LOW IMPACT HYDROPOWER INSTITUTE RECERTIFICATION APPLICATION

Union Gas Hydroelectric Project
(FERC No. 2556, LIHI No. 58)

Prepared by:
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FEBRUARY 2021

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PART I. FACILITY DESCRIPTION

The Union Gas Hydroelectric Project (FERC No. 2556) (the "Union Gas Project" or "Project") was initially certified by the Low Impact Hydropower Institute ("LIHI") in 2010 and then recertified in 2015 for another five years. Messalonskee Stream Hydro, LLC ("Messalonskee or MSH") submits this application to recertify the Project. The only significant change to project operations is that starting in 2020, Messalonskee adopted the practice of nightly shut downs at the Union Gas project from 6pm to 2am from September 1 through October 30 in order to allow for safe downstream eel passage.

The Union Gas hydroelectric facility ("the Union Gas Project"), the fourth hydroelectric project below Messalonskee Lake, is a 1.5 Megawatt ("MW") station located on the Messalonskee Stream in Waterville, Maine. Construction of the Union Gas Project was completed in the early 19th century by the Union Gas & Electric Company and the Project was operated as an unlicensed facility from that time until February 24, 1969, when the Federal Energy Regulatory Commission (FERC) (FERC Project No. 41) issued it a 30-year License.

On December 4, 1991, Central Maine Power ("CMP") filed an application for a new license for the Messalonskee Project. The application proposed the issuance of a consolidated license for four projects: Messalonskee Lake, Oakland, Rice Rips and Union Gas. In 1998, subsequent to the filing of the application for a new license for the Messalonskee Project, ownership of the Messalonskee Project was transferred from CMP to FPL Energy Maine Hydro LLC ("FPL"). Ownership of the project was transferred from FPL to Messalonskee Stream Hydro, LLC in 2003.

The Project is located at river mile 1 approximately 1.6 miles downstream of the Automatic hydroelectric project in the town of Waterville, Maine. No dams are below the Project. Project works consist of a 343-foot-long dam with 1.5-foot-high flashboards; a powerhouse containing one 1.5-MW generator; and a 1.5-mile-long impoundment with a gross storage capacity of 600 acre-feet. The original dam failed in 2001 and was rebuilt in 2007.

Operation of the Union Gas Facility is dependent on inflow to Messalonskee Lake. When inflow to Messalonskee Lake is greater than approximately 570 cfs, the Union Gas project is operated as a run-of-river project. All water that does not go through the turbines is passed over the spillway. When inflow is less than approximately 570 cfs, the project is cycled based on stored water that is released from Messalonskee Lake. MSH utilizes the top 0.5 feet of Messalonskee Lake as storage for generation during the summer months and the top 1.0 foot during the winter months.

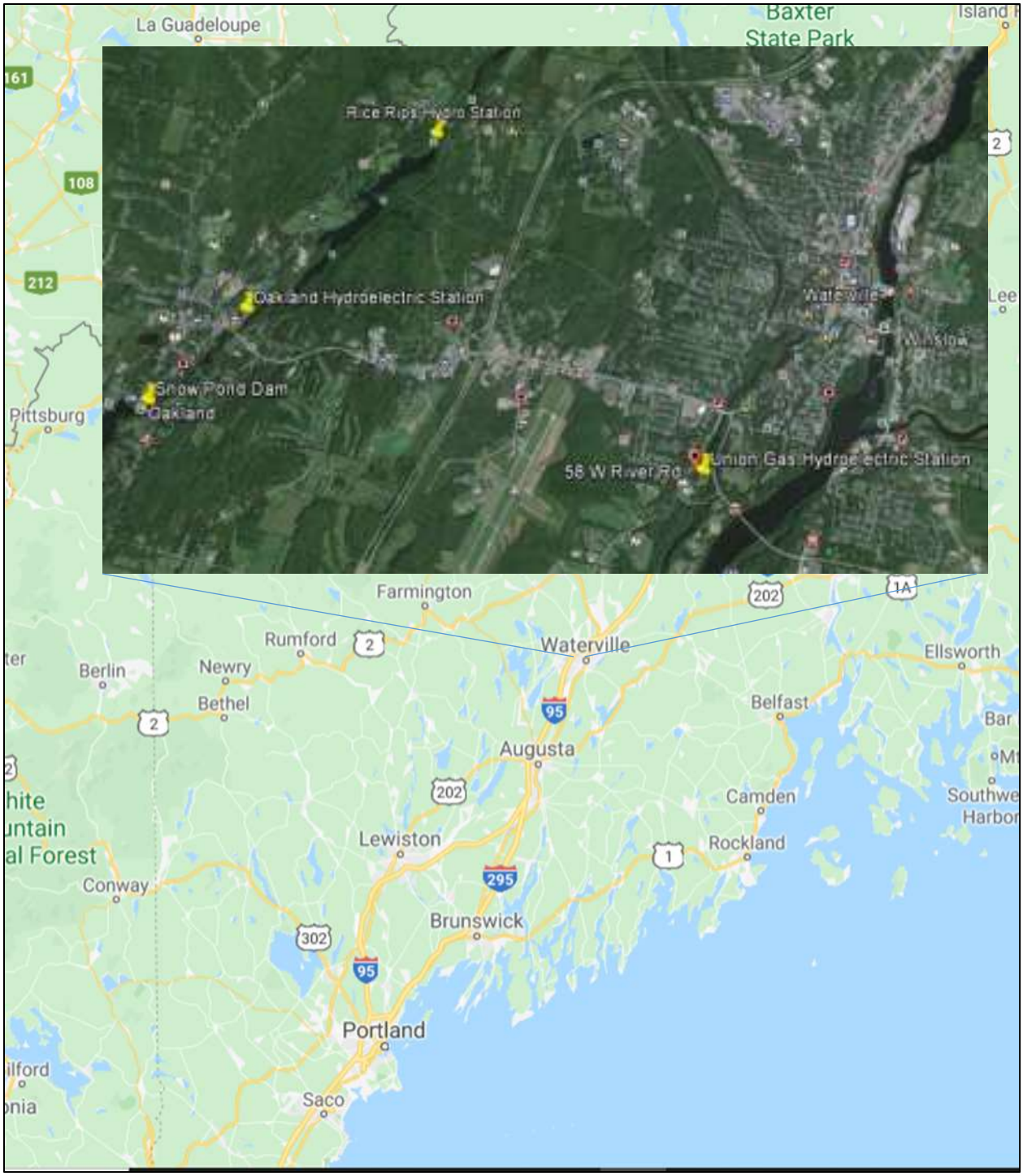


Figure 1 Union Gas Hydroelectric Project location and nearby dams

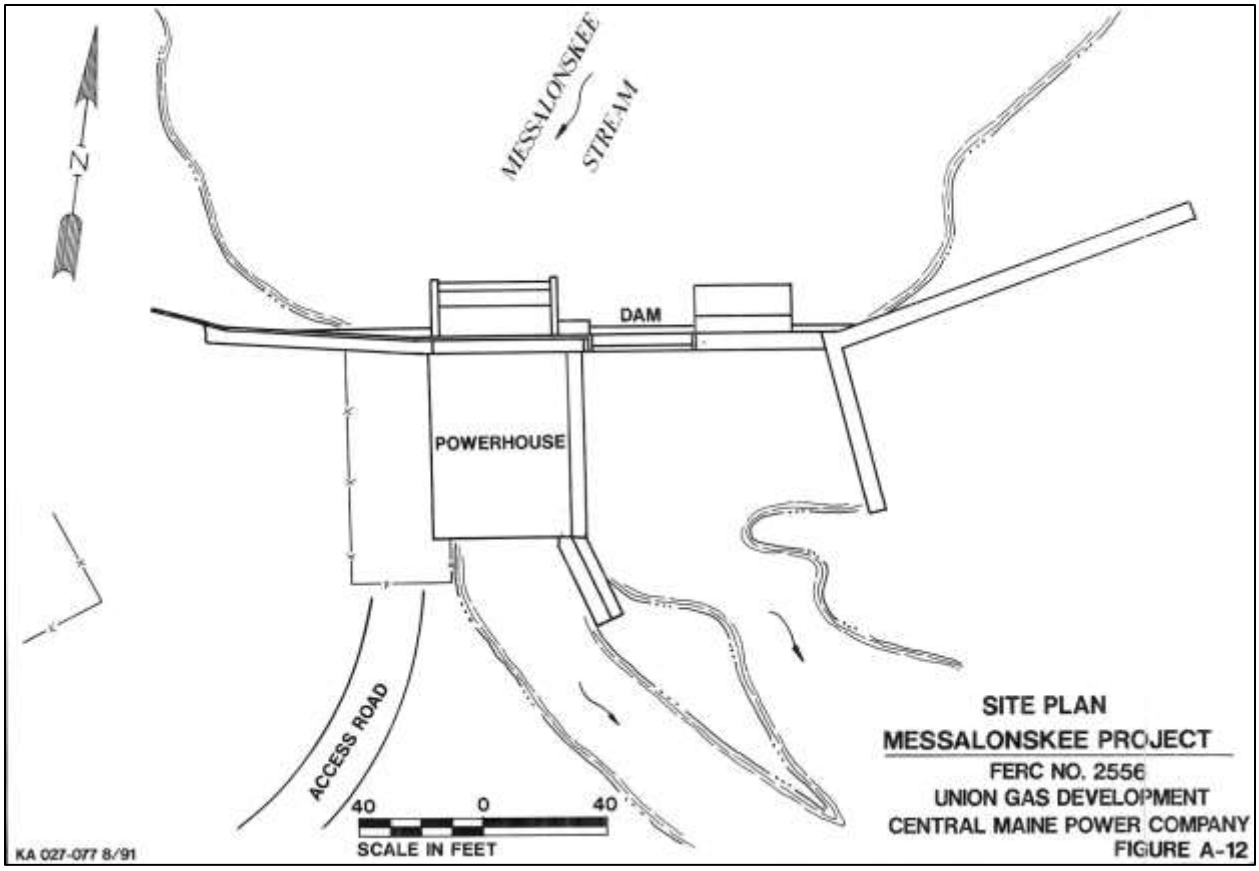


Figure 2 Project Layout

Figure 3 Designated Zones of Effect

Table 1 Facility Description Information

Item	*Information Requested*	*Response (include references to further details)*
Name of the Facility	Facility name (use FERC project name or other legal name)	Union Gas Hydroelectric Project
Reason for applying for LIHI Certification	1. To participate in state RPS program 2. and specify the state and the total MW/MWh associated with that participation (value and % of facility total Mw/MWh). 3. To participate in voluntary REC market (e.g., Green-e) 4. To satisfy a direct energy buyer's purchasing requirement 5. To satisfy the facility's own corporate sustainability goals 6. For the facility's corporate marketing purposes 7. Other (describe)	MA II RPS Program, 100%
	If applicable, amount of annual generation (MWh and % of total generation) for which RECs are currently received or are expected to be received upon LIHI Certification	5,606 MWh, 100%
Location	River name (USGS proper name)	Messalonskee Stream
	Watershed name - Select region, click on the area of interest until the 8-digit HUC number appears. Then identify watershed name and HUC-8 number from the map at: https://water.usgs.gov/wsc/map_index.html	Lower Kennebec HUC 08: 0103000310
	Nearest town(s), county(ies), and state(s) to dam	Waterville, Kennebec, ME
	River mile of dam above mouth	1.0
	Geographic latitude of dam	44.53435
	Geographic longitude of dam	-69.65230
Facility Owner	Application contact names (Complete the Contact Form in Section B-4 also):	Andrew Locke, Essex Power Services, Inc.

Item	*Information Requested*	*Response (include references to further details)*
	Facility owner company and authorized owner representative name. **For recertifications: If ownership has changed since last certification, provide the effective date of the change.**	Messalonskee Stream Hydro, LLC Andrew Locke
	FERC licensee company name (if different from owner)	n/a
Regulatory Status	FERC Project Number (e.g., P-xxxxx), issuance and expiration dates, or date of exemption	FERC Project No. P-2556 Issued July 28, 1999 Expires June 30, 2036
	FERC license type (major, minor, exemption) or special classification (e.g., "qualified conduit", "non-jurisdictional")	Major
	Water Quality Certificate identifier, issuance date, and issuing agency name. Include information on amendments.	Issued August 29, 1995 by State of Maine Department of Environmental Protection
	Hyperlinks to key electronic records on FERC e-library website or other publicly accessible data repositories	FERC License: https://elibrary.ferc.gov/eLibrary/filelist?document_id=1968904&accessionnumber=19990729-0220
Powerhouse	Date of initial operation (past or future for pre-operational applications)	Early 1900s
	Total installed capacity (MW) **For recertifications: Indicate if installed capacity has changed since last certification**	1.5 MW – No change since last certification
	Average annual generation (MWh) and period of record used **For recertifications: Indicate if average annual generation has changed since last certification**	5,606 MWh 2010-2020
	Mode of operation (run-of-river, peaking, pulsing, seasonal storage, diversion, etc.) **For recertifications: Indicate if mode of operation has changed since last certification**	Run-of-river and limited storage Inflow > 570 cfs: run-of-river Inflow < 570 cfs: cycled

