage at the Project dam. The following is a summary of the advantages and disadvantages of these potential options.

The two options that have been considered for upstream fish passage at the Project dam are a Standard Denil fishway and an Alaska Steeppass fishway. A Standard Denil would most likely be constructed of cast-in-place concrete, whereas an Alaska Steeppass would most likely be prefabricated of aluminum and installed in sections. This would result in higher construction cost for the Standard Denil, but the concrete construction would also make it sturdier and more tolerant of high flows, debris and ice. The location of a potential upstream fish passage at the dam is also important in determining the most appropriate style of fishway to use. If a fishway was located on the north end of the spillway it could potentially be used for upstream and downstream fish passage, but it would be more susceptible to damage from high flows, debris and ice. If a fishway was located at the south end of the dam it would be more protected (behind the stanchion bay), but the downstream fish passage flow provided at the north end of the spillway would attract fish away from the upstream fishway. Typically the minimum requirement for upstream fish passage attraction flow at hydroelectric projects is 3% of the station hydraulic capacity (3% x 540cfs = 16.2cfs). The conveyance flow through either a Standard Denil (8.5 cfs) or an Alaska Steeppass (3.5 cfs) would be less than the attraction flow that is typically required. Therefore, a pipe would be required to transport the additional attraction flow from the head pond to the fishway entrance for either of these two options.

6.0 REFERENCES CITED

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada. Bulletin No. 184.

APPENDIX G

CANAAN ENVIRONMENTAL ASSESSMENT

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Service Company of New Hampshire Project No. 7528-009

NOTICE OF AVAILABILITY OF ENVIRONMENTAL ASSESSMENT

(March 26, 2008)

In accordance with the National Environmental Policy Act of 1969 and the Federal Energy Regulatory Commission's regulations, 18 CFR Part 380 (Order No. 486, 52 F.R. 47897), the Office of Energy Projects has reviewed the application for a subsequent license for the 1.1-megawatt Canaan Project, located on the Connecticut River, in Coos County, New Hampshire, and Essex County, Vermont, and has prepared an Environmental Assessment (EA). In the EA, Commission staff analyze the potential environmental effects of relicensing the project and conclude that issuing a subsequent license for the project, with appropriate environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

A copy of the EA is on file with the Commission and is available for public inspection. The EA may also be viewed on the Commission's website at http://www.ferc.gov using the "eLibrary" link. Enter the docket number excluding the last three digits in the docket number field to access documents. For assistance, contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll-free at 1-866-208-3676, or for TTY, (202) 502-8659.

You may also register online at http://www.ferc.gov/docs-filing/esubscription.asp to be notified via email of new filings and issuances related to this or other pending projects. For assistance, contact FERC Online Support.

Comments on the EA should be filed within 30 days from the issuance date of this notice, and should be addressed to the Secretary, Federal Energy Regulatory Commission, 888 First Street, N.E., Room 1-A, Washington, D.C. 20426. Please affix "Canaan Project No. 7528-009" to all comments. Comments may be filed electronically via Internet in lieu of paper. The Commission strongly encourages electronic filings. See 18 CFR 385.2001(a)(1)(iii) and the instructions on the Commission's website under the "eFiling" link. For further information, contact Kristen Murphy at (202) 502-6236.

Kimberly D. Bose,
Secretary.

ENVIRONMENTAL ASSESSMENT
FOR
SUBSEQUENT HYDROPOWER LICENSE

Canaan Project

FERC Project No. 7528-009

New Hampshire/Vermont

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, D.C. 20426

March 2008

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Proposed Action

On July 30, 2007, Public Service Company of New Hampshire (PSNH) filed an application for a subsequent license to operate and maintain the 1.1 megawatt (MW) Canaan Project, located on the Connecticut River in Coos County, New Hampshire, and Essex County, Vermont.

Project Description

The project consists of: a 275-foot-long, 15-foot-high concrete gravity dam equipped with 3.5-foot-high flashboards creating a 20-acre impoundment; a 1,360-foot-long penstock; and a powerhouse with a single turbine-generator unit. The project is described in more detail in section 2.1.1. The project is operated in a run-of-river mode. The project does not use or occupy any federal facilities or land.

Proposed Measures

PSNH proposes no capacity or operating changes, but does propose measures to protect and enhance environmental resources including: releasing a 165 cubic feet per second (cfs) minimum flow into the bypassed reach year-round; developing and implementing final plans for operation compliance monitoring; developing and implementing a final bypassed reach erosion monitoring plan; developing and implementing a final recreation plan that includes a new car-top boating access (take-out) upstream from the dam, signs designating a portage trail and a downstream car-top boating access site that is currently owned by the state of Vermont, and enhancements to an existing recreation area near the powerhouse; and developing and implementing a final historic properties management plan.

Alternatives Considered

This Environmental Assessment (EA) analyzes the effects of continued operation and recommends conditions for a subsequent license for the project. In addition to PSNH's proposal, we consider: (1) PSNH's proposal with staff modifications (staff alternative); (2) a composite alternative (proposed action with staff modifications including the draft water quality certification conditions issued by Vermont Agency of Natural Resources (Vermont ANR)); and (3) no action – continued operation with no changes.

Public Involvement and Areas of Concern

Before filing its license application, PSNH conducted a pre-filing consultation

process under the integrated licensing process. The intent of the Commission's prefiling process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to an application being formally filed with the Commission. During pre-filing consultation, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document was distributed on August 20, 2004. Two scoping meetings were held on September 20 and 21, 2004, in Manchester, New Hampshire, and Canaan, Vermont, respectively. We issued a second scoping document on December 2, 2004, in order to address verbal and written comments submitted during the scoping period. On September 25, 2007, we requested conditions and recommendations in response to the notice of ready for environmental analysis.

The primary issues associated with relicensing the project include: shoreline erosion, minimum flows to protect aquatic resources in the bypassed reach, fish passage and protection, vegetation management, meeting recreational access needs, and protecting cultural resources.

Staff Alternative

Aquatic Resources – The staff alternative includes PSNH's proposals for run-of-river operation, a bypassed reach flow increase from 50 cfs to 165 cfs, and an operation compliance monitoring plan. With these measures, aquatic life and habitat would continue to benefit by stable impoundment levels; habitat for a variety of species would increase in the bypassed reach compared to existing conditions; and all operational procedures and communication protocols would be included in a single plan.

Staff recommend modifying PSNH's proposal to include providing a downstream flow of 90 percent of inflow during impoundment refilling following maintenance drawdowns in order to protect aquatic biota below the project; woody debris management to enhance aquatic biota habitat; and replacement or overlay of the project trashracks with 1-inch clear spaced trashracks to reduce fish entrainment.

Geology and Soils – PSNH proposes to monitor erosion within the bypassed reach to ensure that any trends or changes in erosion patterns are documented and to provide a basis for potential mitigation measures. Staff do not recommend shoreline erosion monitoring at the project because erosion is not a project-related effect.

Terrestrial Resources – Under PSNH's proposal, shoreline habitat would continue to benefit from stable impoundment levels and run-of-river operation.

Threatened and Endangered Species – No federally listed endangered or threatened species are known to exist in the project area.

Recreation – PSNH's proposed recreation plan includes provision of a formal portage, including a new boat access site (take-out) upstream from the dam and signage for portage around the dam to a State of Vermont-owned car-top boat access site downstream (put-in). The recreation plan also includes provisions for a picnic table and signage at an existing recreation area at the project powerhouse.

Staff-recommended additional measures to be included in the recreation plan include vegetation management (mowing and trimming) that allows for the growth of a riparian buffer where possible at project recreation sites; signs interpreting the natural and cultural history at the project as well as any necessary invasive species education; and revision of the project boundary to include the downstream put-in site in order to ensure its maintenance throughout the term of the license.

Cultural Resources – The project is eligible for listing on the National Register of Historic Places. Contributing elements include the powerhouse, dam, intake, penstock, and stone abutments of a previous dam. Under PSNH's proposal, continued project operation would not adversely affect cultural resources, and any necessary replacement of historic property components and future effects such as the potential construction of fish passage facilities and the proposed canoe portage would be addressed in a Historic Properties Management Plan (HPMP).

Staff-recommended additional measures for the HPMP include replacement of the siding on the project's gatehouse, storage building, and shed within five years of issuing a new license. Staff also recommend a Programmatic Agreement, to be executed between the Commission and the SHPOs, which would require the HPMP's finalization, through consultation with the SHPO, and implementation.

Aesthetic Resources – Under PSNH's proposal, minimum flows of 165 cfs in the bypassed reach would create a more substantial veil of water over the dam crest and an additional filling of the channel in the bypassed reach as compared to the current minimum flow of 50 cfs. This would be an aesthetic improvement benefiting both residents and visitors to the Connecticut River Byway.

Staff do not recommend dissolved oxygen monitoring, the installation of upstream and downstream fish passage, fishway effectiveness studies, shoreline erosion monitoring, a riparian vegetation management plan, and installation of a boat cleaning station. Although some of these conditions may become mandatory through the water quality certification, we are not recommending these measures because they either are not currently needed or do not address identified project effects.

Draft license articles to implement the staff alternative are attached in Appendix B.

Under the no-action alternative, environmental conditions would remain the same and no enhancement of environmental resources would occur.

Conclusions

In section 4.2 of the EA, we estimate the annual net benefits of operating and maintaining the project under the three alternatives identified above. Our analysis shows that the annual net benefit would be $-109,280 for the proposed action; $-117,370 for the staff alternative; $-168,800 for the composite; and $-69,500 for the no-action alternative.

On the basis of our independent analysis, we conclude that issuing a subsequent license for the project, with the environmental measures we recommend, would not be a major Federal action significantly affecting the quality of the human environment.

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (6,840 megawatthours annually); (2) the project would save the equivalent amount of fossil-fueled generation and capacity, thereby continuing to help conserve non-renewable energy resources and reduce atmospheric pollution, including greenhouse gases; (3) the recommended environmental measures proposed by PSNH, as modified by staff, would adequately protect and enhance environmental resources affected by the project. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

CANAAN PROJECT
FERC No. 7528-009, New Hampshire/Vermont

1.0 INTRODUCTION

1.1 APPLICATION

On November 30, 2007, Public Service Company of New Hampshire (PSNH) filed a an application with the Federal Energy Regulatory Commission (Commission) for the continued operation of its 1.1-megawatt (MW) Canaan Project located on the Connecticut River in Coos County, New Hampshire, and Essex County, Vermont (figures 1 and 2). The project does not occupy any federal land. PSNH proposes no new capacity and no new construction.

1.2 Purpose of Action and Need for Power

1.2.1 Purpose of Action

The Commission must decide whether to issue a subsequent license for the project and whether conditions should be placed in any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation and water supply), the Commission must give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

Issuing a subsequent license for the Canaan Project would allow PSNH to generate electricity at the project for the term of a subsequent license, making electric power from a renewable resource available to its customers.

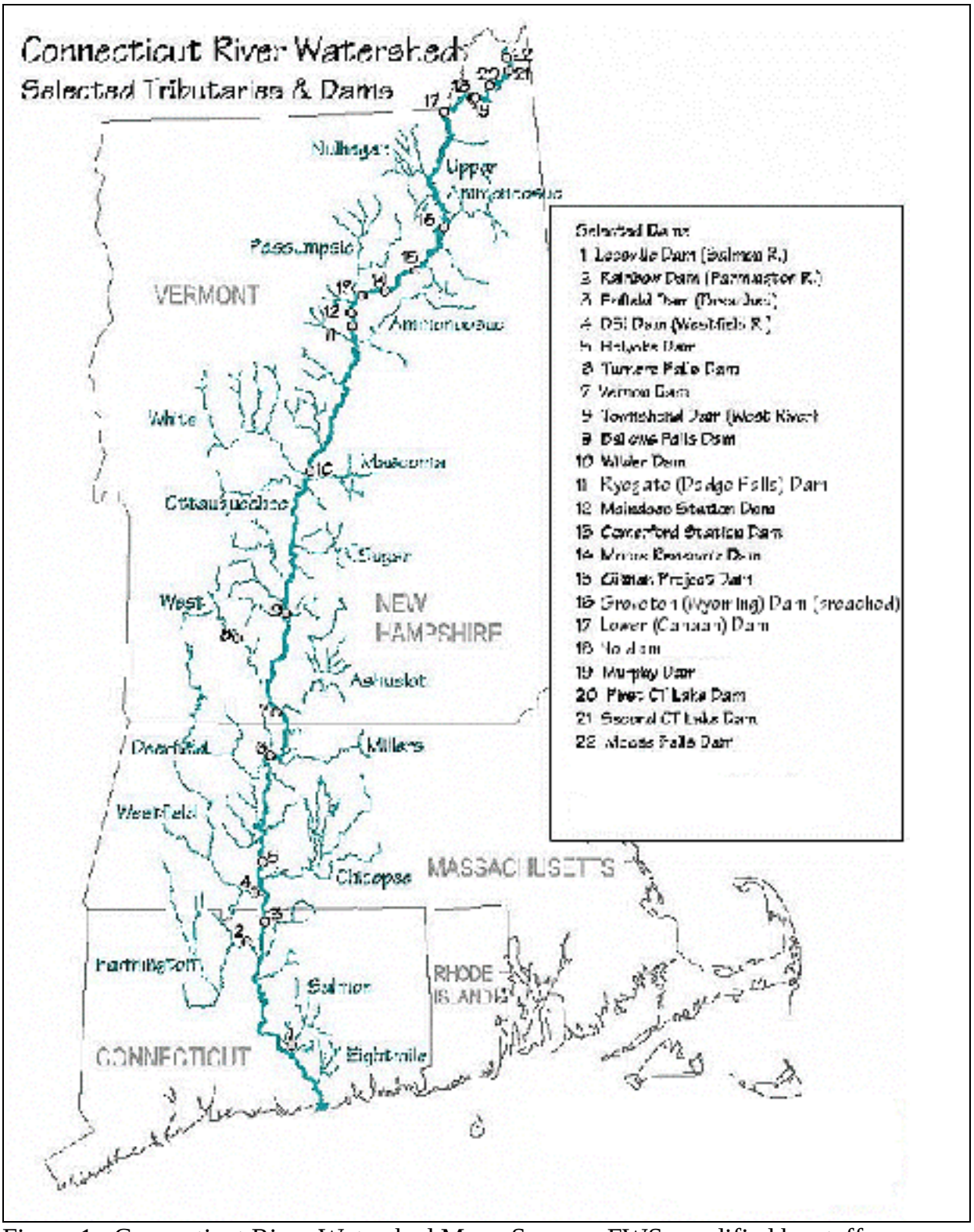


Figure 1. Connecticut River Watershed Map. Source: FWS, modified by staff.

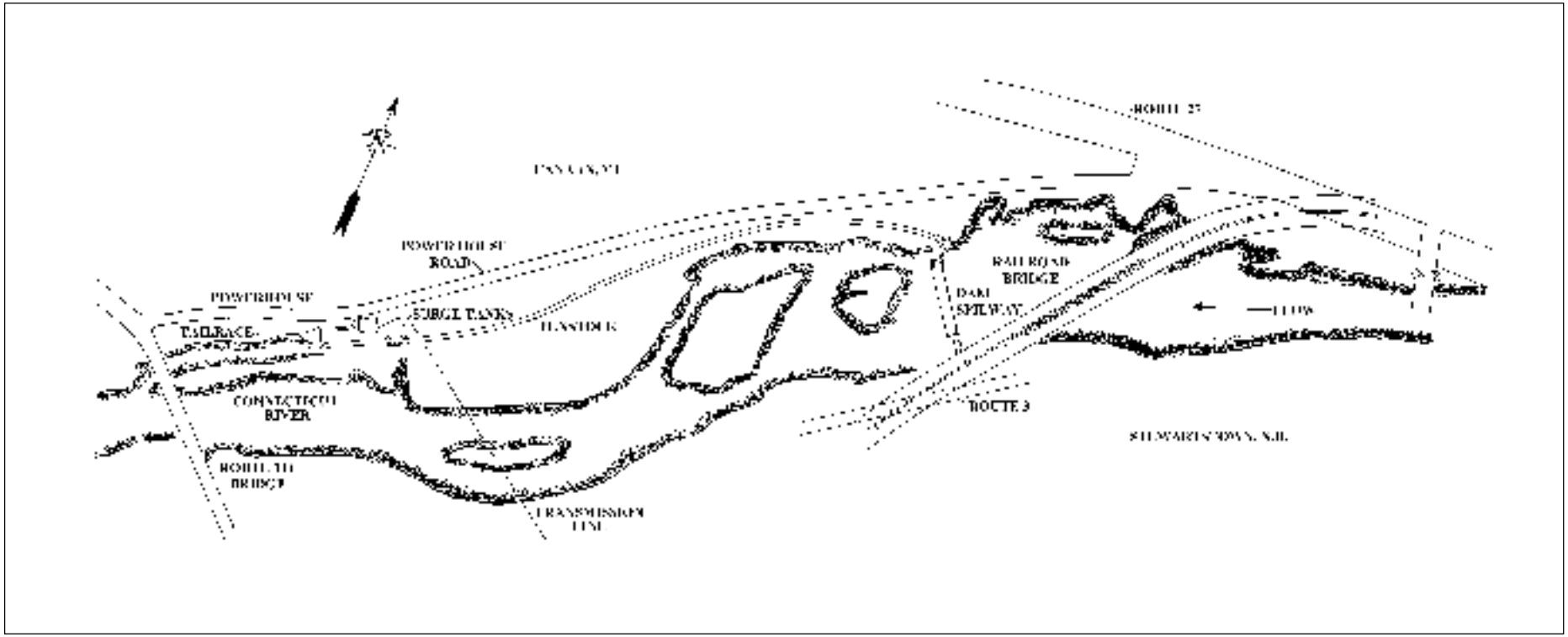


Figure 2. Canaan Project Site Plan. Source: PSNH, modified by staff.

This environmental assessment (EA) assesses the effects associated with operation of the project, alternatives to the proposed project, and makes recommendations to the Commission on whether to issue a subsequent license, and if so, recommends terms and conditions to become a part of any license issued.

In this EA, we assess the environmental and economic effects of continuing to operate the project: (1) as proposed by PSNH; (2) with our recommended measures (staff alternative); and (3) a composite alternative (the staff alternative including the draft water quality certification conditions issued by Vermont ANR). We also consider the effects of the no-action alternative. Important issues that are addressed include monitoring of shoreline erosion, minimum flows necessary to protect aquatic resources in the bypassed reach, the need for fish passage and protection, managing riparian vegetation, meeting recreational access needs, and protecting cultural resources.

1.2.2 Need for Power

To assess the need for project power, we reviewed PSNH's present and anticipated future use of project power, together with that of the operating region in which the project is located. The Canaan Project generates an average of 7,300 MWh annually. Project generation offsets the need for PSNH to buy a proportionate amount of electricity from the market to supply its customers.

The Canaan Project is located in the Northeast Power Coordinating Council (NPCC) region of the North American Electric Reliability Council (NERC). According to NERC, the projected ten-year compound annual growth rate for net annual energy is about 1.2 percent over the 2007-2016 period, with a summer peak demand growth rate of 1.7 percent in the New England area (NERC, 2007).

Power from the Canaan Project would help meet the need for power in the NPCC region in both the short and long-term. The project provides low-cost power that displaces non-renewable, fossil-fired generation and contributes to a diversified generation mix. Displacing the operation of fossil-fueled facilities avoids some power plant emissions and creates an environmental benefit.

1.3 Statutory and Regulatory Requirements

A license for the Canaan Project is subject to numerous requirements under the Federal Power Act and other applicable statutes. The major regulatory and statutory requirements are summarizes in table 1 and described below.

Table 1. Major Statutory and Regulatory Requirements for the Canaan Project

Requirement	Agency	Status
Section 18 of the FPA	Interior	Reservation of authority to

Requirement	Agency	Status
(fishway prescriptions)		prescribe fishways filed on November 20, 2007.
Section 10(j) of the FPA	Interior	Six section 10(j) conditions filed on November 20, 2007.
Section 401 of the Clean Water Act—water quality certification	Vermont ANR	Certification due by November 20, 2008. Preliminary conditions filed on November 27, 2007.
Endangered Species Act Consultation	FWS	No listed species affected.
Coastal Zone Management Act Consistency	Connecticut Department of Environmental Protection	The project is located outside of the coastal zone boundary and coastal species would not be affected.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the Federal Power Act states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the Interior. Interior, by letter filed November 20, 2007, requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

1.3.1.2 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

On November 20, 2007, Interior filed six recommendations under section 10(j), as summarized in table 5, and discussed in section 5.4, Recommendations of Fish and Wildlife Agencies.

1.3.1.3 Section 10(a) Recommendations

Under section 10(a) of the FPA, each hydroelectric license issued by the Commission should be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce; for the improvement and utilization of waterpower development; for the adequate protection, mitigation, and enhancement of fish and wildlife; and for other beneficial public uses, including irrigation, flood control, water supply, recreation, and other purposes.

Interior filed a recommendation pursuant to section 10(a) of the FPA, as follows: The licensee shall serve, prior to or at the time of filing with the Commission, all representatives of the Department on the service list, with a copy of any request the licensee may file for amendment of license, amendment or appeal of any fish and wildlife-related license conditions, or extension of time requests for project construction or implementation of license article provisions[1].

1.3.2 Clean Water Act

Under the section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. On November 20, 2007, PSNH applied to the Vermont ANR for 401 water quality certification (WQC) for the Canaan Project. Vermont ANR received this request on November 20, 2007. Vermont ANR has not yet acted on the request, but filed preliminary terms and conditions on November 27, 2007. Certification is due by November 20, 2008. In its letter filed November 27, 2007, the New Hampshire Fish and Game Department (New Hampshire Fish & Game) state that Vermont ANR will process the water quality certification application in consultation with New Hampshire Fish & Game.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. As referenced in PSNH's Pre-Application Document's Appendix A, FWS staff informed PSNH in a July 9, 2004, phone conversation that there are no known federally listed endangered or threatened species and there is no critical habitat for these species within the project area. No listed species were identified during the 2006 wildlife and wetlands assessment. Because the presence of listed species has not been

[1] C.F.R. § 385.2010 (Service Rule) requires participants filing a document in a proceeding to file documents to each person listed on the official service list for the proceeding.

documented at the project, staff conclude that issuing a license would not affect federally listed threatened and endangered species. Therefore, further consultation under Section 7 is not needed.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Canaan Project is located approximately 370 miles upstream of Long Island Sound and outside of the designated boundaries of the coastal zone. Therefore, the project is not subject to Connecticut coastal zone program review and no consistency certification is needed for the action. By letter dated June 18, 2007 (filed December 27, 2007), the Connecticut Department of Environmental Protection concurred.

1.3.5 National Historic Preservation Act

Section 106 requires that federal agencies "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the operation of the Canaan Project. The terms of the PA would ensure that PSNH addresses and treats all historic properties identified within the project's area of potential effects (APE) through the finalization of the existing draft Historic Properties Management Plan.

1.4 Public Review and Comment

The Commission's regulations (18 CFR, sections 16.8) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the Endangered Species Act, the National Historic Preservation Act, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document was distributed to interested agencies and others on August 20, 2004. Scoping meetings were held on September 20 and 21, 2004, in Manchester, New Hampshire, and Canaan, Vermont, respectively, to request oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
Northeast Kingdom Chapter of Trout Unlimited	October 12, 2004
Connecticut River Watershed Council	October 13, 2004
Vermont Agency of Natural Resources	October 21, 2004
New Hampshire Department of Environmental Services	October 21, 2004

A revised scoping document, addressing these comments, was issued on December 2, 2004.

1.4.2 Interventions

On September 25, 2007, the Commission issued a public notice accepting PSNH's application to relicense the Canaan Project, and soliciting motions to intervene and protests. This notice set November 27, 2007, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene:

Intervening Entity	Date Filed
Connecticut River Watershed Council	November 23, 2007
U.S. Department of the Interior	November 26, 2007
Vermont Agency of Natural Resources	November 27, 2007

No interventions were filed in opposition.

1.4.3 Comments on the License Application

On September 25, 2007, the Commission issued a public notice requesting comments, final recommendations, conditions and prescriptions with a filing deadline of November 27, 2007. The following entities commented.

Commenting Entity	Date Filed
U.S. Department of the Interior	November 20, 2007
Connecticut River Watershed Council	November 23, 2007
Vermont Trout Unlimited	November 21, 2007
Vermont Department of Environmental Conservation	November 27, 2007
New Hampshire Fish and Game Department	November 27, 2007

PSNH filed reply comments on January 7, 2008.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 No-Action Alternative

Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative as the baseline environmental condition for comparison with other alternatives.

2.1.1 Existing Project Facilities

The Canaan project would consists of: (1) a 275-foot-long, 15-foot-high concrete gravity dam that includes: (a) a 150-foot-long spillway equipped with 3.5-foot-high wooden flashboards utilized year-round; (b) a 56-foot-wide section equipped with stoplogs; (c) a 20-foot-wide waste gate section equipped with a 20-foot-wide, 15-foot-high steel tainter gate; (d) an intake structure equipped with a 12.5-foot-wide, 12-foot-high steel gate with a trashrack with 3-inch clear bar spacing; and (e) a non-overflow section between the waste gate and intake structure impounding; (2) a 20-acre impoundment with a normal water surface elevation of 1,055.15 feet mean sea level (msl) leading to; (3) a 1,360-foot-long, 9.0-foot-diameter wood stave penstock connected to; (4) two 21.3-foot-high, 15.3-foot-diameter surge tanks leading to; (5) a powerhouse with a single generating unit with an installed capacity of 1,100 kW discharging water into; (6) a 400-foot-long tailrace; (7) a 1,450-foot-long, 34.5-kV transmission line; and (8) appurtenant facilities. The penstock, powerhouse, and tailrace bypass about a 1,800-foot-long reach of the Connecticut River.

The project boundary encloses all the project facilities described above.

2.1.2 Existing Project Operation

PSNH currently operates the project in a run-of-river mode. The project is operated automatically via a reservoir level control. When inflow at the dam is less than 516 cfs, the reservoir level control maintains the reservoir level between 1055.15 and 1055.25 feet msl, and the project uses water between its maximum (466 cfs) and minimum (55 cfs) hydraulic capacities. When inflow at the dam is above 516 cfs (466 cfs maximum hydraulic capacity plus a 50-cfs bypassed reach flow), the project operates at maximum capacity and excess water is spilled at the dam. PSNH estimates that the total average annual generation is 7,300 MWh.

2.1.3 Existing Environmental Measures

Under the existing license, PSNH is required to provide a total minimum flow of 136 cfs or inflow, whichever is less, downstream of the project (article 21), and provide a continuous average daily flow of 50 cfs, or greater, with the instantaneous minimum flow not less than 40 cfs, or inflow to the project reservoir, whichever is less, into the bypassed reach (article 20).

The project includes the following recreational facilities: (1) a parking area, aesthetic lookout and fishing area near the dam gatehouse on the Vermont side of the river (gatehouse area); and (2) a parking area near the powerhouse with access to bank fishing (powerhouse area). Three additional recreation sites access project waters but are located outside of the boundary: (1) a downstream car-top boat access site with parking located immediately downstream from the Route 114 Bridge and owned by the State of Vermont; (2) parking and access to fishing and to an old railroad bridge on lands owned by New Hampshire (near the dam); and (3) parking and access to the upper impoundment (with informal car-top boat access and fishing) on lands owned by Vermont.

