

APPENDIX C-2  
FERC LETTER TO ROBERT GUNDERSEN, PSNH  
DATED MARCH 5, 2009

SUBSEQUENT ANNUAL FISH PASSAGE FACILITY REPORTS FILED BY PSNH  
2009 - 2011

FEDERAL ENERGY REGULATORY COMMISSION  
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 1893-064--New Hampshire  
Amoskeag, Hooksett and Garvins Falls  
Public Service of New Hampshire

Mr. Robert Gundersen  
Hydro Manager  
Public Service of New Hampshire  
P.O. Box 330  
Manchester, NH 03105-0330

March 5, 2009

Subject: 2008 Fish Passage Facility Status Report

Dear Mr. Gundersen:

This is in response to your letter filed December 1, 2008, providing a report on upstream fish passage activities at the three project developments during 2008. This report was filed pursuant to the Water Quality Certification (WQC) and license Article 401.

Pursuant to the WQC and the fishway prescription issued by the U.S. Department of the Interior you are required to install upstream fish passage facilities within 3 to 5 years at the Hooksett and Garvins Falls developments after passage of a certain number American shad or river herring at the Amoskeag and Hooksett developments. There is an existing upstream fish passage facility at the Amoskeag development. You report that during 2008 that no American shad or river herring were observed at the Amoskeag development.

Your report satisfies the filing requirements of the project license. Thank you for your cooperation in this matter. If you have any questions pertaining to this letter, please contact me at (202) 502-6076.

Sincerely,



John K. Novak  
Biological Resources Branch  
Division of Hydropower Administration  
and Compliance



Public Service  
of New Hampshire

October 27, 2009

D28411

ORIGINAL

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  
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The Northeast Utilities System

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

Mr. Gregg Comstock  
New Hampshire Department of Environmental Services  
Watershed Management Bureau  
29 Hazen Drive  
Concord, NH 03302

FILED  
SECRETARY OF THE  
COMMISSION  
OCT 29 2009  
11:36 AM  
FEDERAL ENERGY REGULATORY  
COMMISSION

P-1873

**RE: FERC Project No. ~~1896~~, Merrimack River Project  
Annual status report regarding the design, construction, and anticipated  
completion date of fish passage facilities**

Dear Ms. Bose and Mr. Comstock:

As outlined in section E-8 of the final New Hampshire Department of Environmental Services (NHDES) Water Quality Certification (WQC # 2003-006.1) dated May 10, 2005 and Federal Energy Regulatory Commission (FERC) License Article 401, Public Service Company of New Hampshire (PSNH) is submitting the following fish passage facility annual status report.

Section E-8 of the WQC references fish passage agreements requiring "upstream fish passage at the Hooksett development after the fifth year following the annual passage of 15,000 American shad at the Amoskeag development, and the construction of upstream passage facilities at the Garvins Falls development after the fifth year following the annual passage of 15,000 American shad at the Hooksett development".

The U.S. Department of the Interior, Fish and Wildlife Service fishway prescription requires the installation of upstream passage facilities for anadromous fish at the Hooksett Dam, to be operational within three years after passage of **either 9,500 or more shad or 22,500 or more river herring** in any given year at the Amoskeag development. Upstream passage facilities at the Garvins Falls Dam for anadromous fish is required to be operational within three years after the passage of: (1) **either 9,800 American shad or 23,200 river herring** at the Hooksett development; (2) if fish passage has been constructed at the Hooksett Development without a fish counting facility, passage of **either 19,300 American shad or 45,800 river herring** at the Amoskeag Development.

Anadromous fish returns ( <http://www.fws.gov/r5cncap/returns.htm> ) to the Merrimack River were marginal in 2009. A total of 23,199 American shad and 1,456 river herring were lifted at Lawrence. Of these fish, 2,799 shad and 140 river herring were lifted at Lowell, the next upstream project.

PSNH set up digital video recording equipment in the Amoskeag fish ladder counting room in early May; however, only a few river herring were observed at Amoskeag.

If you have any questions, please call Mr. Curtis R. Mooney at (603) 744-8855 Ext. 5841.

Sincerely,



Robert Gundersen  
PSNH Hydro Manager

cc:

Mr. John Warner  
U.S. Fish and Wildlife Service  
New England Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-5087

Ms. Carol Henderson  
New Hampshire Fish and Game Department  
11 Hazen Drive  
Concord, NH 03301



Public Service  
of New Hampshire

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February 11, 2010

D28755

The Northeast Utilities System

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

Project No. 1893 - Amoskeag, Hooksett and Garvins Falls  
Project No. 2457 - Eastman Falls  
Project No. 2456 - Ayers Island

FILED  
SECRETARY OF THE  
COMMISSION  
2010 FEB 22 P 2:17  
FEDERAL ENERGY  
REGULATORY COMMISSION

**RE: 2009 Annual Report on Anadromous Fish Passage Activities and Facilities**

Dear Ms. Bose:

Public Service Company of New Hampshire (PSNH) herein submits the 2009 Annual Report on Anadromous Fish Passage Activities and Facilities. Fish passage facility operations and anadromous fish passage studies were conducted at the above referenced projects in accordance with the following:

- United States Department of the Interior (USDOI) Prescription for Fishways for the Merrimack River Project, issued pursuant to Section 18 of the Federal Power Act and dated December 20, 2006.
- A Comprehensive Plan for Provision of Anadromous Fish Passage Measures and Facilities at PSNH's Merrimack - Pemigewasset River Hydroelectric Dams, FERC Projects No. 1893, 2456, and 2457.
- The Merrimack River Project (Amoskeag, Hooksett & Garvins Falls) Upstream and Downstream Fish Passage Plan filed with the FERC January 2008.

**Amoskeag Hydroelectric Station - Project 1893**

**Upstream Fish Passage**

The Amoskeag fish ladder began its operations on April 27, 2009 and closed on July 15, 2009. No river herring or shad were recorded using the fish ladder this season.

Downstream Fish Passage

The downstream bypass was operated from April 1, 2009 through July 15, 2009. The fish bypass was opened again from September 15, 2009 through November 15, 2009 as outlined in the Fishway Prescription.

Hooksett Hydroelectric Station - Project 1893

Upstream Fish Passage

The U.S. Department of the Interior, Fish and Wildlife Service fishway prescription issued December 20, 2006 requires the installation of upstream passage facilities for anadromous fish at the Hooksett Dam, to be operational within three years after passage of either 9,500 or more shad or 22,500 or more river herring in any given year at the Amoskeag development.

Downstream Fish Passage

The downstream fish bypass system was operational from April 1, 2009 through July 15, 2009. The fish bypass was opened again from September 15, 2009 through November 15, 2009 as outlined in the Fishway Prescription.

Garvins Falls Hydroelectric Station - Project 1893

Upstream Fish Passage

Upstream passage facilities at the Garvins Falls Dam for anadromous fish is required to be operational within three years after the passage of: (1) either 9,800 American shad or 23,200 river herring at the Hooksett development; (2) if fish passage has been constructed at the Hooksett Development without a fish counting facility, passage of either 19,300 American shad or 45,800 river herring at the Amoskeag Development.