Item	***Information Requested***	***Response (include references to further details)***
	Number, type, and size of turbine/generators, including maximum and minimum hydraulic capacity and maximum and minimum output of each turbine and generator unit	One Vertical Francis turbine, Rated 1.5 MW. Max 660 CFS Min 324 CFS 1,875 KVA Generator Max output 1.5 MW Min Output .77 MW
	Trashrack clear spacing (inches) for each trashrack	3
	Approach water velocity (ft/s) at each intake if known	Unknown
	Dates and types of major equipment upgrades **For recertifications: Indicate only those since last certification**	N/A
	Dates, purpose, and type of any recent operational changes **For recertifications: Indicate only those since last certification**	Starting in 2020, night time shutdowns were enacted from September 1 through October 30 from 6pm to 2am each evening. The shutdowns were implemented to provide safe downstream eel passage.
	Plans, authorization, and regulatory activities for any facility upgrades or license or exemption amendments	N/A
Dam or Diversion	Date of original dam or diversion construction and description and dates of subsequent dam or diversion structure modifications	1899-sometime in the 1900s.
	Dam or diversion structure length, height including separately the height of any flashboards, inflatable dams, etc. and describe seasonal operation of flashboards and the like	343 foot long dam, of which spillway is 32 ft 3 inches long with 1.5 high flashboards. Flashboards are kept in at all times.
	Spillway maximum hydraulic capacity	Unknown
	Length and type of each penstock and water conveyance structure between the impoundment and powerhouse	N/A
	Designated facility purposes (e.g., power, navigation, flood control, water supply, etc.)	Power supply
Conduit Facilities Only	Date of conduit construction and primary purpose of conduit	n/a

Item	***Information Requested***	***Response (include references to further details)***
	Source water	n/a
	Receiving water and location of discharge	n/a
Impoundment and Watershed	Authorized maximum and minimum impoundment water surface elevations **For recertifications: Indicate if these values have changed since last certification**	Maximum 69.1 feet Minimum 67.8 feet
	Normal operating elevations and normal fluctuation range **For recertifications: Indicate if these values have changed since last certification**	Maintained at 69.1 feet No change
	Gross storage volume and surface area at full pool **For recertifications: Indicate if these values have changed since last certification**	Volume: 600 Acre-Feet Surface Area: 25 acres No change
	Usable storage volume and surface area **For recertifications: Indicate if these values have changed since last certification**	None, run of river
	Describe requirements related to impoundment inflow and outflow, elevation restrictions (e.g., fluctuation limits, seasonality) up/down ramping and refill rate restrictions.	Operation of the Union Gas Facility is dependent on inflow to Messalonskee Lake. When inflow to Messalonskee Lake is greater than approximately 570 cfs, the Union Gas project is operated as a run-of-river project. When inflow is less than approximately 570 cfs, the project is cycled. All water that does not go through the turbines is passed over the spillway. MSH utilizes the top 0.5 feet of Messalonskee Lake as storage for generation during the summer months and the top 1.0 foot during the winter months.

Item	***Information Requested***	***Response (include references to further details)***

	Upstream dams by name, ownership and river mile. If FERC licensed or exempt, please provide FERC Project number of these dams. Indicate which upstream dams have downstream fish passage.	• Automatic Project (FERC #2555)
		  • River Mile 2.5
		• Rice Rips Dam (FERC #2556)
		  • River Mile 7.5
		• Oakland Hydroelectric Project (FERC #2556)
		  • River Mile 9.4
		• Messalonskee Lake Dam (FERC #2556)
		  • River Mile 10.2
		• All Dams owned by MSH
		• Dams have no downstream passage, except for eel (nightly shutdowns 9/1-10/30 each year).

	Downstream dams by name, ownership, river mile and FERC number if FERC licensed or exempt. Indicate which downstream dams have upstream fish passage	• No dams are downstream of Union Gas
	Operating agreements with upstream or downstream facilities that affect water availability and facility operation	N/A
	Area of land (acres) and area of water (acres) inside FERC project boundary or under facility control. Indicate locations and acres of flowage rights versus fee-owned property.	19 acres Dam, power house owned fee simple. (approx. 1 acre) Flowage rights for river portions and banks of impoundment and area below dam.
Hydrologic Setting	Average annual flow at the dam, and period of record used	310 – see study comment in next row.

<table>
<tr><th>Item</th><th>Information Requested</th><th>Response (include references to further details)</th></tr>
<tr><td></td><td>Average monthly flows and period of record used</td><td><table><tr><td>January</td><td>250</td></tr><tr><td>February</td><td>273</td></tr><tr><td>March</td><td>518</td></tr><tr><td>April</td><td>967</td></tr><tr><td>May</td><td>439</td></tr><tr><td>June</td><td>215</td></tr><tr><td>July</td><td>107</td></tr><tr><td>August</td><td>72</td></tr><tr><td>September</td><td>75</td></tr><tr><td>October</td><td>136</td></tr><tr><td>November</td><td>300</td></tr><tr><td>December</td><td>368</td></tr></table>Based on 1989 Hydrologic Analysis</td></tr>
<tr><td></td><td>Location and name of closest stream gaging stations above and below the facility</td><td>Nezinscot and Sheepscot USGS gages – both rivers are in proximity to Messalonskee Stream. No published USGS data exists for Messalonskee Stream. See included Messalonskee Hydrologic Study include with this application (Appendix 1).</td></tr>
<tr><td></td><td>Watershed area at the dam (in square miles). Identify if this value is prorated from gage locations and provide the basis for proration calculation.</td><td>178 square miles</td></tr>
<tr><td></td><td>Other facility specific hydrologic information</td><td>n/a</td></tr>
<tr><td>Designated Zones of Effect</td><td>Number of zones of effect</td><td>3</td></tr>
<tr><td></td><td>Type of waterbody (river, impoundment, bypassed reach, etc.)</td><td>Zone 1 – Impoundment
Zone 2 –Bypass
Zone 3- Tailrace</td></tr>
<tr><td></td><td>Upstream and downstream locations by river miles</td><td>Zone 1: RM 1.5 – RM 1.0
Zone 2: RM 1.0 – RM .9
Zone 3: RM 1 – RM .32</td></tr>
<tr><td></td><td>Delimiting structures or features</td><td>Dam, bypass reach, tailrace below power house</td></tr>
<tr><td colspan="3">Pre-Operational Facilities Only</td></tr>
<tr><td>Expected operational date</td><td>Date generation is expected to begin</td><td>n/a</td></tr>
</table>

Item	*Information Requested*	*Response (include references to further details)*
Dam, diversion structure or conduit modification	Description of modifications made to a pre-existing conduit, dam or diversion structure needed to accommodate facility generation. This includes installation of flashboards or raising the flashboard height. Date the modification is expected to be completed	n/a
Change in water flow regime	Description of any change in impoundment levels, water flows or operations required for new generation	n/a

PART II. STANDARDS MATRICES

Zone of Effects #1 – Impoundment

	Criterion	*Alternative Standards Applied*				
		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*			
F	Threatened and Endangered Species Protection		*x*			
G	Cultural and Historic Resources Protection		*x*			
H	Recreational Resources		*x*			

Zone of Effects #2 –Bypass

	Criterion	*Alternative Standards Applied*				
		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*			
F	Threatened and Endangered Species Protection		*x*			
G	Cultural and Historic Resources Protection		*x*			
H	Recreational Resources		*x*			

Zone of Effects #3–Tailrace

	Criterion	*Alternative Standards Applied*				
		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*			
F	**Threatened and Endangered Species Protection**		*x*			
G	**Cultural and Historic Resources Protection**		*x*			
H	**Recreational Resources**		*x*			

PART III. SUPPORTING INFORMATION

III.A.1 Ecological Flows

Criterion A.2 – Agency Recommendation was selected for all three zones.

Zone of Effects #1 – Impoundment

A	2	<u>Agency Recommendation (see Appendix A for definitions):</u> • 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 protective). • 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 formal 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). • Explain how flows are monitored for compliance.

Supporting Information:

The Union Gas Project is operated in run of river mode. Operation of Union Gas is dependent on inflow to Messalonskee Lake and discharge from the upstream Messalonskee Lake Dam. When inflow to Messalonskee Lake is greater than approximately 570 cfs, Union Gas is operated as a run-of-river project. When inflow is less than approximately 570 cfs the project is cycled. Fifteen cfs is discharged at all times through the bypass reach. All additional water that does not go through the turbines is discharged over the project's spillway and through the bypass.

The Union Gas Facility maintains a relatively constant headpond and has 1.3 feet of usable storage capacity. Article 401 of the project license defined the project minimum flows, stating that "the project shall release a minimum flow of 100 cfs, or project inflows, whichever is less (except at no time shall minimum flows drop below fifteen cfs)." Following the 1999 license order for the three Messalonskee projects with this 100 cfs minimum flow requirement, the licensee requested a rehearing of FERC's order, arguing that the State-ordered flow rate of 15 cfs is adequate to protect fish resources in the Messalonskee. In October, 2000[1], FERC agreed and modified the three licenses to reduce the minimum flow regime to 15 cfs from 100 cfs.

This mode of operation is the result of agency recommendations from the Maine Department of Environmental Protection ("DEP"), as described in the 401 Water Quality Certificate ("WQC") (#L-17585-33-D-N, Issued 8/28/1995) which is included as Appendix 2. As part of the application for the WQC, the applicant conducted a study entitled "Hydrologic Analysis of the Messalonskee Stream Drainage" (attached as Appendix 1). The purpose of this study was to provide an understanding of the watershed and examine the availability of water in Messalonskee Stream. The water quality in Messalonskee Stream was characterized as poor, since the levels of dissolved oxygen observed had in many instances violated state water quality standards. The cause of this dissolved oxygen impairment was determined to be phosphorus loading from the Union Gas wastewater treatment facility, existing dams and hydroelectric facilities, and algal blooms.

The 1990 DEP report "Messalonskee Stream Summary", discussed several options for improving the water quality of the Messalonskee Stream. These options included increasing minimum flows from Messalonskee Lake; complete source elimination of effluent from the Union Gas treatment plant; rerouting the effluent discharge to a location downstream of Union Gas Lake; and removal of effluent during the summer months. Complete source elimination and rerouting the effluent were ruled out as being too expensive to implement. The MDEP Division of Environmental Assessment commented in the WQC that "there is a reasonable assurance that Class C dissolved oxygen standards in Messalonskee Stream will be met if the applicant passes a minimum flow of fifteen cfs through all project developments, including the Union Gas bypass, provided the applicant monitor water quality in Messalonskee Stream."

The Water Quality Monitoring Plan, dated March 30, 2001[2] states that "monitoring will continue (for up to 5 years) until sufficient data has been obtained to confirm that water quality standards are met throughout the stream during extended periods of minimum flow release (fifteen cfs) and high water temperature conditions." These studies were carried out by FPL Energy and sufficiently demonstrated that water quality standards for dissolved oxygen are met throughout the stream. Included in the Application for the WQC was a study entitled "Fishery Resources of the Messalonskee Project", which documented surveys of the impoundments and free flowing stretches of stream at all five developments. Based on a review of these studies, MDEP recommended that a minimum flow of fifteen cfs below all of the project developments

[1] https://elibrary.ferc.gov/eLibrary/docinfo?document_id=2095775
[2] https://elibrary.ferc.gov/eLibrary/docinfo?document_id=2138405

would also be adequate to achieve and maintain suitability of the project waters affected by the project(s) as habitat for fish and other aquatic life (see WQC).

The Union Gas Project is a run-of-river facility and must maintain its impoundment level within 1.3 feet of full impoundment level, 69.1 feet. In practice all four hydro projects on the Messalonskee Stream are operated in tandem resulting in the project keeping a constant head and not significantly increasing or decreasing the streamflow in the Messalonskee Stream. Flow moves downstream from the Messalonskee Lake through the Oakland project, then onto the Rice Rips project, Automatic (FERC No. 2555), and finally the Union Gas project before it enters the Kennebec River. Streamflow levels as reported from these facilities are logged daily as means to ensure compliance with the conditions of the WQC and FERC license. Finally, per its FERC license, the Union Gas Project must ramp down turbine operations over a 30 minute period when shutting down operations.

Zone of Effects #2 – Bypass
The same discussion points discussed in Zone #1 are applicable to Zone #2.

Zone of Effects #3 – Tailrace
The same discussion points discussed in Zone #1 are applicable to Zone #3.

III.B.1 Water Quality

Zone of Effects #1 - Impoundment

B	2	<u>Agency Recommendation:</u> • Provide a copy of the most recent Water Quality Certificate and any subsequent amendments, including the date(s) of issuance. If more than 10 years old, provide documentation that the certification terms and conditions remain valid and in effect for the facility (e.g., a letter from the agency). • Identify any other agency recommendations related to water quality and explain their scientific or technical basis. • Describe all compliance activities related to water quality and any agency recommendations for the facility, including on-going monitoring, and how those are integrated into facility operations.

Supporting Information:

The Maine DEP does not list Messalonskee Stream as impaired, pursuant to the Federal Clean Water Act, Section 303(d). The entire stream is listed as a Category 2, Rivers and Streams Attaining Some Designated Uses – Insufficient Information for Other Uses in the Department's 2016 Integrated Water quality Monitoring and Assessment Report (305b Report)[3].

[3] https://www.maine.gov/dep/water/monitoring/305b/2016/28-Feb-2018_2016-ME-IntegratedREPORT.pdf

The Project received a 401 Water Quality Certificate (WQC) from the State of Maine Department of Environmental Protection ("MDEP") on August 29, 1995 (see Appendix 2). The WQC noted that waters from the outlet of the Messalonskee Lake to its confluence with the Kennebec River are currently designated Class C by the MDEP. Class C waters are of such quality that they are suitable for the designated uses of drinking water supply after treatment; fishing; recreation in and on the water; industrial process and cooling water supply; hydroelectric power generation, and navigation; and as habitat for fish and other aquatic life. As discussed above in the flows sections, the project is required to maintain a minimum flow of fifteen cfs at all times in order to minimize the effect of phosphorus loading and to maintain suitable habitat for fish and other aquatic life.

Pursuant to the WQC, MDEP notes in *c. Discussion* on page 7 and 8, that

"The DEP Division of Environmental Assessment (DEA) comments that implementation of a minimum flow of 15 cfs, in combination with the proposed seasonal land application of effluent from the Union Gas Waste Water Treatment Plant[4], should allow Messalonskee Stream to meet Class C dissolved oxygen standards; however, water quality sampling should be conducted in Messalonskee stream to document attainment of standards."

"There is a reasonable assurance that Class C dissolved oxygen standards in Messalonskee Stream will be met if the applicant passes a minimum flow of 15 cfs through all project developments, including the Union Gas bypass, provided the applicant monitor water quality in Messalonskee Stream. The top 0.5 feet of Messalonskee Lake shall be used for generation flows and to augment natural flows during the summer months as necessary."