2.2 Applicant's Proposal

2.2.1 Proposed Project Facilities

PSNH proposes no new capacity or changes to project facilities.

2.2.2 Project Safety

The project has been operating for over 23 years under the existing license (effective August 1, 1984) and during this time, Commission staff have conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the

terms of the license, and proper maintenance. As part of the relicensing process, Commission staff would evaluate the continued adequacy of the proposed project facilities under a subsequent license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the subsequent license term to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.2.3 Proposed Project Operation

There are no plans to change the current operational mode of the Canaan Project. PSNH states that it would continue to operate the project in a run-of-river mode with minimal reservoir drawdowns (except during brief periods of maintenance or emergency operation). We interpret this to mean the reservoir would continue to be maintained between elevations 1055.15 and 1055.25 feet msl.

2.2.4 Proposed Environmental Measures

Geology and Soils

To monitor erosion within the bypassed reach, PSNH proposes to:

- develop and implement a final shoreline erosion monitoring plan; a draft plan was filed with the application.

Aquatic Resources and Operations

To enhance aquatic habitat and clarify operations, PSNH proposes to:

- release a 165-cfs minimum flow into the bypassed reach year-round; and
- develop and implement a final operation compliance monitoring plan; a draft plan was filed with the application.

Recreation

To enhance recreation opportunities, PSNH proposes to:

- provide a car-top boat take-out and portage around the project dam, enhance the existing put-in downstream from the dam, and enhance a recreation area near the powerhouse, according to a recreation plan; a draft plan was filed with the application.

Cultural

To protect cultural resources at the Canaan Project, PSNH proposes to:

- develop and implement a final historic properties management plan; a draft plan was filed with the application.

2.2.5 Modifications to Applicant's Proposal – Mandatory Conditions

The following mandatory conditions have been provided and are evaluated as part of the Applicant's proposal.

Section 18 Prescription

Interior requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

Section 401 Draft Water Quality Certificate

The preliminary terms and conditions of the draft WQC (further described in Appendix A) specify the following:

- The licensee must complete a dissolved oxygen study and report.
- The licensee must implement permanent downstream fish passage within one year of license issuance and must institute upstream fish passage within two years of license issuance.
- The project must be operated in a run-of-river mode where instantaneous flows below the tailrace must equal instantaneous inflow to the impoundment at all times; when the facility is not operating, all flows must be spilled at the dam.
- A conservation flow of 165 cfs must be maintained in the bypassed reach.
- During special maintenance drawdowns (e.g. flashboard replacement), the rate of release must be controlled so as to limit the impact on aquatic habitat downstream of the dam and on public safety; the drawdown must not exceed 0.5 foot below the dam crest unless written approval is granted by the Vermont Department of Environmental Conservation (Department); during impoundment refill, the licensee must release, below the project, at least 90 percent of instantaneous inflow, and bypass flow requirements must be met at all times.
- The licensee must develop and file with the Department a flow management plan.
- The licensee must develop a plan for continuous monitoring and reporting of flow releases at the project, impoundment levels, and inflows.
- The licensee must provide the Department with a copy of the turbine rating curves for the record within one year of the issuance of a license.

- The licensee must develop a plan for proper disposal of debris associated with project operation.
- The licensee must file proposals with the Department, for review and approval, prior to conducting project maintenance or repair work, including drawdowns exceeding 0.5 foot below the dam crest.
- The licensee must allow public access to the project lands for utilization of public resources, subject to reasonable safety and liability limitations.
- Recreational facilities must be constructed and maintained consistent with a recreation plan approved by the Department, which shall include interpretive signage on historical and natural resources and, where appropriate, details on erosion prevention and sediment control.
- The licensee must design and implement erosion control measures as necessary to address erosion occurring as a result of use of the project lands for recreation.
- The licensee must file, for Department approval, a riparian vegetation management plan within two years of license issuance.
- The licensee must collect data on shoreline erosion during the first and fifth summers following license issuance and following any flood event exceeding a flow of 5,000 cfs and file a report with the Department by the December 1 following the fifth summer.
- As part of the development of the Historic Properties Management Plan, the licensee must propose a schedule for replacement of the vinyl siding on project buildings and modify the addition to the gatehouse consistent with any design recommendations of the Vermont Division for Historic Preservation.
- The licensee must allow the Department to inspect the project area at any time to monitor compliance with certificate conditions.

2.3 Staff Alternative

Under the staff alternative, the project would include all of PSNH's proposed measures except for erosion monitoring in the bypassed reach. In addition, this alternative would include the following measures: (1) release 90 percent of inflow during impoundment refilling following maintenance drawdowns; (2) conduct debris management; (3) replace or overlay the existing trashracks with bars or screens having 1-inch clear spacing; (4) implement the recreation plan with provisions for vegetation management (mowing and trimming) practices that allow for the growth of a riparian buffer, where possible at project recreation sites, and signs interpreting the natural and cultural history at the project as well as any necessary invasive species education; (5) revise the project boundary to include an existing downstream boat access area; (6) implement the HPMP with additional measures and a timeframe for replacing the siding on the project's gatehouse, storage building, and shed; and (7) implement the provisions of a Programmatic Agreement that would be executed between the Commission and the Vermont and New Hampshire State Historic Preservation Officers (SHPOs). Proposed

and recommended measures are discussed under the appropriate resource sections and summarized in section 4 of the EA.

2.4 Alternatives Considered but Eliminated from Further Analysis

We considered one alternative to the applicant's proposal (project retirement via partial or total project removal), but eliminated it from further analysis because it is not reasonable in the circumstances of this case.

2.4.1 Project Retirement

Project retirement could be accomplished with or without dam removal. Either alterative would involve denial of the license application and surrender or termination of the existing license with appropriate conditions. No participant has suggested that dam removal would be appropriate in this case, and we have no basis for recommending it. The project provides a viable, safe, and clean renewable source of power to the region, and provides public recreation opportunities. Thus, dam removal is not a reasonable alternative to relicensing the project with appropriate protection, mitigation and enhancement measures.

The second project retirement alternative would involve retaining the dam and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. Because the power supplied by the project is needed, a source of replacement power would have to be identified. In these circumstances, we don't consider removal of the electric generating equipment to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and recommended environmental measures. Sections are organized by resource area (aquatic, recreation, etc.). Under each resource area, historic and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.2, Comprehensive Development and Recommended Alternative of the EA.

Unless noted otherwise, the sources of our information are the license application (PSNH, 2007) and additional information filed by PSNH (2007).

3.1 General Setting

The Canaan Project is located at river mile 370 on the Connecticut River on the border between New Hampshire and Vermont. The Connecticut River at the Canaan Project has a drainage area of 381 square miles.

The topography of the upper Connecticut River Basin where the project is located is characterized by rolling hills and valleys, and mountainous terrain with meandering rivers and streams. Above the project, hillsides are forested by second growth, often mixed stands of upland hardwood, spruce-fir, and pine; below the project, the floodplain widens and the fields of the floodplain are used for agriculture. Residential housing and roads lay adjacent to the project boundary on both sides of the river. This region experiences all four seasons, with cold winters (average temperature around 19 degrees Fahrenheit), and mild summers (typically temperature is in the 60s).

A dam was originally constructed at the project site in 1927, and was reconstructed in 1943 after the original timber crib dam washed out. A powerhouse was also constructed and project operation began in 1943. The Canaan Project was licensed by the Commission in August 1984.

There are 13 dams on the mainstem of the Connecticut River used for flood storage and/or hydropower generation. The Murphy Dam Project, owned and operated by the New Hampshire DES, is the next upstream dam located about 11 miles upstream of the Canaan Project. The Gilman Project, owned and operated by Dalton Hydro, LLC, is the next downstream dam located about 80 miles downstream of the Canaan Project (figure 1).

3.2 Scope of Cumulative Effects Analysis

According to the Council on Environmental Quality's regulations for implementing NEPA (40 CFR, Section 1508.7), an action may cause cumulative impacts on the environment if its impacts overlap in time and/or space with the impacts of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we have identified aquatic resources, including water quality and aquatic biota, as potentially cumulatively affected by the proposed continued operation and maintenance of the Canaan Project in combination with other developmental activities in the Connecticut River Basin.

3.2.1 Geographic Scope

The geographic scope of the cumulative analysis defines the physical limits or boundaries of the proposed action's effect on the resources. We have identified the scope for aquatic resources to include the Connecticut River from the Bridge Street bridge in Colebrook, New Hampshire, upstream to the confluence with Bishop Brook at the Stewartstown-Clarksville, New Hampshire town line. We chose the above geographic bounds because the effects of proposed project operations on water quality and aquatic biota in combination with other activities in the basin are limited to these areas.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis includes a discussion of past, present, and future actions and their effects on aquatic resources. Based on the potential subsequent license term, the temporal scope looks 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the license application, agency comments, and comprehensive plans.

3.3 Proposed Action and Action Alternatives

In this section, we discuss the effects of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the site-specific environmental effects and any cumulative effects.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EA.

PSNH does not propose to increase the capacity of the project; therefore, we do not expect any effects to socioeconomic resources. We present our recommendations in section 5.2, Comprehensive Development and Recommended Alternative section.

3.3.1 Geology and Soils

Affected Environment

The bedrock geology of the Canaan Project is dominated by metamorphic Devonian and Silurian bedrock (Figure 2). The Devonian bedrock consists of slate, schist, quartzite, and gneiss. The Silurian bedrock consists of schist, quartzite, and minor carbonate rocks. Generally, the Connecticut River Valley is comprised of sediment deposition that occurred during the recession of the glacial Lake Hitchcock ice sheet, which extended from Middletown, Connecticut, to Bath, New Hampshire, almost 100 miles south of the project area. Two other glacial lakes existed in the region, Lake Coos (Lancaster region) and Lake Colebrook, which extended from below Columbia Bridge through the Hall Stream Valley. These lacustrine features contribute to the potential presence of varved soils, which exhibit paired sedimentary layers deposited over the cycle of given year, common in northern lakes where there is a strong contrast in seasonal conditions.

Soils adjacent to the impoundment on the New Hampshire side are primarily comprised of Masardis gravelly fine sandy loam with somewhat excessive drainage and slopes ranging from 3 to 60 percent. Lands along the bypassed reach and downstream of the project on the New Hampshire side are comprised of well-drained, Stetson fine sandy loam with very low slopes ranging from 0 to 3 percent. Soils further downstream of the project at the first meander are comprised of moderately well-drained Lovell very fine sandy loam. This area also has very low slopes of 0 to 3 percent. Although there are no soils data for the Vermont side of the project area, it is comprised of the same bedrock materials and would be expected to be home to the same soils aggregation (NH GRANIT, 2007, as cited in license application).

The slopes of the Canaan impoundment are largely stable and well forested (FGS, 2006). The tailrace, bypassed reach, and river downstream of the dam have varying geomorphology. The terrain on the New Hampshire side of the river, downstream of the dam, is steeply sloped. The embankment is comprised primarily of coarse stone riprap and has a slope of approximately 35 degrees for several hundred feet below the dam. The average slope decreases downstream but increases again in the vicinity of the Route 114 Bridge. The average slope between the surge tanks and dam on the Vermont side is shallow, increasing through the upper 500 feet to the abutment of the dam. The embankment between the Route 114 Bridge and powerhouse has a slope of approximately 45 degrees.

In the immediate project area, the alluvial soils between the dam and the Route 114 Bridge, approximately 2,000 feet downstream, are worn to bedrock in the permanent river channels and are generally thin below the mean high water mark (PSNH, 2004). The channel immediately downstream of the dam is bedrock and several islands are present between the dam and the Route 114 Bridge. These islands are partly bedrock knolls with accumulated sediment. The flow from Canaan Dam is spread across multiple flow paths around the islands and in deeper bedrock channels. Some gravel bars and a

gravel substrate are present immediately upstream the bridge. The channel becomes alluvial downstream of the Route 114 Bridge and flows are confined to a single flow channel (FGS, 2006).

Shoreline Erosion

A Canaan project shoreline erosion study was completed for PSNH by Field Geology Services (FGS) in 2006. The study identified erosion in reaches upstream and downstream of the dam. Upstream, four eroded sites were identified on the impoundment on the upper portion of a high bank of glacial deposits. Figure 3(a) shows one of the two narrow slumps that extended down to river level where a deposit of mud and trees are found. Two lesser slumps that do not extend down the river level, with the debris and mud terminating in the trees on the lower slope, are also present on the New Hampshire side (figure 3b). The remainder of the high bank on the New Hampshire side is well forested and stable.

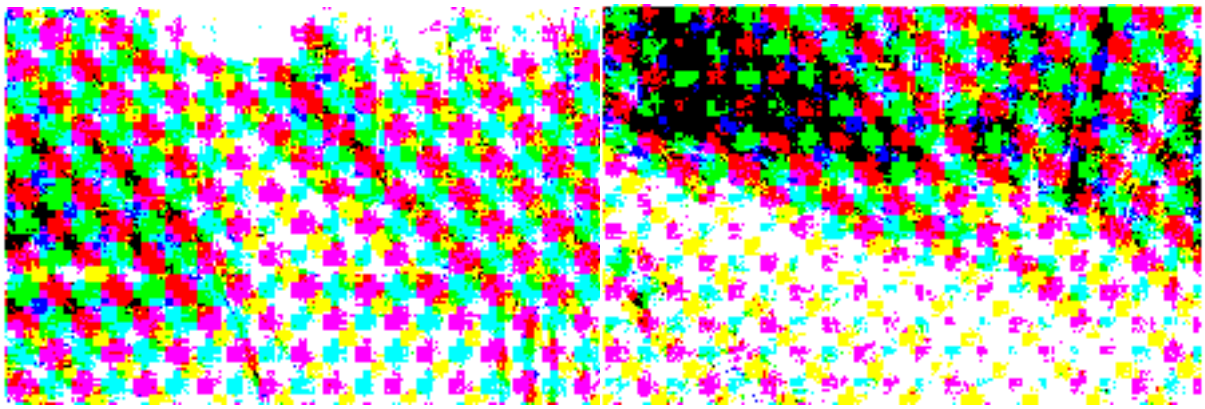


Figure 3. (a) slump reaching base of slope; (b) slump ending in woods before reaching base of slope. Source: FGS, 2006.

The lower bank on the Vermont side of the impoundment is also stable with riprap nearly continuous at the upstream end of the impoundment. One 700-foot segment on the Vermont side is mapped as an area with a high erosion potential. The high erosion rating is due to the close proximity of a road where substantial vegetation and roots are lacking in the bank, but the area is currently identified as stable. Figures 4 and 5 show the bank erosion potential of the different segments of the project's shoreline, which is based on five criteria related to the height of the banks, root depth, root density, bank angle, and surface protection. The figures also indicate the location of riprap and bedrock. See Appendix A of the license application for a complete presentation of oriented ground photographs undertaken for the purpose of future monitoring.

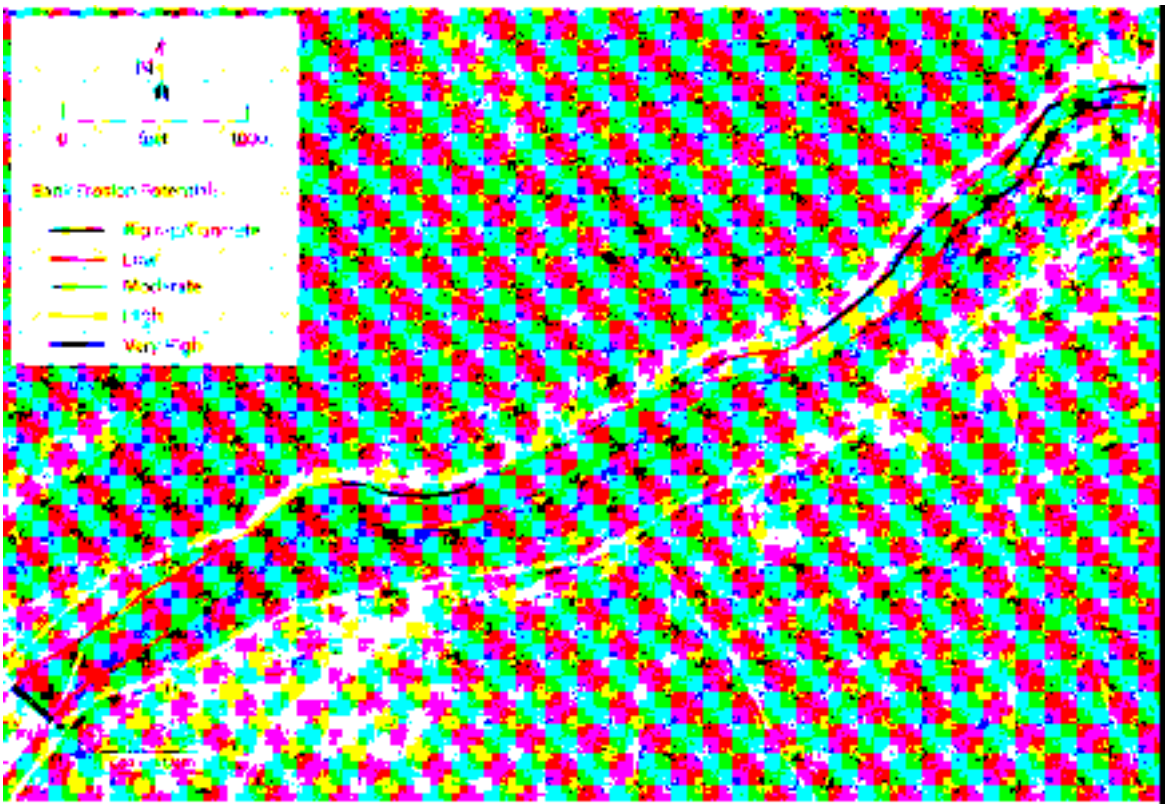


Figure 4. Bank erosion potential upstream from the dam. Source: FGS, 2006.

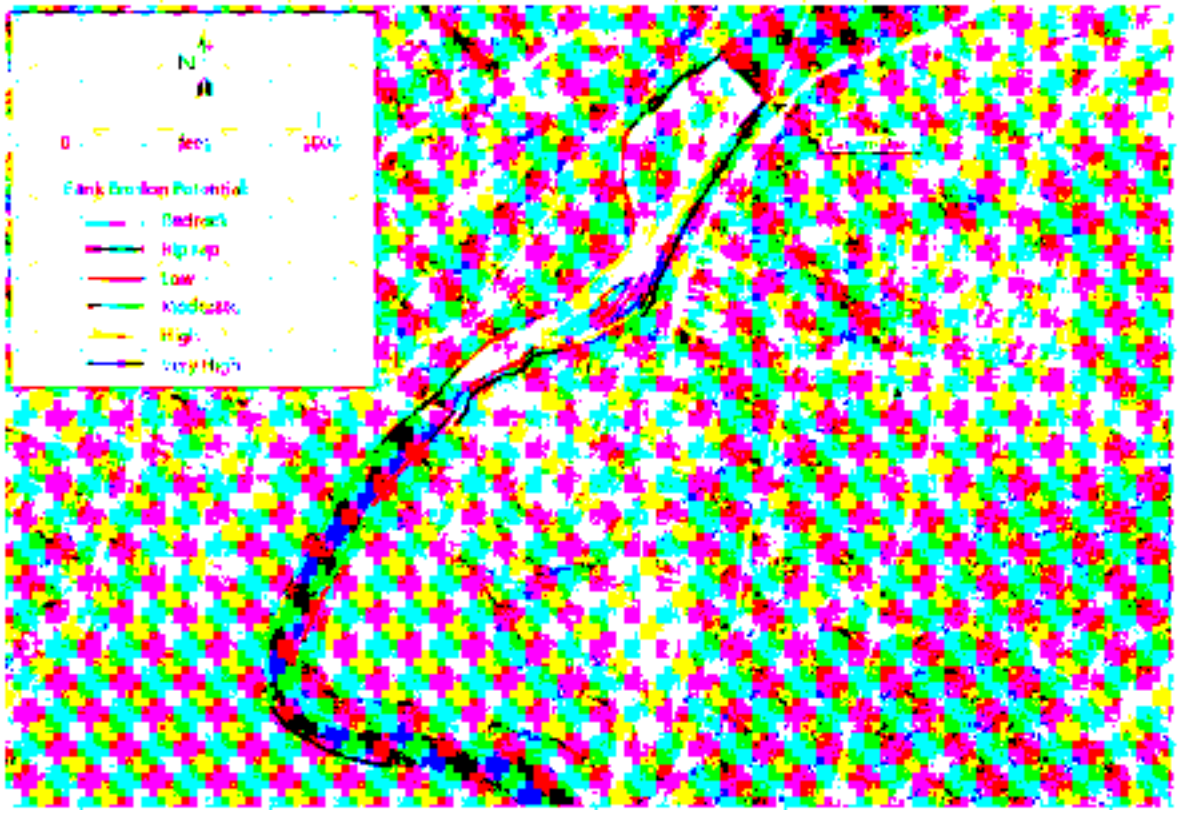


Figure 5. Bank erosion potential downstream from the dam. Source: FGS, 2006.

Downstream from the dam, the low banks are nearly continuously scoured on the left bank for a distance of 1,000 feet downstream of the dam. Complete root systems of small trees are exposed along the bare gravelly banks. These areas have a high to very high potential for continued erosion (Figure 3(b)). Some scour is observed on low banks on the Vermont side of the river and around the islands, but the degree of scour and potential for future erosion is much less than that observed on the left bank due to the presence of occasional bedrock outcrops. Downstream of the Route 114 Bridge, the channel is no longer confined by glacial deposits or controlled by bedrock. The largely tree-lined banks are stable in this straightened reach with the potential for future bank erosion generally moderate to low.

Nine percent of the bypassed reach is armored with riprap or concrete. Bank armoring has not been placed on the scoured lower banks in the bypassed reach except in the immediate vicinity of the dam and the Route 114 Bridge as no other human structures are found below the upper banks.

Environmental Effects

The purpose of the project erosion study was to determine if project operation contributes to bank instability and changes in channel morphology. The study report concludes that the four slump features on upper slopes of the impoundment are the result of concentrated runoff from Route 3 and the erosion is unrelated to pool fluctuations in the impoundment below. However, the report also notes that the project has contributed to sediment storage. Because sediments are retained in the impoundment and not passed downstream, some erosion of low banks and gravel bars has occurred in the bypassed reach. Overall, however, the erosion study concluded that project operation has a minimal effect on bank erosion, because natural flood flows through the run-of-the-river dam exert a much stronger influence on bank stability and channel morphology than pond level fluctuations resulting from maintenance activities or emergency releases and bank erosion downstream of the dam is restricted to low banks inset into higher banks of glacial deposits.

PSNH proposes to continue to operate the Canaan Project as a run-of-river development with minimal impoundment drawdowns (except during brief periods of maintenance or emergency operations) and to provide a minimum bypassed reach flow of 165 cfs for aquatic and aesthetic enhancement purposes. PSNH states that during flashboard replacement, the impoundment would be drawn down 1 foot in order to safely provide maintenance crews with access to the top of the spillway. Vermont ANR, in its draft WQC conditions, specifies that impoundment drawdowns must be limited to 0.5 feet below the dam crest. New Hampshire Fish & Game agrees with the draft WQC conditions.

PSNH does not propose remediation of eroded sites. PSNH proposes to implement a Bypassed Reach Shoreline Erosion Monitoring Plan submitted with the license application. In this plan, PSNH proposes to conduct photographic monitoring of the locations in the bypass reach that were documented during the pre-filing shoreline erosion study. Digital ground photographs were taken along the entire length of the study area with the location of each photograph plotted on an aerial photograph and orientation of the photograph labeled. The condition of the bank at any point within the impoundment upstream of the dam or the bypass reach downstream of the dam can be visually observed with the photographs. PSNH proposes to conduct this level of survey within the bypassed reach the first year following issuance of the new license and again five years later. Comparing monitoring results from these two efforts against the 2006 baseline photography would serve as a basis to determine if additional future monitoring is necessary and if so, an appropriate monitoring interval.

Vermont ANR agrees with PSNH's proposal to initially evaluate erosion one and five years after license issuance, and then determine whether additional monitoring is warranted. However, as a condition of its draft WQC, Vermont ANR would require that the data collected include cross-sectional surveys and monitoring of the impoundment shoreline as well as the bypassed reach. New Hampshire Fish & Game agrees with the draft WQC conditions.

The Connecticut River Watershed Council (Watershed Council) recommends that FERC include a license condition that requires PSNH to develop and implement a plan to reduce sediment from the erosion sites along the project reservoir on the New Hampshire shore.

Staff Analysis

Erosion along the impoundment

PSNH's proposal to continue operating in a run-of-river mode with limited impoundment fluctuations would provide stable water levels in the impoundment and minimize the potential for erosion along the project impoundment.

Based on our review, the four most highly eroded areas within the impoundment are due to road drainage problems along Route 3, particularly since: (1) the slumps are located where excess drainage over the top of the bank is concentrated in low areas; (2) the lower ends of two slump features terminate in the woods before reaching the impoundment; and (3) the slump features occur at the top of the high bank with only sediment and debris accumulation taking place on the lower portion of the bank.

We also note the study report's finding that the most significant changes in pond elevation in the impoundment generally occur at flows greater than 1,000 cfs, and that,

although occasional maintenance drawdowns take place, natural high flows cause a greater variation in the hydrologic factors (including water levels) affecting the shoreline than do any operation-related drawdowns. The annual flow duration curve (PSNH, 2007) shows that flows exceeded 1,000 cfs about 27% of the time for the period of record. It therefore seems likely that variations in river flow have a greater effect on any current or future erosion at the project than occasional impoundment drawdowns of one foot for the purpose of flashboard replacement (generally once annually), and other occasional maintenance activities or emergency operations.

Vermont ANR's recommendation for monitoring the impoundment shoreline would enable PSNH to evaluate whether bank erosion within the impoundment is accelerating through time or is slowing down and to evaluate its effects on project resources. However, as described above, the causes of the erosion are generally not project-related. We also note that only 5.4 percent of the impoundment's shoreline has a "high" erosion potential rating (no areas have a rating of "very high"), while the remaining shoreline has low to moderate erosion potential or is currently armored with riprap or concrete.

Erosion in the bypassed reach

The study report noted that some level of erosion that has occurred in the bypassed reach is related to sediment being retained in the impoundment rather than being passed downstream. Retaining sediments in the impoundment can increase the likelihood of downstream scouring. However, from a flow perspective, a run-of-river project like this would have no effect on downstream bank erosion because the project is merely passing downstream the flow variability that occurs upstream of the project.

It is unknown whether the erosion in the bypassed reach is accelerating through time or slowing down, and likewise the timing of the erosion that already occurred is indeterminable, based on existing information. Photodocumenting the bypassed reach one and five years after licensing, as proposed by PSNH, would help document trends or changes in erosion patterns. An erosion monitoring plan would provide a mechanism for evaluation of the causes and need for more frequent monitoring or control measures in the event of increased or problematic erosion at the project. Resurveying cross sections taken in the bypassed reach, as recommended by Vermont ANR, would provide additional means for monitoring bank erosion of the low banks. However, because no structures are at risk from additional scouring, and no connection has been identified between erosion in the bypassed reach and effects to other resources (aquatic habitat, riparian vegetation, etc.), monitoring erosion in the bypassed reach may not be beneficial at this project. For instance, the results of a bypass habitat study demonstrated that the substrate was generally not embedded (the space between larger rocks was not filled with fine substrate). Substrate with low embeddedness is consistent with quality habitat for macroinvertebrates and fish, so the retention of sediment by the dam does not appear to

be a problem for aquatic habitat within the bypassed reach. Therefore, monitoring erosion in the bypassed reach would likely be primarily an academic exercise and not inform decisions on potential future enhancement measures.