Downstream Fish Passage

The downstream fish bypass operated from April 1, 2009 through July 15, 2009. The fish bypass was opened again from September 15, 2009 through November 15, 2009 as outlined in the Fishway Prescription.

**Eastman Falls Hydroelectric Station -Project 2457**

**Upstream Fish Passage**

The need for an upstream fish passage facility will be determined in the year 2010.

**Downstream Fish Passage**

The downstream fish bypass was operational from April 1 through June 15, 2009.

The bypass was opened again during the fall from October 1 through November 15, 2009 as prescribed in the revised Fall Bypass Operating Schedule dated 10/19/1995 for the Ayers Island and Eastman Falls Hydroelectric facilities.

**Ayers Island Hydroelectric Station -Project 2456**

**Upstream Fish Passage**

The need for an upstream fish passage facility will be determined in the year 2010.

**Downstream Fish Passage**

The downstream fish bypass was operational from April 1 through June 15, 2009.

The bypass was opened again during the fall from October 1 through November 15, 2009 as prescribed in the revised Fall Bypass Operating Schedule dated 10/19/1995 for the Ayers Island and Eastman Falls Hydroelectric facilities.

**Results of Studies and/or Observations Undertaken**

PSNH met with the State and Federal agencies on December 10, 2009 to discuss the results of the following studies undertaken in 2009.

**Project 2456**

**Ayers Island Hydroelectric Station**

PSNH again worked cooperatively with the USFWS and USGS in 2009 to operate the fish sampler during the downstream smolt migration.

## **Project 2457**

### **Eastman Falls Hydroelectric Station**

No studies were conducted at Eastman Falls in 2009.

## **Project 1893**

### **Garvins Falls Hydroelectric Station**

#### ***Eel Survey***

PSNH contracted Normandeau Associates to conduct an eel survey at Garvins Falls during August and September. The purpose of this study was to locate where upstream-migrating eels were possibly congregating and where an interim eel way should be located the following summer (2010).

Four baited eel pots were set each week for 2 consecutive 24 hour periods with 2 traps set below the fish bypass exiting from the canal and 2 traps below the dam cut out (eastern bypass). A total of 64 eel pot samples was the maximum number possible between 1 July and 31 August 2009 (4 days x 4 stations x 8 weeks). Eel pots were set and retrieved on a weekly basis.

During the eel pot sets, night surveys occurred twice weekly in the area around the fish bypass and the eastern bypass (dam spillway). A total of 16 samples were possible based on twice weekly sampling events occurring from 1 July to 31 August 2009. Surveys were conducted at night by biologists and eels located were given a GPS point and pictures were taken.

Captured or observed eels were categorized in the following size classes: small (less than 6 inches), medium (between 6 and 12 inches), and large (greater than 12 inches).

High flows on the Merrimack River in July and August 2009 resulted in water being spilled over the dam at the Project as well as water being released through the waste gate adjacent to the fish bypass. These flows often created conditions where it was unsafe to approach the required locations for eel pot sets. As a result, eel pot sets were restricted to the days of 21-23 July, 11-13 August, 18-20 August, and 24-26 August 2009. Additionally no traps were set in the eastern bypass during the week 21-23 July 2009 for safety reasons described above. A total of 20 eel pot samples were collected, with 12 coming from the fish bypass reach and 8 from eastern bypass reach.

Eel pots set in the vicinity of the fish bypass were placed in locations FB-1 to FB-5 while eel pots at the eastern bypass were set at sites EB-1 and EB-2. Results of the eel pot sets are shown in Table 1. The only eels captured were below the fish bypass on 26 August 2009 in the trap set at location FB-3 (Figure 1, Figure 5). Both eels were between 6 and 12 inches in length.



Table 1: Number and size range of eels captured in eel pot survey below Garvins Falls Hydroelectric Project 21 July 2009 to 26 August 2009.

Date Set to Pull	Number of eels collected						
	FB-1	FB-2	FB-3	FB-4	FB-5	EB-1	EB-2
7/21 to 7/23	0	0					
8/11 to 8/13			0	0		0	0
8/18 to 8/20			0		0	0	0
8/24 to 8/26			2 (med)		0	0	0

Similar to the eel pot component of the study, the survey was restricted to times when flow conditions made it possible to safely search for eels. Eel surveys were conducted in the fish bypass reach during 21 and 23 July, 2009 and were conducted in both the fish bypass and eastern bypass reaches between 11 August and 26 August 2009. A total of 14 samples were collected, 8 in the fish bypass reach and 6 in the eastern bypass reach.

A total of four eels were seen during night surveys. Three of these eels were located in the vicinity of the fish bypass while one was located toward the western side of the dam. Eel 1, a medium sized eel, was located along the western side of the dam in fast shallow water moving over a rock ledge below a breach in the boards. Of the three eels located in the fish bypass reach, one (Eel 2) was medium sized (6 to 12 inches) and was located in a slow moving flow downstream of the fish bypass. The other two eels were small (less than 6 inches) and were located in the water below the fish bypass (Eel 3) or in the water leaking from the fish bypass (Eel 4).

Table 2: Number and size of eels observed below Garvins Falls Hydroelectric Project from 21 July 2009 to 26 August 2009.

Date	Mean Discharge (cfs) during dates*	No. of Eels and Location			Time
		Fish Bypass Reach	Between Bypass Reaches	Below Eastern Bypass	
7/21/2009	4080	1 small	-	-	21:26
7/23/2009	5540		-	-	
8/11/2009	5060	1 medium			21:35
8/13/2009	5850		1 medium		21:50
8/18/2009	3560	1 small			21:30
8/20/2009	3460				
8/24/2009	6670				
8/26/2009	5490				

\* Mean discharge from USGS gauge at Goff's Falls on Merrimack River.

A total of six eels were captured or observed below Garvins Falls Hydroelectric Project between 1 July and 31 August 2009. Five of these six eels were captured or observed in the vicinity of the fish bypass flow downstream of the exit suggesting that this area is where the majority of up-river migrating eels are attempting to breach the Project.

Adverse conditions reduced the sampling effort from 8 weeks to 4 weeks and even when water was considered safe to sample, it was often not necessarily conducive to sighting eels. It is important to take into consideration that the fish bypass area was searched more often (when the eastern bypass reach was unsafe) and even when both reaches were searched, the water conditions along the eastern bypass often were more difficult to search for eels due to flows and spill. This raises the possibility that flow conditions in 2009 may have played a role in the greater number of eels captured or observed in the fish bypass reach during this study.

#### ***Downstream Adult Silver Eel Radio-Telemetry Study***

PSNH contracted Normandeau Associates to conduct an adult silver eel downstream radio-telemetry study at Garvins Falls. The purpose of this study was to determine what passage routes out-migrating adult silver eels were using.