As noted in the Ecological Flows section of this application, MSH complies with the 15 cfs minimum flow requirement and here have been no changes in the regulatory status of the project since its last LIHI certification in 2015 nor have there been any agency comments noting deficiencies in the project's compliance with its WQC.

Messalonskee has initiated contact with the MDEP to review if the original WQC certification terms and conditions remain valid and in effect for the facility.

Zone of Effects #2 – Bypass
The same discussion points discussed in Zone #1 are applicable to Zone #2.

Zone of Effects #3 – Tailrace
The same discussion points discussed in Zone #1 are applicable to Zone #3.

[4] In 2012, the Town of Oakland completed the transition of its sewer system to the Waterville Sewerage District (WSD) system. The town's former treatment plant was converted to a pump station, thereby eliminating the discharge of treated sewerage into Messalonskee Stream and instead delivering raw sewerage to the Webb Road sewer piping in Oakland, where it flows into the WSD system en route to the Kennebec Sanitary Treatment District plant. https://www.maine.gov/dacf/municipalplanning/comp_plans/Oakland_2020.pdf pg. 61

III.C.1 Upstream Fish Passage

Zone of Effect #1 - Impoundment

C	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 protective). • 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. • Describe any provisions for fish passage monitoring or effectiveness determinations that are part of the agency recommendation, and how these are being implemented. • Provide evidence that required passage facilities are being operated and maintained as mandated (e.g. meets season, coordination with agencies)

Supporting Information:
There is no available evidence supporting historic presence of anadromous species in any portion of Messalonskee Stream and there is a very limited quantity of meaningful rearing and spawning habitat upstream of the dams for anadromous species. The catadromous American eel are present in Messalonskee stream.

In 2010 a proposal was made, at the request of the Maine Department of Marine Resources (MDMR), to address the lack of upstream and downstream passage for American eel, the only diadromous species that have historically used Messalonskee Stream (see Appendix 3). Between 2010 and 2018 upstream passage was installed at all five dams on the Messalonskee Stream, with the last passage being installed at Messalonskee Lake Dam in 2018. MDMR approved the passages as permanent in 2019 (see Appendix 4).

Zone of Effects #2 – Bypass
The same discussion points discussed in Zone #1 are applicable to Zone #2.

Zone of Effects #3 – Tailrace
The same discussion points discussed in Zone #1 are applicable to Zone #3.

III.D.1 Downstream Fish Passage

ZoE #1 - Impoundment

D	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 protective). • Explain the scientific or technical basis for the agency recommendation, including method and data used. This is required

		regardless of whether the recommendation is part of a Settlement Agreement or not. • Describe any provisions for fish passage monitoring or effectiveness determinations that are part of the agency recommendation, and how these are being implemented. • Provide evidence that required passage facilities are being operated and maintained as mandated (e.g. meets season, coordination with agencies)

As noted in Section 3, there is no available evidence supporting historic presence of anadromous species in any portion of Messalonskee Stream and there is a very limited quantity of meaningful rearing and spawning habitat upstream of the dams for anadromous species. The catadromous American eel are present in Messalonskee stream.

D	PLUS	<u>Bonus Activities:</u> • If advanced technology has been or will be deployed, explain how it will increase fish passage success relative to other options. • If a basin-scale redevelopment strategy is being pursued, explain how it will increase the abundance and sustainability of migratory fish species in the river system. • If adaptive management is being applied, describe the management objectives, the monitoring program pursuant to evaluating performance against those objectives, and the management actions that will be taken in response to monitoring results.

No downstream passage was provided for eel at the Union Gas project until 2020. Up until 2020, eel were trapped at the Messalonskee Lake Dam and trucked down to the tailrace of the Union Gas project. This program had limited success and in 2020 after consulting with MDMR, it was decided that downstream passage would be provided by shutting down all four hydroelectric projects, including Union Gas, from 6pm to 2am from September 1 through October 30. This approach was followed for 2020 and resulted in 11 eels being trapped at the Union Gas project (the last project on the Messalonskee Stream) (see Appendix 5). Messalonskee will continue to follow this plan prospectively and adjust the timing of the shutdowns based on feedback from MDMR.

This basin-scale redevelopment strategy will ensure that downstream migrants will face no threat from the projects during the shutdowns. The removal of this man made threat will

greatly contribute to increasing the abundance and sustainability of eel on the Messalonskee Stream.[5]

Zone of Effects #2 – Bypass
The same discussion points discussed in Zone #1 are applicable to Zone #2.

Zone of Effects #3 – Tailrace
The same discussion points discussed in Zone #1 are applicable to Zone #3.

III.E.1 Shoreline and Watershed Protection

Zone of Effects #1 – Impoundment

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.

Supporting Information:
The primary watershed area for the Messalonskee projects is the Messalonskee Lake that is impounded by the Messalonskee Lake dam located in the village of Union Gas, Maine. The Messalonskee Lake has a total drainage area of 177 square miles. From the Messalonskee Lake to the limits of the watershed, the landscape is forested and rural with small towns scattered throughout. The bedrock of the Messalonskee Lake watershed is made up of a mixture of sand, silt, clay, gravel and granite. All of the land in the immediate vicinity of the Lord's South dam is urban in character, developed and privately owned.

The watershed area formed by the Union Gas dam impoundment extends approximately 1.5 miles upstream from the Project to the Automatic dam. The Union Project has a gross reservoir volume of 600 acre-feet. The 200-foot boundary zone extending around the Union impoundment is highly developed, bordered by a steep gradient and is comprised of land occupied by commercial buildings and residential homes.

The flows below the Union Gas hydroelectric project have minimal effect on shoreline erosion due to the predominantly granite and gravel substrates in the tailrace areas. There has been minimal colonization of exposed shorelines by emergent plants within the 200-foot boundary area due to the inhospitable landscape and steep slopes along 60 percent of the shoreline.

[5] Full upstream passage for eel was available starting in 2018 with the installation of the Messalonskee Lake Dam upstream passage, the last page on the Messalonskee Stream to be installed. Based on the lifecycle of eel it will be approximately 15 to 16 years before large downstream eel populations begin to be seen.

All of the Messalonskee projects, including the Union Gas Project, are required per Article 408 of Messalonskee' s FERC license issued on July 28, 1999 to operate within the guidelines of a Waterfowl Management Plan developed in conjunction with and periodically reviewed by the Maine Department of Inland Fishers and the U.S. Fish and Wildlife Service[6]. The most recent Waterfowl Survey was completed in the summer of 2020[7].

Zone of Effects #2 – Bypass
The same discussion points discussed in Zone #1 are applicable to Zone #2.

Zone of Effects #3 – Tailrace
The same discussion points discussed in Zone #1 are applicable to Zone #3.

III.F.1 Threatened and Endangered Species

Zone of Effects #1 –Impoundment

F	2	Finding of No Negative Effects: • Identify all federal and state listed species that are or may be in the immediate facility area based on current data from the appropriate state and federal natural resource management agencies. • Provide documentation that there is no demonstrable negative effect of the facility on any listed species in the area from an appropriate natural resource management agency or provide documentation that habitat for the species does not exist within the ZoE or is not impacted by facility operations.

Supporting Information:
An online data check of the USFWS IPaC website[8] shows that the federally-threatened Northern long-eared bat could be present in the Project vicinity (Appendix 6). There is no critical habitat designated for the bat.

The IPaC report also lists Atlantic salmon present in the Gulf of Maine; however, per consultation with USFW during the 2015 LIHI Rectification process, passage of Atlantic salmon in the Messalonskee watershed is not desirable and there is no adverse effect from the lack of fish passage and the normal operation of the Union Gas Dam (Appendix 7).

Per the Maine Department of Inland Fisheries and Wildlife, Black Terns are the only state listed endangered species associated with the Messalonskee Lake (Appendix 8). The Black Terns nest in the summer in the Messalonskee Lake impoundment; however, as evidenced through the waterfowl survey process, their habitat and nesting practices are not adversely impacted by the operation of the Messalonskee projects, including the management of the Messalonskee Lake water level.

[6] https://elibrary.ferc.gov/eLibrary/docinfo?document_id=2057133
[7] https://elibrary.ferc.gov/eLibrary/docinfo?document_id=14924833
[8] https://ecos.fws.gov/ipac/

Zone of Effects #2 – Bypass
The same discussion points discussed in Zone #1 are applicable to Zone #2.

Zone of Effects #3 – Tailrace
The same discussion points discussed in Zone #1 are applicable to Zone #3.

III.G.1 Cultural and Historic Resources

Zone of Effects #1 – Impoundment

G	2	Approved Plan: • Provide documentation of all approved state, 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.

Supporting Information:
Under its license, Article 414, Messalonskee is required to assess on a periodic basis whether precontact period archaeological resources reported within the Messalonskee Project were being impacted by the ongoing operation of the Messalonskee Project, specifically the adjustment of the Messalonskee Lake levels for hydro operations. The most recent report was submitted to FERC in August of 2020 with the support of the Maine Historic Preservation Commission[9]. The report concluded that project operations continue to have no negative effect on the sites identified for monitoring. The next survey is schedule for 2024.

Zone of Effects #2 – Bypass
The same discussion points discussed in Zone #1 are applicable to Zone #2.

Zone of Effects #3 – Tailrace
The same discussion points discussed in Zone #1 are applicable to Zone #3.

III.H.1 Recreational Resources

Zone of Effects #1 – Impoundment

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.

Supporting Information:

[9] https://elibrary.ferc.gov/eLibrary/docinfo?document_id=14881284

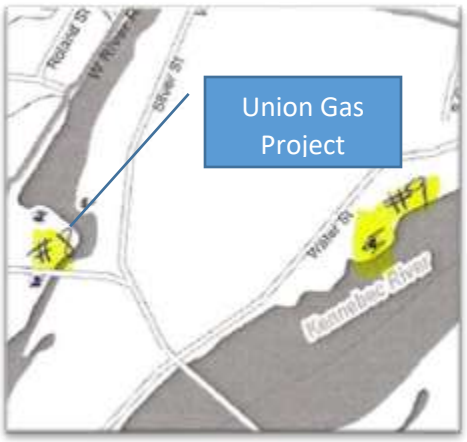
Article 412 of the Messalonskee license requires monitoring of the recreational needs and facilities at the Project every six years. The most recent report was filed on July 14, 2016[10].

In response to the report's filing, FERC ordered MSH on September 6, 2016 to consult with various agencies as to the need for accessible fishing at MSH's Union Gas Project. The outcome of that effort resulted in an ADA accessible fishing platform being installed at the Messalonskee Lake.[11][12]

The next recreational survey was schedule to be submitted by September 30, 2021; however, due to the Corona Virus pandemic, FERC approved a delay of one year. As such, the next survey will be conducted during 2021-22 and submitted in the fall of 2022.

The Union Gas Project offers a boat ramp on the Kennebec River and fishing in the tailrace along with informal access from the East side of the river.

#	Location
8	UG: Informal East Side Access
8	UG: Tail Race Fishing
9	UG: Waterville Boat Ramp



[10] https://elibrary.ferc.gov/eLibrary/docinfo?document_id=14477838
[11] https://elibrary.ferc.gov/eLibrary/docinfo?document_id=14619550
[12] https://www.wabi.tv/content/news/Wheelchair-Accessible-Fishing-Platform-Open-for-Use-in-Oakland-444023243.html

PART IV. CONTACTS

Company Contacts

Project Owner: Messalonskee Stream Hydro, LLC	
Name and Title	Andrew Locke, President
Company	HCE Dodge Falls, Inc., Operating Member
Phone	(617) 367-0032
Email Address	alocke@essexhydro.com
Mailing Address	55 Union Street, Boston, MA 02108
Project Operator (if different from Owner):	
Name and Title	Robert Thornton, Operations Manager
Company	Essex Power Services, Inc.
Phone	617-367-0032
Email Address	rthornton@essexhydro.com
Mailing Address	c/o Essex Hydro Associates, 55 Union St, 4th Floor Boston, MA 02108
Consulting Firm / Agent for LIHI Program (if different from above):	
Name and Title	
Company	
Phone	
Email Address	
Mailing Address	
Compliance Contact (responsible for LIHI Program requirements):	
Name and Title	Andrew Locke, Treasurer
Company	Essex Power Services, Inc.
Phone	(617) 367-0032
Email Address	alocke@essexhydro.com
Mailing Address	c/o Essex Hydro Associates, 55 Union Street, Boston, MA 02108
Party responsible for accounts payable:	
Name and Title	Maureen Donnelly
Company	Essex Power Services, Inc.
Phone	(617) 367-0032
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Mailing Address	c/o Essex Hydro Associates, 55 Union Street, Boston, MA 02108

Agency Contacts

Agency Contact (Check area of responsibility: Flows_ _, Water Quality __, Fish/Wildlife Resources _X_, Watersheds _X_, T/E Spp. _, Cultural/Historic Resources __, Recreation __):	
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Mailing Address	306 Hatchery Road East Orland, ME 04431

Agency Contact (Check area of responsibility: Flows_x_, Water Quality _X_, Fish/Wildlife Resources __, Watersheds _X_, T/E Spp. __, Cultural/Historic Resources __, Recreation __):	
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Name and Title	Kathy Howatt, Hydropower Coordinator, DLRR
Phone	207-446-2642
Email address	Kathy.Howatt@maine.gov
Mailing Address	17 State House Station Augusta, Maine 04333-0017

Agency Contact (Check area of responsibility: Flows__, Water Quality __, Fish/Wildlife Resources _, Watersheds __, T/E Spp. _ _, Cultural/Historic Resources _x_, Recreation __):	
Agency Name	Maine Historic Preservation Commission
Name and Title	Dr. Arthur Spiess, PhD., Chief Historic Preservationist
Phone	207-287-2789
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Agency Contact (Check area of responsibility: Flows__, Water Quality __, Fish/Wildlife Resources _X_, Watersheds __, T/E Spp. __, Cultural/Historic Resources __, Recreation _ _):	
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Email address	gail.wippelhauser@maine.gov
Mailing Address	#172 State House Station Augusta, ME 04333

Agency Contact (Check area of responsibility: Flows__, Water Quality __, Fish/Wildlife Resources __, Watersheds __, T/E Spp. __, Cultural/Historic Resources _ _, Recreation _x_):	
Agency Name	Bureau of Parks and Lands
Name and Title	James Vogel, Senior Planner
Phone	207-287-2163
Email address	
Mailing Address	22 State House Station Augusta, ME 04333-0022

Agency Contact (Check area of responsibility: Flows__, Water Quality _ _, Fish/Wildlife Resources _X_, Watersheds _x_, T/E Spp. __, Cultural/Historic Resources __, Recreation __):	
Agency Name	Maine Department of Inland Fisheries
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Email address	John.perry@maine.gov
Mailing Address	284 State Street, 41 SHS Augusta, ME 04333

Agency Contact (Check area of responsibility: Flows_ _, Water Quality __, Fish/Wildlife Resources _X_, Watersheds _ _, T/E Spp. _x , Cultural/Historic Resources __, Recreation __):	
Agency Name	Maine Department of Inland Fisheries
Name and Title	Keel Kemper, Regional Wildlife Biologist
Phone	207-287-5369
Email address	Keel.Kemper@maine.gov
Mailing Address	270 Lyons Road Sidney, ME 04988

PART V. SWORN STATEMENT

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 Messalonskee Stream Hydro, 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.