Regarding the Watershed Council's recommendation that PSNH reduce sediment from the erosion sites along the project impoundment on the New Hampshire shore, we note that the placement and anchoring of large woody debris at the base of the slump areas likely prevents sediment and debris from entering the river by trapping sediment on the lower slope. We also note, however, that these erosion areas are not project-related.

Unavoidable Adverse Effects

Periodic impoundment drawdowns, associated with maintenance or emergency operations, could contribute to erosion along the impoundment; but such occasions would be rare. Project operations would continue to have a minimal effect on the timing, location, and magnitude of the bank erosion and related morphological adjustments in comparison with naturally occurring flow events.

3.3.2 Aquatic Resources

Affected Environment

Water Quantity

The Connecticut River is the largest river in New England, flowing 407 miles, generally southwest, from the Connecticut Lakes in northern New Hampshire to Long Island Sound at Old Saybrook, Connecticut (Figure 2). The river has a total drainage area of approximately 11,250 square miles, 3,928 square miles of which are in Vermont and 3,046 square miles of which are in New Hampshire (New Hampshire DES, 1991 and Watershed Council, 2007). The Canaan Project has a drainage area of 381 square miles and includes Hall and Indian Streams, as well as Lake Francis and the Connecticut Lakes.

There are 13 dams on the mainstem of the Connecticut River used for flood storage and/or hydroelectric generation (figure 1). Murphy dam, owned and operated by the New Hampshire Department of Environmental Services (New Hampshire DES), is the next upstream dam located approximately 11 miles upstream of the Canaan Project. Minimum flow releases from the Murphy dam are governed by the terms of the Connecticut Lakes Supplementary Agreement of August 1997. The agreement requires minimum flows from Murphy dam of 85 cfs or inflow (whichever is less) from April through September and 170 cfs or inflow (whichever is less) from October through May.

The Gilman Hydroelectric Project (No. 2392), owned and operated by Dalton Hydro, LLC, is the next downstream dam from the Canaan Project. The Connecticut

River between Canaan dam and the Gilman Project encompasses over 80 miles and is the longest navigable free-flowing stretch of the Connecticut River in Vermont (NVDA 2007).

The Canaan dam impounds a reservoir of approximately 20 acres with a gross storage capacity of approximately 200 acre-feet. The impoundment has a maximum depth of approximately 16.5 feet at normal headwater elevation 1055.2 msl. The Canaan Project is operated in a run-of-river mode. It is operated automatically, on-site, via pond level control. The minimum capacity of the turbine is approximately 55 cfs and the maximum capacity is 466 cfs. The current minimum flow requirements established under the existing license are to release a total of 136 cfs or inflow, whichever is less. At least 50 cfs is released at the dam into the project's bypassed reach and the remaining 86 cfs (or inflow if less) is generally released through the turbine. The current minimum bypassed reach flow of 50 cfs is slightly lower than the 7Q10 flow[2] at the project, determined by Vermont ANR to be about 68 cfs based on flow records from 1958-2004. All flows greater than 516 cfs are discharged into the bypassed reach.

Average daily streamflow at the Canaan Project site was computed combining average daily flows from the U.S. Geological Survey (USGS) gage No. 01129200 (Connecticut River below Indian Stream near Pittsburg, NH)[3] and flows from USGS gage No. 01129300 (Halls Stream near East Hereford, Quebec)[4].

The average river flow at the Canaan Project is 821 cfs with a mean of 696 cfs. The maximum and minimum daily flows of record are 8,240 cfs (on April 22, 1992) and 40 cfs (on August 21, 1975), respectively. Typically, flows are highest in April and lowest in July and August. Seventy-one percent of the year there is more water entering the project than the 466 cfs total capacity of the generating unit. Due to the run-of-river operational requirements, inflows in excess of the hydraulic capacity of the unit are spilled over the dam. During the remaining 29 percent of the year, most of the river flow

[2] The lowest flow which has occurred on a given stream reach for seven consecutive days over the previous 10-year period of flow records.

[3] The contributing drainage area at USGS gage no. 01129200 (Connecticut River below Indian Stream near Pittsburg, NH) is 254 square miles.

[4] The contributing drainage area at USGS gage no. 01129300 (Halls Stream near East Hereford, Quebec) is 85 square miles. To account for the intermittent drainage area not directly measured by the Halls Stream USGS gage, flows at this gage were adjusted by a factor of 1.49 (1.49 = 127 square miles of drainage area between Pittsburg USGS gage and Canaan dam/85 square miles of drainage area at Halls Stream USGS gage).

is diverted from the river through the penstock and powerhouse, reentering the river at the powerhouse tailrace.

Water Quality

Water Quality Standards

The Connecticut River in the project area has been classified by Vermont and New Hampshire as a Class B water (New Hampshire DES, 1991;VTWRB, 2006). For both states, Class B waters are acceptable for fishing, swimming and other recreational purposes, and after treatment, for water supply. The only criteria which are potentially influenced by the project are dissolved oxygen (DO), temperature, turbidity, and pH.

New Hampshire standards for DO are 75 percent saturation or an instantaneous minimum of 5 mg/l, temperature not to affect designated uses, pH in the 6.5-8.0 range, and turbidity of 10 Nephelometric Turbidity Units (NTUs) or less. Vermont standards for DO are a minimum of 7.0 milligrams per liter (mg/l) and 75 percent saturation, temperature increase of no more than 1.0 ºF, pH in the 6.5-8.5 range, and turbidity of 10NTUs or less.

Water Quality Monitoring

The Joint Commissions' Connecticut River Headwaters Subcommittee Plan indicates that the Connecticut River above the confluence of the Upper Ammonoosuc River in Groveton, approximately 30 miles downstream of the project, is "in excellent condition." Specifically, this section of the Upper Connecticut River has adequate DO levels, is largely free of algal blooms, and provides for sufficient waste assimilation from point and non-point source pollution (Joint Commissions, 1997a).

In 2004, the New Hampshire DES conducted a water quality assessment to determine the safety of swimming and other river recreation and the quality of aquatic habitat for over 100 miles of the river, including project waters. For recreation activities, the level of E. coli bacteria was measured and assessed against New Hampshire state water quality standards. To determine the suitability of the river for aquatic habitat, New Hampshire DES assessed DO, pH, specific conductance, and temperature. Because New Hampshire DES has no numeric limits for specific conductance and temperature, only DO and pH levels were compared with state water quality standards. The project impoundment and the 10 miles from the project dam to the confluence with the Mohawk River were found to be "fully supporting" for aquatic life and fishing/boating. The impoundment was found to be "not supporting" for swimming due to E. coli bacteria and data for the river between the dam and the Mohawk River provided inconclusive results with regard to swimming.

In 2000, the New Hampshire Department of Fish and Game (New Hampshire Fish & Game) conducted a study on water temperatures for three monitoring stations: a) downstream from Murphy Dam in Pittsburg, New Hampshire, approximately 10 miles upstream of the Canaan Project; b) West Stewartstown, where the project is located; and c) in Colebrook, New Hampshire, approximately 10 miles downstream from the project. Temperature monitoring results indicated that the project area has "excellent temperature regimes for salmonids, as daily high temperatures never exceeded 70 °F." The mean temperatures for the Pittsburg, West Stewartstown and Colebrook sites were 55.8 °F, 59.0 °F, and 61.0 °F, respectively. This finding was confirmed by temperature data for the Connecticut River approximately 7 miles upstream of the Canaan dam for January 1, 2000, through August 9, 2006 (Table 5). Mean temperatures peak during late summer, reaching just over 60 °F on average. None of the daily means were equal to or exceeded 70 °F.

The 2004 EPA-approved section 303(d) list for New Hampshire waters lists the 20 acres of the Canaan impoundment as being impaired due to polychlorinated biphenyls (PCBs). The cause of these impairments is listed as unknown (New Hampshire DES, 2004). The proposed 2006 section 303(d) list for New Hampshire waters also includes the Canaan impoundment as impaired because of PCBs as a result of atmospheric deposition and the presence of E. coli (New Hampshire DES, 2006).

The 2004 section 303(d) list also identifies approximately 12 miles of the Connecticut River below Canaan dam as impaired due to PCBs (New Hampshire DES, 2004). The draft 2006 section 303(d) list identifies a 2-mile section of the Connecticut River downstream of Canaan dam as impaired as a result of low pH levels, and the presence of PCBs and E. coli. A 10-mile section of the Connecticut River further downstream is impaired as a result of PCBs (New Hampshire DES, 2006).

Aquatic Habitat

The project is located at a point in the river where the width and gradient change significantly. Upstream of the project, the river is relatively steep, narrow, and fast, compared to downstream of the project where the river is wider and slower.

Bypassed Reach

The substrate of the 1,800-foot-long bypassed reach is irregular and composed of ledge, cobble, and boulders. The primary habitat types are pools and cobble-strewn riffles carved from the granitic bedrock. Mesohabitat types for all wetted area within the bypassed reach were identified and mapped as part of the bypassed reach aquatic habitat study conducted during pre-filing consultation. Ten qualitative mesohabitat types were identified during the survey based on water depth, water velocity, substrate, and channel morphology. Rapid and run habitats were the most abundant and represented 70 percent

of the habitat. Most habitats were heterogeneous in terms of water depth and velocity characteristics, with significant amounts of boulder and cobble substrate. Substrate was generally not embedded, which means that the space between larger rocks was not filled with fine substrate. Low embeddedness is consistent with quality habitat for macroinvertebrates and fish.

Impoundment

The benthic environment of the impoundment's lower reach is characterized generally by the soft, finely sorted sediments of a stilling basin. The upper reach of the pond tends to have the hard and well-sorted, course substrate characteristic of the riverine reach above, but with a higher embeddedness than the bypassed reach. The littoral areas of the pond are very limited, with little submergent or emergent vegetation (see section 3.3.3 for discussion of vegetation).

Fish Community

The Connecticut River in the project vicinity supports a cold-water fish community. Sport and recreational fisheries in the project area (Murphy dam through the Canaan - Stewartstown area) are provided primarily by populations of rainbow trout, brown trout, brook trout, white sucker, and dwarf longnose sucker. Populations of rainbow and brown trout are supported by stocking. The indigenous and naturally-reproducing population of brook trout is supplemented by stocking. Annual stocking of trout in the upper reach is concentrated primarily above the project, in the Pittsburg - Clarksville, New Hampshire, river reach below Murphy dam. The Canaan impoundment also receives an annual allotment of stocked trout. The extensive free-flowing reach below the project (Stewartstown to Stratford) is the subject of a somewhat less intensive stocking effort. The stocking program occurs because while the naturally reproducing populations are currently sustaining themselves, the levels are not adequate to meet the high level of angling pressure experienced in this area of the Connecticut River.

Chain pickerel, yellow perch, smallmouth bass, largemouth bass, rock bass, suckers, and the stocked salmonids are the primary components of the sport and recreational fishery in the extensive lower reach below the project. The Connecticut River has been the subject of an intense Atlantic salmon restoration effort over the last 25 years. The closest tributary to the project that is stocked with Atlantic salmon fry/parr is the Mohawk River in Colebrook, New Hampshire below the project boundary. A recent electroshocking survey conducted in tributaries to the Connecticut River by Normandeau Associates demonstrated that wild brook trout were abundant in the tributaries both above and below the project (Normandeau, 2006).

The New Hampshire Fish & Game conducted electrofishing surveys within an upstream tributary (Bishop Brook; New Hampshire Fish & Game2004a) and a

downstream tributary (Simms Stream; New Hampshire Fish & Game, 2004b). The Bishop Brook survey documented six species, composed mainly of salmonid and cyprinid species. The Simms Stream survey documented ten species, also composed mainly of salmonid and cyprinid species.

The NHF&G manages both the upstream and downstream areas of the Canaan Project as a put-and-take trout fishery. The sport fishery for trout species is maintained through a yearly stocking program of hatchery-raised, catchable-size (6-12 inch) trout. During the 2006 season, the State of New Hampshire stocked over 5,000 trout into the Connecticut River within the town of Stewartstown. Trout stocked during 2006 were comprised of 2,000 1-year-old brown trout, 500 1-year-old brook trout, 70 3-year-old brook trout and 2,500 1-year-old rainbow trout (Dianne Emerson, NHF&G, personal communication 2007). A significant stocking program in the area has been in existence since at least the mid 1930's, and is not expected to be discontinued in the near future.

Environmental Effects

Dissolved Oxygen Study and Report

PSNH intended to conduct DO monitoring before filing its application. However, due to river conditions during scheduled sampling times, this monitoring has not been conducted. Vermont ANR, as a condition of its draft WQC, would require that, when feasible after license issuance, PSNH conduct DO monitoring in accordance with a protocol acceptable to the Vermont ANR. New Hampshire Fish & Game states that it agrees with Vermont ANR' draft WQC conditions.

Our Analysis

Given the small and shallow impoundment, low water retention times, run-of-river operation, and documented high water quality in the upper Connecticut River Basin, it is unlikely that the required DO monitoring would document any existing or potential effect of the project on DO. If DO monitoring is required and conducted, and if a problem is identified, then the data could be useful as a baseline against which to judge the efficacy of any future DO remediation efforts.

Run-of-River Operation

The project currently operates in a run-of-river mode and PSNH proposes no change. Impoundment levels would continue to be stable and project outflows would equal project inflows, except during some scheduled maintenance activities as discussed below under the heading "reservoir drawdown and refilling procedures." Interior recommends this mode of operation under section 10(j) and Vermont ANR would require it as a condition of the draft WQC. New Hampshire Fish & Game states that it agrees

with Vermont ANR's draft WQC conditions.

Our Analysis

Because there would be no change in project operation, there would be no effect on water quality, streamflow, or aquatic habitat as a result of this continued mode of operation. Run-of-river operation is the most environmentally protective way in which the project can operate, compared to any scenario involving storage and peaking. By not storing water, the water in the impoundment is less likely to increase in temperature or decrease in DO content. Habitat below the project would continue to experience the same variation of flows as occurs above the project.

Minimum Bypassed Reach Flows

Under current conditions, the project's 1,800-foot-long bypassed reach receives a minimum flow of 50 cfs, or inflow, whichever is less. When project inflow exceeds 516 cfs (the project's hydraulic capacity of 466 cfs plus 50 cfs minimum flow), surplus water is spilled into the bypassed reach to maintain a stable impoundment level and maintain run-of-river conditions. When the project is not generating, as might occur during scheduled maintenance or unscheduled shutdown, all inflow to the project is spilled through the bypassed reach.

PSNH proposes to increase the minimum flow in the bypassed reach to 165 cfs to enhance water quality and aquatic habitat in the bypassed reach. This flow is based on a habitat-based flow study conducted in 2005 and 2006. This proposal matches Interiors 10(j) recommendation and is also consistent with a condition of the draft WQC. Vermont ANR specifies that the flow is to be released as "full crest spillage" unless PSNH gets approval from Vermont ANR to release part of the flow through the Tainter gate. Such approval would be dependent on a determination by Vermont ANR that the spillage and downstream flow distribution would "support aquatic habitat and aesthetics." New Hampshire Fish & Game states that it agrees with Vermont ANR's draft WQC conditions.

Our Analysis

PSNH, in consultation with the agencies, studied the relationship between flow and aquatic habitat during 2005 and 2006. In consultation with the agencies, habitat types were mapped, transects were chosen, and habitat quantity and suitability for brook trout, rainbow trout, longnose dace, and macroinvertebrates were assessed using suitability curves and flow releases of 77 cfs, 129 cfs, 165 cfs, and 212 cfs. Figure 6 summarizes the relationship between flow and weighted useable width for the bypassed reach.

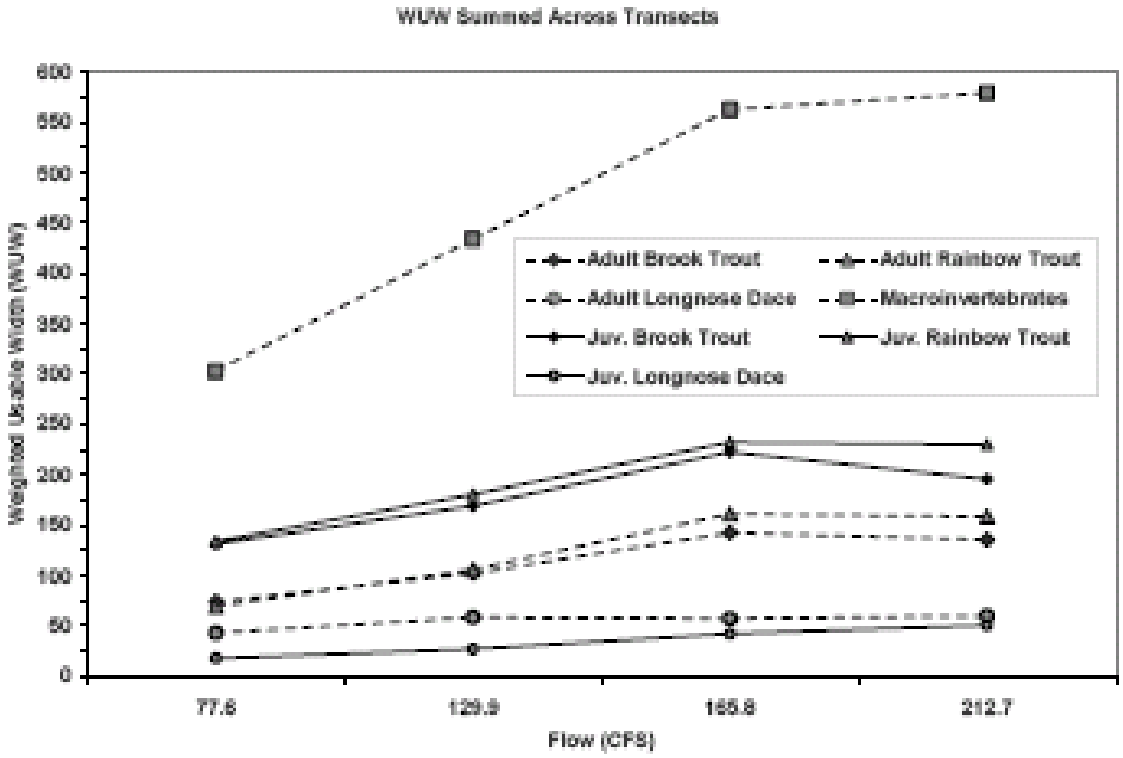


Figure 6. Summed weighted useable width versus flow for all transects, species, and life stages in the Canaan bypassed reach. Source: Normandeau (2007).

Flow beyond 165 cfs results in little or no gain in weighted habitat (figure 6). Specifically, because macroinvertebrates need very little depth, any increase in width would result in a slight increase in weighted habitat for them. However, juvenile brook trout could actually have less weighted habitat at 212 cfs than 165 cfs. The species and life stages evaluated would have approximately three to four times as much weighted habitat under the proposed flow release of 165 cfs, compared to the existing condition of 50 cfs.

Flow Continuation During Reservoir Drawdown and Refilling Procedures

Occasionally, due to either scheduled maintenance or flashboard failure, the reservoir is drawn down below the dam crest and run-of-river operation is interrupted. PSNH proposes that during flashboard replacement, the impoundment would be drawn down 1 foot in order to safely provide maintenance crews with access to the top of the spillway. Following flashboard replacement, a minimum of 165 cfs would be released until the impoundment is refilled and run-of-river operation could resume. Vermont ANR, in its draft WQC, specifies that reservoir drawdowns must be limited to 0.5 foot below the dam crest and that during the drawdown and refilling period, 90 percent of inflow must be released below the project, including continuous maintenance of the 165-

cfs minimum flow to the bypassed reach. New Hampshire Fish & Game states that it agrees with Vermont ANR's draft WQC conditions. Interior recommends under section 10(j) (recommendation 3) that the minimum flow of 165 cfs in the bypassed reach not be interrupted during such events and that the total project releases (generation plus spillage) should correspond to seasonal aquatic base flows (ABFs) of 190 cfs from June 1 through September 31 (sic), 381 cfs from October 1 to March 30 (sic), and 1,524 cfs from April 1 through May 31. If project inflows are below these ABFs, then Interior recommends that 90 percent of the inflow be released below the project.

Our Analysis

Maintaining flow in the bypassed reach and below the project during project maintenance activities is important for the protection of aquatic biota. While most fish successfully move to deeper areas when flow decreases, many macroinvertebrates are not as mobile. Additionally, with lower flows, both fish and macroinvertebrates are more likely to be preyed on or stressed by increased water temperatures and decreased DO levels, especially in the summer. As stated above, Interior's recommended ABF flows could be provided through a combination of spillage and generation. The flow study conducted for the bypassed reach provides information for evaluating spillage flows. However, no similar study was conducted for the river reach below the confluence of the tailrace and the bypassed reach.

The PSNH-proposed 165-cfs flow provides approximately 3 to 4 times the amount of weighted useable habitat for fish and aquatic invertebrates in the bypassed reach, compared to the existing minimum flow of 50 cfs. However, as stated above, flows higher than 165 cfs did not improve habitat conditions in the bypassed reach for most of the species life stages evaluated. The 190-cfs summer ABF recommended by Interior for summer minimum releases should prevent adverse effects to aquatic organisms in the summer by both protecting aquatic habitat and preventing water quality problems such as elevated temperatures and low DO.

When drawdowns occur in the spring, which would typically be the case for flashboard replacement, inflows would likely be much higher than 165 cfs and the danger of high water temperatures and low DO should not be a concern. Similarly, in fall and winter, flows would most likely be well in excess of 165 cfs and typical air temperatures should minimize the risk to aquatic biota from elevated temperatures and low DO.

Providing Interior's recommended seasonal ABF flows for spring, fall, and winter (in addition to the summer ABF of 190) would provide benefits beyond those related to water quality. In the fall and winter, for example, brook trout and brown trout spawning and egg incubation could be improved by providing the ABF flows (compared to PSNH's proposed 165 cfs) if redds that were excavated at higher flows are dewatered by a flow of 165 cfs, even for brief periods, during freezing temperatures. Similarly, during the

spring, spawning of suckers, dace, and numerous other species could potentially be improved by preventing either egg desiccation or freezing.

Operation Compliance Monitoring Plan

PSNH submitted a draft operation compliance monitoring plan with its application in which it specifies procedures for typical operations, flood control operations, flashboard replacement, and shutdown events (scheduled and unscheduled). The plan also describes procedures for maintaining and calibrating compliance instruments such as water level sensors, maintaining records and providing them to the agencies, and reporting deviations from normal operation. PSNH states that it intends to consult further with the agencies after license issuance to finalize this plan. Interior recommends under section 10(j) and Vermont ANR includes in its draft WQC, that the plan be finalized in consultation with the agencies. In addition, Vermont ANR would require the development of a turbine rating curve accurately depicting the relationship between the volume of river flow through the powerhouse and hourly project generation within 1 year of license issuance. The curve, plotted on a graph, would be used to verify the accuracy of minimum flow releases in the bypassed reach based on hourly generation. New Hampshire Fish & Game states that it agrees with Vermont ANR's draft WQC conditions.

Our Analysis

An operational compliance monitoring plan and turbine rating curve would not affect aquatic resources directly. However, there could be indirect benefits from better communication between PSNH, the agencies, and the Commission. For example, misunderstandings about exactly how to operate the project to remain in compliance with the WQC and license would be less likely to occur if all aspects of project operations are clearly agreed upon and explained in one document. If the final WQC and license require fishways to be constructed and operated, then including operational procedures (including communication and reporting protocols) for the fishways in the compliance monitoring plan would ensure that they have the greatest potential benefit.

Debris Management Plan

PSNH's proposal does not include any particular method for handling debris that collects on the project's trashracks. The draft WQC states that PSNH shall develop a debris disposal plan in consultation with Vermont ANR. New Hampshire Fish & Game states that it agrees with Vermont ANR's draft WQC conditions.

Our Analysis

We interpret this measure to be a plan for sorting debris into man-made material

and natural material, and then either disposing it or passing it over the dam as appropriate. However, Vermont ANR provides no explanation for why this plan is necessary or what the plan should contain.

Debris that collects on the trashracks is typically a mixture of man-made and natural material. Man-made material can create an adverse effect on aesthetic resources if it is passed downstream. Natural debris, such as tree branches and logs provide important habitat and nutrients for many aquatic organisms such as fish and aquatic insect larvae, as well as basking habitat for turtles and frogs. If this material is removed from the river and discarded, that potential habitat is lost. Separating the man-made debris from natural debrisand passing the natural debris over the dam would benefit both aesthetic and aquatic resources.

Fish Protection and Passage

Currently, there are no upstream passage facilities at the project and any downstream passage of fish occurs either via spillage or turbine passage. The current trashracks have clear spacing of 2.41 inches and an approach velocity of 1.7 feet per second (fps) when the project is operating at maximum capacity. There is nothing in the record to suggest entrainment and/or impingement mortality is currently a problem.

PSNH evaluated the technical and economic feasibility of providing downstream fish protection, downstream passage, and upstream passage at the project (Kleinschmidt 2006a and 2006b). PSNH determined that such measures are not warranted and does not propose to install them. PSNH based this determination on the lack of need from a fisheries management perspective combined with the cost, which it considers to be excessive.

Interior recommends (10(j) recommendation 5) that PSNH install and operate upstream and downsteam fishways at the project. Interior recommends that design plans and installation schedules be submitted to the Commission within 1 year of license issuance. Interior also requested that the Commission reserve its authority to require fishways as may be prescribed in the future.

Vermont ANR, as a condition of the draft WQC would require PSNH to "implement" year-round downstream passage and protection from entrainment and impingement within 1 year of license issuance. Vermont ANR also would require, within 2 years of license issuance, that PSNH "institute" upstream fish passage which would be operated from April 1 through June 30 and September 1 though December 15, with adjustment based on experience or specific conditions during a given year. Both downstream and upstream passage designs would be developed in consultation with Vermont ANR, the Vermont Department of Fish and Wildlife (VDFW), the New Hampshire Fish & Game, and Interior. New Hampshire Fish & Game states that it agrees

with Vermont ANR's draft WQC conditions. Both the Watershed Council and Vermont Trout Unlimited (Vermont TU) also recommend installation of upstream and downstream passage at the project.

In its reply comments PSNH continues to support the conclusion that fish passage and protection measures are not warranted, because: (1) habitat for spawning and overwintering occurs both upstream and downstream of the project; (2) brook trout already spawn successfully in numerous tributaries; (3) the distance that fish are required to migrate is very site-specific and studies have documented a wide range of migration distances; and (4) the state depends on stocked trout to manage this fishery.

Our Analysis

Upstream Passage

The potential benefits of fish passage depend on the species in the project area, the resource management goals of the resource agencies, and the limiting factors of existing conditions. Atlantic salmon juveniles are not stocked above the project. Therefore, adults do not return below Canaan dam and juveniles do not need to get around Canaan dam on their way back to the ocean. However, brook, brown, and rainbow trout are stocked in the river above and below the project and brook trout are documented as having some natural production. Brook trout are the indigenous trout in the area and reproduce successfully in many of the tributaries (Normandeau 2006). Although habitats upstream of the project and downstream of the project are generally quite different, both spawning and overwintering habitat are present in both reaches of the river (Kleinschmidt 2007). Whether and how much resident trout populations migrate depends on site-specific conditions and the need for such migration. In some instances, migrations can be several miles to reach preferred habitat and in other cases trout spawn near their summer habitat (Burrell et al. 2000; Knouft and Spotila 2002; Meyers et al. 1992; Curry et al. 2002; Rodriguez, 2002). Other species that are known to migrate seasonally, which could potentially benefit from fish passage, include various suckers and minnow species.