Prior to collection of silver eels for testing, a total of five stationary radio-telemetry receiver set-ups were installed at Garvins Falls to monitor the potential routes of passage. Receiver set-ups at the spillway bypass, gatehouse, forebay and tailrace consisted of a Lotek SRX-400 telemetry receiver and a 6-element yagi antenna. The receiver set-up at the fish bypass consisted of a Lotek SRX-400 telemetry receiver and a drop antenna positioned within the flow draining into the plunge pool. Each stationary receiver set-up was calibrated and range tested prior to eel releases.

In addition to stationary telemetry, manual surveys were planned to determine locations of radio-tagged eels upstream and downstream of the Project as necessary to confirm downstream movement.

A total of three American eels were captured by electro-fishing and held for further examination. Two were captured within the Hooksett Pool and one was captured within the Garvins Pool.

Length, weight and eye dimensions for the three eels, as well as the calculated eye index value for determining sexual maturity. Calculated index values for eels ranged from 7.0 to 10.8 and based on those values all three eels were radio-tagged. Following the overnight holding period, two of the three eels (Transmitter ID's 2 and 3) were determined to be behaving in a normal manner and were considered suitable for release. The third eel (Transmitter ID 1) was not maintaining an upright position and was exhibiting non-normal swimming behavior. It should be noted that this eel was behaving in a similar manner prior to transmitter surgery. As a result, the transmitter was removed and this eel was returned to Hooksett Pool. The remaining eels were released near the Turkey River, upstream of the Project, at 1400 on September 24, 2009.

Downstream passage by Garvins Falls was recorded for both radio-tagged eels. The first of the two eels (Transmitter ID 2) was initially detected on the spillway antenna on October 7, 2009 at 0427. This individual was next detected at 0429 on the gatehouse antenna followed quickly by the forebay antenna. At 0436 this eel was detected on the tailrace antenna indicating that it had passed downstream through the powerhouse turbine. There were no detections for this individual by the drop antennae in the fish bypass. River discharge on the date of passage (as measured at Goffs Falls) was 3,720 cfs and each of the four units at Garvins were generating. Passage of this eel through the Project occurred three days after an increase in river discharge associated with a rain event. This eel was consistently detected by manual telemetry from a stationary position along the east bank of Hooksett Pool below the Project throughout the month of October. It is suspected that this eel succumbed to mortality associated with turbine passage.

The second eel was detected by the spillway bypass antenna at 1706 on October 25, 2009. This individual was not recorded on any of the other four receivers and it is suspected that it moved downstream past Garvins via the spillway bypass. River discharge prior to passage of this eel was increasing and on the date of passage was 7,390 cfs. Similar to Transmitter ID 2, this eel passed through the Project three days after an increase in river discharge. The four Project units were generating on the date of passage. This eel was not detected within Hooksett Pool during a follow up manual telemetry survey suggesting that it survived passage through the Project spillway bypass and continued downstream.

Although the sample size for this study was small, observed routes of passage were divided equally between the bypass spillway and the Project turbines. Work conducted in the Magauadavic River, New Brunswick reported that 76% of out-migrating silver eels utilized the turbines for downstream passage routes while the remainder moved downstream through bypass structures (Carr and Whoriskey 2008). Within the Nive River, France, 66% of European eels passed over the dam, 27% utilized bypass structures and 7% used the turbines for downstream passage. Downstream passage routes selected by out-migrating silver eels will vary between locations based on site-specific factors.

#### Hooksett Hydroelectric Station

It was agreed at the November 13, 2008 fish passage meeting that PSNH would try to make simple modifications to the flashboards (i.e. drill holes in the boards) near the eastern side of the island to make sure there is sufficient water trickling down the rocks for eel passage. In addition, PSNH and the agencies had planned a site visit during the summer of 2009 to see if there are any other minor modifications that can be made to enhance eel passage. Unfortunately, high water prevented the site visit from occurring. PSNH and the agencies will try to arrange for the site visit during the summer of 2010.

### Amoskeag Hydroelectric Station

PSNH set up a new digital video recording system in the counting room at the Amoskeag fish ladder on May 7, 2009; however, no river herring or shad were recorded using the fish ladder in 2009. For a complete breakdown of fish returns to the Merrimack River see the USFWS web page at <http://www.fws.gov/r5cneafp/returns.htm>.

The Amoskeag eel trap was installed in the base of the fish ladder on July 16, 2009 and ran until October 8, 2009. The last eel to be captured was on September 8 and the trap was removed for the season on October 9.

Eight hundred and fifty four (854) eels were captured and transported to the Amoskeag headpond during sampling.

This compares to a total of two thousand three hundred forty eight (2348) eels captured in 2008.

	Total	< 6 inches	6-12"	>12"
2009	854	260	403	191
2008	2348	563	981	804
2007	764	N/A	N/A	N/A
2006	3144	1220	982	942
2005	405	134	152	119
2004	2144	848	830	466
2003	641	253	241	147

### **Mitigative Measures Proposed or Implemented Based on the Results of the Studies or Observations**

As outlined in the *Merrimack River Project (Amoskeag, Hooksett & Garvins Falls) Upstream and Downstream Fish Passage Plan* (filed with FERC January 9, 2008), PSNH plans to conduct the following studies in 2010:

- Evaluation of the passage efficiency of shad and river herring in the Amoskeag fish ladder if shad and river herring are present.
- Evaluate the best location for upstream eel passage in the eastern bypass at Amoskeag.
- Repeat the evaluation to determine the best location for upstream eel passage along the western bypass and fish bypass at Garvins Falls.
- Conduct the downstream clupeid passage study at Garvins Falls in the fall if test fish are available.
- Repeat the downstream eel passage study at Garvins Falls in the fall.

PSNH will re-install the eel trap in the Amoskeag tailrace in 2010. Captured eels will be sized before their release into the headpond. A summary report will be provided to the agencies at the end of 2010.

PSNH will work cooperatively with the USFWS and NHFGD to operate the Ayers Island fish sampler during the 2010 downstream smolt migration.

PSNH will continue meeting regularly with the State and Federal agencies to develop fish passage strategies and monitor the progress of Fish Passage Agreements.

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If you have any questions or require further information, please contact Mr. Curtis R. Mooney at 603-744-8855, ext. 5841.

**PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE**



Robert Gundersen  
Hydro Manager

Original (1)  
Copies (8)

cc:

Mr. Ralph Abele  
EPA New England  
Office of Ecosystem Protection (CWQ)  
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Concord, NH 03301

Mr. Joe McKeon  
U.S. Fish and Wildlife Service  
Central New England Fisheries Resource Office

151 Broad Street  
Nashua, NH 03063

Mr. Gregg Comstock  
New Hampshire Department of Environmental Services  
Watershed Management Bureau  
6 Hazen Drive, PO Box 95  
Concord, NH 03302

Mr. John Warner  
U.S. Fish and Wildlife Service  
New England Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-5087

FEDERAL ENERGY REGULATORY COMMISSION  
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 1893-014--New Hampshire  
Merrimack River Project

Project No. 2457-003--New Hampshire  
Eastman Falls

Project No. 2456-009--New Hampshire  
Ayers Island  
Public Service of New Hampshire

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SECRETARY OF THE  
ENERGY  
2010 JUN 11 A 9 53  
FEDERAL ENERGY  
REGULATORY COMMISSION

Mr. Robert Gundersen  
Hydro Manager  
Public Service of New Hampshire  
P.O. Box 330  
Manchester, NH 03105-0330

June 9, 2010

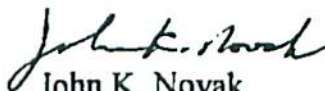
Subject: 2009 Anadromous Fish Passage Report

Dear Mr. Gundersen:

We have received the 2009 Annual Report on Anadromous Fish Passage Activities and Facilities filed February 22, 2010, for the Merrimack River Project, the Eastman Falls Project, and the Ayers Island Project. This report was filed pursuant to the fish passage requirements of the license for each of these projects. The report includes upstream and downstream fish passage activities at each of these projects, operation dates for the passage facilities, results of studies, and plans for diadromous fish studies in 2010.

This filing satisfies the fish passage reporting requirements for 2009. Thank you for your cooperation in this matter. If you have any questions pertaining to this letter, please contact me at (202) 502-6076.

Sincerely,



John K. Novak  
Biological Resources Branch  
Division of Hydropower Administration  
and Compliance

FEDERAL ENERGY REGULATORY COMMISSION  
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 1893-042--New Hampshire  
Merrimack River Project  
Public Service of New Hampshire

February 14, 2011

Mr. James J. Kearns  
780 North Commercial Street  
P.O. Box 330  
Manchester, NH 03105-0330

Subject: 2010 Fish passage facilities report

Dear Mr. Kearns:

We received your 2010 annual fish passage facilities report, filed December 3, 2010, for the Merrimack River Project, pursuant to Article 401 of the project license.<sup>1</sup> Upstream fish passage is required sequentially upstream at each development contingent on anadromous fish passage triggers being met at downstream developments. The report states that you installed digital video recording equipment in the Amoskeag fish ladder counting room in early May 2010, and no river herring or shad were observed.

This filing satisfies the fish passage reporting requirements for 2010. Your next report is due by December 31, 2011. Please be advised that, while Commission staff will continue to review these filings, staff will no longer issue acknowledgement letters for future filings under this license requirement, unless further Commission action is needed. When your future filings for this requirement are posted on the Commission's e-library system, you may consider that as acknowledgment of the Commission's receipt of your submittal. Thank you for your cooperation in this matter. If you have any questions pertaining to this letter, please contact me at (202) 502-6833.

Sincerely,



Holly Frank  
Aquatic Resources Branch  
Division of Hydropower Administration  
and Compliance

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<sup>1</sup> Order Issuing New License. 119 FERC ¶ 61,170 (May 18, 2007).





Public Service  
of New Hampshire

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The Northeast Utilities System

February 22, 2011

**D29913**

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

Project No. 1893 - Amoskeag, Hooksett and Garvins Falls  
Project No. 2457 - Eastman Falls  
Project No. 2456 - Ayers Island

**RE: 2010 Annual Report on Anadromous Fish Passage Activities and Facilities**

Dear Ms. Bose:

Public Service Company of New Hampshire (PSNH) herein submits the 2010 Annual Report on Anadromous Fish Passage Activities and Facilities. Fish passage facility operations and anadromous fish passage studies were conducted at the above referenced projects in accordance with the following:

- United States Department of the Interior (USDO) Prescription for Fishways for the Merrimack River Project, issued pursuant to Section 18 of the Federal Power Act and dated December 20, 2006.
- A Comprehensive Plan for Provision of Anadromous Fish Passage Measures and Facilities at PSNH's Merrimack - Pemigewasset River Hydroelectric Dams, FERC Projects No. 1893, 2456, and 2457.
- The Merrimack River Project (Amoskeag, Hooksett & Garvins Falls) Upstream and Downstream Fish Passage Plan filed with the FERC January 2008.

**Amoskeag Hydroelectric Station - Project 1893**

**Upstream Fish Passage**

The Amoskeag fish ladder began its operations on April 26, 2010 and closed on July 15, 2010. No river herring or shad were recorded using the fish ladder this season.

Downstream Fish Passage

The downstream bypass was operated from March 31, 2010 through July 15, 2010. The fish bypass was opened again from September 15, 2010 through November 15, 2010 as outlined in the Fishway Prescription.

**Hooksett Hydroelectric Station - Project 1893**

Upstream Fish Passage

The U.S. Department of the Interior, Fish and Wildlife Service fishway prescription issued December 20, 2006 requires the installation of upstream passage facilities for anadromous fish at the Hooksett Dam, to be operational within three years after passage of either 9,500 or more shad or 22,500 or more river herring in any given year at the Amoskeag development.

Downstream Fish Passage

The downstream fish bypass system was operational from March 31, 2010 through July 15, 2010. The fish bypass was opened again from September 15, 2010 through November 15, 2010 as outlined in the Fishway Prescription.

**Garvins Falls Hydroelectric Station - Project 1893**

Upstream Fish Passage

Upstream passage facilities at the Garvins Falls Dam for anadromous fish is required to be operational within three years after the passage of: (1) either 9,800 American shad or 23,200 river herring at the Hooksett development; (2) if fish passage has been constructed at the Hooksett Development without a fish counting facility, passage of either 19,300 American shad or 45,800 river herring at the Amoskeag Development.

Downstream Fish Passage

The downstream fish bypass operated from March 31, 2010 through July 15, 2010. The fish bypass was opened again from September 15, 2010 through November 15, 2010 as outlined in the Fishway Prescription.

### **Eastman Falls Hydroelectric Station -Project 2457**

#### Upstream Fish Passage

The need for an upstream fish passage facility will be determined in the year 2015.

#### Downstream Fish Passage

The downstream fish bypass was operational from March 29 through June 11, 2010.

The bypass was opened again during the fall from October 1 through November 15, 2010 as prescribed in the revised Fall Bypass Operating Schedule dated 10/19/1995 for the Ayers Island and Eastman Falls Hydroelectric facilities.

### **Ayers Island Hydroelectric Station -Project 2456**

#### Upstream Fish Passage

The need for an upstream fish passage facility will be determined in the year 2015.

#### Downstream Fish Passage

The downstream fish bypass was operational from March 29 through June 11, 2010.

The bypass was opened again during the fall from October 1 through November 15, 2010 as prescribed in the revised Fall Bypass Operating Schedule dated 10/19/1995 for the Ayers Island and Eastman Falls Hydroelectric facilities.

### **Results of Studies and/or Observations Undertaken**

PSNH met with the State and Federal agencies on December 7, 2010 to discuss the results of the following studies undertaken in 2010.

### **Project 2456**

#### Ayers Island Hydroelectric Station

No studies were conducted at Ayers in 2010.

### Project 2457

#### Eastman Falls Hydroelectric Station

No studies were conducted at Eastman Falls in 2010.