Company Name: Messalonskee Stream Hydro, LLC
Authorized Representative:
Name: Andrew Locke
Title: President, HCE Dodge Falls, Inc.
Operating Member, Messalonskee Stream Hydro, LLC

Authorized Signature: 
Date: February 6, 2021

List of Appendices

- Appendix 1: Messalonskee Hydrologic Study
- Appendix 2: State of ME Water Quality Certificate
- Appendix 3: Letter to Maine DRM Re Eel Passage
- Appendix 4: Messalonskee Upstream Eel Passage Reports and MDMR Approval
- Appendix 5: MSH Union Gas Eel Study Report
- Appendix 6: USFW iPAC Union Gas Report
- Appendix 7: 20160218 USFW Email re LIHI & Endangered Species Email
- Appendix 8: 20210122 MDIFW Endangered Species Messalonskee Email

HYDROLOGIC ANALYSIS
of the
MESSALONSKEE STREAM
DRAINAGE
for
CENTRAL MAINE
POWER COMPANY

prepared by

NORTHROP, DEVINE & TARBELL, INC.
CONSULTING ENGINEERS

OCTOBER 1989

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I. INTRODUCTION AND PURPOSE

Central Maine Power Company (CMP) owns and operates four small hydroelectric stations on Messalonskee Stream. These stations, from upstream to downstream, are Oakland (4000 hp), Rice Rips (2800 hp), Automatic (1250 hp), and Union Gas (2000 hp). CMP also owns and operates the Messalonskee Lake Dam which is located immediately upstream of the Oakland Station. Messalonskee Lake provides storage and flow regulation for the four downstream hydroelectric stations within the constraints imposed by recreational users and lake shore property owners.

The five dams owned by CMP comprise four hydroelectric projects licensed by the Federal Energy Regulatory Commission. These are as follows:

- FERC No. 2559 - Oakland (includes Messalonskee Lake)
- FERC No. 2557 - Rice Rips
- FERC No. 2555 - Automatic
- FERC NO. 2556 - Union Gas

The licenses for each of the four projects expire on December 31, 1993. By current FERC regulations, new license applications must be submitted no later than December 31, 1991. As part of its efforts to obtain new licenses for the stations on Messalonskee Stream, CMP has initiated work on the environmental aspects of the projects.

A complete and accurate understanding of the hydrologic characteristics of the Messalonskee Stream watershed is an essential prerequisite to environmental analysis of the projects and consideration of the possibility of changes to flow regimes in the lower Messalonskee drainage.

This report is intended to provide definition of historic and current hydrologic conditions in the Messalonskee Stream drainage and examine the potential for modifying the present flow regime and regulation pattern.

II. CHARACTERISTICS OF THE MESSALONSKEE STREAM WATERSHED

A. Physical Characteristics

Messalonskee Stream is located within the Kennebec River watershed, as shown in Figure 1. It has a total drainage area of 210 square miles at its mouth. The Messalonskee Stream drainage area is situated in the southern edge of the Kennebec River watershed. Messalonskee Stream enters into the Kennebec River in the town of Waterville, approximately two miles north of the Sidney/Waterville town line.

The headwaters of the Messalonskee drainage are formed by the Belgrade Lakes, consisting of North Pond, East Pond, Salmon Lake, Great Pond, Long Pond, and Snow Pond (Messalonskee Lake). Figure 2 shows the Messalonskee Stream watershed. The drainage area at the outlet of Messalonskee Lake is 177 square miles. The drainage area at the outlet of Long Pond is 121 square miles. The discharge from Long Pond occurs at Wings Mills Dam and flows directly into Messalonskee Lake. The remaining 56 square miles of drainage area above Messalonskee Lake Dam consists of several, small, unregulated lowland streams.

The terrain in the basin can be classified as hilly with relatively wide valleys. While the upland areas can be relatively steep, the perennial streams are generally low gradient, meandering drainages with numerous adjoining wetlands. The normal elevation of East Pond, the uppermost impoundment, is 263 ft, while the elevation of Messalonskee Lake, the lowest of the Belgrade Lakes, is 235.4 ft. Messalonskee Stream discharges into the Kennebec River at an elevation of about 26 ft. Of the 209 ft drop between Messalonskee Lake and the Kennebec River, 176

ft are developed for hydroelectric purposes by the Oakland, Rice Rips, Automatic, and Union Gas impoundments. Figure 3 contains a profile of the stream between Messalonskee Lake and the Kennebec River.

The quantity and distribution of river flow to the lower Messalonskee Stream (below Messalonskee Lake) is predominantly controlled by the operation of Messalonskee Lake Dam. The drainage areas of each of CMP's four hydroelectric sites are indicated in Table 1.

In turn, the quantity and distribution of river flow into Messalonskee Lake is significantly affected by the operation of the Belgrade Lakes. The drainage area at the Wings Mills Dam at the outlet of Long Pond is 121 mi^2, representing 68% of the drainage area above Messalonskee Lake Dam.

North Pond, East Pond, Salmon Lake, Great Pond, and Long Pond comprise (along with Messalonskee Lake) the Belgrade Lakes. The existence and management of these impoundments dominates the flow regime of the lower Messalonskee Stream. It is important to note that the Belgrade Lakes are managed almost exclusively for recreational purposes. The following sections of this report will investigate and define the effect of the management of the Belgrade Lakes on the streamflow characteristics of Messalonskee Stream. Table 2 provides a summary of the lakes of the upper Messalonskee drainage.

Table 1

Drainage Area of Project Dams
Messalonskee Projects

Facility	Drainage Area (mi^2)	Percent of Drainage Area Controlled by Messalonskee Lake Dam
Oakland Station	178	99%
Rice Rips Station	185	96%
Automatic Station	205	86%
Union Gas Station	207	86%

Table 2

Lakes of the Upper Messalonskee Drainage

Name	Normal Water Elev. (ft)	Surface Area (acres)	Drainage Area (mi^2)
East Pond	263.0	1,823	7
North Pond	254.0	2,115	27
Salmon Lake	278.0	667	9
Great Pond	247.7	8,228	83
Long Pond	238.1	2,718	121
Messalonskee Lake[1]	235.4	3,600	177

[1]Top of flashboards.

B. Historic Operating Mode of Messalonskee Lake

While the Belgrade Lakes have historically been managed for flood control and recreational uses, the lower Messalonskee Stream has historically been managed predominantly for generation of electricity to the extent consistent with meeting the expectations of recreational users and shorefront owners along Messalonskee Lake. While no explicit agreement exists, it has been CMP's historic practice to manage water levels in Messalonskee Lake to enhance recreational use during the summer months. A drawdown of 0.5 ft is a target level for management purposes. A drawdown of 1.0 ft or greater is used under extreme hydrologic conditions.

CMP's hydroelectric stations on Messalonskee Stream are operated as a peaking system. The individual projects, when considered separately, operate essentially as run-of-river in that they utilize available inflow and, with the exception of Union Gas, do not draw down the ponds. The Messalonskee system peaking operation is created by management and releases from Messalonskee Lake. When inflows or storage from the lake are available, the system is operated a limited number of hours per day at approximately 530 cfs to 570 cfs constrained by maintaining the target pool level on Messalonskee Lake between elevations 234.9 ft and 235.4 ft. (mean sea level datum). According to the plant operators, a significant number of complaints begin to be registered by waterfront property owners when the pond exceeds 235.6 ft or drops below 234.7 ft. When the plants are not generating, the outflow from Messalonskee Lake Dam is limited to leakage flows estimated at 12 cfs to 15 cfs. The narrow operating band of Messalonskee Lake severely limits its operational flexibility and minimizes the availability of its

storage for downstream uses. Within the normal 6 inch operating band, the storage potential is estimated to be roughly 1500 acre-feet of water. This is equivalent to 25 cfs for one month. At Union Gas, the pond level is controlled by an automated float system, and is drawn down approximately a foot and a half in order to store and utilize the inflow from upstream leakage and runoff for generation.

III. FLOW DURATION ANALYSIS AND RESULTS

A. Available Data and Records

As indicated in Section I, the purpose of this report is to define historic and likely future flow conditions in the lower Messalonskee Stream. The objectives for this report are three-fold:

1. Develop monthly flow duration curves representative of long-term historic flow conditions which accurately portray the quantity and distribution of flow available at each of the project dams.

2. Concentrating on critical low flow months, analyze the potential impact of Water level Order #L-011097-36-A-N enacted on October 30, 1985 which governs the operation of Salmon Lake, Great Pond, and Long Pond (see Appendix 1).

3. Determine the flow available for continuous release from Messalonskee Lake which would be consistent with the Water Level Order while protecting the recreation, fish, wildlife and wetland resources of Messalonskee Lake.

Available data for the project was examined for its adequacy for accomplishing these three objectives. A summary of available data is provided below.

1. Project Data

CMP has collected daily headpond and gate opening data at Messalonskee Dam since the 1940's.

2. U.S.G.S. Data

The United States Geological Survey water supply data for the Nezinscot and Sheepscot Rivers was compiled for analysis. These gages both have long-term records available and are in the proximity of the Messalonskee drainage. The Nezinscot River gage has flow records available since October 1941 while the Sheepscot River gage has continuous records available since October, 1938. No published USGS data exists for Messalonskee Stream.

3. N.O.A.A. Data

Precipitation data from the National Oceanic and Atmospheric Administration were compiled for the Augusta, Waterville, and Rumford stations.

4. Miscellaneous Sources

Other sources of significant information included the DEP Water Level Order #L-011097-36-A-N, DEP files concerning this water level order, interviews with CMP field and office personnel, and CMP internal files.

B. Flow Duration Analysis: Methodology and Results

In reviewing the available data base, it was apparent that the most significant limitations were the lack of gaged streamflow data in Messalonskee or Belgrade Stream, and the lack of historic operations data at Wings Mills Dam (the inlet to Messalonskee Lake).

Data collected by CMP at the Messalonskee Lake Dam was available, and was compiled and reviewed to determine its adequacy for use in further analysis. This data consists of single entry, daily logs maintained by the Plant Operator recording the elevation of Messalonskee Lake, the gate opening, the output of Oakland Station, the time of day that the gate opening was initiated, and the total energy generated for the previous 24 hours. The data were analyzed, and found to be unreliable for the following reasons:

1. The headwater staff gauge is located upstream of the fish protection screen. The screen is often partially clogged by debris thereby developing headlosses which are highly variable, but can exceed 12 inches. Therefore, headwater elevations recorded by the operator will not be representative of actual headwater levels at the gate structure.

2. The headwater levels are recorded using a local datum. The relationship of this datum to mean sea level datum and the elevation of project structures is not known. Therefore, actual head on the gates could not be readily determined.

3. The Plant Operator reported that a drawdown occurs in the approach flow to the gates when one or two gates are open full. This drawdown reflects a headloss due to approach channel geometry. This headloss is variable, but in all cases reduces the head at the gate itself.

4. The actual discharge coefficient of the gate and gate structure is difficult to determine and estimates could be as much as 15% to 20% in error.

Based on these findings, these data were judged to be inadequate for the task of developing reliable monthly flow duration characteristics.

Despite the lack of reliable data collected on-site, it was felt that flow duration curves for the Messalonskee drainage could be simulated reasonably well by utilizing historic data for nearby gaged stream.

ND&T reviewed the available USGS data and drainage area characteristics above several gaged sites. Records were examined to identify gaged sites having both a long-term record and watershed characteristics similar to the Messalonskee drainage. It was preferred that selected gaged sites represent relatively unregulated drainages in order to develop estimates of the amount of inflow likely to be available to Messalonskee Lake during any month. Once inflow was estimated, the historic Messalonskee Lake operating guidelines could be applied to establish flow duration characteristics at the outlet. This attempt to simulate historic flows makes two significant assumptions:

1. Messalonskee Lake storage is limited to less than monthly carry-over, that is, monthly inflow equals monthly outflow.

2. The upper Belgrade Lakes were historically operated as run-of-river facilities.

The first assumption should be reasonably accurate because of the limited operating band of Messalonskee Lake. The second assumption is less certain, as historic operating records for the Belgrade Lakes are unavailable. Nonetheless, the second assumption is generally considered to be historically valid during the low flow summer months when the impoundments were managed to maintain water levels at spillway crest during the recreation season.