Both New Hampshire Fish & Game and Vermont ANR have stated that increasing natural reproduction of brook trout is among their management goals (letters dated November 27, 2007 and November 26, 2007, respectively). Additionally, it is possible that Atlantic salmon restoration plans could include the river upstream of the project in the future, although this is not currently the case. We note that Interior's reservation of authority would allow for fish passage facilities to be prescribed, installed, and operated at any point in the future term of the license.

As discussed in section 3.3.1.1, the habitat upstream of the project is quite different from that below the project. While tributaries suitable for trout spawning exist both above and below the project, the river above the project is generally more suitable

for salmonid spawning than the river below the project because of differences in substrate, velocity, and depth. However, there is not enough information in the record to assess whether limited access to spawning habitat is adversely affecting trout populations. This information could potentially be gathered with a multi-year study, but it would require a study design that could determine which, if any, of the many potential factors are limiting trout populations. Such factors could include, but would not be limited to, the amount and quality of spawning habitat, the distribution and quality of other required habitat types for different life stages, predation, angler harvest, disease, siltation, other water quality issues, and invertebrate and other prey populations. Such a study would be beyond the scope of this licensing proceeding. Therefore, all that can be said based on the current information is that if upstream passage is provided and operated effectively at the Canaan Project, then trout populations below the project would have access to more spawning habitat than they have access to now. If access to spawning habitat is currently limiting trout populations, then upstream passage may result in more trout production and larger populations, assuming some other factor is not preventing population growth.

Downstream Protection and Passage

The project's existing trashracks have wider clear spacing than FWS's typical recommendation of 1.0 inch, although the maximum approach velocity is below FWS's typical recommendation of 2.0 fps. We can assume that at least some entrainment occurs at the project, although due to the lack of any documented fish kills in the project's history, it is likely that any mortality is minimal. Any fish that are entrained probably have at least a 90 percent survival rate, based on the low head and turbine type at the project (Winchell et al. 2000). However, installing trashracks with 1-inch clear spacing would likely reduce the number of fish entrained at the project. For example, based on the results of studies conducted by Lawler et al. (1991) we calculate that brown trout of approximately 9 inches or longer would be protected from entrainment by the 1-inch spaced trashracks. Because brook trout and rainbow trout have similar body shape to brown trout, we estimate similar protection for those species. In addition, swimming speeds reported for adult trout are 7 to 12 fps (Bell, 1991), which easily exceed approach velocities (1.7 fps) in front of the trashracks, thereby reducing the likelihood of impingement effects.

As with upstream passage, the potential benefits of downstream passage would depend on how many fish are currently being entrained or impinged and whether fish populations are currently adversely affected by not having access to certain habitat types generally more abundant below the project, such as overwintering habitat. If certain habitat types are limiting trout survival upstream of the project, and if the downstream passage allows fish to access such habitat types, then fish survival and populations could potentially increase. Additionally, if upstream passage is provided, then a downstream passage route would allow those fish that ascend the ladder to safely return downstream.

Fishway Effectiveness Studies

Interior recommends that PSNH evaluate the effectiveness of both upstream and downstream fishways, based on a study plan and schedule filed with the Commission within 1 year of license issuance and developed in consultation with Interior, New Hampshire Fish & Game, and VDFW.

Our Analysis

Presumably, any fishways installed at the project would be proven designs and appropriately sized and located for the Canaan Project. This would be determined through consultation with the agencies. However, successful fishway operation depends upon site-specific conditions and, therefore, can not be assumed based on a similar fishway installation at a different project. If fishways are installed at the Canaan Project, effectiveness studies would determine if they are operating properly. The results of such studies could be used to make any necessary adjustments to the structures themselves or the precise operational procedures, ensuring that the fishways have the intended effect of successfully and safely passing fish.

Cumulative Effects

During the scoping process, aquatic resources were identified as potentially cumulatively affected by the proposed and recommended measures being considered in this EA. The proposed increase of the bypassed reach minimum flow to 165 cfs, and its correspondent increase in the quality and amount of habitat for fish and invertebrates, could provide a cumulative beneficial effect for the health of fish and invertebrate populations in the upper Connecticut River. This could occur if fish and invertebrates experience more successful spawning and survival of certain life stages, which in turn disperse to colonize other parts of the upper river basin.

Additionally, the increased flow could provide a small incremental improvement to the already high water quality of the upper river. With additional flow, more aeration is likely to occur, which could increase DO below the project. Also, increased flow would minimize pockets of standing water and thus reduce the likelihood of any temperature increases in the bypassed reach and downstream of the project.

Finally, if upstream and downstream fish passage facilities are installed at the project, there is the potential that fish spawning and survival would increase. This could occur if the current lack of passage is somehow limiting fish populations by preventing them from gaining access to necessary habitats such as spawning or overwintering habitat. As discussed above, it is not known at this time whether access to certain habitat types is limiting fish populations. If it is, and if populations increase due to installation of fish passage facilities, then the upper river basin could be beneficially and cumulatively

affected by this increased production and survival of fish.

Unavoidable Adverse Effects

Unavoidable adverse impacts are limited to some entrainment mortality that would persist with the continued operation of the Canaan Project. There is no indication that any losses associated with this effect have a significant effect on fishery resources or fish populations within the project area. Trashracks with 1.0-inch clear spacing would minimize this effect.

3.3.3 Terrestrial Resources

Affected Environment

The project boundary encloses about 5.9 acres of land within the Northeast Highlands physiographic region of the state of Vermont and within the Connecticut Lakes ecoregion of New Hampshire. Because of its granitic bedrock and elevation, the soils in this area are not particularly fertile. The project area is characterized by evergreen forest comprised predominantly of fir and spruce trees.

The shoreline along the Connecticut River in the project vicinity is relatively steep and sloped. The Vermont side of the river is bound by Power House Road and Route 253 (formerly Vermont Route 27 and so labeled on figure 2). A strip of scrub and upland forest vegetation ranging from 50 to 300 feet in width extends from the shoreline to these roads along both the impoundment and bypassed reach (Kleinschmidt, 2006d). The majority of the project's riparian habitat lies on the New Hampshire side of the river between the shoreline and Route 3, with widths ranging from about 50 to 500 feet. This riparian zone consists of largely undeveloped forested land comprised of upland, mixed hardwood, and spruce-fir forest vegetation which stabilizes the steep embankment. Residential housing and commercial developments begin to crowd the river's edge at the upper extent of the impoundment and upriver to Beecher Falls on both sides of the river, limiting riparian habitat and vegetative cover. Immediately downstream from the dam, along the bypassed reach, widths from the shoreline to Route 3 on the New Hampshire side and to Power House Road on the Vermont side are generally less than 100 feet wide; this width increases further downstream and gives way to development upstream of the Route 114 Bridge in Stewartstown, New Hampshire.

Several species of woody and herbaceous vegetation occupy the Vermont shoreline along the bypass reach and tailwater, including: Virginia creeper or woodbine, wild red raspberry, and birdsfoot trefoil (also called birdsfoot deervetch). On the New Hampshire side of the river, both the impoundment and the bypassed reach are dominated by scrub/shrub and stands of mixed hardwood species including: black ash and white birch shrubs, which occur in high frequency, wild black cherry, poplar, and slippery elm,

as well as some occurrence of speckled alder, box elder, and silver maple. These areas of vegetation consist of dense shrub understories amidst immature, second growth stands. The areas between these stands at the top of the riverbank and the low water mark are populated by dense grasses, herbaceous and other woody vegetation. This zone generally lies below the mean high water mark, providing some littoral habitat, and is susceptible to seasonal disturbance from high flows and river ice. The limited forested areas along the New Hampshire shoreline along the tailwater near West Stewartstown Village and on both sides of the river at the upper end of the impoundment near Beecher Falls border commercial and residential development and thus are likely subject to periodic human disturbances.

Four invasive species have been identified at the project. These are: Morrow's honeysuckle, reed canary grass, yellow iris, and hawkweed (Kleinschmidt, 2006d).

Wetlands and Aquatic Vegetation

Three types of wetlands have been documented in the project area (figure 7). Below the dam, the dominant cover type is palustrine forested wetlands. Species associated with this cover type have root systems that are able to penetrate the coarse substrate found below the dam. Above the dam, palustrine emergent and palustrine scrub/shrub wetlands occur. The topography at the head of the impoundment on the Vermont side and the fine, well-sorted substrate creates favorable conditions for the palustrine emergent species that grow there. With the exception of this area, the topography of the impoundment is very steep and wetland areas are confined to the very edge of the river bank.

The littoral area in the impoundment is limited, with a few discreet patches of submergent aquatic vegetation documented on the eastern bank of the impoundment. The lack of littoral habitat is primarily due to the steep sloped impoundment with upland forest growth down to the edge of water. Short segments of littoral habitat were found along the Vermont shoreline with species including arrowhead and pickerel weed. In addition, limited areas of submergent aquatic vegetation were identified along the New Hampshire shoreline and consisted of coontail and ribbon-leaf pondweed (Kleinschmidt, 2006d).

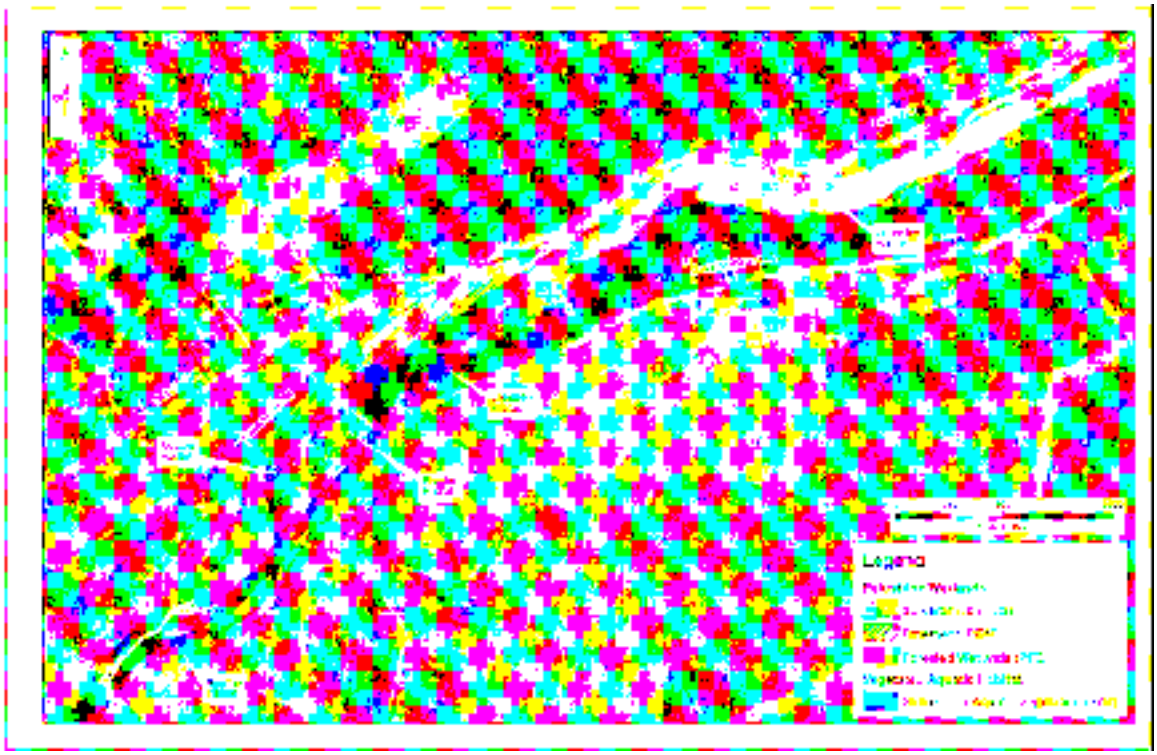


Figure 7. Wetlands and aquatic vegetation at the Canaan Project. Source: Kleinschmidt, 2006.

Wildlife

Limited wildlife habitat exists within the project area. While the habitat that does exist around the impoundment can be classified as good to high quality and large tracts of forested and open habitat surround the project area beyond the roads that border the project, wildlife access is limited by surrounding commercial and residential development and paved roadways. Habitat immediately downstream of the dam is characterized as generally poor quality (Kleinschmidt, 2006d).

Various indigenous small birds and small upland game and furbearing mammals use the project area. What limited habitat does exist in the impoundment has been to have historically been occupied by nesting wood ducks, black ducks, and American merganser, as documented by PSNH. Though reportedly of poor habitat quality, both resident and migratory species are reported to use the lowland areas and floodplain downstream of the project. Wildlife observations made during the 2006 assessment included: great blue heron, various small birds, minnows, frogs, an unidentified snake, beaver, rodents, and moose. Further evidence of wildlife use of the project area included game trails in the dense understory and signs of beaver activity.

PSNH indicates that the Connecticut River serves as a migratory route for inland waterfowl species, but to a minor degree. Stone & Webster (1983), indicates that a

number of inland migrating species have been documented at Lake Frances, located 10 miles upstream of the Canaan Project. These species include: black duck, mallard, American goldeneye, ringnecked duck, hooded merganser, Canada goose, and snow goose. Other waterfowl likely to periodically use habitat in the project area include teal, scoter and goldeneye (Lacaillade, 1975). Great blue heron are frequently observed feeding in the shallow waters downstream of the dam and in the bypass reach. It is likely that other wading bird species may also seasonally occupy the near shore shallows within the project area.

Environmental Effects

Project Operation

The project currently operates in a run-of-river mode and PSNH proposes no change. Impoundment levels would continue to be stable and project outflows would equal project inflows, except during some scheduled maintenance activities as discussed above under the heading "reservoir drawdown and refilling procedures." Interior recommends this mode of operation under section 10(j) and Vermont ANR would require it as a condition of the draft WQC.

PSNH proposes to increase the minimum flow in the bypassed reach from 50 to 165 cfs to enhance water quality and aquatic habitat. This proposal matches Interiors 10(j) recommendation and is also a condition of the draft WQC. New Hampshire Fish & Game states that it agrees with Vermont ANR's draft WQC conditions.

Our Analysis

Run-of-river operation is the most environmentally protective way in which the project could operate, compared to any scenario involving storage and peaking. Habitat below the project would continue to experience the same variation of flows as occurs above the project. Maintaining the impoundment at a stable level benefits the emergent wetlands and riparian vegetation along the shoreline by decreasing incidence of dewatering and flooding. Minimum flows in the bypassed reach would benefit those species of palustrine forested wetlands that thrive on saturated or partially saturated soils.

Vegetation Management

Currently, PSNH manages vegetation around the fences, buildings, penstock, concrete abutments, and the grounds area at the powerhouse and dam gatehouse. Except for the dam abutment area, the entire project shoreline along the New Hampshire side of the river is vegetated. PSNH maintains grasses, shrubs and herbaceous vegetation along both sides of the penstock located on the strip of land between Powerhouse Road and the shoreline of the bypassed reach. The area is maintained to provide access to the penstock

for periodic maintenance and inspection activities. PSNH also maintains an area of woody shrub vegetation on the steep embankment between Powerhouse Road and the tailrace. This is done in order to maintain stability of the steep bank and provide long term prevention of larger growth that could eventually fall into the tailrace.

Within the project boundary on the Vermont side of the Connecticut River, the only piece of land where vegetation maintenance is performed down to the water line is a small area that represents approximately 40 feet of reservoir shoreline, just upstream of the dam gatehouse.

PSNH does not propose to develop a shoreline or riparian vegetation management plan. PSNH recognizes that mowing the grass down to the waters edge is a concern in one area of the impoundment. Since this area will be used as the proposed portage take-out, PSNH proposes to continue to mow this narrow strip of land.

The Watershed Council recommends that FERC include a license condition that requires PSNH to add native woody plant species along the Vermont shore and to implement the Joint Commissions and Canaan town plans rather than being responsible solely for FERC riparian zone management requirements. The Watershed Council believes that this replanting work would benefit the river by adding shade, large woody debris, and bank stability, as well as minimizing road runoff. In addition, the Watershed Council recommends that PSNH stop mowing the land area next to the road and parking area at the powerhouse in order to decrease the amount of runoff entering the river from the roadway and parking area.

The draft WQC would require PSNH to develop a riparian vegetation management plan to enhance wildlife habitat and water quality through enhancement of the existing vegetated riparian zone. This plan would identify: current vegetative conditions and riparian zone uses that affect vegetation, the need for supplemental planting (if any), invasive plant species, and long term measures to restore and manage riparian zone vegetation. New Hampshire DES states that it agrees with the conditions in Vermont ANR's draft WQC.

In response, PSNH notes that woody vegetation planted along the Vermont shoreline of the impoundment would impeded anglers who gain access from the Upper Reservoir Access Area and work their way downstream along the impoundment of this project. PSNH concludes that, by establishing trees and shrubs in this section, people without watercraft would be limited to fishing opportunities around the dam. In addition, PSNH notes that the establishment of woody vegetation along this narrow section of land would eliminate vistas of the upper reservoir, as seen from Vermont Route 254/27. And finally, PSNH states that unmaintained trees could interfere with traffic flow along the road, and that the associated additional shade on the roadway would necessitate the use of more ice melting materials to be used to provide safe travel in the winter months. These

materials would ultimately be deposited in the Connecticut River.

Staff Analysis

There are two items of particular concern regarding riparian vegetation: (1) those areas that are currently mowed by PSNH, especially the approximately 40-foot length of the Vermont shoreline area just upstream from the gate house, which is currently mowed down to the water; and (2) the approximately 1,200-foot strip of Vermont shoreline upstream from the dam that is bordered by Route 253/27.

The 40-foot length of the shoreline that is mowed to the water's edge currently lacks a riparian buffer of any sort, which likely results in an input of sediment and other runoff from the uphill roadways into project waters. Eliminating mowing in this area, as well as around the powerhouse facilities, would have a minor benefit to terrestrial and aquatic wildlife at the project if natural vegetation fills in this relatively small area to provide cover, habitat, shade, woody debris, and to act as a buffer against runoff However, canoe portage has been recommended at the project (see section 3.3.5 on recreation) and this site upstream from the dam on the Vermont side has been identified for a take-out and car-top boat access. We note, however, that access could be provided to recreation users without continuing to mow to the water's edge for this entire portionof the shoreline. Allowing a fringe of herbaceous and woody vegetation to grow along the shoreline, with breaks in it only for the purpose of boat access or for fishing trails, could improve the project's current riparian buffer.

Concerning the segment of land along Route 253/27, we note that this, too, is an area used for recreation, since those interested in bank fishing are able to walk there from the Upper Reservoir Access Area downstream towards the Dam Gatehouse Area. Currently, it appears that the land immediately adjacent to the road is mowed (not by PSNH), and between this mowed area and the water there are upland grasses on the upper slopes, scrub/shrub wetlands on the steep slopes where grasses and woody shrubs dominate, and often the vegetation transitions to herbaceous emergent wetland species at the water's edge (see figure 8).

Figure 8. Route 253/27 along the Vermont shoreline of the impoundment. Source: Kleinschmidt, 2006d.

The strip of mainly herbaceous vegetation that currently exists provides habitat and cover for insects, which benefits the aquatic and terrestrial biota that feed on them, and likely decreases the amount of sediment and other runoff from the road that reaches project waters. The additional benefit to wildlife of adding woody vegetation, as recommended by the Watershed Council, is difficult to ascertain, as there is already a large amount of upland forest in the area and the herbaceous vegetation provides alternative habitat and foraging opportunities. Woody vegetation would benefit aquatic life by providing shade and additional woody debris. Increased woody vegetation along the road could negatively affect aesthetics, if it grows to the extent that it blocks viewpoints of the impoundment.

Developing and implementing a riparian vegetation management plan that considers appropriate measures for enhancing riparian habitat and addressing invasive species, as required by Vermont ANR's draft WQC, could benefit wildlife and water quality slightly at the project through the encouragement of a more complete riparian buffer. Because the great majority of project shoreline is naturally vegetated or covered with rip-rap, there are few places where vegetation restoration is likely to be beneficial. On the other hand, restoring woody vegetation to these areas could potentially decrease the available recreational access, especially for bank fishing.

An alternative option would be to implement measures for vegetation maintenance at project recreation sites with the least amount of mowing or trimming possible while still providing adequate recreational access for existing uses (bank fishing, walking) and new or enhanced uses (portage facilities, picnicking).

Boat Cleaning Stations

The Watershed Council is concerned with the presence of *Didymosphenia geminate* (or didymo, a nuisance algae) within this reach of the Connecticut River, and recommends that PSNH install two boat cleaning stations at the Canaan Project; one at the portage take-out up river of the dam and one at the launch area at the down river end of the project. The boat cleaning station designs would be based on New Hampshire DES designs that the Watershed Council anticipates will be available within the next year.

In its reply comments PSNH states that such facilities are not necessary at small hydroelectric projects, and provides an outline of recommended procedures for addressing *Didymosphenia geminate* infections, as suggested by a Vermont ANR document (source not cited):

1. Check: before leaving a river or stream, remove all obvious clumps of algae and look for hidden clumps. Leave them at the affected site. If you find any later, do not wash them down drains; dispose all material in the trash.
2. Clean: Soak and scrub all items for at least one minute in either hot (140 degrees F) water, a two percent solution of household bleach or a fiver percent solution of salt, antiseptic hand cleaner, or dishwashing detergent.
3. Dry: If cleaning is not practical, wait an additional 48 hours after the item is completely dry before contact or use in any other waterway.

PSNH notes that these procedures involve much more than a cold water rinse and can be performed by responsible boaters when leaving a site and at a car wash or at home. PSNH adds that the chemical, hot water, and waste water disposal facilities required in connection with a boat cleaning facility sufficient to address didymo, as well as the real estate, permitting, and other costs of such facilities are likely to be significant. PSNH concludes that, if such facilities are truly necessary, regional siting of the facilities and regulations requiring their use seem more appropriate than requiring such facilities at small hydroelectric projects. Lastly, PSNH states that two such facilities within less than a mile of each other are unnecessary. PSNH therefore does not propose any measures relating to the control of *Didymosphenia geminate*.

Our Analysis

Didymosphenia geminate, commonly known as “didymo,” is an aquatic nuisance alga that has been documented in the northern reaches of the Connecticut River (Vermont ANR, 2007). Didymo reaches nuisance levels when it expands into nutrient-rich waters and grows in blooms that form thick mats on the river bed and disrupt native wildlife and vegetation. It typically spreads from river to river on the clothing and equipment of people who come in contact with it.

The relationship between the presence of didymo in the Connecticut River and the Canaan Project is unclear. PSNH, in its license application and study reports, does not document the presence of didymo, but it appears likely that didymo exists in this part of the Connecticut River, based on recent reports from Vermont ANR (Vermont ANR, 2007). If New Hampshire or Vermont state agencies implement measures for the control of these nuisance algae, they may request cooperation from PSNH or may require control measures as WQC conditions. Vermont ANR's draft WQC condition requiring a riparian vegetation management plan, which requires the identification of invasive plant species, may also provide a mechanism for installation of educational signs, should they be determined by the state to be necessary for managing invasive plant species at the project. Measures for the installment of signage at recreation sites for the purposes of educating the public about how to prevent the spread of nuisance species could also be included in a final recreation plan for the project. It is unclear what measures would be involved in the Watershed Council's recommendation to install two boat cleaning stations. Given the lack of evidence of a connection between project operation and the spread of didymo, educational signage at recreation sites would be more commensurate with the scope of the project and any potential effects on the spread of didymo.

Unavoidable Adverse Effects

Limited mowing of areas around project facilities and recreation sites would continue to occur at the project. This practice would continue to eliminate small areas of natural vegetation and its associated habitat. Due to the minimal area being mowed, this effect would be minor.

3.3.4 Threatened and Endangered Species

PSHN, in the 2004 PAD, states that based on review of existing information and personal communication with the New Hampshire Audubon Society, FWS, and New Hampshire Natural Heritage Bureau staff, no endangered or threatened species are known to inhabit the project area and there is no critical habitat for these species within the project area. No populations or critical habitat of threatened or endangered species were identified during the 2006 wildlife and wetlands assessment. Therefore PSNH does not propose any specific environmental measures to enhance or protect RTE species.

Our Analysis

Due to the absence of listed species and their habitat in the project vicinity, relicensing of the Canaan Project would have no effect on threatened or endangered species. Should any listed species migrate through or use the area in the future, they would likely benefit from the stability provided by run-of-river operation with limited impoundment fluctuations, minimum flows in the bypassed reach, and the continued

existence of a naturally vegetated riparian zone throughout the majority of the shoreline.

3.3.5 Recreation

Affected Environment

Regional Recreation

Connecticut River Byway

New Hampshire Route 3 from Pittsburg to Lancaster and Vermont Route 102 from Canaan to Lunenburg have been designated as Scenic Byways within the Connecticut River Byway system and fall within the study area.[5] The Connecticut River Scenic Byway contains a system of over 500 miles of state roads bordering the Connecticut River in both states, and the goal is to balance the preservation, promotion, enjoyment, and stewardship of the Connecticut River Valley and to link people, organizations, communities, and agencies in promotion of the byway as a tourism asset.

See Appendix A of the *Final Recreation, Land Use and Aesthetics Study Report* (PSNH, 2007) for complete lists of recreational resources within 30 miles of the project.

Recreation in the Project Vicinity

There are six public recreation access sites in the project area (see figure 9). The sites are listed from upstream to downstream and described below (photos from PSNH's Final Recreation Report).

[5] Route 253 turns into Route 102 once it crosses Route 114, going south.