### Project 1893

#### Garvins Falls Hydroelectric Station

##### *Downstream Adult Silver Eel Radio-Telemetry Study*

PSNH contracted Normandeau Associates to conduct an adult silver eel downstream radio-telemetry study at Garvins Falls. The purpose of this study was to determine what passage routes out-migrating adult silver eels were using.

##### *Eel Capture:*

Boat electrofish sampling for out-migrating silver eels was conducted during the first two weeks of September, 2010. Two nights of electrofish effort per week were conducted at locations in Garvins and Hooksett Pools of the Merrimack River with the intention of intercepting out-migrating silver eels. Sampling was conducted near major tributaries to Garvins and Hooksett Pools (Soucook River, Big Bog Brook, Turkey River) and in areas of habitat where it was deemed by professional judgment that silver eels may be present. The seasonal timing of this sampling was coordinated with moon phase as previous work with the species had documented higher catch rates during the last quarter and new moon phases (McGrath et al. 2003). During September, 2010, the last quarter and new moon phases took place during the first and second weeks of the month.

In addition to the targeted electrofish sampling, field crews conducting electrofish sampling within Garvins and Hooksett Pools for a separate project during the August-September time period were instructed to net and retain any potential silver eels.

##### *Determination and radio-tagging of silver eels:*

Upon capture, eels were visually examined in the field for external characteristics likely to indicate they were of reproductive age. Individuals with yellow coloration were released back into the Merrimack River. Captured eels which displayed the silver coloration of a potentially out-migrating adult eel were transferred to a holding tank and maintained in ambient Merrimack River water. Each eel was anesthetized using a combination of chilled Merrimack River water

and MS-222. The total length (mm), vertical eye diameter (mm) and horizontal eye diameter (mm) were recorded for each individual. A previously described correlation between eye size, body length and gonad development for the closely related European eel (*Anguilla anguilla*) was used to determine whether individuals were mature and likely to be out-migrating from the system (Pankhurst 1982). This relationship can be described using the formula:

$$I = [(A+B)^2\pi/L]*100$$

where,

I = index value,

A = horizontal eye diameter,

B = vertical eye diameter,

L = total body length.

During the previously reported study (Pankhurst 1982), eels with an index value of  $\leq 6.5$  were classified as sexually immature and eels with an index value of  $> 6.5$  were classified as sexually mature. The same determining criteria used during that study was used in this study. Eels determined to be sexually mature based on the above index as well as external characteristics were selected for surgical implantation of a radio transmitter. Surgical implantation is the preferred method for affixing radio-transmitters to American eels (Cottrill et al. 2006). An incision was made off center on the ventral surface of the individual. The incision was made just long enough to insert the transmitter into the body cavity of the individual and was closed with 3 individually stitched and tied sutures. Following surgery, the eel was transferred back to the holding tank and maintained in ambient Merrimack River water for a 24 hour period. Following that recovery period, eels were assessed for normal behavior prior to release and were then trucked to the Merrimack River and released in the Garvins Pool approximately  $\frac{1}{4}$  mile upstream of the Project near the Turkey River confluence.

Radio transmitters used in this study were Lotek model MCFT-3EM and had an expected battery life of 206 days. Transmitters emitted a pulse every 2.5 seconds on a frequency of 150.210 MHz. Each transmitter was coded to emit a unique identifying signal so that individual eels could be identified by a receiver.

#### *Downstream passage:*

Prior to collection of silver eels for testing, a total of five stationary radio-telemetry receiver set-ups were installed at Garvins Falls to monitor the potential routes of passage. Receiver set-ups at the spillway bypass, gatehouse, forebay and tailrace consisted of a Lotek SRX-400 telemetry receiver and a either a 4-element or 6-element yagi antenna. The receiver set-up at the fish bypass consisted of a Lotek SRX-400 telemetry receiver and a drop antenna positioned within the flow draining into the plunge pool. Each stationary receiver set-up was calibrated and range tested prior to eel releases.

In addition to stationary telemetry, manual surveys were planned to determine locations of radio-tagged eels upstream and downstream of the Project as necessary to confirm downstream movement.

## Results

### *Eel Capture:*

A total of two American eels (suspected of potentially being silver eels based on external visual inspection) were captured by electrofishing and held for further examination. Both eels were captured within Hooksett Pool.

### *Determination and radio-tagging of silver eels:*

Total length and eye dimensions for the two eels, as well as the calculated eye index value for determining sexual maturity, are presented in Table 1. Calculated index values for eels were 6.0 and 9.4 and based on those values a single eel was radio-tagged. Following the overnight holding period, the individual was determined to be behaving in a normal manner and was considered suitable for release. The single radio-tagged eel was released near the Turkey River, upstream of the Project, at 1221 on September 22, 2010.

**Table 1. Physical measurements (total length, horizontal and vertical eye measurements) used to calculate eye index, capture and release information recorded for silver eels prior to radio-tagging.**

Capture Date	Capture Pool	Total Length (mm)	Eye - Horizontal (mm)	Eye - Vertical (mm)	Eye Index	Transmitter ID #	Release Date
8/30/2010	Hooksett	840	10.414	9.652	9.4	1	9/22/10
9/10/2010	Hooksett	735	7.874	7.112	6.0	-	-

### *Downstream passage:*

Downstream passage by Garvins Falls was recorded for the radio-tagged eel. Transmitter ID 1 was initially detected on the spillway antenna on September 30, 2010 at 2109 followed quickly by the gatehouse antenna at 2110. At 2111 this eel was detected on the tailrace antenna indicating that it had passed downstream through the powerhouse turbine. There were no detections for this individual by the drop antenna in the fish bypass. River discharge on the date of passage (as measured at Goffs Falls) was 3,000 cfs and two of the four units at Garvins were generating while passage occurred. Passage of this eel through the Project occurred around the onset of a large increase in river discharge and while the Project headwater was being lowered in anticipation of increased flows associated with that rain event. This eel was detected by manual

telemetry within Hooksett Pool, approximately 1.1 miles below the Project on October 11, 2010 and again in the same location on November 4, 2010. Given the lack of downstream movement for this individual over the five week period following passage, it is suspected that this individual succumbed to mortality.

## **Discussion**

The downstream movement pattern of a single adult American eel was assessed at Garvins Falls during the fall of 2010. The radio-tagged eel in this study displayed localized movements in the vicinity of the Turkey River confluence for a period of 8 days following release. This localized movement behavior prior to downstream migration is similar to that observed for internally tagged silver eels released in other radio-telemetry studies (Durif et al. 2003; Carr and Whoriskey 2008) as well as that observed for the two silver eels released above the Garvins Project during the fall of 2009.

The observed route of passage for the eel released during the fall of 2010 was through the Project turbines. Similarly, during the fall of 2009, 50% (n=1) of silver eels released above the Garvins Project moved downstream through the turbines while the remainder (n=1) moved downstream over the spillway.