Because of the extensive storage and regulation of Messalonskee Stream, it was recognized that its flow characteristics would be quite unique. The Messalonskee Stream drainage above Messalonskee Lake Dam has fully 17% of its area comprised of water bodies. An additional 2 to 3% is characterized by hydrophytic vegetation with direct access to a free water surface. Even in more humid climates, evaporation can significantly exceed precipitation during summer months and, on smaller drainages, play a significant role in the availability of water.

Therefore, the approach to simulation developed by ND&T was to first estimate flow duration characteristics for the watershed in an unregulated state, then apply the regulation pattern used by CMP on these unregulated flows, and finally, to account for the additional losses due to evaporation.

Following the review of USGS records, two gages were selected for analysis based on proximity and drainage area similarity. The gages selected include the Nezinscot and Sheepscot River gages. The Nezinscot River drainage is located 33 miles west southwest of the Messalonskee drainage with a drainage area above the gage of 169 mi^2. The Nezinscot drainage is generally steeper than the

Messalonskee with narrower river valleys and the average elevation is about 200 feet higher. The Sheepscot drainage is located about 25 miles east southeast of the Messalonskee drainage with a drainage area above the gage of 145 square miles. The Sheepscot drainage is generally flatter than the Messalonskee with lower hills and wider river valleys and the average elevation is about 250 ft lower than the Messalonskee drainage. The long-term average daily discharge of each gage is provided in Table 3 in terms of both flow rates and runoff volume per square mile.

While the Messalonskee drainage is more similar to the Nezinscot drainage in terms of terrain and relief, it is more similar to the Sheepscot drainage with respect to river valley geometry and wetland development. The Messalonskee Stream drainage is situated in the transition between the steeper and more rugged drainages to the west and the coastal drainages to the east.

Based on the similarities among these watersheds, it was determined that the long-term (unregulated) monthly inflow to Messalonskee Lake can be estimated by averaging the Nezinscot and Sheepscot River flow data. Therefore, the average monthly volume of inflow to Messalonskee Lake Dam was estimated by computing the mean monthly runoff volume in acre-feet per square mile of the Nezinscot and Sheepscot Rivers and multiplying the average of the monthly means for the two watersheds by the drainage area above the Messalonskee Lake Dam (177 mi^2). Table 4 provides the results of this process.

Using a similar methodology, ND&T also developed estimated flow duration characteristics of the inflow to Messalonskee Lake for

Table 3

Discharge Characteristics of the Nezinscot and Sheepscot Rivers

Month	Nezinscot River		Sheepscot River	
	Mean Daily Flow (cfs/mi^2)	Runoff Volume (ac-ft/mi^2)	Mean Daily Flow (cfs/mi^2)	Runoff Volume (ac-ft/mi^2)
Jan	1.29	79.3	1.52	93.5
Feb	1.46	81.0	1.62	90.0
Mar	2.91	179.0	2.94	180.8
Apr	5.71	339.8	5.22	310.6
May	2.57	158.0	2.39	147.0
Jun	1.27	75.6	1.16	69.0
Jul	0.68	41.8	0.53	32.6
Aug	0.48	29.5	0.33	20.3
Sep	0.50	29.8	0.35	20.8
Oct	0.97	59.6	0.57	35.1
Nov	1.73	102.9	1.66	98.8
Dec	1.91	117.4	2.25	138.3
Avg	1.79		1.71	
Annual Total		1,295.9		1,238.0

Source: USGS Gage records

Table 4

Long-Term Monthly Inflow to Messalonskee Lake

	Mean Daily Flow (cfs)	Volume (ac-ft)
Jan	250	15,372
Feb	273	15,139
Mar	518	31,834
Apr	967	57,559
May	439	26,120
Jun	215	12,797
Jul	107	6,584
Aug	72	4,407
Sep	75	4,476
Oct	136	8,380
Nov	300	17,852
Dec	368	22,637
Mean	310	
Total		224,250

Based on proration of Nezinscot and Sheepscot River gaged data.

each month. This was done by first developing monthly flow duration curves for each of the Nezinscot and Sheepscot drainages. The flow values used in these curves were in terms of cfs per square mile. Each monthly flow duration curve for both rivers was divided into 20 intervals. At each interval, the flow value in cfs per square mile of the Nezinscot and Sheepscot Rivers were averaged. The average value, so derived, was then multiplied by the drainage area above Messalonskee Lake Dam to arrive at the monthly flow duration curves for inflow to Messalonskee Lake.

Next, by applying the operating guidelines of Messalonskee Lake Dam to the estimated available volume of water in any given month, ND&T developed long-term monthly flow duration data for the outflow from Messalonskee Lake Dam.

The inflow and outflow duration curves derived in this manner are shown in Figures 4 through 15. These curves also account for the fact that the current minimum release at Messalonskee Lake Dam, which occurs by leakage through the gates and masonry dam, has been reported to be about 12 cfs.

The flow duration curves of Figures 4 through 15 are considered to be applicable to the Oakland and Rice Rips stations as well as Messalonskee Lake Dam. An additional 30 square miles of watershed drain to Messalonskee Stream between Messalonskee Lake Dam and Automatic Dam. This principally consists of Fish Brook. To account for this additional drainage, runoff factors derived as described above were applied to the intervening drainage area and new flow duration curves were developed. These are shown in Figures 16, 17 and 18.

The flow duration curves shown in Figures 4 through 18 were developed based on the similarities between the Messalonskee Lake watershed and the Nezinscot River and Sheepscot River watersheds. While similar in many respects, the Messalonskee Lake drainage differs from both the Nezinscot and Sheepscot River drainages in two significant ways. First, the regulation of the natural flow regime imposes changes to the distribution of the runoff. This was accounted for by adjusting the estimated natural inflow to reflect the regulation criteria used by CMP. Second, the proportion of drainage area dedicated to impoundments is very significant in the Messalonskee watershed. This has the effect of reducing the quantity of natural runoff due to evaporation losses, specifically during the months of July and August. The impact of evaporation losses is discussed below.

C. Analysis of the Effect of Evaporation on the Flow Duration Characteristics of Messalonskee Stream

As mentioned above, the Messalonskee Stream watershed is quite unique in that fully 17% of its drainage area is comprised of water bodies and an additional 2 to 3% consists of hydrophytic vegetation with continuous access to free water. Evaporation losses from reservoirs in the northeastern United States is generally believed to be of little significance when compared to evaporation losses from reservoirs in the more arid zones of the country. However, under certain circumstances, evaporation losses can be important. This is particularly true in watersheds where the lake surface area is high with respect to natural inflow. The Messalonskee Stream drainage meets these two criteria, particularly during the months of July and August.

It is recognized at the outset that reliable data on the evaporation rates of lakes in the northeast is not generally available. However, there are two basic tenets that will be applied to this analysis. First, evaporation from a free water surface of a given area is greater than evapotranspiration (ET) from that same area. ET is limited by the availability of soil moisture and the rate at which water can be transported through soil. Second, ET can be no greater than precipitation in a basin unless water is brought into the basin from an outside source.

While it is recognized that absolute data is not available to analyze the effect of evaporation with complete accuracy, sufficient data is available to develop rough estimates of the losses to be expected.

Based on evaporation data from Linsley and Franzini in Water Resources Engineering,[1] estimated evaporation rates for the months of July, August and September would be 4.1 inches, 3.5 inches, and 2.4 inches, respectively. Average precipitation for these months at Messalonskee Lake are approximately 3.4 inches, 3.3 inches, and 3.2 inches, respectively. Based on a review of USGS records for unregulated, wooded watersheds, approximately 15% of precipitation results in runoff during the month of August, which is the lowest month in this regard. Therefore, ET can be estimated to be 2.8 inches in August (85% of precipitation). The difference between the estimated evaporation in August of 3.5 inches and ET in August of 2.8 inches is 0.7

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1. R. K. Linsley and J. B. Franzini, "Water-Resources Engineering," Table 2-4, p. 36, McGraw-Hill, New York, 1972.

inches. This estimate of 0.7 inches is an approximation of the net loss of water to evaporation over a lake surface versus an upland drainage area.[1]

One can readily see that this represents a very small loss when considering a small impoundment or a larger watershed with a few large impoundments. However, in the case of the Messalonskee drainage basin above Messalonskee Lake Dam which has a total water surface area of 19,151 acres (not including adjacent wetlands), this loss amounts to over 1,100 acre-feet of water. This is equivalent to a continuous flow of about 18 cfs. In other words, the impact of the Belgrade Lakes on flow in Messalonskee Stream in August is to reduce stream runoff by about 18 cfs on the average. The importance of this is self-evident. Based on the flow duration curves developed as described in Section B, the median inflow to Messalonskee Lake Dam in August without evaporation losses is estimated to be 44 cfs (.25 cfs/mi^2). Including watershed evaporation losses, ND&T would estimate the actual median inflow to Messalonskee Lake in August to be about 26 cfs.[2]

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1. Data collected by the National Weather Service at New Gloucester, Maine indicate that the above values of evaporation are likely to be conservative, that is, they underestimate the actual evaporation rates. See R.K. Farnsworth and E.S. Thompson, Hydrologic Research Lab, National Weather Service, NOAA Silver Spring, MD, Table I, pg. 34.

2. Inclusive of evaporation losses from Messalonskee Lake.

Again, it is noted that these figures are not absolute values, but they do indicate the general significance of the evaporation losses. In addition, during shorter-duration dry periods, the evaporation losses may be higher and precipitation lower, thereby reducing further the runoff available at the outlet of the impoundments. Also, other data indicate evaporation rates may be greater than those used in this analysis.

Table 5 provides an estimate of the impact of evaporation losses on median flows for the months of July, August, and September applicable to the inflow to Messalonskee Lake.

D. Analysis of the Potential Impacts of the Belgrade Lakes Water Level Order on Availability of Flows at Messalonskee Lake Dam

As mentioned previously, the Maine DEP issued Water Level Order L-011097-36-A-N on October 30, 1985 which governs the operation of the dams at Salmon Lake, Great Pond, and Long Pond. One of the stipulations of the Order is that the minimum release from Long Pond shall be 8 cfs. There is no minimum release required from Great Pond. The Water Level Order also specifies that between June 1 and Labor Day, lake levels shall be maintained as close to the spillway crest as possible.

Figures 10, 11 and 12 show the estimated long-term flow duration characteristics of inflow to Messalonskee Lake for July, August, and September, respectively, without evaporation losses. Median flows for these three months were provided in Table 5 above.

Table 5

Effect of Evaporation on Median Inflows to Messalonskee Lake

Month	Median Inflow in cfs	
	Without Evap. Losses	With Evap. Losses
July	73	42
August	44	26
September	37	37

The flow values provided in Table 5 above do not reflect the potential impact of the Water Level Order enacted in October, 1985. It is recognized that Salmon Lake, Great Pond and Long Pond are managed strictly for recreation during the summer months and CMP has no control over the discharge of water from these lakes. When one also considers that the operating band of Messalonskee Lake is limited to a target of 0.5 ft, and that the minimum discharge from Long Pond may be 8 cfs for lengthy periods of time, then it is evident that the Water Level Order may impose significant limitations to water availability from Messalonskee Lake.

At first glance, the value of 8 cfs from Long Pond would appear to be exceeded virtually all of the time. However, three factors must be considered when evaluating the likelihood of achieving a continuous release of 8 cfs from Long Pond.

First, as considered above for the drainage area above Messalonskee Lake, evaporation losses can significantly reduce the availability of outflow from Long Pond. Applying evaporation losses, the median August flow from the exit of Long Pond is anticipated to be about 15 cfs.

Second, water use by hydrophytic, wetland vegetation, which was not considered in the above calculations, will also serve to reduce the availability of flow.

Finally, the goal to maintain levels in the Belgrade Lakes at spillway crest results in a lake management technique based on flow pulsing from impoundment to impoundment instead of continuous bypass with outflow equaling inflow less evaporation losses.

Giving due consideration to these three factors and the likelihood that conservative evaporation values have been used in the analysing, it is highly probable that the releases from Long Pond will be 8 cfs for significant periods of time. Figure 19 provides estimated flow duration curves with releases from Long Pond being limited to 8 cfs. ND&T recommends that these curves be used for planning purposes. Table 6 provides adjusted median inflows for July, August, and September derived by limiting the flow from Long Pond to 8 cfs.

The flow values in Table 6 are judged to represent reasonable values considering the significant effect that evaporation losses have on the Messalonskee watershed and the method of operating the Belgrade Lakes.

E. Use of Messalonskee Lake Storage for Low Flow Augmentation

There is no formal minimum release requirement at Messalonskee Lake Dam at present. The Maine DEP has established an expectation of a minimum release of 12 cfs as stated in its Water Level Order. CMP has estimated leakage losses at Messalonskee Lake Dam to be about 12 cfs to 15 cfs. The estimated median August inflow to Messalonskee Lake is 22 cfs. It is likely that this flow rate could be discharged 100% of the time from Messalonskee Lake Dam without impacting the sensitive lake level regime in Messalonskee Lake. However, it should also be recognized that evaporation rates could be somewhat higher than estimated during any given summer season. Therefore, some flexibility should be maintained by CMP in adjusting flows from Messalonskee Lake Dam to avoid impacts to Messalonskee Lake.

Table 6

Adjusted Median Inflows to
Messalonskee Lake Considering the Belgrade Lakes
Water Level Order

Month	Adjusted Median Inflow[1] (cfs)
July	31
August	22
September	20

---

1. Values were arrived at by applying the median flow rate in cfs/mi^2 derived as described in Section III.B to the drainage area between Long Pond and Messalonskee Lake Dam (56 mi^2) then adding 8 cfs as outflow from Long Pond.

Available storage in Messalonskee Lake within the normal 0.5 ft operating band is estimated to be 1500 acre-feet. ND&T believes that the available storage in Messalonskee Lake could be used to maintain the 22 cfs when inflows are less than the August median value, but only to the extent that Messalonskee Lake is not drawn below elevation 234.9.