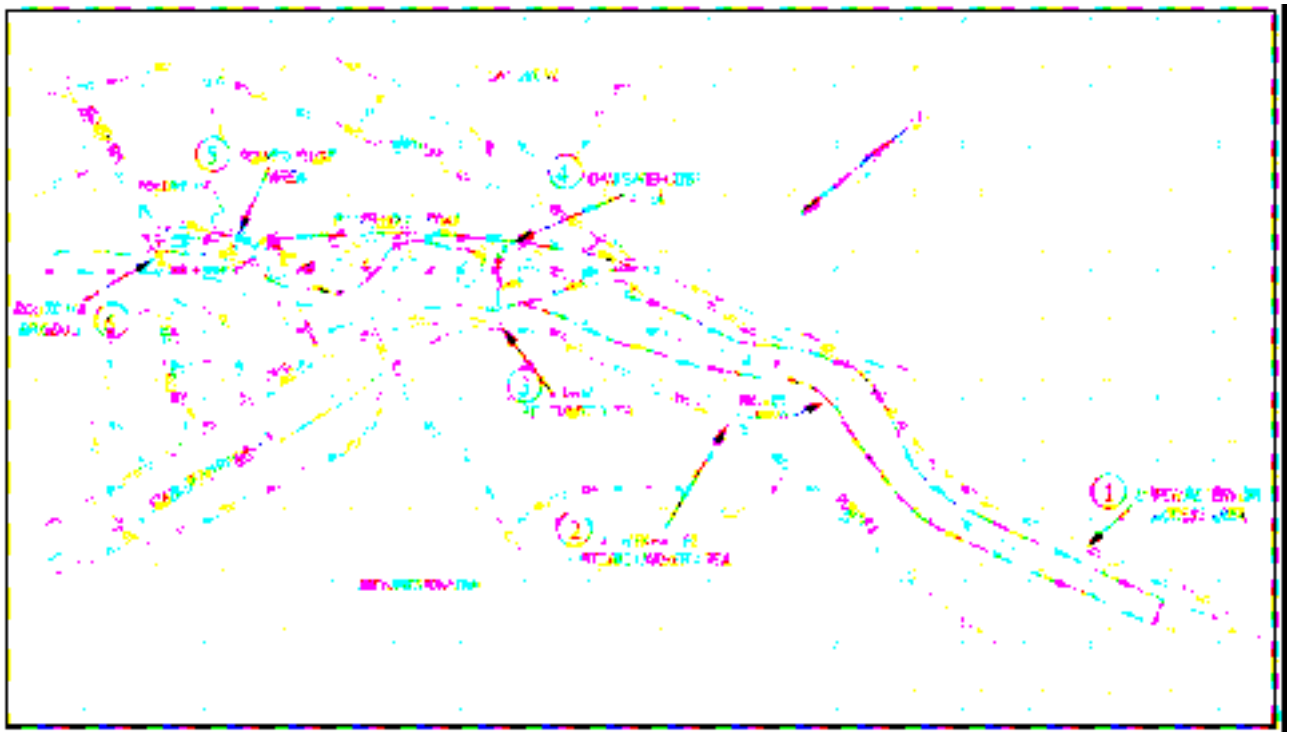
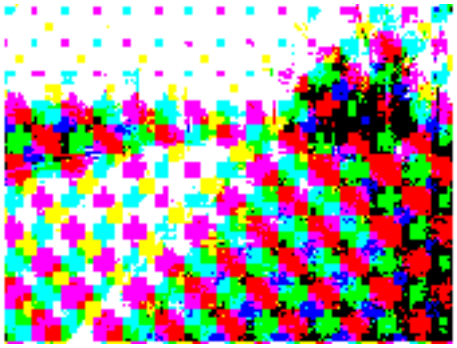


Figure 9. Six recreation sites at the Canaan Project. Source: PSNH, 2007 modified by staff.

1. Upper Reservoir Access Area (VT side): This site, which consists of two pull-offs and short trails to the reservoir, is the only feasible access to the upper portion of the reservoir since the New Hampshire shoreline is heavily vegetated and very steep. The site provides parking for eight vehicles outside of the project boundary on land owned and maintained by the state of Vermont, informal car-top boat access, access for bank fishing, and access for sight-seeing with views of the reservoir .

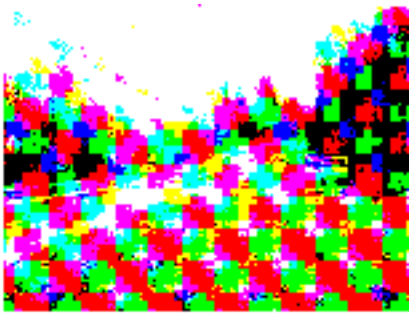
The trails show signs of slight erosion. Dense vegetation and steepness of slope are barriers to accessibility at this site.

2. 45th Parallel Historic Marker Area (NH side): The state of New Hampshire has placed a roadside exhibit marker, which marks the 45th Parallel, at a small turnoff on the New Hampshire side of the Connecticut River. This site is located outside of the project boundary approximately ¼ mile upstream from the dam off Route 3. The area provides



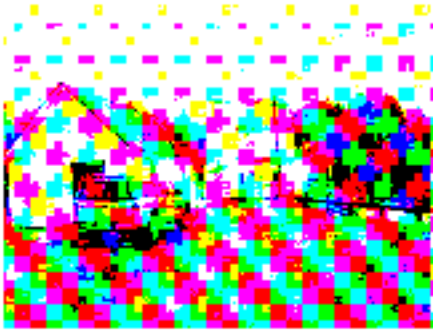
parking for two vehicles, the marker describing the 45th Parallel, and access for aesthetic sightseeing that provides a limited view of the upper reservoir. Due to the steepness and woody vegetation growing on the banks, there is no direct access to the reservoir from this point.

3. Dam Abutment Area (NH side): Adjacent to the dam, this approximately ¼-acre area is used by persons engaging in fishing, sightseeing, hiking, and as a thruway for snowmobile activity during the winter. The site provides two gravel parking areas, outside of the project boundary and on either side of Route 3 with room for five vehicles, an old railroad bed leading to an old railroad bridge that spans the reservoir, access to the reservoir for bank fishing , and access to the area downstream of the dam for bank fishing. The reservoir and areas downstream of the dam along the river are visible from this site, with upstream views of moderately graded banks with upland vegetation between Power House Road and the reservoir shoreline on the Vermont side of the reservoir. The railroad bridge is state-owned and used by snowmobilers in the winter and pedestrians in the summer. Residents and workers from local businesses use the railroad bridge as a walking trail that connects Route 3 in New Hampshire to Power House Road in Vermont.



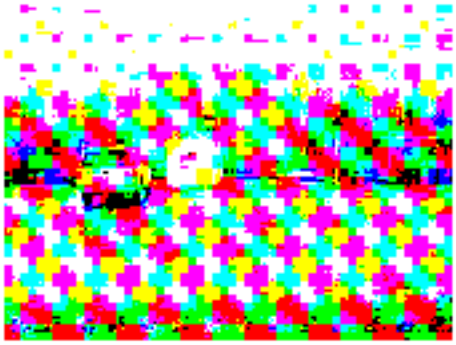
The abutment shows signs of deterioration due to weather, age, and recreational use. The area is littered with fishing line, tackle, and general litter. The slope running down the wing-wall shows signs of erosion due to informal recreational access. PSNH has recently installed new wooden steps for access to the release gate structure, which are also used by recreation users.

4. Gatehouse Area (VT side): Located adjacent to the dam and entirely within the project boundary, this site provides a parking area for two vehicles, a reservoir lookout and fishing area, and limited downstream views. The view upstream includes an old railroad bridge, a small portion of the 20-acre reservoir, and steeply graded banks with upland vegetation on the opposite bank. The downstream view includes project structures located in the area (the gatehouse, fencing, and penstock). The parking lot and associated structures and clearings cover approximately 200 square feet. People that come to fish or sightsee usually congregate between the gatehouse and an auxiliary building located in proximity to the parking area. Visitors are



protected from falls into the reservoir by a wooden fence. The area appears well maintained and does not show evidence of vandalism or erosion. There is a small area adjacent to and just upstream from this area that is mowed and maintained down to the water line; visitors fish and access the reservoir in this area.

5. Powerhouse Area (VT side): This approximately 1/8-acre site is located entirely within the project boundary on the Vermont side of the river, 1,400 feet downstream of the dam, and provides one parking area for approximately four vehicles and bank fishing access to the tailrace area. The area from the parking lot to the employee entrance to the powerhouse is well maintained and litter free. A fishing access trail shows signs of erosion and litter associated with fishing activity. Because of the steepness of the slope and no formally established trail. The adjacent Power House Road has the only key viewpoints where water cascading over the dam is visible to the public.



6. Route 114 Bridge Area: This site is located outside of the project boundary and is owned and maintained by the state of Vermont. It is located a short distance downstream from the powerhouse off of Route 114 on the Vermont side of the bridge and consists of a paved access road and parking space (cul-de-sac) for three vehicles, an unpaved car-top boat access, and unpaved bank fishing access. The access road, cul-de-sac, and river access occupy about 1/8-acre. The area appears maintained but contains litter associated with fishing activities. Because of the pavement and rocky shoreline, this area does not show signs of erosion.

Anyone parking in this area to recreate must park so as not to block access to a fire hydrant that the local fire department uses to draw water from the river. There is a private field located adjacent to the Route 114 Bridge area that allows parking for a fee of $5.00 which includes the use of additional amenities such as an open shower, tables, and fire rings.

Connecticut River Canoe and Kayak Access

In Pittsburg, New Hampshire, below the Pittsburg-Clarksville Bridge, there is boating access to a 9.25-mile remote wilderness section of the Connecticut River ending in West Stewartstown, New Hampshire/Canaan, Vermont just below the 114 Bridge in Canaan, Vermont (near the project). This section of river offers some quickwater, Class I and II rapids, and Class III drops. Scouting is advised, and portages are necessary. Anyone paddling this stretch of river must take out at above the Canaan Project dam, portage around the dam and put back in the river at the 114 Bridge on the Vermont side. There is currently no formal canoe portage trail located around the Project dam. At this time, the best place to exit the river is at the informal access area located at the upper end of the reservoir along Vermont Route 253/27. There is a dirt turn-off for car-top boat access to the Project reservoir with a limited parking area. Under existing conditions, individuals can portage by following Vermont Route 253/27 down to Power House Road, following Power House Road to the intersection with Route 114, crossing the road, and following the access road down to the river.

From the boating access located in Canaan below the 114 Bridge, there is access to a 24.5-mile stretch of the Connecticut River ending in North Stratford, New Hampshire, at the bridge. For shorter runs, the Colebrook-Lemington Bridge Access (approximately 10 miles) or Columbia Covered Bridge Access (approximately 14 miles) offers the opportunity for car-top access. This section of river offers views of pastureland, old Lyman Falls dam, and views of Mt. Monadnock. Scouting is advised at Lyman Falls dam, and a portage may be necessary. The breached dam at Lyman Falls, 8 miles below the Columbia Covered Bridge, is a place to pull out and scout ahead. The falls can sometimes be run, especially on the New Hampshire side. The state of Vermont has established Lyman Falls State Park here, with help from Joint Commissions and the Vermont River Conservancy. This section of river offers some flatwater, quickwater, and Class I and II rapids.

Existing Uses

As part of the relicensing process, PSNH, with the Louis Berger Group, Inc., conducted a 1-year study (July 2005 –June 2006) to obtain information to characterize existing recreation, land use, and aesthetic resources at the Canaan Project. The final study report is included in the license application.

During July 2005 through June 2006, the Route 114 Bridge Area received the highest level of people recreating, while the dam abutment area received the highest level of vehicular use as compared to the other recreational access sites. People primarily recreated during the morning period (33 percent) followed closely by the afternoon period (29 percent) with the majority of the use (83 percent) occurring during the week. The total estimated annual recreational visitation at the project during the study period

was 2,439, with that use being fairly evenly distributed throughout the year. The primary recreational activities observed at the recreational access sites were walking (48 percent) and fishing (28 percent).

Environmental Effects

The report for the recreation study concludes that existing and projected future recreational use at the project is anticipated to remain low and would likely remain dispersed throughout the project area. PSNH states that existing facilities generally provide the level and type of development that is suitable for the type and extent of recreational use that occurs within the project area.

PSNH identifies three areas where additional access or modification to recreational access would be beneficial and proposes to:

1. **Provide car-top access site and portage trail**

There is no formally designated portage access trail to safely portage around the Canaan dam. Currently, individuals wishing to portage around the project dam must traverse Vermont Route 253/27 down to Power House Road, follow Power House Road to the intersection with Route 114, cross the road, and follow an unmarked access road down to the river.

Figure 10 shows the proposed portage route. A new access site would be located above the dam on the north bank of the reservoir where boaters may access the reservoir or take out for portage around the dam (figure 11). The area is relatively flat and located within the project boundary. PSNH proposes to continue to mow and maintain the vegetation in this area for easy access for boaters. Portage trail users

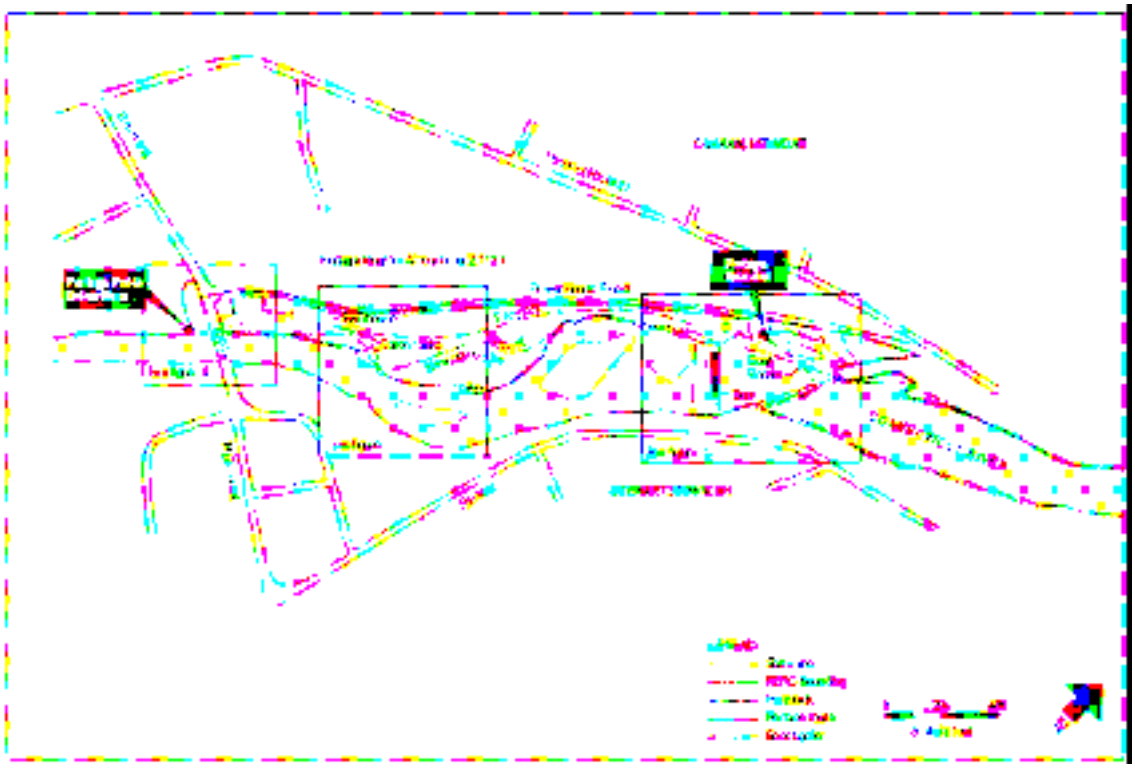


Figure 10. Proposed portage route. Source: PSNH, 2007.

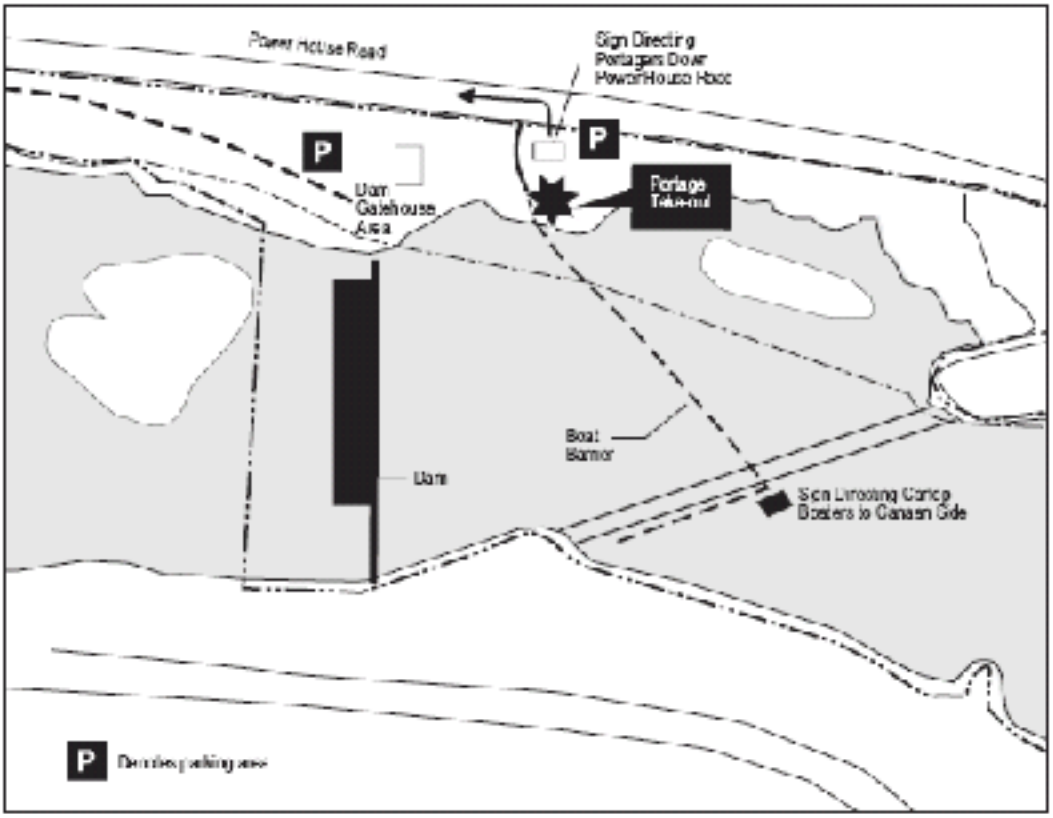


Figure 11. Proposed portage take-out above the dam. Source: PSNH, 2007.

would travel in a southwesterly direction down Power House Road to the intersection with Route 114, cross the road, and follow the access road down to the river under the bridge. The portage trail length would be about 2,112 feet.

To inform boaters approaching this access area, a sign would be placed at the midsection of the railroad bridge, and the safety boom would be angled from the midsection of the railroad bridge down to the access area and secured with an anchor. Placement of the anchor and sign would be the only minimal ground-disturbing activity, and PSNH proposes to use best management practices to ensure minimal sediment disturbance during installation.

The proposed take-out area contains space for parking one vehicle, and there is also parking available directly at the gatehouse located about 50 feet downstream.

2. Enhance car-top boat access below the dam

Currently, there is a car-top access point and parking area located on the Vermont side of the river immediately below the project at the Route 114 Bridge.
The state of Vermont owns and maintains the land on which the access road and cul-de-sac are located. Although these lands are located outside of the project boundary, PSNH has the deeded right in common with other members of the public to pass, repass, and travel over these lands. PSNH proposes to consult with the state of Vermont and request permission to provide signage denoting the car-top boating access area and location where public (no fee) parking is allowed (figure 12). The placement of the sign will be the only ground-disturbing activity expected to occur, and PSNH would use best management practices to ensure minimal soil disturbance during installation.

Figure 12. Proposed car-top boat access below the dam. Source: PSNH, 2007.

3. Enhance the recreation area near the powerhouse

PSNH proposes to continue to maintain the powerhouse area. In addition, to encouraging individuals visiting the newly nationally designated Connecticut River Byway to stop and enjoy the site, PSNH proposes to place a picnic table at this site (figure 13). This site would also serve as a resting area for individuals using the proposed portage trail. A sign would be placed at the site to inform users of the site. The placement of the sign would be the only ground-disturbing activity expected to occur, and PSNH would use best management practices to ensure minimal soil disturbance during installation.

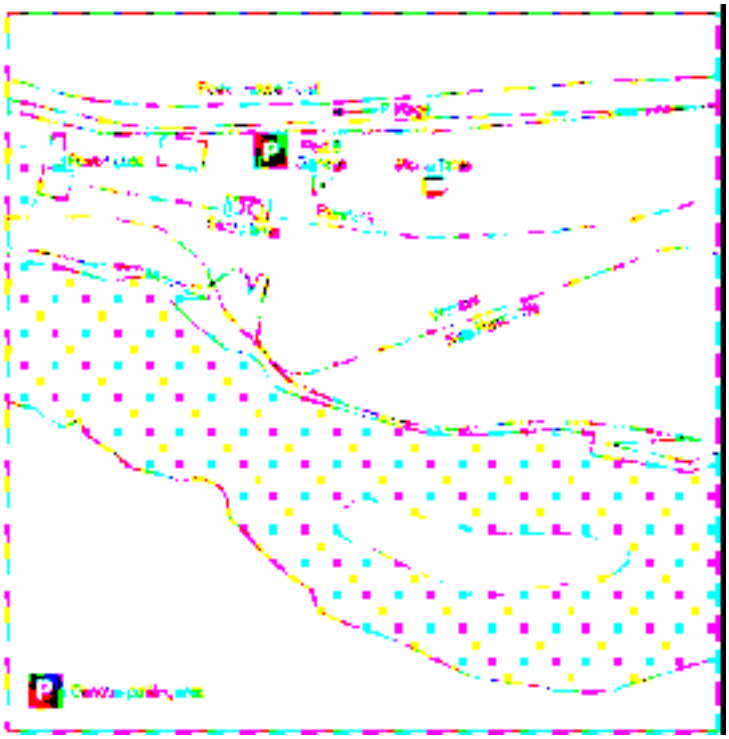


Figure 13. Proposed picnic table and signage at powerhouse access area. Source: PSNH, 2007.

These measures are included in PSNH's proposed recreation plan, filed with the license application. According to the plan, these enhancements would be implemented within one year of license issuance and PSNH would monitor their use in conjunction with the schedule set forth for the FERC Licensed Hydropower Development Recreation report (Form 80). If the level of use starts to exceed their capacity, PSNH would assess the need for improvements in consultation with resource agencies and municipalities.

PSNH proposes to maintain the upstream car-top access, portage trail, and powerhouse area, which are located within the project boundary. Concerning the car-top boat access area below the project dam at the Route 114 Bridge, which is located outside of the project boundary and owned and maintained by the state of Vermont, PSNH

proposes to inspect the facilities annually in order to evaluate the condition of the facilities. Repairs would be made as needed to maintain the downstream access facilities in a safe and functional condition. PSNH proposes to annually inspect any signage agreed to by the state of Vermont and placed at the put-in and to repair or replace signs as needed.

Vermont ANR, as a condition of its draft WQC, would require the proposed recreation plan to include the provision of interpretive signs by PSNH, due to the rich history of the area and the appropriate publicly accessible location for such signage. Vermont ANR would also require the plan to include, where appropriate, details on erosion prevention and sediment control. New Hampshire Fish & Game states that it agrees with Vermont ANR's draft WQC conditions.

Staff Analysis

Based on future population estimates and use patterns in the project area, current recreation facilities appear to be adequately meeting recreation demand, with the exception being the lack of a formally designated portage trail. As noted by Vermont ANR during scoping (letter filed October 21, 2004), a boat take-out and put-in would accommodate paddlers on trips down the Connecticut River. The proposed portage, which extends from approximately 200 feet upstream from the dam to the downstream side of the Route 114 Bridge, is approximately 2,112 feet long. For those carrying canoes, this can be a long distance. However, the portage would be considerably shorter than what currently is available, as the nearest (informal) take-out is located between a quarter and a half mile upstream from the dam. Overall, therefore, the portage length would decrease by approximately 1,120-2,440 feet, which would benefit those boaters able to traverse the 2,112-foot-long portage trail.

For car-top boaters and others using the downstream access area, signs would clarify the presence of boating access and public parking, benefiting users. This is the only boating access available downstream from the project and the only site available for those wishing to portage around the dam. Including the put-in, with its access road and associated parking, within the project boundary as a project facility would ensure that it is maintained if, in the future, the state of Vermont cannot, for whatever reason, continue maintaining the site.

Enhancing the existing recreation area near the powerhouse, through provision of a picnic table and signage, would encourage individuals visiting the nationally designated Connecticut River Byway to stop and enjoy views of the project area. Continuing to mow in the area of the proposed upstream take-out and portage access and around the powerhouse would continue to facilitate bank fishing access.

Although erosion is not a project-related issue, increased recreational use and

access at the project due to the proposed enhancements could result in some erosion or increased runoff of sediments at each site (from increased automobile parking and walking), particularly where the vegetation is mowed down to the water's edge. Allowing grasses and shrubs to grow to maturity along parts of the shoreline at these sites would result in some enhancement to the riparian buffer, which would aid in erosion and sediment control at these recreation sites. Appropriate mowing practices could be determined in order to ensure that this buffer is provided, where possible, and that facility and recreational access, including bank fishing (i.e. with walking trails), are maintained. Such measures would be consistent with Vermont ANR's requirement that erosion prevention and sediment control measure be included in the recreation plan. Should signs be necessary for the purposes of invasive species education, such signs could be placed at recreation sites to prevent the spread of problem species.

Interpretive signs, as required in Vermont ANR's draft WQC, would educate the public about the history of the area, which is discussed in the cultural resources section below. Including the provision of these signs in the recreation plan would allow for coordination of all necessary signage, which could be designed to complement the historic and scenic setting.

Unavoidable Adverse Impacts

Some minor amount of sediment may enter the Connecticut River as a result of recreation facility enhancements or installation of signs at recreation sites. Some minor and short-term increase in traffic, noise, and visual disturbance during construction of recreation enhancements and sign installation could occur.

3.3.6 Cultural Resources

Affected Environment

Area of Potential Effect

The Advisory Council on Historic Preservation (Advisory Council) defines an Area of Potential Effect (APE) as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE for the Canaan Project includes; (a) lands enclosed by the project boundary; and (b) any lands or properties outside the project boundary where project operation or project-related actions may cause changes in the character or use of historic properties, if any exist. The APE consists of the adjoining bypassed reach of the Connecticut River and extends from the upstream end of the project impoundment, approximately 4,000 feet above Canaan dam, to the outfall of the tailrace at the Route 114 (Main Street) Bridge, approximately 1,800 feet below the dam. All of the APE, except those areas located in the bypassed reach, are within the project

boundary. It specifically comprises:

- a zone 33 feet (10 meters) wide immediately inland of the shoreline of the project pond at its normal elevation of approximately 1,055 feet;
- project lands owned by PSNH in fee simple, which are located primarily on the right (westerly, Vermont) bank below the former Maine Central Railroad (RR) bridge (essentially the area east of Power House Road in Canaan, Vermont, to the shoreline of the bypassed reach, between Vermont Routes 114 and 253/27; and
- the bypassed reach below the Canaan dam, including a zone 33 feet (10 meters) wide on the left (easterly, New Hampshire) bank immediately inland of the former, pre-impoundment shoreline of the Connecticut River.[6]

Archaeological Resources

PSNH commissioned a Phase IA archaeological assessment of the project (LBG, 2006a) during pre-filing consultation. The study, developed in consultation with the Vermont and New Hampshire State Historic Preservation Officers (SHPOs) and Alnobak Heritage Preservation Center, consisted of a literature search and reconnaissance-level field inspection. The APE was divided into 15 segments, each of which was assessed for its potential to contain archaeological resources and for evidence of erosion potentially attributable to project operation. The archaeological consultants identified four historic-period archaeological sites and five shoreline segments that are sensitive for prehistoric archaeological resources. The historic archaeological sites consist of a stone-lined foundation with associated 19th to 20th century debris; remnants of a wooden structure of unknown origin partly submerged within the impoundment; structural remains of the Allen Electric Light Plant (precursor to the Canaan project); and the possible location of a 19th century building. The archaeologically-sensitive segments exhibited minimal active erosion, attributed chiefly to ice scouring and bank undercutting.

In comments on the survey, the SHPOs recommend that Phase IB subsurface investigations be undertaken at the four historic period archaeological sites to obtain more information about their characteristics and potential National Register eligibility. The fieldwork portion of the Phase IB archaeological survey was conducted May 7-18, 2007. The results of the Phase 1B study indicate that of the four sites identified in Phase 1A plus one additional site evaluated under Phase 1B, two sites are eligible (W.F. Allen Electric Light Company Site [VT-ES-55] and C.H. Weeks factory Site [VT-ES-56]) and one (Timber Crib Site [VT-CO-72]) may be eligible for listing on the National Register of Historic Places.