Downstream movements of silver eels monitored during this study, as well as during the 2009 study, occurred after a delay of several days. Downstream movement during 2010 took place just prior to a large increase in river flows associated with a significant storm event. Similar to our observations, downstream movements of out-migrating adult American eels (Carr and Whoriskey 2008) and European eels (Durif et al. 2003; Winter et al. 2006) have been noted to coincide with increases in river discharge associated with storm events during the fall season. Timing of downstream passage for the radio-tagged eel in this study occurred during the early-night hours.

## *Eel Survey*

PSNH contracted Normandeau Associates to conduct an eel survey at Garvins Falls during July and August. The purpose of this study was to locate where upstream-migrating eels were possibly congregating and where an interim eel way should be located the following summer.

The survey locations at the Garvins Falls Project were concentrated in the area directly below the fish bypass exit (below the canal), the area downstream of the removed wooden flashboard on the dam which provides the required minimum flow in the 500-ft bypass reach and the stretch between these bypasses on the western shoreline. The presence of eels in the survey areas was determined using a combination of baited eel pots and visual surveys conducted during night hours.

## *Eel Pots:*

A total of four eel pots were set each week for a 48-hr period. At Garvins Falls, two traps (T-1 and T-2) were set at locations near the eastern bypass and two traps (T-3 and T-4) were set in the water below the fish bypass. Eel pots were set on a Tuesday evening prior to the night surveys and retrieved during the Thursday night survey of the same week.

#### *Night Surveys:*

Visual surveys for eels were conducted on Tuesday and Thursday nights during the months of July and August, 2010. Surveys were initiated after sunset (approximately 2100) and were conducted using headlamps and handheld spotlights. At Garvins Falls, surveys were concentrated in the area below the fish bypass and in the vicinity of the eastern bypass with some effort also expended along the western shore of the 500 ft. bypass reach between the two areas.

Night surveys were conducted by two Normandeau biologists and eels located and captured were photographed and a GPS location was recorded. Captured or observed eels were categorized based on size class: small (less than 6 in), medium (6 in-12 in), and large (> 12 in).

## **Results**

#### *Eel Pots:*

Thirty-one out of a possible thirty-two eel pot samples were collected at Garvins Falls during July and August, 2010. A single sample was voided during week 1 when a trap (T-1) was stranded by lower water levels below the eastern bypass. This trap had been set along the waters edge during higher flows and was stranded as a result of decreased river flow. Two eels were captured during the eight weeks of sampling at Garvins Falls. Both eels were captured in traps set below the eastern bypass, one (6 to 12 in.) during the week 2 set and one (12+ in.) during the week 4 set.

#### *Night Surveys:*

A total of 9 eels were observed at Garvins Falls during the sixteen surveys. Two were located near the exit of the bypass at the end of the canal, four were located among the flowage along the face of the dam from the western side to the eastern bypass, and three were located between the 2 bypasses at an area of leakage. All eels observed during night surveys conducted below Garvins Falls were in the medium (6-12 in) or large (> 12 in) size classes.

The small number of eels caught and observed below Garvins Falls were found in three areas; the face of the dam east to the bypass cutout, the base of the fish bypass at the canal and at an area of leakage midway between the two bypass areas. The greatest concentration of eels was located along the dam face and the eastern bypass (n=6) with lower numbers observed in the area of leakage (n = 3) and the fish bypass (n=2).



### Hooksett Hydroelectric Station

No studies were conducted at Hooksett in 2010.

### Amoskeag Hydroelectric Station

#### *Eel Survey*

PSNH contracted Normandeau Associates to conduct an eel survey at Amoskeag during July and August. The purpose of this study was to locate where upstream-migrating eels were possibly congregating and where an interim eel way should be located the following summer.

The eel trap and night survey field work was conducted during the period 1 July 2010 through 31 August 2010. The survey locations at the Amoskeag Project were concentrated in the region below the eastern bypass. The presence of eels in the survey areas was determined using a combination of baited eel pots and visual surveys conducted during night hours.

#### *Eel Pots:*

A total of four eel pots were set each week for a 48-hr period. All four traps at Amoskeag (T-5 through T-8) were set at locations downstream of the eastern bypass flow. Eel pots were set on a Tuesday evening prior to the night surveys and retrieved during the Thursday night survey of the same week.

#### *Night Surveys:*

Visual surveys for eels were conducted on Tuesday and Thursday nights during the months of July and August, 2010. Surveys were initiated after sunset (approximately 2100) and were conducted using headlamps and handheld spotlights. Surveys at Amoskeag were conducted in the area below the eastern bypass and followed the eastern shoreline up to the bypass exit including the bays of the old gatehouse.

Night surveys were conducted by two Normandeau biologists and eels located and captured were photographed and a GPS location was recorded. Captured or observed eels were categorized based on size class: small (less than 6 in), medium (6 in-12 in), and large (> 12 in).

### **Results**

#### *Eel Pots:*

Sixteen out of a possible thirty-two eel pot samples were collected at Amoskeag during July and August, 2010 (due to suspected vandalism). During weeks 1 and 2, a total of three traps were missing (due to suspected vandalism) at the time of retrieval. No eel pots were set during the last three weeks of August (weeks 6-8). A single, medium-sized eel was captured at Station T-5, closest to the bypass, during week 5.

#### *Night Surveys:*

A total of 196 eels were observed during night surveys below Amoskeag's eastern bypass. The majority of these eels were observed on the concrete apron abutting the old gatehouse east of the bypass flow and within the old gatehouse bays where leakage provided attraction water. Of the total number observed below Amoskeag, 159 eels were small (0-6 in), 36 were medium (6-12 in) and 1 was > 12 in.

The small number of eels caught and observed below Garvins Falls were found in three areas; the face of the dam east to the bypass cutout, the base of the fish bypass at the canal and at an area of leakage midway between the two bypass areas. The greatest concentration of eels was located along the dam face and the eastern bypass (n=6) with lower numbers observed in the area of leakage (n = 3) and the fish bypass (n=2).

A total of 197 eels were captured or observed below Amoskeag's eastern bypass, the majority of which were less than 6 in. (n = 158). The greatest concentration of eels in the surveyed area downstream of Amoskeag was located at the concrete apron and the old gatehouse bays east of the bypass. Based on these observations, it appears that juvenile American eels are attempting to pass upstream of the Amoskeag Project at that location.

#### *Fish Ladder Effectiveness Study*

PSNH set up a new digital video recording system in the counting room at the Amoskeag fish ladder on May 21, 2010; however, no river herring or shad were recorded using the fish ladder in 2010. For a complete breakdown of fish returns to the Merrimack River see the USFWS web page at <http://www.fws.gov/r5cneafp/returns.htm>.

#### *Fish Ladder Eel Trap*

The Amoskeag eel trap was installed in the base of the fish ladder on July 8, 2010 and ran until October 18, 2010. The last eel to be captured was on October 6 and the trap was removed for the season on October 18.

Five hundred and sixty seven (567) eels were captured and transported to the Amoskeag headpond during sampling.

This compares to a total of eight hundred and fifty four (854) eels captured in 2009.