IV. CONCLUSIONS

Based on the hydrologic analysis presented in this report, Figures 4 through 15 represent the unregulated, long-term monthly flow characteristics of inflow and outflow from Messalonskee Lake without considering evaporation losses during the summer months. These curves were developed using flow data from similar, local drainages with little or no flow regulation and without significant impoundment area. The outflow curve is also considered representative of flows at the Oakland and Rice Rips Projects. Figures 16, 17, and 18 portray flow duration curve estimates for the Automatic and Union Gas Projects developed by the same technique with additional downstream drainage area contribution added.

These curves represent an overall, long-term perspective of flow characteristics for the drainage without intensive regulation. Using these data, the unregulated median August flow at Messalonskee Lake Dam is estimated at 44 cfs. This represents a local, site-specific estimate of the aquatic base flow (ABF) for an unregulated drainage without evaporation losses.

The Messsalonskee drainage however, is not typical of unregulated drainages, and is actually quite unique. Fully 17% of the drainage area consists of open surface waters (the Belgrade Lakes) and an additional 2 to 3% of the surface area consists of wetlands. This exceptionally large surface water area and extensive wetland area results in large evaporative losses during the summer months. Finally, water management on the drainage is focused on regulating water levels at or near full pond throughout the summer for recreational use on the Belgrade Lakes. Therefore, when significant precipitation occurs there is little or no capacity to capture and store it.

These unique drainage basin characteristics and water management practices result in a significant reduction of summer flows. Summer inflow to Messalonskee Lake is likely to be limited to only 8 cfs, the minimum release required by water Level Order L-011097-36-A-N, for weeks at a time. Adding the drainage basin contributions below Wings Mills Dam, this amounts to approximately 22 cfs at Messalonskee Lake Dam. These extended low flow periods will result in an actual median August flow of approximatley 22 cfs.

Acknowledging these flow restrictions, ND&T developed the curves presented in Figure 19, assuming only an 8 cfs discharge from Long Pond. These curves represent conservative, yet realistic, estimates of available flow at Messalonskee Lake Dam during critical low flow months, and are recommended for use when considering alternative flow regimes in Messalonskee Stream. A comparison of estimated unregulated versus actual (regulated) median inflows to Messalonskee Lake during July, August and September is presented in Table 7.

Based upon these analyses, the flow available for continuous release for the critical summer months is about 22 cfs. The limited available storage in Messalonskee Lake (1,500 acre-feet) could be used to maintain the median flow during times when inflows are less than the median value. This assumes that water management on the Belgrade Lakes (including Messalonskee Lake) will continue to focus on the maintenance of stable near-full pond levels during the summer months. Given that the evaporation rates applied to the Belgrade Lakes are estimates only, ND&T recommends that CMP retain some flexibility in adjusting discharges from Messalonskee Lake Dam if target lake levels become threatened during any given period.

Table 7

Estimated Unregulated and Actual Median Inflows to Messalonskee Lake

	Median Inflow (cfs)	
	Estimated Unregulated	Estimated Actual
July	73	31
August	44	22
September	37	20