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[6] The bypassed reach, which is identified as an “area of high archaeological sensitively” (high likelihood of containing cultural deposits) could be affected by erosion caused by project releases.

Historical Resources

An historical resources survey, developed in consultation with the SHPOs, was conducted to identify project facilities and other buildings or structures eligible for inclusion in the National Register of Historic Places (LBG 2005). The survey concluded that the facilities of the Canaan project are eligible for the National Register for their association with water-powered industry in Vermont and New Hampshire, and as representative of 1920s hydroelectric facilities in the region. The powerhouse, dam, intake, penstock, and stone abutments of a previous dam contribute to the significance of the hydroelectric station. Non-contributing elements, based on insufficient age or lack of integrity, are the gatehouse, a storage building, a shed, the outdoor substation, and the surge tanks. A 19th century railroad truss bridge spanning the project impoundment, although not associated with the project, is eligible as a significant example of 19th century railroad engineering.

By letter to PSNH, dated May, 17, 2006, the New Hampshire SHPO concurred with the National Register eligibility of the Canaan Project facilities as a Historic District. During a teleconference held May 15, 2006, the Vermont SHPO stated that the powerhouse, dam, intake, penstock, and stone abutments are eligible for the National Register.

The SHPOs concurred with the overall findings of the historical resources survey and requested that PSNH revise the survey report to address several recommendations for clarification and additional information, including the Phase 1B study.

Environmental Effects

The Canaan Project is an existing facility that is operated run-of-river. PSNH is proposing to continue to operate run-of-river and is not proposing any changes to project facilities other than a canoe portage at the dam and some minor enhancements to an existing car-top boat access and existing recreation area near the powerhouse. To make the gatehouse, storage building, and a shed more compatible with the character of the Historic District, PSNH proposes to remove the vinyl siding from the structures and replace it with wood siding in connection with routine project maintenance. As noted in section 3.3.2 Aquatic Resources, a fish passage facility could be required at the project dam which is eligible for the National Register.

Vermont ANR's draft WQC references PSNH's proposal to replace the vinyl siding on the gatehouse, storage building, and shed with wood siding as part of future routine maintenance. Vermont ANR states that the design of the existing addition to the gatehouse may be incompatible with the design of the historic gatehouse. Vermont ANR's draft conditions would require that corrective action on at least these two issues

be taken within five years of issuing a license.

Staff Analysis

We have reviewed the proposed action relative to the potential effects on Register-eligible properties. No adverse effects are anticipated from continued project operation. The project would continue to be operated in a run-of-river mode and no significant changes to project structures or ground disturbing activities are proposed. We agree, however, with the SHPOs' determination that the Canaan Project's powerhouse, dam, intake, penstock, and stone abutments are eligible to be listed on the National Register.

PSNH has prepared a draft Historic Properties Management Plan (HPMP) to govern management of cultural resources in the project's APE over the term of a new license. The draft HPMP contains policies and procedures for identifying effects of project operation, over the term of the license, on historic properties, and for development and implementation, in consultation with the SHPOs and Abenaki Heritage Preservation Center, of measures to avoid, minimize or mitigate any adverse effects. The draft HPMP provides for additional archaeological investigations in the event that PSNH undertakes any ground-disturbing activities in areas of the project sensitive for prehistoric archaeological resources.

The draft HPMP has provisions for addressing the effects and mitigation of constructing a fish passage facility and the proposed canoe portage. Prior to construction, PSNH would consult with the SHPOs on measures to avoid, minimize or mitigate any adverse effects to the project dam. Such measures could include, but not be limited to, designing the fish passage facility to be compatible with the historic character of the dam and recordation of the dam according to Historic American Building Survey/Historic American Engineering Record prior to construction. The HPMP also includes specific measures to resolve any potential adverse effects arising from license requirements such as, replacing the vinyl siding on the gatehouse, storage building and shed. PSNH may also need to repair/replace the existing penstock. Prior to undertaking any such activity, PSNH would consult with the SHPOs to determine the appropriate methods and approach is necessary to preserve and/or document the historic fabric of the penstock.

The draft HPMP has been provided to the SHPOs for review, but the SHPOs have not filed comments on the plan. However, by e-mail dated November 21, 2007, the Vermont SHPO mentioned that information on historic structures on the Vermont side on the river should be compiled on the Vermont Historic Site and Structures Forms and this information should be included in the final HPMP.

Staff have reviewed the draft HPMP and note that in addition to revising the draft HPMP to address the Vermont SHPOs comments the following items are typically

included:

1. a procedure for training PSNH personnel in the management of cultural resources;

2. clarification of the process that would be used when cultural resources located on land not owned by PSNH are affected by project operation;

3. a process to ensure long-term preservation of historic properties;

4. a process to ensure coordination with any other resource management plans required in the license;

5. a process for periodic review and revision; and

6. a listing of the known historic archaeological sites and identification of measures to protect the sites.

Vermont ANR's reference that the design of the existing addition to the gatehouse may be incompatible with the design of the gatehouse and recommendation that corrective actions be implemented is not clear. Staff assume that Vermont ANR is referring to the addition that was installed on the gatehouse in the 1980s. The addition, storage building, and shed have white vinyl siding. Staff assume that Vermont ANR is recommending that the vinyl siding on the gatehouse, storage building and shed be replaced and not that the addition on the gatehouse be removed.

As noted, some of the project's facilities are contributing elements to the Canaan Project Historic District. The gatehouse, storage building, and shed have been determined to be non-contributing elements to the Historic District because of insufficient age and lack of integrity. The more modern vinyl siding contrasts with the older wood exteriors on the other project buildings and may detract from the area's historic character. PSNH's proposal to replace the vinyl siding in connection with routine maintenance would mitigate the incompatibility of the siding material

Staff do not believe that historic properties would be adversely affected by issuing a license to continue operating the Canaan Project with the execution of a PA and implementation of the HPMP. PSNH's proposal would not raise the impoundment level, nor is PSNH proposing any modification to the project's civil works. However, during the term of any new license construction or modification to the project may be necessary.

Executing a PA between the SHPOs and the Commission, which would include a stipulation to finalize and implement the HPMP that includes guidelines for maintaining the project's facilities and addresses any inadvertent discoveries resulting from other activities involving project operation and maintenance for the term of any new license,

should adequately protect cultural resources at the project.

3.3.7 Land Use and Aesthetics

Affected Environment

The project reservoir is bounded on the New Hampshire side by Route 3 and on the Vermont side by Route 253/27 and the New Hampshire railroad right-of-way. Much of the project shoreline is steeply graded with upland forest vegetation, which obscures most views of the river from late spring through fall. The lands located downstream of the project are mainly privately owned and are used for agricultural purposes. Immediately downstream from the Route 114 Bridge on the Vermont side are some municipal lands where the Canaan Public Schools and sewage treatment plant are located. Underneath the Route 114 Bridge is a hydrant that the local fire department maintains for emergency uses and has marked with a no parking sign.

There is a railroad track located between the Connecticut River and Route 3 on the New Hampshire side south of the Canaan Project. The railway goes south to North Stratford and continues on to Groveton, New Hampshire.

Aesthetics

On the New Hampshire side of the Connecticut River there are only limited view points because much of the project shoreline is steeply graded with upland forest vegetation, which obscures most views of the river from late spring through fall. The best views on the New Hampshire side are located at the 45th Parallel site, which only gives a view of the upper portion of the reservoir, and at the dam abutment area (see figure 9) where, if you walk up onto the railroad bridge, you have a view of the lower reservoir, project dam and gatehouse, and area downstream of the dam. From the dam abutment site, you can view water cascading over the dam.

On the Vermont side of the Connecticut River, there are more opportunities for sight-seeing. Travelers on Vermont Route 253/27 from Beecher Falls towards Canaan witness a view of the Connecticut River as it transforms from a riverine setting into an impoundment contained within steep slopes and upland vegetation. Travelers continuing down Power House Road can view the old railroad bridge and dam features and structures. The view becomes more limited on Power House Road downstream from the dam due to the penstock location.

The project works located at the dam gatehouse area (above figure 9) include the dam's gatehouse, one outbuilding, fencing, and the wooden stave penstock. The buildings have white vinyl exteriors. The gatehouse was modified at one time and a

different material was added to the top of the structure and painted a light green color. Fencing in the area includes wood fencing around the entrance and the combined viewing and fishing area, black iron fencing, and chain link fencing enclosing project works.

The major visual resources at the powerhouse area (figure 9) include the project's 1,360-foot-long, 9-foot-diameter wood stave penstock, two 21.3-foot-high, 15.3-foot-diameter steel surge tanks with a white vinyl-sided outbuilding in front, and a red brick powerhouse. This view illustrates the commercial development of hydropower at the site. Iron fencing is painted black in the area with the exception of some wood fencing and chain link fencing enclosing transmission facilities.

The final view of the project lands and waters is located at the Route 114 Bridge where you can look upstream at the powerhouse and running waters coming down from the dam. The Connecticut River then flows under the bridge, past a private camping/parking area, school ball fields, and turns out of sight.

Flow Aesthetics

Under the existing license, PSNH provides a total minimum flow of 136 cfs or inflow, whichever is less, with about 86 cfs being passed through the generating unit and 50 cfs passed at the dam into the bypassed reach. When inflow at the dam is at or above 516 cfs, the turbine generator operates at maximum capacity (466 cfs) and the remaining 50 cfs or more is passed at the dam. When inflow is less than 466 cfs, the pond level control operates the station between the maximum and minimum turbine capacities. The minimum capacity of the turbine is about 55 cfs. The pond level control set point is 1055.20 feet to maintain the pond level between elevations 1055.15 and 1055.25 feet.

Environmental Effects

The only land use issues identified at the project concern recreation and vegetation management, which are addressed in sections 3.3.3 Terrestrial Resources and 3.3.5 Recreation. Also, see section 3.3.3 for a discussion of proposed and recommended riparian vegetation management measures that could have a minor effect on aesthetic viewpoints of the reservoir.

Aesthetic Flows

To assess the adequacy of spillage at the dam (not to include flows through the hydroelectric generation facilities) to allow for aesthetic views of the shoreline downstream, PSNH evaluated the following flows: 78 cfs; 130 cfs; 166 cfs; and 213 cfs. At the base flow (which is comparable to what flows are being passed in the bypass reach at the existing minimum requirement of 50 cfs), the flashboards are exposed and can be

viewed.[7] Water flows over the entire face of the dam, but at low levels. The rocky riverbed and shoreline below the dam are exposed with pools and ripples in the river channel. When the 130 cfs flow is reached, the flashboards become less visible and the water spilling over the entire face of the dam becomes more turbulent. The water in the channel downstream is moving quicker with many of the ripples becoming flooded. As the water passes under the Route 114 Bridge there is still some water cascading over rocks and some shoreline exposed. With a flow of 166 cfs being passed over the dam, even less of the flashboards become visible and the water over the face of the dam is greater and slightly more turbulent. In the area downstream of the dam there are fewer isolated pools and the water is running faster. As flow reaches the Route 114 Bridge the water has flooded out many of the cascading whitewater ripples and the shoreline is characteristic of a river at full flow (water reaching from shoreline to shoreline without appearing to overflow its banks). At the final assessed flow of 213 cfs, flashboards are less visible and flow over the face of the dam is very turbulent. Downstream of the dam, water is flowing quickly over the rocky river bed, and below the 114 Bridge the river looks like it may be at the top of its banks with no exposed shoreline.

The existing minimum flow requirement of 50 cfs at the dam provides for aesthetic flows over the face of the dam and some flow through the bypass reach. PSNH is proposing to provide a minimum bypass flow of 165 cfs for aquatic and aesthetic enhancement purposes.

Vermont ANR comments that the bypass flows and full crest spillage, as proposed by PSNH, will enhance aesthetics. Vermont ANR notes, however, that if the final operations compliance plan uses a gate discharge in lieu of full crest spillage, it will be necessary to determine how much spillage is necessary to address aesthetics.

Staff Analysis

PSNH's proposal of a minimum flow of 165 cfs into the bypassed reach would provide a more substantial veil of water and more turbulent flows over the face of the dam than the current minimum flow of 50 cfs provides. See figure 14 for comparison between assessed flows of 157 cfs and 78 cfs. Downstream from the dam, there would be few isolated pools and quickly moving water with a flow of 157 cfs.

[7] See Appendix C of the Final Recreation, Land Use and Aesthetics Study Report (Louis Berger, 2006) for representative photographs of the dam and river at assessed flows.

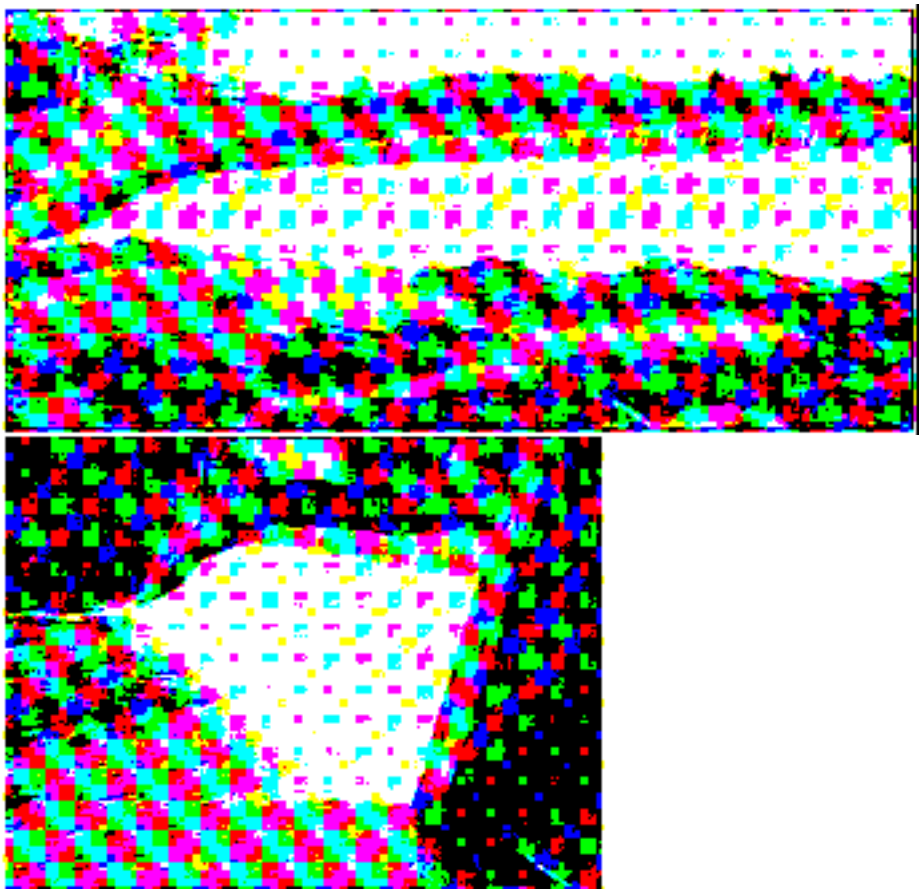

Figure 14. Views of the dam at 78 cfs (above) and 157 cfs (below). Source: Louis Berger, 2006.

Increased flows over the dam crest and in the bypassed reach would be an aesthetic improvement and would benefit both residents and visitors to the Connecticut River Byway. The operations compliance plan could include a provision for the determination of the amount of spillage is necessary to address aesthetics in the case that a gate discharge is used in lieu of full crest spillage.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Canaan Project's use of the northern Connecticut River for hydropower purposes to see what effect various environmental measures would have on the project's cost and power benefits. Consistent with the Commission's approach to economic analysis, the power benefit of the project is determined by estimating the cost of obtaining the same amount of energy and capacity using the likely alternative generating resources available in the region. In keeping with Commission policy as described in Mead, our economic analysis is based on current electric power

cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits. [8]

Our analysis includes: (1) an estimate of the net power benefit of the project for each of the licensing alternatives; and (2) an estimate of the cost of individual measures considered in the EA for the protection, mitigation and enhancement of environmental resources affected by the project. To determine the net power benefit for each of the licensing alternatives, we compare project costs to the value of the power output as represented by the cost of a likely alternative source of power in the region. For any alternative, a positive net annual power benefit indicates that the project power costs less than the current cost of alternative generation resources and a negative net annual benefit indicates that project power costs more than the current cost of alternative generation resources. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 Power and Economic Benefits of the Project

Table 2 summarizes the assumptions and economic information we use in our analysis. We find that the values provided by PSNH are reasonable for the purposes of our analysis.

Table 2. Staff parameters for economic analysis of the Canaan Project. Source: staff.

Parameters	Values (2008$)	Sources
Period of analysis	30 years	Staff
Term of financing	20 years	Staff
Interest/cost of capital	6.0 percent	Staff
Escalation rate	0 percent	Staff
Federal and State tax rate	40.5 percent	PSNH
Net investment [1]	$304,000	Staff
Insurance [2]	$6,400	PSNH
Operation and maintenance cost [2]	$340,200	PSNH
Energy and capacity value	$65.00/MWh	PSNH

[8] 72 FERC 61,027 (1995).

[1] This is the estimated book value of the project depreciated to 2008 (see section 7, license application). The cost to file for relicense was $550,000 (see section 4, license application).
[2] From table A-1 of the license application.

As currently operated, the 1.1-MW Canaan Project generates an average of 7,300 MWh annually. Table 2 includes PSNH's estimated value of power as the cost of alternative generation available to its customers. The replacement value of energy and capacity cost is $65.00/MWh. This value is a reasonable estimate of total energy and capacity for measuring the economic benefits of project operation, and for the cost of replacing power for any alternative that would reduce project generation.

4.2 Comparison of Alternatives

Table 3 summarizes the annual cost, power benefits, and annual net benefits for the four alternatives considered in this EA: no-action, PSNH's proposal, the staff alternative, and the composite.

Table 3. Summary of annual net benefits of the alternatives for the Canaan Project Source: staff.

Parameter	No-Action Alternative	Proposed Action	Proposed Action with staff recommended measures	Composite Alternative (Staff + draft mandatory conditions)
Annual generation (MWh)	7,300	6,840	6,840	6,840
Installed capacity (MW)	1.1	1.1	1.1	1.1
Annual power value ($)	474,500	444,600	444,600	444,600
Annual cost ($)	544,000	553,880	561,970	613,400
Annual net benefit ($)	-69,500	-109,280	-117,370	-168,800

4.2.1 No-Action Alternative

Under the no-action alternative, the project would continue to operate as it does now. The project generates an average of 7,300 MWh of electricity annually. The average annual power value of the project under the no-action alternative would be about $474,500 ($65.00/MWh). The average annual cost of producing this power including insurance, depreciation, operation and maintenance costs, and taxes would be about $544,000 ($74.52/MWh). In other words, the project produces energy at a cost that is

greater than the currently available alternative generation by about $-69,500 ($-9.52/MWh).

4.2.2 PSNH's Proposal

PSNH proposes to increase the minimum flow in the bypassed reach which would result in lost generation. The estimated annual generation of the proposed project would be about 6,840 MWh. As proposed by PSNH (see table 4), the Canaan Project would have an average annual power value of $444,600 ($65.00/MWh), an average production cost (levelized over the 30-year period of our analysis) of about $553,880 ($80.97/MWh), and an annual net benefit of about $-109,280 ($-15.97/MWh).

4.2.3 Staff Alternative

The staff alternative includes the same capacity and energy attributes as those of PSNH. Table 4 shows the staff recommended additions, deletions, and modifications to PSNH's proposed environmental measures and the estimated cost of each.

Based on the total capacity of 1.1 MW, and an average annual generation of 6,840 MWh, the Canaan Project would have an average annual power value of $444,600 ($65.00/MWh), an annual production cost (levelized over the 30-year period of our analysis)of about $561,970 ($82. 16/MWh), and an annual project benefit of about $-117,370 ($-17. 16/MWh). The staff alternative would reduce the net annual benefit by about $8,090 ($1. 18/MWh) compared to the project as proposed by PSNH.

4.2.4 Composite Alternative – Proposed Action with Staff-Recommended Measures including Draft Certification Conditions

The composite alternative includes the same capacity and energy attributes as those of PSNH. Table 4 shows the Vermont ANR recommended conditions to PSNH's proposed environmental measures and the estimated cost of each.

Based on the total capacity of 1.1 MW, and an average annual generation of 6,840 MWh, the Canaan Project would have an average annual power value of $444,600 ($65.00/MWh), an annual production cost (levelized over the 30-year period of our analysis)of about $613,400 ($89.68/MWh), and an annual project benefit of about $-168,800 ($-24.68/MWh). The composite alternative would reduce the net annual benefit by about $59,520 ($8. 70/MWh) compared to the project as proposed by PSNH.

4.3 Cost of Environmental Measures

Table 4 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a

30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 4. Summary of annual costs (2007$) of the proposed and recommended measures for the Canaan Project. Source: staff.

Measures	Recommending Entity	Capital Cost	Operation and Maintenance Cost	Levelized Annual Cost
Continue run-of-river mode of operation [a]	PSNH, Interior, Vermont ANR, Staff	0	0	0
Maintain 165 cfs minimum flow, or inflow, in the bypassed reach year-round [b]	PSNH, Interior, Vermont ANR, Staff	0	0	29,900
During reservoir refilling, release downstream flow of 190 cfs from 6/1 – 9/31, 381 cfs from 10/1 – 3/30 1,524 cfs from 4/1 – 5/31 If inflow is less than target flow, release 90% of inflow below the project [c]	Interior	0	0	0
Limit reservoir drawdowns to 0.5 foot below dam crest, and release 90% of inflow below the project and file proposals prior to drawdowns [d]	Vermont ANR	0	0	0
Limit reservoir drawdowns to 1.0 foot below dam crest and release 90% of inflow below the project [d]	Staff	0	0	0
Develop and implement an operation compliance monitoring plan [e]	PSNH, Interior, Vermont ANR, Staff	0	0	0
Provide a turbine rating curve(s) depicting flow/production [c]	Vermont ANR, Staff	0	0	0
Develop and implement a DO study report	Vermont ANR	5,000	0	360
Install and operate upstream fishways	Interior, Vermont ANR,	618,000	0	44,900

Measures	Recommending Entity	Capital Cost	Operation and Maintenance Cost	Levelized Annual Cost
	NH FGD, Watershed Council,			
Install and operate downstream fishways	Interior, Vermont ANR, NH FGD, Watershed Council,	156,500	0	11,370
Install trashrack overlay or replacement	Interior, Staff	88,000	2,000	8,390
Evaluate the effectiveness of the fishways	Interior	50,000	0	3,630
Develop and implement a debris management plan	Vermont ANR, Staff	1,000	500	570
Develop and implement a shoreline erosion monitoring plan	PSNH, Vermont ANR,	20,000	0	1,450
Include monitoring of the impoundment and cross sectional surveys in the shoreline erosion monitoring plan	Vermont ANR	20,000	0	1,450
Develop and implement an erosion and sediment control plan along NH shoreline [f]	Watershed Council	0	0	0
Develop and implement a riparian vegetation management plan	Vermont ANR	4,000	0	290
Add native woody plants along VT shoreline [f]	Watershed Council	0	0	0
Develop boat cleaning stations at portage take-out and put-in sites	Watershed Council	5,000	1,000	1,360
Allow public access to project lands [d]	Vermont ANR, staff	0	0	0
Develop and implement a recreation plan [g]	PSNH, Vermont ANR, Staff	20,000	1,800	3,250
Include erosion and sediment	Vermont ANR,	8,000	0	580

Measures	Recommending Entity	Capital Cost	Operation and Maintenance Cost	Levelized Annual Cost
control measures, additional signage, and boundary revision in the recreation plan	Staff			
Develop and implement a final HPMP	PSNH, Vermont ANR, Staff	30,000	2,000	5,180
Execute PA[h]	Staff	0	0	0

[a] Run-of-river is the current mode of project operation, therefore no additional annual cost is incurred.
[b] This is the annual cost of increasing the minimum flow from 50 cfs to 165 cfs (a 115 cfs increase) in the bypassed reach year-round, resulting in about 460 MWh of lost annual generation.
[c] We assume the seasonal reservoir refill downstream flows would be released through the powerhouse resulting in minimal cost.
[d] The cost of this measure would be minimal.
[e] The cost of this measure is included in the project annual O&M. This measure includes the flow management and monitoring plans recommended by Vermont ANR.
[f] The cost of this measure is included in the Vermont ANR recommendation.
[g] PSNH proposes to develop a canoe portage, an upstream canoe/kayak access point, and enhance the recreation area near the powerhouse.
[h] The cost to implement the programmatic agreement is included in the cost to develop and implement the historic properties management plan.

4.4 Greenhouse Gases

The Canaan Project, under the staff alternative, produces approximately 6,840 MWh of electrical generation per year. By producing hydroelectricity, the project displaces the need for fossil-fueled plants to operate, thereby avoiding some power plant emissions, particularly carbon dioxide, and creating an environmental benefit. The amount of greenhouse gas emissions that are avoided depends on the type of power displaced, which is region-specific. For this project, the most likely replacement for project power would be from existing gas-fired plants. Without the project, the emissions of carbon dioxide would increase by about 1,340 metric tons per year (using a carbon intensity factor of 196 kg C/MWh).

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Comparison of Alternatives

In this section, we compare the developmental and environmental effects of PSNH's proposal, PSNH's proposal as modified by staff, a composite alternative (PSNH's proposal as modified by staff including the draft water quality certification conditions), and a no-action alternative.

We estimate the annual net benefits of operating and maintaining the project under the four alternatives identified above. Our analysis shows that the annual net benefit would be $-109,280 for the proposed action; $-117,370 for the staff alternative; $-168,800 for the composite; and $-69,500 for the no-action alternative.

We summarize the environmental effects of the different alternatives below.

In table 5, we compare the environmental effects of PSNH's proposal, PSNH's proposal as modified by staff, the composite alternative (staff modifications including the draft water quality certification conditions), and the no-action alternative.

Table 5. Comparison of alternatives for the Canaan Project. Source: FERC staff.

Resource	No-Action Alternative	Proposed Action	Proposed Action with staff recommended measures	Composite Alternative (Staff + draft mandatory conditions)
Annual Generation	7,300 MWh	6,840 MWh	6,840 MWh	6,840 MWh
Aquatic Resources	Run-of river operation, minimum downstream flow of 136 cfs, and a minimum bypassed reach flow of 50 cfs	Run-of-river operation with minimal reservoir drawdowns (except during brief periods of maintenance or emergencies) would continue to protect downstream aquatic resources Increasing bypassed reach minimum flows to 165 cfs would benefit aquatic habitat Limiting drawdowns (for the purpose of maintenance-related activities) to 1.0 foot would protect shoreline and littoral habitat at the project. An operations	Operating as proposed but with the provision of 90 percent of inflow released during impoundment refilling (following maintenance drawdowns) would add aquatic biota protection below the project during drawdowns. Downstream aquatic habitat would be enhanced by debris management Fish entrainment would be reduced by the replacement or overlay of trashracks with 1-inch clear spacing	Operating as recommended by staff, but limiting drawdowns (for the purpose of brief and infrequent maintenance-related activities) to 5.0 foot would have negligible benefits on shoreline and littoral habitat at the project (over 1.0 foot). Fish passage facilities could provide resident trout and other species access to additional habitat, but access to habitat is not a demonstrated limiting factor for survival and growth of populations.