**Mitigative Measures Proposed or Implemented Based on the Results of the Studies or Observations**

As outlined in the Merrimack River Project (*Amoskeag, Hooksett & Garvins Falls*) Upstream and Downstream Fish Passage Plan (filed with FERC January 9, 2008), PSNH plans to conduct the following studies in 2011:

- Evaluation of the passage efficiency of shad and river herring in the Amoskeag fish ladder if shad and river herring are present.
- Install an interim eel passage facility in the eastern bypass at Amoskeag.
- Repeat the evaluation to determine the best location for upstream eel passage along the western bypass and fish bypass at Garvins Falls.
- Repeat the downstream clupeid passage study at Garvins Falls in the fall if test fish are available.
- Repeat the downstream eel passage study at Garvins Falls in the fall.

PSNH will continue meeting regularly with the State and Federal agencies to develop fish passage strategies and monitor the progress of Fish Passage Agreements.

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If you have any questions or require further information, please contact Mr. Curtis R. Mooney at 603-744-8855, ext. 5841.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE



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The Northeast Utilities System

February 23, 2012

**D30998**

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

Project No. 1893 - Amoskeag, Hooksett and Garvins Falls

Project No. 2457 - Eastman Falls

Project No. 2456 - Ayers Island

**RE: 2011 Annual Report on Anadromous Fish Passage Activities and Facilities**

Dear Ms. Bose:

Public Service Company of New Hampshire (PSNH) herein submits the 2011 Annual Report on Anadromous Fish Passage Activities and Facilities. Fish passage facility operations and anadromous fish passage studies were conducted at the above referenced projects in accordance with the following:

- United States Department of the Interior (USDO I) Prescription for Fishways for the Merrimack River Project, issued pursuant to Section 18 of the Federal Power Act and dated December 20, 2006.
- A Comprehensive Plan for Provision of Anadromous Fish Passage Measures and Facilities at PSNH's Merrimack - Pemigewasset River Hydroelectric Dams, FERC Projects No. 1893, 2456, and 2457.
- The Merrimack River Project (Amoskeag, Hooksett & Garvins Falls) Upstream and Downstream Fish Passage Plan filed with the FERC January 2008.

**Amoskeag Hydroelectric Station - Project 1893**

Upstream Fish Passage

The Amoskeag fish ladder began its operations on April 25, 2011 and closed on July 13, 2011. No river herring or shad were recorded using the fish ladder this season.

### Downstream Fish Passage

The downstream bypass was operated from April 1, 2011 through July 15, 2011. The fish bypass was opened again from September 15, 2011 through November 15, 2011 as outlined in the Fishway Prescription.

### **Hooksett Hydroelectric Station - Project 1893**

#### Upstream Fish Passage

The U.S. Department of the Interior, Fish and Wildlife Service fishway prescription issued December 20, 2006 requires the installation of upstream passage facilities for anadromous fish at the Hooksett Dam, to be operational within three years after passage of either 9,500 or more shad or 22,500 or more river herring in any given year at the Amoskeag development.

#### Downstream Fish Passage

The downstream fish bypass system was operational from April 1, 2011 through July 15, 2011. The fish bypass was opened again from September 15, 2011 through November 15, 2011 as outlined in the Fishway Prescription.

### **Garvins Falls Hydroelectric Station - Project 1893**

#### Upstream Fish Passage

Upstream passage facilities at the Garvins Falls Dam for anadromous fish is required to be operational within three years after the passage of: (1) either 9,800 American shad or 23,200 river herring at the Hooksett development; (2) if fish passage has been constructed at the Hooksett Development without a fish counting facility, passage of either 19,300 American shad or 45,800 river herring at the Amoskeag Development.

#### Downstream Fish Passage

The downstream fish bypass operated from April 1, 2011 through July 15, 2011. The fish bypass was opened again from September 15, 2011 through November 15, 2011 as outlined in the Fishway Prescription.

**Eastman Falls Hydroelectric Station -Project 2457**

Upstream Fish Passage

The need for an upstream fish passage facility will be determined in the year 2015.

Downstream Fish Passage

The downstream fish bypass was operational from April 4 through June 7, 2011.

The bypass was opened again during the fall from October 1 through October 28, 2011 as prescribed in the revised Fall Bypass Operating Schedule dated 10/19/1995 for the Ayers Island and Eastman Falls Hydroelectric facilities. PSNH received permission from the agencies to close the downstream bypass early.

**Ayers Island Hydroelectric Station -Project 2456**

Upstream Fish Passage

The need for an upstream fish passage facility will be determined in the year 2015.

Downstream Fish Passage

The downstream fish bypass was operational from April 4 through June 7, 2011.

The bypass was opened again during the fall from October 1 through October 28, 2011 as prescribed in the revised Fall Bypass Operating Schedule dated 10/19/1995 for the Ayers Island and Eastman Falls Hydroelectric facilities. PSNH received permission from the agencies to close the downstream bypass early.

**Results of Studies and/or Observations Undertaken**

PSNH met with the State and Federal agencies on January 19, 2012 to discuss the results of the following studies undertaken in 2011 and also review study plans for 2012.

**Project 2456**

Ayers Island Hydroelectric Station

No studies were conducted at Ayers in 2011.



### **Project 2457**

#### Eastman Falls Hydroelectric Station

No studies were conducted at Eastman Falls in 2011.

### **Project 1893**

#### Garvins Falls Hydroelectric Station

##### *Eel Survey*

PSNH contracted Normandeau Associates to conduct an eel survey at Garvins Falls during July and August. The purpose of this study was to locate where upstream-migrating eels were possibly congregating and where an interim eel way should be located the following summer.

The survey locations at the Garvins Falls Project were concentrated in the area directly below the fish bypass exit (below the canal), the areas east and west of the bypass spillway and an area of leakage from the power canal. The presence of eels in the survey areas was determined using a combination of baited eel pots and visual surveys conducted during night hours.

##### *Eel Pots:*

Baited eel traps were set weekly as river conditions allowed from 5 July through 23 August 2011 for 48 hour periods. A single trap each was placed in the vicinity of the fish bypass adjacent to the canal and in the leakage area. Two traps each were placed within the regions east and west of the eastern bypass. Eel traps were set and retrieved on a weekly basis.

##### *Night Surveys:*

On Tuesdays and Thursday from 5 July through 23 August 2011 visual surveys were conducted in wadable regions of each of the four search areas. Surveys were conducted after sunset (typically around 2100) and the location of eels sighted were marked with a GPS and pictures taken if possible. Night surveys were conducted within each of the four search areas when river flows were appropriate both for crew safety as well as for eels to potentially be present.

### **Results**

##### *Eel Pots:*

A total of 37 eel trap samples were successfully collected during 2011. The majority of eels captured were in the 6-12" size class followed by the >12" size class. No eels in the 0-6" size class were captured during 2011. Catch per unit effort (# eels / 24 hour trap set) is presented in Table 2. The reach east of the eastern bypass had the highest CPUE while no eels were captured within the fish bypass reach adjacent to the canal. Catch per unit effort on the western side of the eastern bypass was less than half that observed on the eastern side.