FIGURES

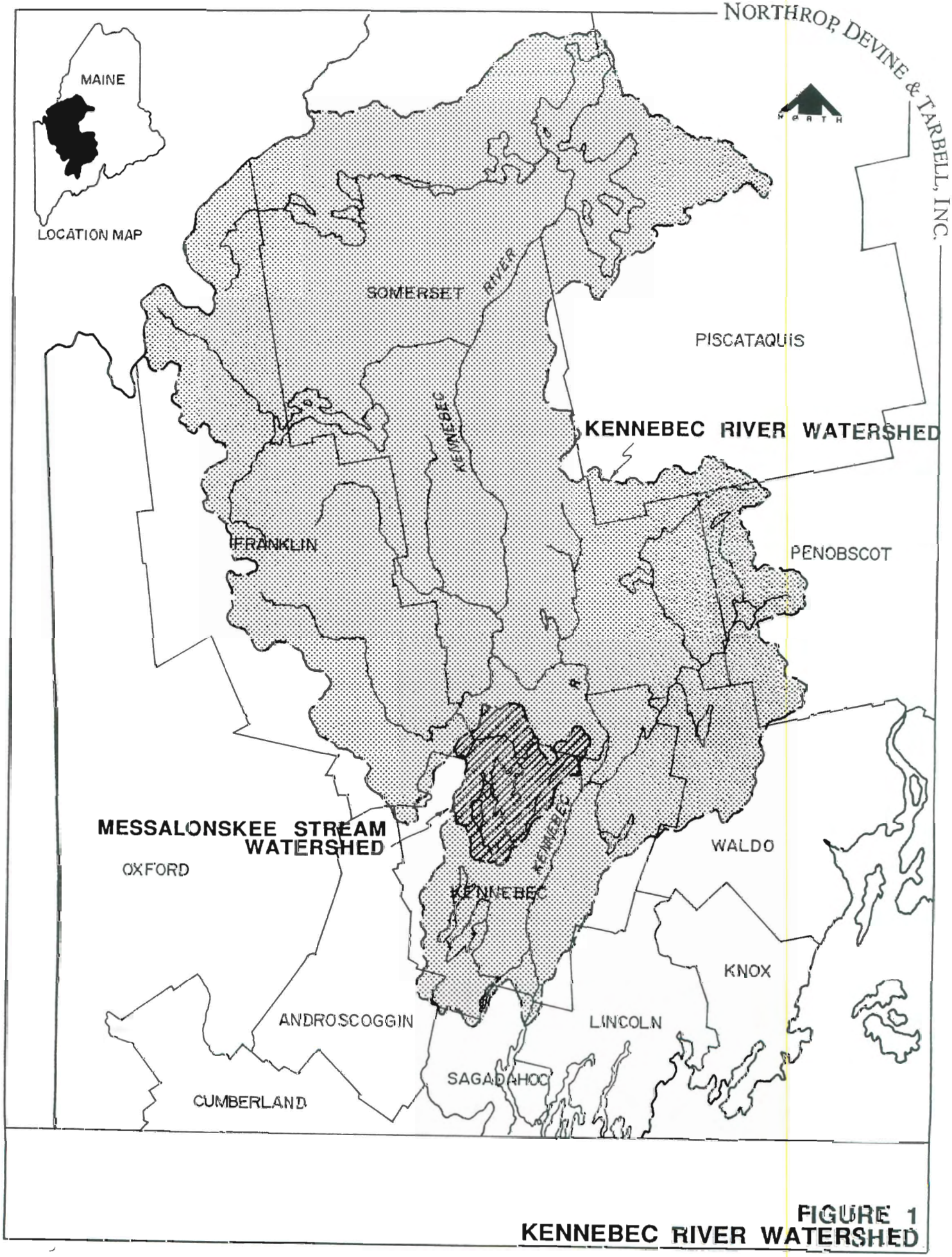


FIGURE 1
KENNEBEC RIVER WATERSHED

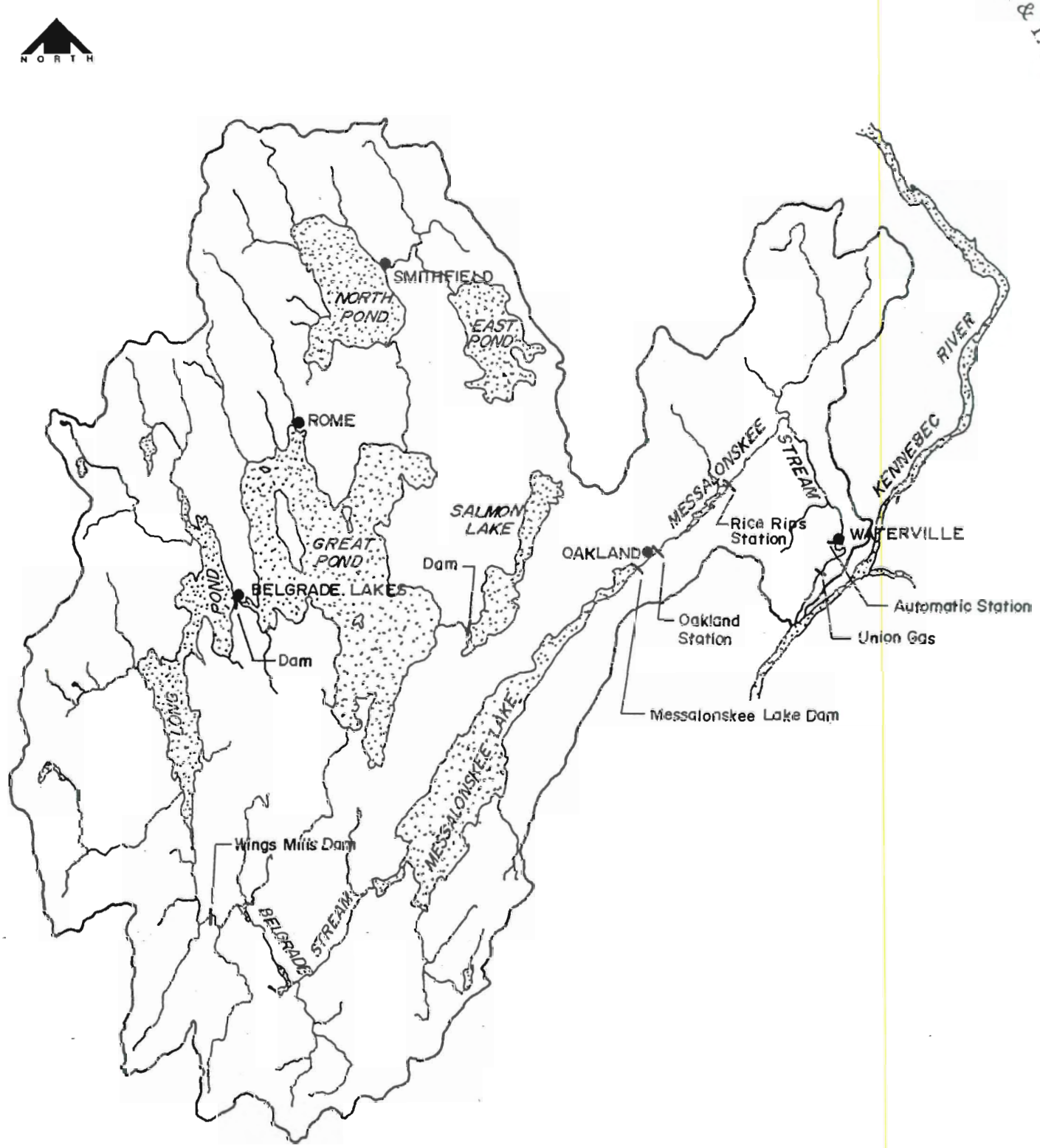


FIGURE 2
MESSALONSKEE STREAM WATERSHED

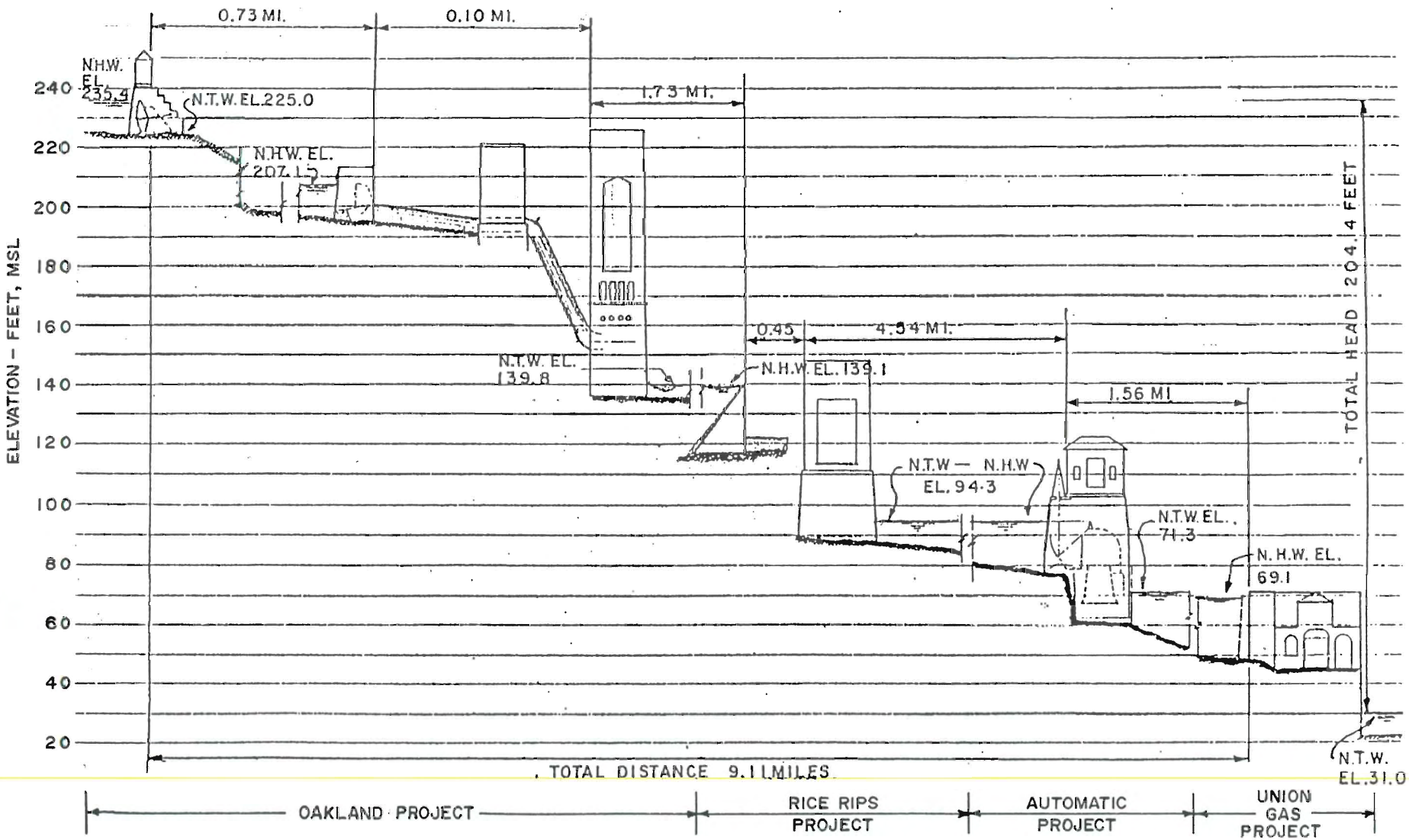


FIGURE 3
PROFILE
MESSALONSKEE STREAM

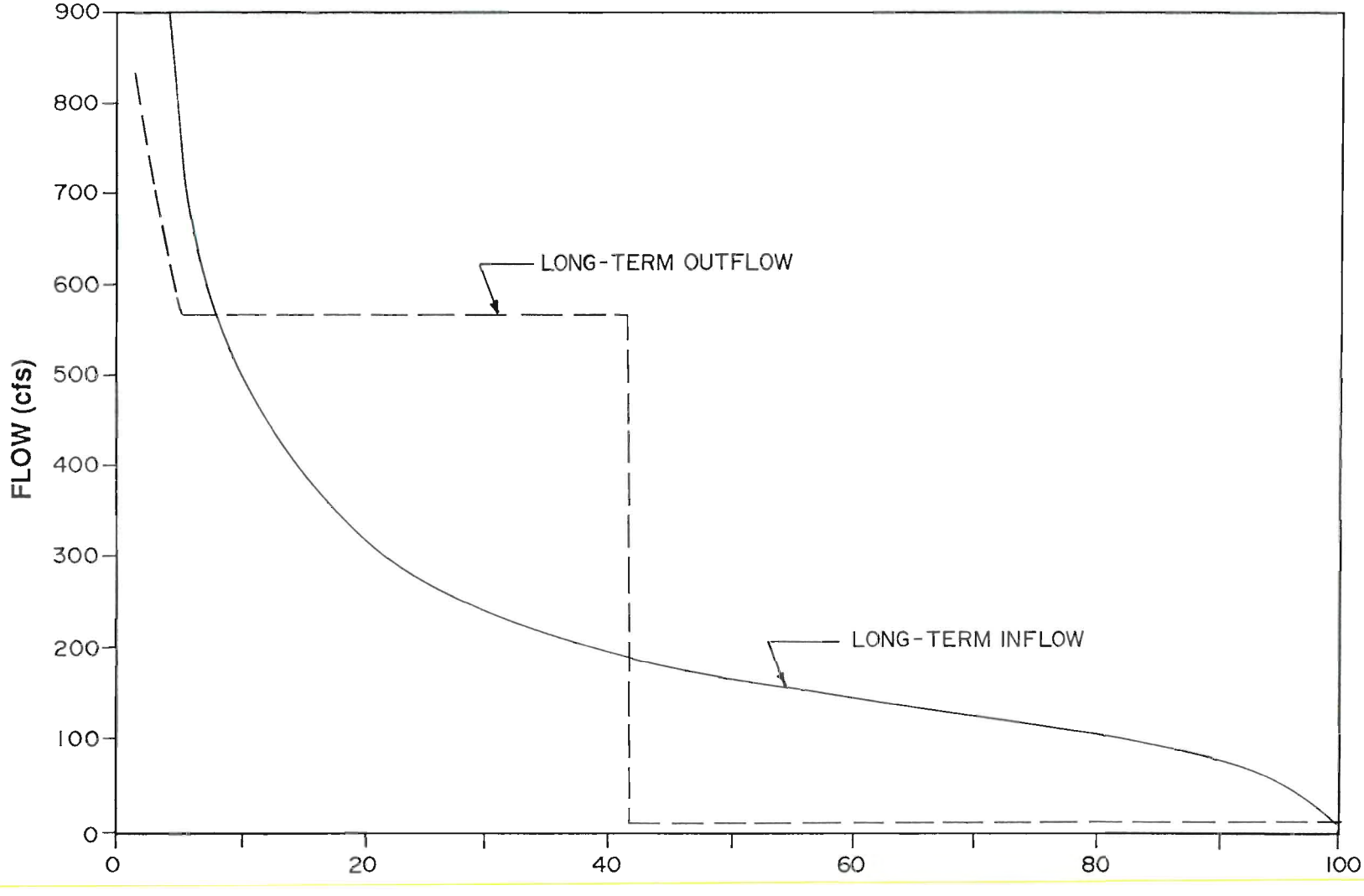


FIGURE 4
ESTIMATED FLOW DURATION CURVE
MONTH OF JANUARY
MESSALONSKEE LAKE DAM

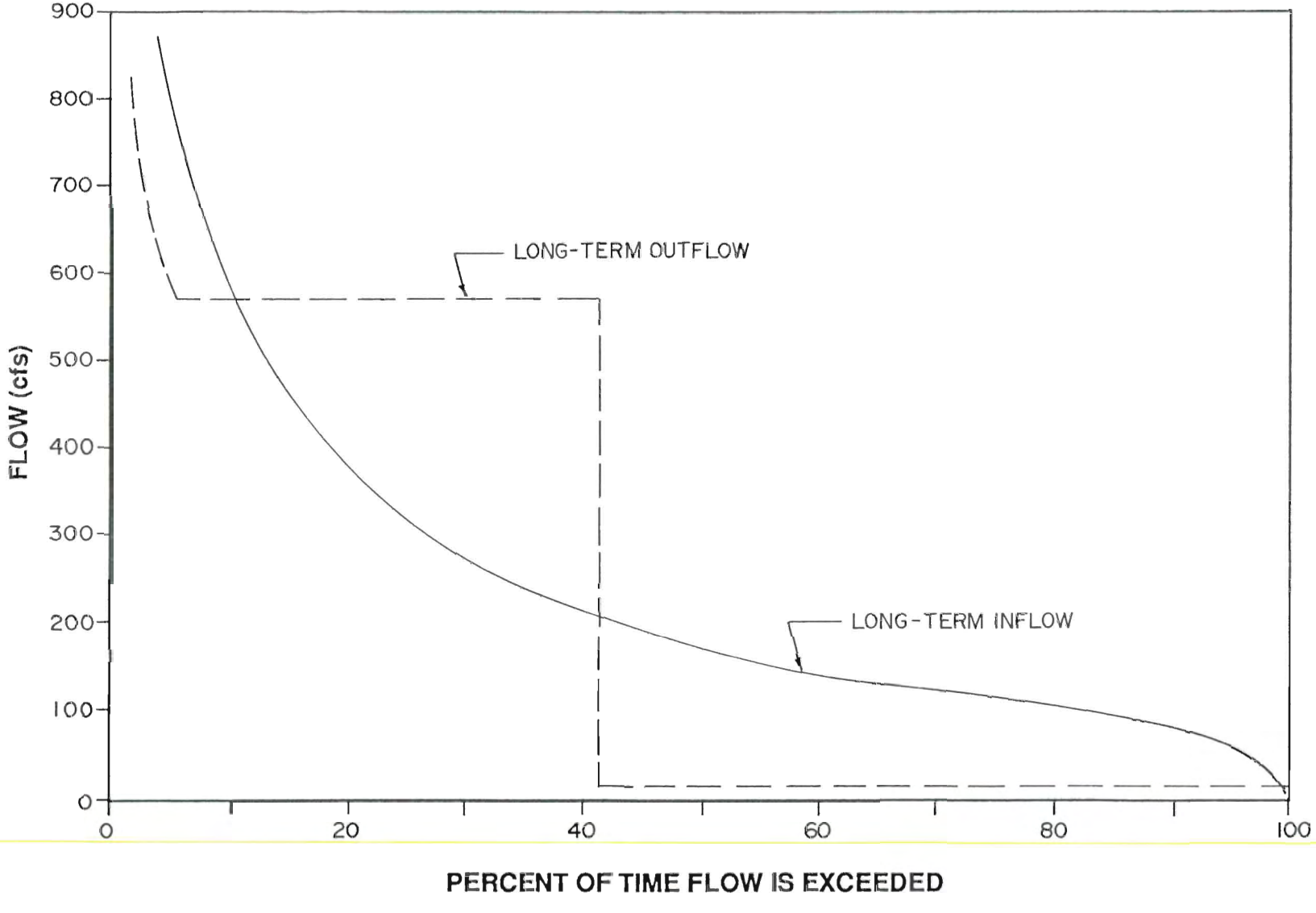


FIGURE 5
ESTIMATED FLOW DURATION CURVE
MONTH OF FEBRUARY