Resource	No-Action Alternative	Proposed Action	Proposed Action with staff recommended measures	Composite Alternative (Staff + draft mandatory conditions)
		compliance monitoring plan would ensure the protection of aquatic resources		
Geology and Soils	No existing measures	Bypassed reach shoreline erosion monitoring plan would help track trends or changes in erosion patterns, but need for erosion-related enhancement measures have not been documented.	Vegetation management in recreation plan would provide minor enhancements to the riparian buffer, with the indirect benefit of providing additional sediment control at recreation sites	Shoreline erosion monitoring in the bypassed reach and the impoundment would track trends or changes in erosion patterns, however, erosion in the impoundment is not project-related and erosion in the bypassed reach is related to natural flow variability.
Terrestrial Resources	Run-of river operation; mowing and other management of vegetation around the fences, buildings, penstock, concrete abutments, and the grounds area at the powerhouse and dam gatehouse	Stable impoundment levels and run-of-river operation would continue to benefit shoreline habitat	In addition to proposed measures, vegetation management in the recreation plan would provide some additional riparian vegetation at recreation sites	Vegetation management plan could provide some enhancement to riparian vegetation, but opportunities are limited and could affect recreational access and aesthetics
Recreation and Land Use	Mowing around powerhouse and dam gatehouse continues to enhance bank fishing	Signage for new take-out and new portage would benefit boaters	Vegetation management (mowing and trimming) practices that allow for the growth of a riparian buffer	Erosion prevention and sediment control measures (unspecified) may provide some benefits to shoreline

Resource	No-Action Alternative	Proposed Action	Proposed Action with staff recommended measures	Composite Alternative (Staff + draft mandatory conditions)
	opportunities	Enhancement of an existing recreation area at the project powerhouse would benefit sightseers and those using the portage	where possible, would aid in sediment control at recreation sites Interpretive and invasive species signs would educate the public about project-related resources Revising the project boundary to include the downstream put-in site would ensure maintenance throughout the term of the license	stability and aquatic habitat (through sedimentation control) near recreation sites, but opportunities beyond those recommended by staff are limited.
Cultural Resources	No existing measures.	HPMP would ensure protection of historic properties	Additional measures would improve the HPMP's ability to ensure protection of historic properties; a timeframe for the replacement of siding on project structures would ensure compliance with this measure. A Programmatic Agreement between the Commission and the	No changes to staff's recommended measures

Resource	No-Action Alternative	Proposed Action	Proposed Action with staff recommended measures	Composite Alternative (Staff + draft mandatory conditions)
			SHPOs would require the HPMP's finalization and implementation	
Aesthetic Resources	Run-of river operation, minimum downstream flow of 136 cfs, and a minimum bypassed reach flow of 50 cfs	Minimum flows of 165 cfs in the bypassed reach and limiting maintenance drawdowns to 1.0 foot would improve aesthetics, benefiting both residents and visitors to the Connecticut River Byway	Operating as proposed but with the provision of 90 percent of inflow released during impoundment refilling (following maintenance drawdowns) would protect aesthetic resources	Operating as recommended by staff, but limiting maintenance-related drawdowns to 0.5 foot would be a slight improvement to aesthetics at the impoundment over 1.0 foot; however, this benefit is negligible since maintenance drawdowns are brief and infrequent

5.2 Comprehensive Development and Recommended Alternative

Sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to all uses of the waterway on which a project is located. When we review a hydropower project, we consider the water quality, fish and wildlife, recreation, cultural, and other non-developmental values of the involved waterway equally with its electric energy and other developmental values. In deciding whether, and under what conditions a hydropower project should be licensed, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing the waterway.

This section contains the basis for, and a summary of, our recommendations for relicensing the Canaan Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

A. Recommended Alternative

Based on our independent review and evaluation of the environmental and economic effects of the proposed action, the proposed action with additional staff-recommended measures, the composite alternative, and no action, we recommend the proposed action with additional staff-recommended measures, as the preferred alternative.

We recommend this alternative because: (1) issuing a subsequent license would allow PSNH to continue operating the project as a beneficial and dependable source of electric energy; (2) the project, with an installed capacity of 1.1 MW, would eliminate the need for an equivalent amount of fossil-fuel-produced energy and capacity, which helps conserve these nonrenewable resources and limits atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures would protect water quality, enhance fish and wildlife resources, and improve public use of project recreation facilities and resources.

Measures proposed by PSNH

PSNH proposes to continue to operate the project in a run-of-river mode, and release 165-cfs minimum flow in the bypassed reach year-round. PSNH also proposes to develop and implement final plans for operation compliance monitoring, bypassed reach erosion monitoring, historic properties management, and recreation.

Additional Staff-Recommended Measures

Our recommended alternative includes measures proposed by PSNH, with the exception of bypassed reach erosion monitoring, with some additional staff-

recommended measures including: a release of 90 percent of inflow during impoundment refilling; additional recreation measures that include vegetation management (mowing and trimming) practices and signage; a project boundary revision to include a downstream boat access site; debris management; trashrack replacement or overlays; implementation of the HPMP with additional measures including a timeframe for replacing the siding on the project facilities, and execution of a programmatic agreement. We discuss the rationale for the measures we our recommending or not recommending below.

Run-of-river operation

Run-of-river is the current and proposed mode of operation. It is also the mode of operation required in the draft certification. Run-of-river operation would protect aquatic life and habitat in the impoundment by minimizing water fluctuations. Downstream habitat would be protected because flows would mimic the natural hydrograph. Therefore, we recommend that PSNH continue to operate the project in a run-of-river mode. This measure would have no additional cost.

Minimum bypassed reach flow of 165 cfs

The project bypasses a 1,800-foot section of the Connecticut River that provides habitat for trout, macroinvertebrates, and several minnow species. The current project license requires a minimum flow of 50 cfs to be released into the bypassed reach. PSNH proposes, and the agencies recommend, increasing the minimum flow to 165 cfs. The habitat/flow study conducted during pre-filing consultation indicates that habitat for a variety of species would increase substantially over current conditions with 165 cfs compared to 50 cfs. Flows beyond 165 cfs would provide essentially no additional benefit. Therefore, staff recommend that any subsequent license include a requirement for a minimum flow in the bypassed reach of 165 cfs, the benefit of which would be worth the estimated annual cost of $29,900.

Impoundment drawdown and refilling procedures

Run-of-river operation occasionally needs to be suspended so the impoundment can be drawn down for maintenance, including annual flashboard replacement. PSNH proposes to limit drawdowns to 1.0 foot below the dam crest during flashboard replacement events (for the safety of workers), and to maintain a minimum flow of 165 cfs in the bypassed reach during the drawdown and when the impoundment is refilling. It is not clear whether these procedures would apply for all drawdowns or just those associated with flashboard replacement. Vermont ANR, in its draft WQC, would require that drawdowns be limited to 0.5 foot and that 90 percent of inflow be spilled into the bypassed reach while the project is refilling. Interior recommends seasonal ABF flows of 191 cfs (June 1 – September 30), 381 cfs (October 1 – March 31), and 1,524 cfs (April 1

– May 31) be released during reservoir refilling. These flows could be a combination of generation and spillage. If project inflow is below these seasonal ABF flows, then Interior recommends that 90 percent of inflow be released during refilling.

Maintaining a flow in the bypassed reach and below the project would protect aquatic life and habitat during drawdowns, especially in summer when low flows could cause dangerous temperature increases or during winter when low flows could cause freezing or desiccation of fish, fish redds, or invertebrates. We recommend that drawdowns be limited to 1.0 foot below the dam crest as proposed. Vermont ANR's 0.5-foot limit seems unnecessarily strict and may inhibit workers' ability to safely access the top of the spillway. In addition, Vermont ANR has not provided any information that would indicate that the additional 0.5 foot of drawdown for short periods of time cause any lasting significant adverse effects in the impoundment. Regarding flow continuation, we also recommend that 90 percent of inflow be released through a combination of generation and spillage (including the 165 cfs minimum flow in the bypassed reach) during impoundment refilling to protect aquatic biota in the bypassed reach and below the project.

If 90 percent of the inflow is released during refilling, we do not see the need to release the specific ABF flows which Interior recommends. Because the purpose of run-of-river operation is to maintain flows as close as possible to natural flows, then releasing 90 percent of inflow would more closely approximate run-of-river conditions than simply providing the somewhat arbitrary ABF seasonal flows which do not take into account year to year differences in the hydrograph. Releasing 90 percent of inflow could also simplify operation and compliance monitoring. The details of the drawdown procedures should be included in the operations compliance monitoring plan which we recommend below. This measure would have a minimal annual cost because seasonal refill downstream flows above the minimum bypassed flow of 165 cfs would be released through the powerhouse for power generation

Operation compliance monitoring plan

PSNH proposes to consult with Vermont ANR and New Hampshire DES after license issuance to finalize its draft operations compliance monitoring plan. The agencies both recommend such a monitoring plan. An operations compliance monitoring plan would reduce the likelihood of misunderstandings about how the project must operate to be in compliance with the license. Having all operational procedures, monitoring methods (including turbine rating curves showing the relationship between river flow and project generation), and reporting requirements in one document would also simplify and improve communication between PSNH, the agencies, and the Commission. Therefore, we recommend that such a plan be finalized shortly after license issuance. In addition to operational mode, minimum flow release, and drawdown and refilling procedures, we recommend that, in the event that fish passage facilities are installed at the project, the

operations compliance monitoring plan include all the operational and reporting procedures related to fish passage activities at the project. Should any final plan determine that a gate discharge will be used in lieu of full crest spillage, we recommend that PSNH determine the necessary spillage to address aesthetics and the distribution of flows for aquatic habitat protection directly downstream from the dam. The benefit of the plan would be worth its estimated cost, which has been included in the project's annual O&M cost.

Trashracks replacement or overlays

The project's existing trackracks have a 3-inch clear spacing which is wider than the 1.0-inch spacing that is typically recommended for fish protection. Although no agencies have recommended 1.0-inch spaced trashracks, Vermont ANR (draft WQC), Interior (10(j)), New Hampshire Fish & Game, TU, and the Watershed Council all recommend downstream passage. Staff do not recommend downstream fishways, as discussed below. Instead, staff recommend installing trashracks with 1-inch clear spacing which would likely reduce the number of fish entrained at the project. The existing trashracks could be replaced or overlayed with bars or screens having 1-inch clear spacing at an estimated annual cost of $8,390.

Debris management plan

Natural and man-made debris drifts with the river current and collects on the project trashracks. Currently there is nothing in the record to describe how PSNH handles this debris, although it appears that PSNH must be disposing of the debris because staff did not observe any accumulation of debris at the project during the site visit. The Vermont ANR draft WQC would require PSNH to develop a debris disposal plan, which staff interpret as a plan to sort debris and either dispose of it properly or pass it downstream to enhance habitat for aquatic biota. Natural (woody) debris can provide valuable habitat for aquatic organisms. Such debris should be passed downstream to ensure that its valuable habitat potential is realized. Man-made debris should be removed to protect aquatic life and aesthetic resources. We recommend an article requiring PSNH to collect, sort, and properly dispose of man-made debris and pass natural debris over the dam. Though we do not consider a plan necessary for the implementation of debris management, these measures are consistent with Vermont ANR's condition and would be included in any debris disposal plan required by the final WQC. The benefit of this measure would be worth its estimated annual cost of $570.

Recreation Plan

The project includes the following recreational facilities: (1) a parking area, aesthetic lookout and fishing area near the dam gatehouse on the Vermont side of the river (gatehouse area); and (2) a parking area near the powerhouse with access to bank

fishing (powerhouse area). Three additional recreation sites access project waters but are located outside of the boundary: (1) a downstream car-top boat access site with parking located immediately downstream from the Route 114 Bridge and owned by the State of Vermont; (2) parking and access to fishing and to an old railroad bridge on lands owned by New Hampshire (near the dam); and (3) parking and access to the upper impoundment (with informal car-top boat access and fishing) on lands owned by Vermont. PSNH proposes to finalize and implement its proposed draft recreation plan, which includes provision of a formal portage around the dam. The propose portage would include a new boat access site (take-out) upstream from the dam and signage for portage around the dam to the State of Vermont-owned car-top boat access site downstream from the Route 114 Bridge (put-in). The proposed draft recreation plan also includes measures to enhance the existing powerhouse area (through provision of a picnic table and signage). PSNH proposes to continue to maintain the powerhouse area and the proposed new upstream take-out, which are located entirely within the project boundary, and to annually inspect the State of Vermont-owned downstream access and conduct any necessary maintenance work at that site. PSNH also proposes to continue to mow in the area of the proposed upstream take-out and portage access and around the powerhouse in order to facilitate bank fishing access. Vermont ANR, as a condition of its draft WQC, would require the proposed recreation plan to include signage on historical and natural resources, as well as details on erosion prevention and sediment control, where appropriate.

Based on current use patterns in the project area, recreation facilities appear to be adequately meeting recreation demand, with the exception being the lack of a formally designated portage. Providing portage, as proposed by PSNH, would ensure that boaters are able to safely navigate around the project. Improving the recreation area near the powerhouse would enhance the recreation experience at the project. Upgrading the signage would direct the public to designated access areas. Interpretive signage, as recommended by Vermont ANR, would provide information on the historical and natural significance of the project. Our preference, however, is that interpretive signage at the project provide information of the significance of the project, rather than general information about the project area or region. The provision of that type of signage would be more appropriate for local, county, or state government. This signage could also include invasive species education, if necessary, at project recreation sites. Measures to address invasive plant species are included in Vermont ANR's draft WQC condition requiring riparian vegetation management; however, because the spread of invasive species by boats may be a concern (particularly for nuisance algae species), it is appropriate to include invasive species signage in the recreation plan.

The put-in portion of the proposed portage includes an access road and car-top access to the river, with associated parking, on the Vermont side of the river near the Route 114 Bridge. This existing facility is owned and maintained by the state of Vermont. PSNH proposes to provide signage, in consultation with Vermont, to inform

the public of the access area and public parking. This is the only boating access available downstream from the project, and the only site available for those wishing to portage around the dam. Placing this site entirely within the project boundary as a project facility would ensure it is maintained if, in the future, the state of Vermont cannot continue maintaining the site. Therefore, we recommend that the project boundary be revised to include the Route 114 Bridge area car-top boat access site.

In regards to PSNH's proposal to continue to mow in the area of the proposed upstream take-out and portage access and around the powerhouse area, we agree that this would help to facilitate bank fishing, an important recreational opportunity at the project. There may, however, be areas at the powerhouse and at other recreation sites that are currently mowed that are not necessary for facility or recreational access. Allowing grasses and shrubs to grow to maturity along parts of the shoreline would provide additional riparian buffer in these areas and may not significantly impede bank fishing (i.e. through use of walking trails). Although erosion is not a project-related issue, it is likely that the recreation enhancements will increase recreational use at the project, and so the enhanced riparian buffer would provide some erosion and sediment control related to this use. This measure would be consistent with Vermont ANR's draft WQC condition requiring erosion prevention and sediment control, where appropriate.

We therefore recommend that the measures included in the draft recreation plan filed with the license application be required in any license issued for the Canaan Project with the following additions:

1. The licensee shall file a report with the Commission that includes: (1) as-built drawings for the existing parking area, aesthetic lookout and fishing area near the dam gatehouse on the Vermont side of the river (gatehouse area) and for the new recreation enhancements, which include: (a) a new upstream boating access (take-out for portage) with signage and adjustment of the safety boom; (b) signage at the downstream site (put-in for portage); (c) installation of a picnic table and sign at the powerhouse area; and (d) additional signage describing natural and cultural resources at project recreation sites; and (2) documentation of consultation with Vermont Agency of Natural Resources, the New Hampshire Department of Fish and Game, and the Vermont and New Hampshire State Historic Preservation Officers on the design of the above-mentioned signs for educating the public about natural resources (including any necessary invasive species educational signs) and cultural resources at the project; and

2. The licensee shall implement mowing practices that allow shoreline grasses and shrubs to grow to maturity along all parts of the shoreline that are not necessary for boating access; the as-built drawings required above should indicate areas where mowing will be eliminated or occur less frequently.

The benefit of these measures to multiple resources at the project (aesthetics, wildlife habitat, recreation, and cultural resources) would be worth the estimated annual cost of this measure is $3,830.

Historic Properties Management Plan

As described earlier, the powerhouse, dam, intake, penstock, and stone abutments of a previous dam contribute to the historic significance of the hydroelectric station. Non-contributing elements, based on insufficient age or lack of integrity, include the gatehouse, a storage building, a shed, the outdoor substation, and the surge tanks. A 19th century railroad truss bridge spanning the project impoundment, although not associated with the project, is eligible as a significant example of 19th century railroad engineering. Any future ground-disturbing activity at the project could adversely affect sites eligible for the National Register of Historic Places. Additionally any modifications to the project facilities could affect their eligibility for the National Register.

PSNH proposes to replace the vinyl siding on the gatehouse, storage building, and shed with wood siding in the future in connection with routine maintenance so that the structures will be more compatible with the historic character of the project area.

A Vermont ANR draft condition would require replacing the siding within five years of issuing any new license. The gatehouse, storage building, and shed are not eligible for the National Register of Historic Places and have been determined to be non-contributing elements to the Historic District. Thus, the timing for replacing the vinyl siding would not necessarily have an effect on National Register eligibility. However, leaving the timing for this enhancement measure open-ended seems unreasonable and it's unclear what type of routine maintenance activity would facilitate and/or reduce the cost of siding replacement. Therefore, to provide some certainty for compliance purposes, it seems reasonable to require that the siding be replaced within 5 years of the issuance of any new license.

PSNH has prepared a draft Historic Management Plan (HPMP) to govern management of cultural resources in the project's APE over the term of a new license. The HPMP includes protection measures for the historic properties identified as being affected or potentially affected by project operation. The draft HPMP includes provisions for protecting cultural resources during construction activities, such as the proposed canoe portage and enhancements to the existing car-top boat access and existing powerhouse recreation area. The draft HPMP also includes guidance for constructing the proposed fish passage facility, replacing the trashrack at dam and future repair work on the penstock, both structures are eligible for the National Register.

The cultural resource report identified five shoreline segments (two in the

bypassed reach and three in the reservoir) as sensitive for prehistoric archaeological resources that are currently experiencing only minimal erosion. The erosion is attributable primarily to ice scouring and bank undercutting. Section VI.B of the draft HPMP states that in the event that PSNH is required, as a condition of a new license, to develop and implement an erosion monitoring program, PSNH would include these archaeological-sensitive segments in that program and provide the SHPOs with copies of any monitoring reports.

We recommend that any license issued for the Canaan Project require that the draft HPMP filed with the license application be implemented with the following additions:

1. a listing of the known historic archaeological sites and identification of measures to protect the sites;

2. providing the information on historic structures on the Vermont side of the river on Vermont Historic Site and Structures Forms;

3. a procedure for training PSNH personnel in the management of cultural resources;

4. clarification of the process that would be used when cultural resources located on land not owned by PSNH are affected by project operation;

5. a process to ensure long-term preservation of historic properties;

6. a process to ensure coordination with any other resource management plans required in the license;

7. a process for periodic review and revision; and

8. replacing the siding on the project's gatehouse, storage building, and shed within five years of issuing a new license.

Because the Vermont and New Hampshire SHPOs have not provided comments on the HPMP, PSNH should make the modifications discussed above within 30 days of the issuance of the EA and send the HPMP to the SHPOs for their review. The SHPOs would have 30 days to provide comments on the HPMP. If the SHPOs require any revisions to the HPMP, PSNH will have 30 days to make the revisions and file a revised HPMP with the Commission. Thus, PSNH would have 90 days from the date of issuance of this EA to file a revised HPMP with the Commission.

Because planned activities could affect any historic properties eligibility for the National Register we recommend implementing the provisions of a PA that would be

executed between the Commission and the Vermont and New Hampshire State Historic Preservation Officers to protect properties that may be affected by the project. The PA would stipulate that the HPMP, approved in the license order, be implemented.

With the execution of the PA, the historic and archaeological resources at the project would continue to be adequately protected under the terms of any new license which would be worth the estimated annual cost of $5,180.

B. Measures not Recommended

Dissolved Oxygen Monitoring and Report

The draft WQC requires PSNH to conduct DO monitoring and file a report with Vermont ANR. This measure has an estimated annual cost of $360.

DO in the area is high and in compliance with state standards. No change in project operation is proposed with the exception that more flow would be released to the bypassed reach, which could improve DO in the bypassed reach and downstream of the project. Therefore, we do not see a connection between project operation and the need for any DO measures.

Upstream Passage

There are no upstream passage facilities at the project and PSNH has proposed none. Vermont ANR (draft WQC), Interior (10(j)), New Hampshire Fish & Game, TU, and the Watershed Council all recommend upstream passage. Interior also requested a reservation of authority to prescribe fishways in the future. Providing upstream passage at this project has an estimated capital cost of $618,000 and an estimated annual cost of $44,900.

The existing fish community in the project area consists of resident trout species and a typical New England assemblage of other resident fish species, including sunfish, suckers, and minnows. Some of these species, including trout, suckers, and certain minnows are known to migrate varying distances seasonally in some rivers depending on the need to find suitable habitat for spawning or overwintering. Successful reproduction of brown and brook trout is documented both upstream and downstream of the project. This is known to occur in the tributaries and may also occur in the Connecticut River. If upstream passage is provided at the project, trout and other species may have access to additional habitat and their populations may exhibit higher survival and growth. However, there is nothing in the record to indicate that existing survival and growth are deficient, nor is there any information to indicate whether access to additional habitat is currently a limiting factor for fish populations. Therefore, we do not recommend upstream passage at the Canaan Project at this time.

Downstream Passage

There are no specific downstream passage facilities at the project, so fish that pass the project downstream do so either via the spillway or through the turbines. PSNH proposes no downstream passage measures. Vermont ANR (draft WQC), Interior (10(j)), New Hampshire Fish & Game, TU, and the Watershed Council recommend downstream passage to include measures to prevent entrainment and impingement which would have an estimated capital cost of $156,000 and an annual cost of $11,370.

Mortality from turbine passage at the project is most likely minimal because the project's head and turbine type probably result in over 90 percent survival of any entrained fish (Winchell et al., 2000). Replacing the existing 3-inch spaced trashracks or overlaying them with bars or screens having 1-inch clear spacing as recommended by staff would further reduce the likelihood of entrainment-related mortality at an estimated annual cost of $8,390. Providing this level of protection without a specific downstream passage facility appears sufficient given that the existing fish community is comprised of resident trout species that are naturally reproducing both up and downstream of the project. Therefore, we do not recommend a specific downstream passage facility be required.

Fishway Effectiveness Studies

Interior recommends, under 10(j), that PSNH conduct evaluations of the effectiveness of the upstream and downstream fishways. If downstream and/or upstream fishways are installed at the project, effectiveness studies would ensure that they have the intended effect of safely and effectively passing fish. As discussed above, we do not recommend either downstream or upstream fishways because we do not think the potential benefits justify the cost. Therefore, effectiveness studies would not be necessary. However, if fishways are installed because they are required as a result of mandatory WQC conditions or any future section 18 prescriptions, then we recommend that effectiveness studies be conducted. This measure has an estimated annual cost of $3,630.

Erosion Monitoring

In its bypassed reach shoreline erosion monitoring plan, PSNH proposes to monitor shoreline erosion in the bypassed reach, through photodocumentation, one and five years after licensing. The results would be compared to the 2006 baseline information in order to evaluate if further measures, including additional monitoring, are necessary. PSNH proposes to continue to operate the Canaan Project as a run-of-river development with minimal impoundment drawdowns (except during brief periods of maintenance or emergency operations) and to provide a minimum bypass and

downstream flow of 165 cfs for aquatic and aesthetic enhancement purposes. Vermont ANR agrees with PSNH's proposal to initially evaluate erosion one and five years after license issuance, and then determine whether additional monitoring is warranted. However, as a condition of its draft WQC, Vermont ANR would require that the data collected include cross-sectional surveys and monitoring of the impoundment shoreline as well as the bypassed reach. New Hampshire Fish & Game agrees with Vermont ANR's draft WQC conditions. The Connecticut River Watershed Council (Watershed Council) recommends that FERC include a license condition that requires PSNH to develop and implement a plan to reduce sediment from the erosion sites along the project reservoir on the New Hampshire shore.

Sediment storage in the impoundment creates a sediment deficit responsible for the lack of deposition in low banks and bars within the bypassed reach. The results of the bypassed reach habitat study demonstrated that the substrate was generally not embedded (the space between larger rocks was not filled with fine substrate). Low embeddedness is consistent with quality habitat for macroinvertebrates and fish, and so the retention of sediment by the dam does not appear to be problematic to habitat within the bypassed reach. In addition, there are no human structures at risk from additional scouring. We therefore do not recommend additional monitoring of erosion in the bypassed reach since the benefits do not outweigh the costs.

Erosion in the impoundment is not project-related. High peak flows and roadway drainage problems, particularly along Route 3 on the New Hampshire side, are the primary causes of the documented erosion. PSNH proposes to continue run-of-river operation with only occasional drawdowns for the purpose of flashboard replacement and other maintenance activities. We therefore do not recommend monitoring of erosion within the impoundment.

Riparian Vegetation Management Plan

Vermont ANR's draft WQC would require PSNH to develop a riparian vegetation management plan to enhance wildlife habitat and water quality through the encouragement of a naturally vegetated riparian zone. The plan would identify: current vegetative conditions and riparian zone uses that affect vegetation, the need for supplemental planting (if any), invasive plant species, and long term measures to restore and manage riparian zone vegetation. New Hampshire DES agrees with this condition. The Watershed Council also recommends vegetation management measures, including planting native woody plant species along the Vermont shoreline at the project and ceasing mowing activity around the powerhouse area.

Developing and implementing a riparian vegetation management plan could benefit wildlife and water quality at the project by enhancing the existing riparian buffer. However, because the majority of project shoreline is naturally vegetated, covered with

rip-rap, or characterized by steep slopes, any benefit would likely be insignificant or unmeasurable. Erosion prevention and sediment control measures within our recommended recreation plan would allow for mowing practices that encourage the natural growth of riparian vegetation where possible, as well as any necessary signs for invasive species management at recreation sites. Therefore, we are not recommending vegetation management measures for encouraging or planting native plant species.

Boat Cleaning Station

The Watershed Council recommends that PSNH construct and maintain a boat cleaning station at the portage take-out and put-in for the purpose of didymo (nuisance algae) control. The record contains no documentation of the presence of didymo in the project area, so a connection between continued project operation and the need for didymo control has not been established. Therefore we are not recommending a boat cleaning station. Certain invasive species have been documented in the project area, however, and including information on methods for avoiding their spread should be included on project signage at boat put-in and take-out areas.

C. Conclusion

Based on our review of the agency and public comments filed on the project and our independent analysis pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, we conclude that licensing the Canaan Project, as proposed by PSNH with additional staff-recommended measures, would be best adapted to a plan for improving or developing the northern Connecticut River waterway.

5.3 Unavoidable Adverse Impacts

A minor, short term increase in erosion, traffic, noise, and visual disturbance could occur when the proposed recreation enhancements are being implemented. Some minor fish entrainment and mortality would continue. This long-term impact is expected to be minor, given the health of the existing fishery in the project.