#### *Night Surveys:*

The results of the eel surveys in each search area and the number of eels in three size classes (0-6", 6-12", and >12") are presented in Table 3. Visual surveys were restricted to the search areas east and west of the eastern bypass during the three week period where the canal was drained and no surveys were conducted on 25 August due to excessive spill.

Eels were more frequently observed in the search areas adjacent to the eastern bypass than within the leakage area or fish bypass adjacent to the canal. Although survey effort was less in those two search areas due to the draining of the Garvins Falls power canal for repairs (affecting surveys from 19 July to 4 August 2011), only a single eel was observed in the two search areas whose flow is supplied by the power canal. In the two eastern bypass search areas, eels were more frequently sighted on the eastern side than the western side.

Differences in size composition of eels observed occurred between the two search areas of the eastern bypass. On the western side, the majority of eels were in the 6-12" size class, accounting for 50% of all eels (Table 3). On the eastern side, the 0-6" size class was most frequently observed (Table 3) followed by the 6-12" size class.

**Table 1: Weekly catch (by size class) of American eels captured in eel traps set within each of the four search areas below Garvins Falls during the period 5 July through 25 August 2011.**

Sample Dates	Fish Bypass Area (n=3)			Leakage Area (n=3)			Dam Bypass-West Side (n=19)			Dam Bypass-East Side (n=12)		
	0-6"	6-12"	>12"	0-6"	6-12"	>12"	0-6"	6-12"	>12"	0-6"	6-12"	>12"
7/5 to 7/7	NA	NA	NA	NA	NA	NA	0	2	1	0	0	0
7/12 to 7/14	0	0	0	0	0	0	0	0	0	0	1	0
7/19 to 7/21	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0
7/26 to 7/28	NA	NA	NA	NA	NA	NA	0	0	0	0	0	1
8/2 to 8/4	NA	NA	NA	NA	NA	NA	0	0	0	0	2	0
8/9 to 8/11	0	0	0	0	0	0	0	0	0	0	1	0
8/16 to 8/18	0	0	0	0	1	0	0	0	0	0	0	0
8/23 to 8/25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total by size class	0	0	0	0	1	0	0	2	1	0	4	1
Total by search area	0			1			3			5		

**Table 2: Catch per unit effort (# eels/24 hour period) obtained for eel traps set within each of the four search areas below Garvins Falls during the period 5 July through 25 August 2011.**

CPUE (eels per 24 hour period)			
Fish Bypass Area (n=3)	Leakage Area (n=3)	Dam Bypass-West Side (n=19)	Dam Bypass-East Side (n=12)
0.00	0.14	0.07	0.17

**Table 3: Nightly observations (by size class) of American eels visually detected within each of the four search areas below Garvins Falls during the period 5 July through 25 August.**

Sample Date	Mean daily discharge (cfs)*	Number of eel and location											
		Fish Bypass Area			Leakage Area			Dam Bypass-West Side			Dam Bypass-East Side		
		0-6"	6-12"	>12"	0-6"	6-12"	>12"	0-6"	6-12"	>12"	0-6"	6-12"	>12"
7/5/2011	2,485											1	
7/7/2011	2,364											1	
7/12/2011	1,979								2			3	
7/14/2011	1,477							2	4	1		1	
7/19/2011	1,357	NA	NA	NA	NA	NA	NA	3			4		
7/21/2011	1,349	NA	NA	NA	NA	NA	NA				2	4	
7/26/2011	1,105	NA	NA	NA	NA	NA	NA	1	1		2	3	
7/28/2011	1,502	NA	NA	NA	NA	NA	NA	1			1		
8/2/2011	1,269	NA	NA	NA	NA	NA	NA	1			12	2	
8/4/2011	1,103	NA	NA	NA	NA	NA	NA				1		
8/9/2011	1,119								2	1	1		
8/11/2011	1,293								2			1	
8/16/2011	3,934												
8/18/2011	4,897					1		1	1	1		1	
8/23/2011	5,230										1		
8/25/2011	4,050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total by size class		0	0	0	0	1	0	9	12	3	24	17	0
Total by search area		0			1			24			41		

### Hooksett Hydroelectric Station

No studies were conducted at Hooksett in 2011.

### Amoskeag Hydroelectric Station

#### *Fish Ladder Effectiveness Study*

PSNH set up digital video recording equipment in the counting room at the Amoskeag fish ladder on May 25, 2011; however, no river herring or shad were recorded using the fish ladder during 2011. For a complete breakdown of fish returns to the Merrimack River see the USFWS web page at <http://www.fws.gov/r5cneafp/returns.htm> .

#### *Fish Ladder Eel Trap*

The Amoskeag eel trap was installed in the base of the fish ladder on July 14, 2011 and ran until October 20, 2011. The last eel to be captured was on October 6 and the trap was removed for the season on October 21.

Two thousand two hundred and eighteen (2218) eels were captured and transported to the Amoskeag headpond during sampling.

This compares to a total of five hundred and sixty seven (567) eels captured in 2010.

#### *Eastern Bypass Eelway*

Based on the results of eel pot sampling and visual surveys conducted during the summer of 2010, an eelway location was selected and design plans for an eelway were created by Kleinshmidt Associates. The eelway plans were sent to the USFWS and NHFGD for their review and comment on March 1, 2011.

Comments were received on March 13, 2011 and revised plans were sent out March 28 for USFWS approval. Additional comments were received on April 18 and addressed in an email dated April 27, 2011. A formal letter from the USFWS commenting on the eel ladder plans was received May 24, 2011.

The plans for a permanent eel fishway in the eastern bypass were submitted to FERC on June 9, 2011 and June 24, 2011. FERC issued an order approving the upstream eel passage plan September 6, 2011.

Seventy five percent of the upstream eelway was installed during the fall of 2011; however, higher than normal river flows prevented installation of the entrance block for the ladder. PSNH plans to install the entrance block, eelway tray and holding tank after the 2012 spring freshet.

**Mitigative Measures Proposed or Implemented Based on the Results of the Studies or Observations**

As outlined in the Merrimack River Project (Amoskeag, Hooksett & Garvins Falls) Upstream and Downstream Fish Passage Plan (filed with FERC January 9, 2008), PSNH plans to conduct the following studies in 2012:

- Evaluation of the passage efficiency of shad and river herring in the Amoskeag fish ladder if shad and river herring are present.
- Complete installation of the eel passage facility in the eastern bypass at Amoskeag.
- Meet with NHFGD, USFWS and outside professionals at Garvins Falls to try and determine feasible upstream eel passage options.
- Repeat the downstream clupeid passage study at Garvins Falls in the fall if test fish are available.
- Repeat the downstream eel passage study at Garvins Falls in the fall if test fish are available.

PSNH will continue meeting regularly with the State and Federal agencies to develop fish passage strategies and monitor the progress of Fish Passage Agreements.

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If you have any questions or require further information, please contact Mr. Curtis R. Mooney at 603-744-8855, ext. 5841.

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