5.4 Recommendations of Fish and Wildlife Agencies

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission is to include conditions based on recommendations provided by the federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission finds that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall

attempt to resolve such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency. In response to the REA notice, Interior recommended (letter filed November 20, 2007) six fish and wildlife measures. Table 5 lists the 10(j) recommendations, and whether the measures are recommended by staff. Recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document and the previous section.

Table 6. Analysis of fish and wildlife agency recommendations for the Canaan Project. Source: staff.

Recommendation	Agency	Within scope of section 10(j)?	Annual cost	Recommended Adopting?
1. Operate project in run-of-river mode	Interior	Yes	0	Yes
2. Maintain 165-cfs minimum flow in the bypassed reach year-round	Interior	Yes	29,900	Yes
3. During reservoir refilling, release 190 cfs from 6/1 – 9/31, 381 cfs from 10/1 – 3/30, and 1,524 cfs from 4/1 – 5/31 below the project. If inflow is less target flow, release 90 percent of inflow below the project	Interior	Yes	0	No
4. Develop an operation compliance monitoring plan	Interior	Yes	0	Yes
5. Install and operate upstream and downstream fishways at the project dam	Interior	Yes	56,270	No
6. Evaluate the effectiveness of the fishways	Interior	Yes	3,630	No

Reservoir refilling flows

We are making a preliminary determination that Interior's section 10(j) recommendation concerning minimum flows to be released downstream from the project during impoundment refilling is inconsistent with the comprehensive development and

public interest standards of sections 10(a) and 4(e) of FPA.

Run-of-river operation occasionally needs to be suspended so the impoundment can be drawn down for maintenance, including annual flashboard replacement. Interior recommends seasonal ABF flows of 191 cfs (June 1 – September 30), 381 cfs (October 1 – March 31), and 1,524 cfs (April 1 – May 31) be released during reservoir refilling. These flows could be a combination of generation and spillage. If project inflow is below these seasonal ABF flows, then Interior recommends that 90 percent of inflow be released during refilling. Staff recommend releasing 90 percent of inflow below the project during reservoir refilling; it is the seasonal ABF flows that we find inconsistent with comprehensive development and public interest standards.

Maintaining a flow in the bypassed reach and below the project would protect aquatic life and habitat during drawdowns, especially in summer when low flows could cause dangerous temperature increases and low DO, but also during fall, winter, and spring when low flows could cause freezing or dessication of fish, fish redds, or invertebrates. If 90 percent of the inflow is released during refilling, we do not see the need to release the specific ABF flows which Interior recommends. Because the purpose of run-of-river operation is to maintain flows as close as possible to natural flows, then releasing 90 percent of inflow would more closely approximate run-of-river conditions than simply providing the somewhat arbitrary ABF seasonal flows which do not take into account year to year differences in the hydrograph. Releasing 90 percent of inflow could also simplify operation and compliance monitoring which may decrease operating expenses at the project. The exact amount of operating costs is not known at this time because the details of the project's operational compliance monitoring plan would not be finalized until after any license is issued for this project. We assume that the seasonal ABF flows would be released downstream of the powerhouse, and flows between 466 cfs and 55 cfs (the maximum and minimum hydraulic capacities) would flow through the powerhouse for power generation. ABF flows above 466 cfs and below 55 cfs would be spilled over the dam. There would be no annual cost associated with this measure.

Upstream and downstream passage

We are making a preliminary determination that Interior's section 10(j) recommendation for upstream and downstream passage is inconsistent with the comprehensive development and public interest standards of sections 10(a) and 4(e) of FPA.

Interior recommends upstream and downstream passage. Interior does not specify the species for which passage should be provided in their specific recommendation, although based on comments it has made during this proceeding, it appears that brook trout is the primary species of interest.

The existing fish community in the project area consists of resident trout species and a typical New England assemblage of other resident fish species, including sunfish, suckers, and minnows. Some of these species, including trout, suckers, and certain minnows are known to migrate varying distances seasonally in some rivers depending on the need to find suitable habitat for spawning or overwintering. Successful reproduction of brown and brook trout is documented both upstream and downstream of the project. This is known to occur in the tributaries and may also occur in the Connecticut River. If upstream passage is provided at the project, trout and other species may have access to additional habitat and their populations may exhibit higher survival and growth. However, there is nothing in the record to indicate that existing survival and growth are deficient, nor is there any information to indicate whether access to additional habitat is currently a limiting factor for fish populations.

Regarding downstream passage, whatever mortality from turbine passage that might be occurring at the project is most likely minimal because there is no documentation of fish kills and the project's head and turbine type would probably result in over 90 percent survival of any entrained fish (Winchell et al., 2000). Existing trashrack spacing is wider than FWS-recommended spacing (3.0 inches versus 1 inch), but approach velocities are below those recommended by FWS (1.7 fps versus 2.0 fps). As with upstream passage, the species which occur in the project area, and the documentation of natural reproduction by both brown and brook trout, call into question whether a specific downstream passage facility is needed. Existing information does not allow us to conclude what, if any, effect access to additional habitat might have on resident fish populations, or whether access to habitat is currently limiting populations.

Therefore, we do not recommend upstream and downstream passage facilities at this time and note that we recommend any license issued include a reservation of authority to prescribe fishways in the future if needed and justified. Upstream passage at this project has an estimated capital cost of $618,000 and an estimated annual cost of $44,900. Downstream passage has an estimated capital cost of $156,000 and an annual cost of $11,370.

As an alternative, we recommend that the existing trashracks be replaced or overlayed with bars or screens having 1-inch clear spacing to further reduce the likelihood of entrainment. Based on the results of studies conducted by Lawler et al. (1991) we calculate that brown trout of approximately 9 inches or longer would be protected from entrainment by the 1-inch spacing. Because brook trout and rainbow trout have similar body shape to brown trout, we estimate similar protection for those species. The low approach velocities in front of the trashracks would also make fish impingement unlikely. The estimated annual cost of our alternative measure (new trashracks or overlays) has an estimated annual cost of $8,390.

Fishway Effectiveness Studies

We are making a preliminary determination that Interior's section 10(j) recommendation for fishway effectiveness studies is inconsistent with the comprehensive development and public interest standards of sections 10(a) and 4(e) of FPA.

Interior recommends that PSNH conduct evaluations of the effectiveness of the upstream and downstream fishways. If downstream and/or upstream fishways are installed at the project, effectiveness studies would ensure that they have the intended effect of safely and effectively passing fish. As discussed above, we do not recommend either downstream or upstream fishways because we do not think the potential benefits justify the cost. Therefore, effectiveness studies would not be necessary. This measure has an estimated annual cost of $3,630.

5.5 Consistency with Comprehensive Plans

Section 10(a)(2) of the FPA, 16 U.S.C § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal and state comprehensive plans for improving, developing, or conserving waterways affected by the project. We reviewed 15 comprehensive plans that are applicable to the Canaan Project.[9] No inconsistencies were found.

[9] (1) Connecticut River Atlantic Salmon Commission. 1992. A management plan for American shad in the Connecticut River Basin. Sunderland, Massachusetts. 16 pp.; (2) Connecticut River Joint Commissions. 1997. Connecticut River corridor management plan. Charlestown, New Hampshire. May 1997. 123 pp.; (3) New Hampshire Office of State Planning. 1977. Wild, scenic & recreational rivers for New Hampshire. Concord, New Hampshire. June 1977. 63 pp.; (4) New Hampshire Office of State Planning. 1989. New Hampshire wetlands priority conservation plan. Concord, New Hampshire. 95 pp.; (5) New Hampshire Office of State Planning and Energy Programs. 2003. New Hampshire outdoors, 2003-2007: Statewide Comprehensive Outdoor Recreation Plan (SCORP). Concord, New Hampshire. March 2003.; (6) 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.; (7) Policy Committee for Fisheries Management of the Connecticut River. 1982. A strategic plan for the restoration of Atlantic salmon to the Connecticut River Basin. Laconia, New Hampshire. September 1982. 49 pp and appendices.; (8) 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.; (9) State of New Hampshire. 1992 Act designating segments of the Connecticut River for New Hampshire rivers management and protection program. Concord, New Hampshire. May 15, 1992. 7 pp.; (10) Connecticut River Atlantic salmon Commission. 1998. Strategic plan for the restoration of Atlantic salmon to the

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Canaan Project is licensed as proposed with the additional staff-recommended measures, the project would continue to operate while providing enhancements to fish and wildlife resources, improvements to recreation facilities, and protection of cultural resources in the project area, if discovered.

Based on our independent analysis, issuance of a license for the Canaan Project, as proposed with additional staff-recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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8.0 LIST OF PREPARERS

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APPENDIX A

Vermont Agency of Natural Resource
Draft Water Quality Certificate filed November 27, 2007
Preliminary Terms and Conditions

The following recommended terms and conditions should be considered preliminary pending the completion of the water quality certification process. Where a recommendation provides for post licensing review and approval, the Agency expects that the final water quality certification will include provisions for Agency consultation with the New Hampshire Department of Environmental Services. The Agency presumes that the final articles will also provide for FERC approval in most if not all cases. References to the *Department* mean the Vermont Department of Environmental Conservation.

1. Water Chemistry: Dissolved Oxygen

When technically feasible based on critical river flow and water temperature conditions, the licensee shall complete the dissolved oxygen study following the protocol agreed upon with the Department and the New Hampshire Department of Environmental Services. The study report shall be filed by the December following the season of sampling and shall include proposed remediation to address substandard conditions, if identified, and an implementation schedule, both subject to Department approval. The Department may require additional sampling, if needed, or post-remediation sampling to determine effectiveness. The licensee shall notify the Department by October 1 of each year as to whether it was successful in completing the sampling effort.

2. Fish Passage

Downstream fish passage. The licensee shall implement permanent downstream fish passage within one year of license issuance. The design shall include provisions to prevent entrainment and impingement, and shall be functional year-round and at all normal impoundment levels (e.g., with and without flashboards). The design shall be developed in consultation with the Department, the Vermont Department of Fish and Wildlife, the New Hampshire Department of Fish and Game, and the U.S. Fish and Wildlife Service, and shall be subject to Department approval prior to implementation.

Upstream fish passage. Within two years of license issuance, the licensee shall institute upstream fish passage, subject to plan approval by the Department. The Department, the Vermont Department of Fish and Wildlife, the New Hampshire Department of Fish and Game, and the U.S. Fish and Wildlife Service shall be consulted during plan development. The plan shall include an erosion control and

water management plan designed to assure compliance with water quality standards during construction. The facilities shall be operated from April 1 through June 30 and September 1 through December 15, with adjustment based on experience or specific conditions during a given year, either at the licensee's request and subject to fisheries resource agencies' approval or pursuant to a mutual request by the fisheries resource agencies. PSNH shall notify the Department of these temporary or permanent schedule changes by providing supporting documentation.

3. Flow Needs- Below Project Tailrace

Except during special maintenance drawdowns and refills, the facility shall be operated in a true run-of-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam.

4. Flow Needs- Bypass

When the facility is operating, a conservation flow of 165 cfs (to be refined based on the verification flow measurement as discussed in the text above) shall be maintained in the penstock-bypassed reach. This flow shall be maintained as full crest spillage, unless the licensee proposes to release a portion of the flow through the tainter gate, in which case, the proposal is subject to Department approval after a determination is made that the spillage and downstream flow distribution will support aquatic habitat and aesthetics.

5. Flow and Impoundment Level Management Related to Maintenance Drawdowns

During special maintenance drawdowns (e.g. flashboard replacement), the rate of release shall be controlled so as to limit the impact on aquatic habitat downstream of the dam and on public safety; the drawdown must not exceed 0.5 foot below the dam crest unless written approval is granted by the Vermont Department of Environmental Conservation (Department).

During impoundment refill following a special maintenance drawdown or flashboard replacement, the licensee shall release, below the project, at least 90 percent of instantaneous inflow. While the impoundment is being refilled, bypass flow requirements shall be met at all times.

6. Flow Management Plan

The licensee shall develop and file with the Department a flow management plan detailing how the project will be operated to comply with the bypass conservation flow and operating mode limitations described above. The plan shall be subject to

Department review and approval. The Department reserves the right of review and approval of any material future changes made to the plan.

7. Monitoring Plan for Impoundment and Flow Management

The licensee shall develop a plan for continuous monitoring and reporting of flow releases at the project (spillage and turbine discharge), impoundment levels, and inflows. The plan shall include procedures for reporting deviations from prescribed operating requirements to the Department, explaining the reasons for those deviations, and indicating measures to be taken to avoid recurrences. The licensee shall maintain continuous records of flows and impoundment levels and provide such records on a regular basis as per specifications of the Department. The plan shall be subject to Department review and approval. The Department reserves the right of review and approval of any material future changes made to the plan.

8. Turbine Rating Curves

The licensee shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within one year of the issuance of the license.

9. Debris Disposal Plan

The licensee shall develop a plan for proper disposal of debris associated with project operation, including trashrack debris. The plan shall be subject to Department review and approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

10. Maintenance and Repair Work

Any proposals for project maintenance or repair work, including drawdowns exceeding 0.5 foot below the fixed dam crest to facilitate repair/maintenance work, shall be filed with the Department for prior review and approval.

11. Public Access

The licensee shall allow public access to the project lands for utilization of public resources, subject to reasonable safety and liability limitations. Any proposed limitations to river access to be imposed by the licensee shall first be subject to written approval by the Department. In cases where an immediate threat to public safety exists, access may be restricted without prior approval; the licensee shall so notify the Department and shall file a request for approval, if the restriction is to be permanent or long term, within 14 days of the restriction of access.

12. Recreational Facilities

Recreational facilities shall be constructed and maintained consistent with a recreation plan approved by the Department. The plan shall include interpretive signage on historical and natural resources. The plan shall be developed in consultation with the Department, the Vermont Division for Historic Preservation, and the New Hampshire Department of Environmental Services. The plan shall be filed with the Department within one year of license issuance and shall include an implementation schedule. Where appropriate, the recreation plan shall include details on erosion prevention and sediment control. Modifications to the recreation plan shall also be subject to Department approval over the term of the license.

13. Erosion Prevention and Sediment Control

Upon written request by the Department, the licensee shall design and implement erosion control measures as necessary to address erosion occurring as a result of use of the project lands for recreation. Any work that exceeds minor maintenance shall be subject to prior approval by the Department.

14. Riparian Vegetation Management Plan

Within two years of license issuance, the licensee shall file, for Department approval, a riparian vegetation management plan, which shall include an inventory of current vegetative conditions and riparian zone uses that affect the vegetation; indication of the need for supplemental planting, if any, with an implementation schedule; identification of invasive plant species, if any, and a schedule for removal; and information on long term measures to restore and manage riparian zone vegetation.

15. Shoreline Erosion

The licensee shall collect data on shoreline erosion during the first and fifth summers following license issuance and following any flood event exceeding a flow of 5,000 cfs. The scope and type of data collected shall be consistent with the recommendations in *Shoreline Erosion Study for Canaan Hydroelectric Project*, October 2006. The data shall be compared to the reference data collected for that study report to determine where active erosion is occurring, how that may affect water quality, and what, if any, risk the erosion presents to project works and roadways and other public infrastructure. A report shall be filed with the Department by the first December 1 following the fifth summer. The report shall provide the comparative evaluation, impact/risk assessment, a remediation proposal based on the assessment, and recommendations on subsequent monitoring. The remediation proposal is subject to Department approval.

16. Aesthetics and Historical Resources

As part of the development of the Historic Properties Management Plan (or Cultural Resources Management Plan), the licensee, in consultation with the Vermont Division for Historic Preservation, shall propose a schedule for replacement of the vinyl siding on the three project buildings as discussed in the license application and modifying the addition to the gatehouse consistent with any design recommendations of the Vermont Division for Historic Preservation.

17. Compliance Inspection by Department

The licensee shall allow the Department to inspect the project area at any time to monitor compliance with certificate conditions.

Appendix B. Draft License Articles

On November 27, 2007, the Vermont Agency of Natural Resources (Vermont ANR) filed a section 401 draft water quality certificate containing 17 preliminary terms and conditions.

I. Mandatory Conditions

We recommend including the following mandatory conditions in any license issued for the project:

Vermont ANR Condition Nos. 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, and 17

Although we do not recommend draft WQC condition No. 1 for a dissolved oxygen study, No. 2 for fish passage, No. 5 for the impoundment level limitation of 0.5 foot, No. 13 for erosion control measures occurring as a result of use of the project lands for recreation, No. 14 for a riparian vegetation management plan, and No. 15 for shoreline erosion monitoring, we recognize that any valid mandatory conditions must be included in any license issued for the project.

II. Additional License Articles Recommended by Commission Staff

We recommend including the following license articles for any license issued for the project:

Draft Article 001. *Administrative Annual Charges*. The licensee shall pay the United States annual charges, effective the first day of the month in which the license becomes effective, and as determined in accordance with provisions of the Commission's regulations in effect from time to time, for the purposes of reimbursing the United States for the cost of administration of Part I of the Federal Power Act. The authorized installed capacity for that purpose is 1,100 kilowatts. Under the regulations currently in effect, projects with authorized installed capacity of less than or equal to 1,500 kilowatts will not be assessed annual charges.

Draft Article 002. *Exhibit Drawings.* Within 45 days of the date of the effective date of the license, the licensee shall file the approved exhibit drawings in aperture card and electronic file formats.

(a) Three sets of the approved exhibit drawings shall be reproduced on silver or gelatin 35mm microfilm. All microfilm shall be mounted on type D (3-1/4" X 7-3/8") aperture cards. Prior to microfilming, the FERC Drawing Number (i.e., P-1234-#### through P-1234-####) shall be shown in the margin below the title block of the approved

drawing. After mounting, the FERC Drawing Number shall be typed on the upper right corner of each aperture card. Additionally, the Project Number, FERC Exhibit (i.e., F-1, G-1, etc.), Drawing Title, and date of this license shall be typed on the upper left corner of each aperture card.

Two of the sets of aperture cards shall be filed with the Secretary of the Commission, ATTN: OEP/DHAC. The third set shall be filed with the Commission's Division of Dam Safety and Inspections, New York Regional Office.

(b) The licensee shall file two separate sets of exhibit drawings in electronic raster format with the Secretary of the Commission, ATTN: OEP/DHAC. A third set shall be filed with the Commission's Division of Dam Safety and Inspections, New York Regional Office. Exhibit F drawings must be segregated from other exhibits and identified as (CEII) material under 18 CFR §388.113(c). Each drawing must be a separate electronic file, and the file name shall include: FERC Project-Drawing Number, FERC Exhibit, Drawing Title, date of this license, and file extension in the following format [P-1234-####, G-1, Project Boundary, MM-DD-YYYY.TIF]. Electronic drawings shall meet the following format specification:

IMAGERY - black & white raster file
FILE TYPE – Tagged Image File Format (TIFF), CCITT Group 4
RESOLUTION – 300 dpi desired, (200 dpi min)
DRAWING SIZE FORMAT – 24” X 36” (min), 28” X 40” (max)
FILE SIZE – less than 1 MB desired

Draft Article 003. *Exhibit G Drawings.* Within 60 days of the effective date of this license, the licensee shall file, for Commission approval, revised exhibit G drawings enclosing all project features that are necessary for operation and maintenance of the project, including the car-top boat access area located near the Route 114 Bridge. The exhibit G drawings shall be filed electronically pursuant to 18 CFR sections 4.39 and 4.41.

Draft Article 004. *Commission Approval, Reporting, Notification, and Filing of Amendments Required by Mandatory Conditions.*

(a) Requirement to file plans for Commission approval.

Various conditions of this license found in the Vermont ANR’ draft WQC (Appendix A) require the licensee to prepare and implement plans in consultation with other entities for approval by Vermont ANR without prior Commission approval. Each such plan shall also be submitted to the Commission for approval. These plans are listed below:

Draft WQC Condition	Plan Name	Date Due to Commission

No.		
2	Downstream Fish Passage Design	Within 6 months of the effective date of the license
2	Upstream Fish Passage Design	Within 1 year and 6 months of the effective date of the license
6	Flow Management Plan	Within 6 months of the effective date of the license
7	Monitoring Plan for Impoundment and Flow Management	Within 6 months of the effective date of the license
9	Debris Disposal Plan	Within 6 months of the effective date of the license
12	Recreation Plan	Within 6 months of the effective date of the license
14	Riparian Vegetation Management Plan	Within 1 year and 6 months of the effective date of the license

The licensee shall prepare these plans after consultation with the Vermont Agency of Natural Resources, the New Hampshire Department of Fish and Game, the New Hampshire Department of Environmental Services, and the U.S. Fish and Wildlife Service. The licensee shall submit to the Commission documentation of consultation, copies of comments and recommendations by consulted entities made in connection with each plan and a description of how each plan accommodates the comments and recommendations. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information. The Commission reserves the right to make changes to any plan or recommendation submitted. Upon Commission approval, each plan or recommended measure becomes a requirement of the license, and the licensee shall implement the plan or measure.

(b) Requirement to file reports with the Commission

Various conditions of this license found in the Vermont ANR's draft WQC require the licensee to prepare reports documenting the results of various studies and surveys without filing the reports with the Commission. Each such report shall also be filed with the Commission. These reports are listed below:

Draft WQC Condition No.	Report Name	Date Due to Commission
1	Dissolved Oxygen Study	By the December 1 following the season of sampling
8	Turbine Rating Curves	Within six months of the effective date of the license issuance
15	Shoreline Erosion Monitoring and Report	By the December 1 following the fifth summer following license issuance

The licensee shall submit to the Commission documentation of any consultation, and copies of any comments and recommendations made by any consulted entity in connection with each report.

(c) Requirement to Notify Commission of Planned and Unplanned Deviations from License Requirements

The Vermont ANR's draft WQC conditions noted below would allow the licensee to temporarily modify project operation under certain conditions. The Commission shall be notified prior to implementing such modifications, if possible, or in the event of an emergency, as soon as possible, but no later than 10 days after each such incident. The New Hampshire Department of Environmental Services shall also be notified prior to implementing any modifications, if possible.

Draft WQC Condition No.	License Requirement
4	This flow (165 cfs in the bypassed reach) shall be maintained as full crest spillage, unless the licensee proposes to release a portion of the flow through the Tainter gate, in which case, the proposal is subject to Department approval after a determination is made that the spillage and downstream flow distribution will support aquatic habitat and aesthetics
5	The drawdown shall not exceed 0.5 foot below the dam crest unless written approval is granted by the Department
10	Any proposals for project maintenance or repair work, including drawdowns exceeding 0.5 foot below the fixed dam crest to facilitate repair/maintenance work, shall be filed with the Department for prior review and approval.
11	Any proposed limitations to river access to be imposed by the licensee shall first be subject to written approval by the

	Department. In cases where an immediate threat to public safety exists, access may be restricted without prior approval; the licensee shall so notify the Department and shall file a request for approval, if the restriction is to be permanent or long term, within 14 days of the restriction of access.

Draft Article 005. *Run-of-river operation*. The licensee shall operate the project in a run-of-river mode, in accordance with Water Quality Certification condition No. 3, for the protection of aquatic habitat and water quality in the Connecticut River. The licensee shall at all times act to minimize the fluctuation of the reservoir surface elevation by maintaining a discharge from the project so that, at any point in time, flows, as measured immediately downstream from the project tailrace, equal the sum of inflows to the project reservoir.

Run-of-river operation may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement between the licensee and the Vermont Agency of Natural Resources, New Hampshire Department of Environmental Services, and U.S. Department of the Interior. If the flow is so modified, the licensee shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Draft Article 006. *Comprehensive Operations Compliance Monitoring Plan.* Within six months of the effective date of the license, the licensee shall file with the Commission, for approval, a comprehensive operation compliance monitoring plan that is consistent with Water Quality Certification conditions No. 6, No. 7, and No 8. The plan shall also include operational and reporting procedures related to any fish passage activities at the project.

Draft Article 007. *Debris management*. The licensee shall collect debris which accumulates on the trashracks and spillway. The licensee shall sort this debris into man-made debris and natural, woody debris. Man-made debris should be removed from the river and disposed of in accordance with state and local laws. Natural woody debris shall be passed over the dam for the purposes of enhancing aquatic habitat in the river below the project.

Draft Article 007. *Trashrack replacement or modification plan.* Within six months of the effective date of the license, the licensee shall file design drawings for replacing, modifying or overlaying the existing trashracks to achieve a clear spacing between the bars of no more than 1.0 inches. The purpose of this requirement is to minimize potential fish entrainment at the project.

The licensee shall design the trashracks after consultation with the Vermont

Agency of Natural Resources, the New Hampshire Department of Fish and Game, and the U.S. Fish and Wildlife Service. The licensee shall include with the drawings documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the design. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the design with the Commission. If the licensee does not adopt a recommendation, the filing shall include the Licensee's reasons based on project specific information.

The Commission reserves the right to require changes to the plan. No land-disturbing activities shall begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 008. *Reservation of Authority to Prescribe Fishways*. Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or provide for the construction, operation, and maintenance of such fishways as may be prescribed by the Secretary of the Interior pursuant to section 18 of the Federal Power Act.

Draft Article 009. *Recreation Plan.* The licensee shall implement the recreation management plan filed with the license application for the project (volume I), including the additional measures and modifications listed below:

(1) Within 1 year of the effective date of the license, the licensee shall file a report with the Commission that includes: (a) as-built drawings for the existing parking area, aesthetic lookout and fishing area near the dam gatehouse on the Vermont side of the river and for the new recreation enhancements, which include: a new upstream boating access (take-out for portage) with signage and adjustment of the safety boom; signage at the downstream site (put-in for portage); installation of a picnic table and sign at the powerhouse recreation area; and additional signage describing natural and cultural resources at project recreation sites; (b) documentation of consultation with Vermont Agency of Natural Resources, the New Hampshire Department of Fish and Game, and the Vermont and New Hampshire State Historic Preservation Officers on the design of the above-mentioned signs for educating the public about natural resources (including any necessary invasive species educational signs) and cultural resources at the project; and

(2) The licensee shall implement mowing practices that manage vegetation such that shoreline grasses and shrubs are allowed to grow to maturity along all parts of the shoreline that are not necessary for boating access; the as-built drawings

required in item (1) shall indicate areas where mowing will be eliminated or occur less frequently.

Draft Article 010. *Programmatic Agreement and Historic Properties Management Plan.* The licensee shall implement the Programmatic Agreement Among the Federal Energy Regulatory Commission and the Vermont and New Hampshire State Historic Preservation Officers for Managing Historic Properties that may be Affected by Issuing a License to Public Service of New Hampshire for the Continued Operation of the Canaan Hydroelectric Project in Essex County, Vermont and Coos County, New Hampshire (FERC No. 7528), executed on [pending], including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee shall continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license. If the Programmatic Agreement is terminated, the licensee shall obtain approvals from or make notifications to the Commission and the Vermont and New Hampshire State Historic Preservation Offices where the HPMP calls upon the licensee to do so.

Draft Article 011. *Use and Occupancy.* (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 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 use 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, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type 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 that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline;

and (4) food plots and other wildlife enhancement. 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 use 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 impoundment 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 modification 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 or roads where 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 impoundment. 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. If no conveyance was made during the prior calendar year, the licensee shall so inform the Commission in writing no later than January 31 of each year.

(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 certification 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 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an 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 project waters at normal 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 60 days before conveying any interest in project lands under this paragraph (d), the licensee must submit a letter to the Director, Office of Energy Projects, 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 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 paragraph (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 report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (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 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 drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article shall not apply to any part of the public lands and reservations of the United States included within the project boundary.