MESSALONSKEE LAKE DAM

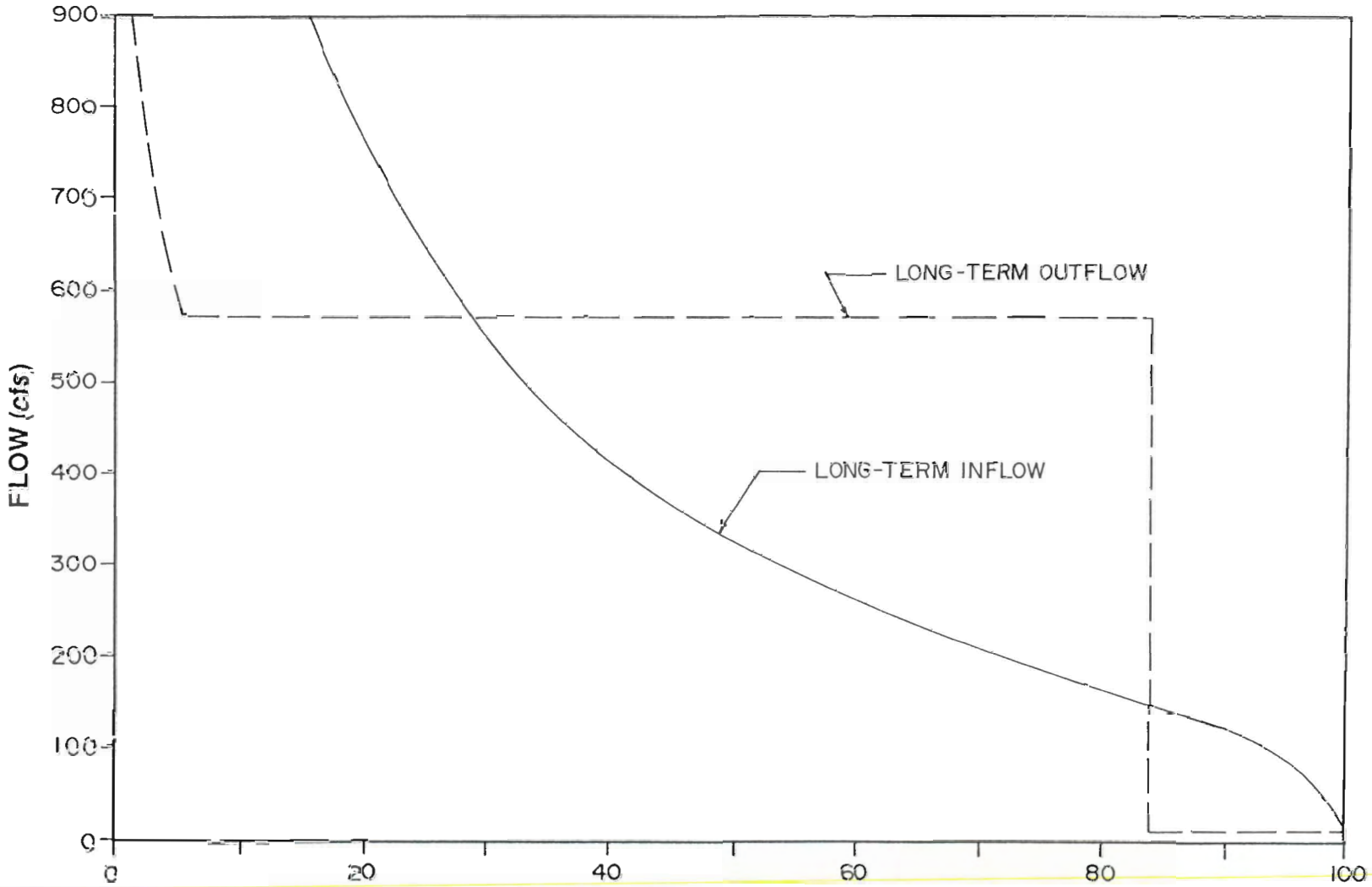


FIGURE 6
ESTIMATED FLOW DURATION CURVE
MONTH OF MARCH
MESSALONSKEE LAKE DAM

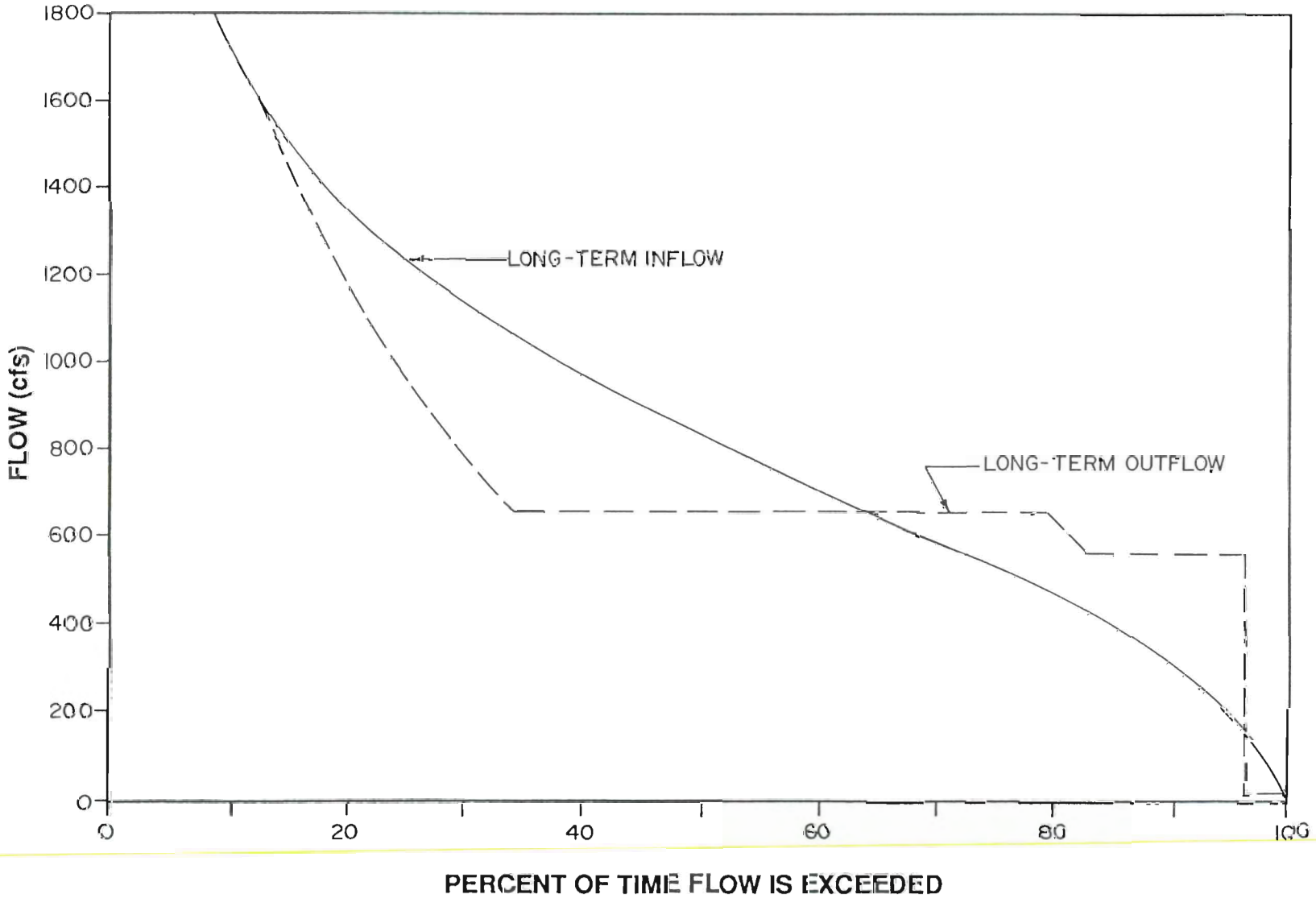


FIGURE 7
ESTIMATED FLOW DURATION CURVE
MONTH OF APRIL
MESSALONSKEE LAKE DAM

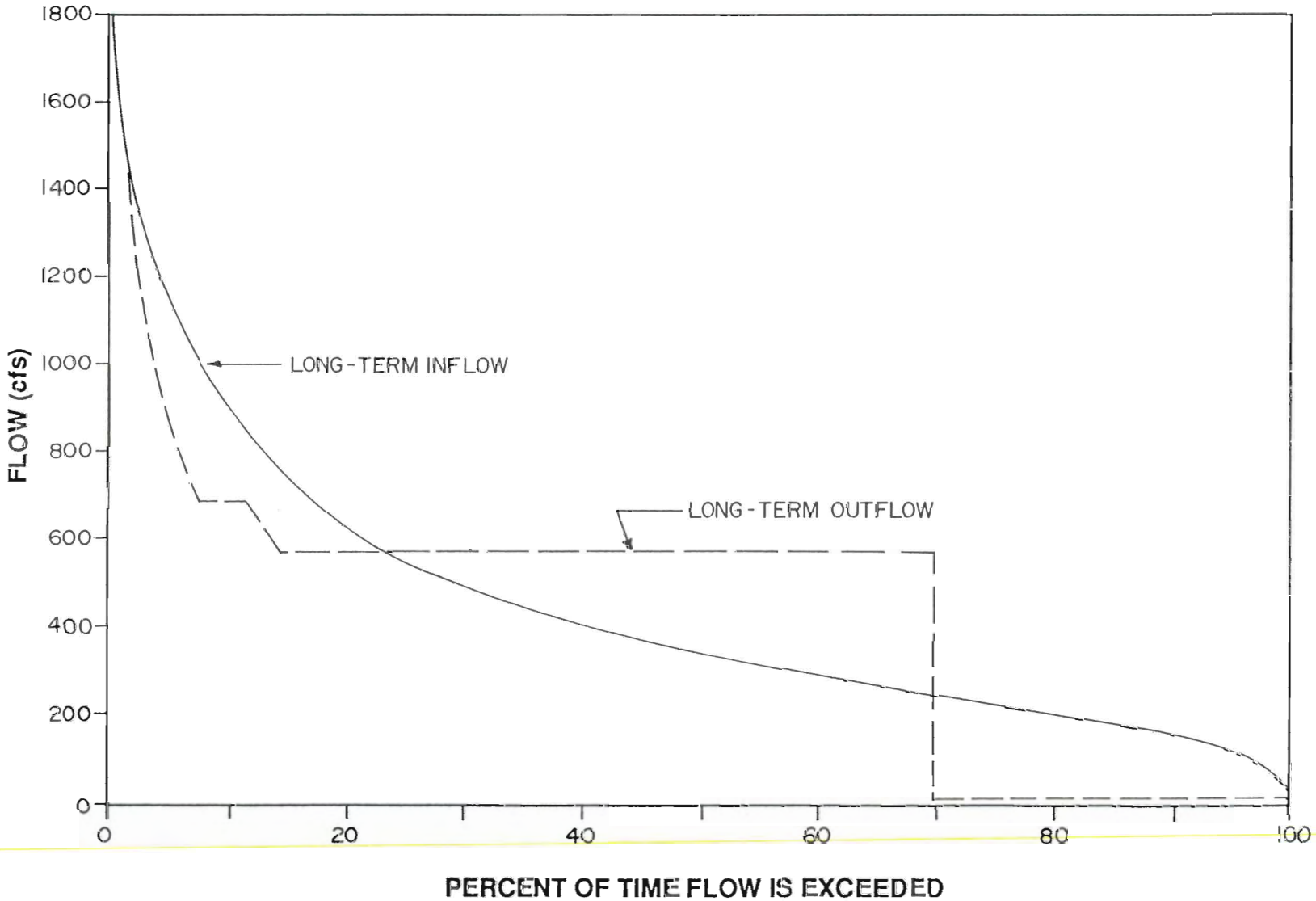


FIGURE 8
ESTIMATED FLOW DURATION CURVE
MONTH OF MAY
MESSALONSKEE LAKE DAM

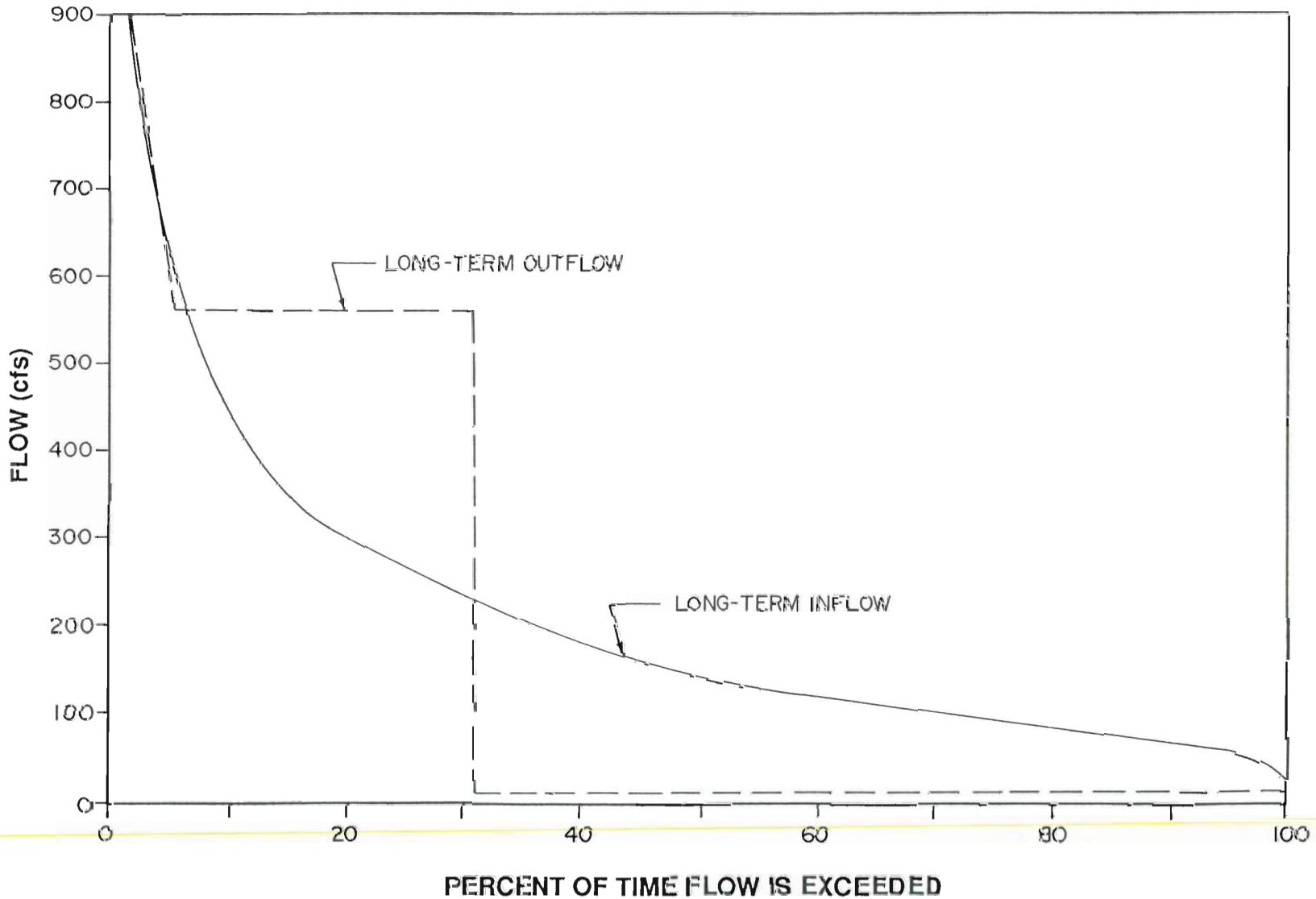
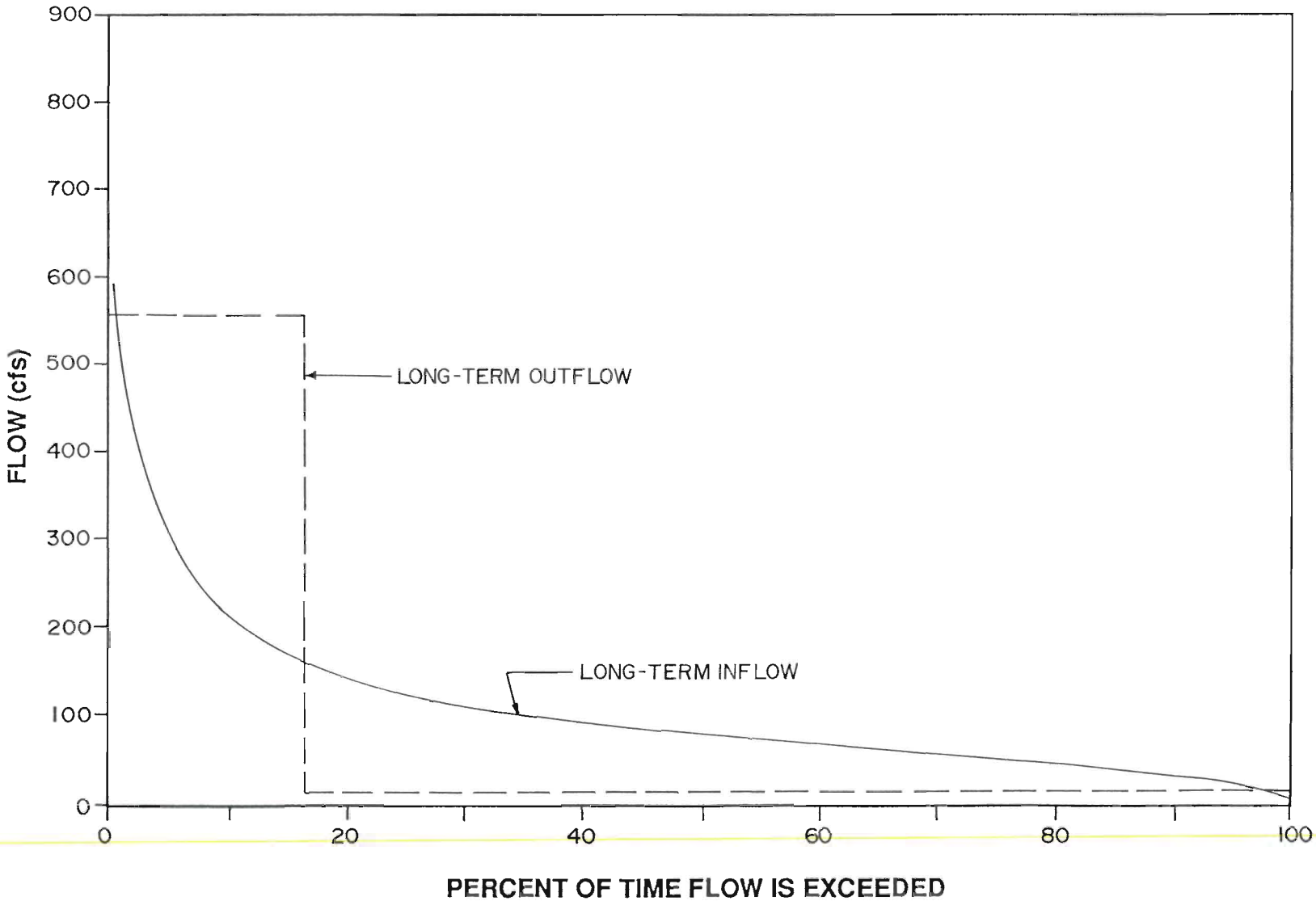


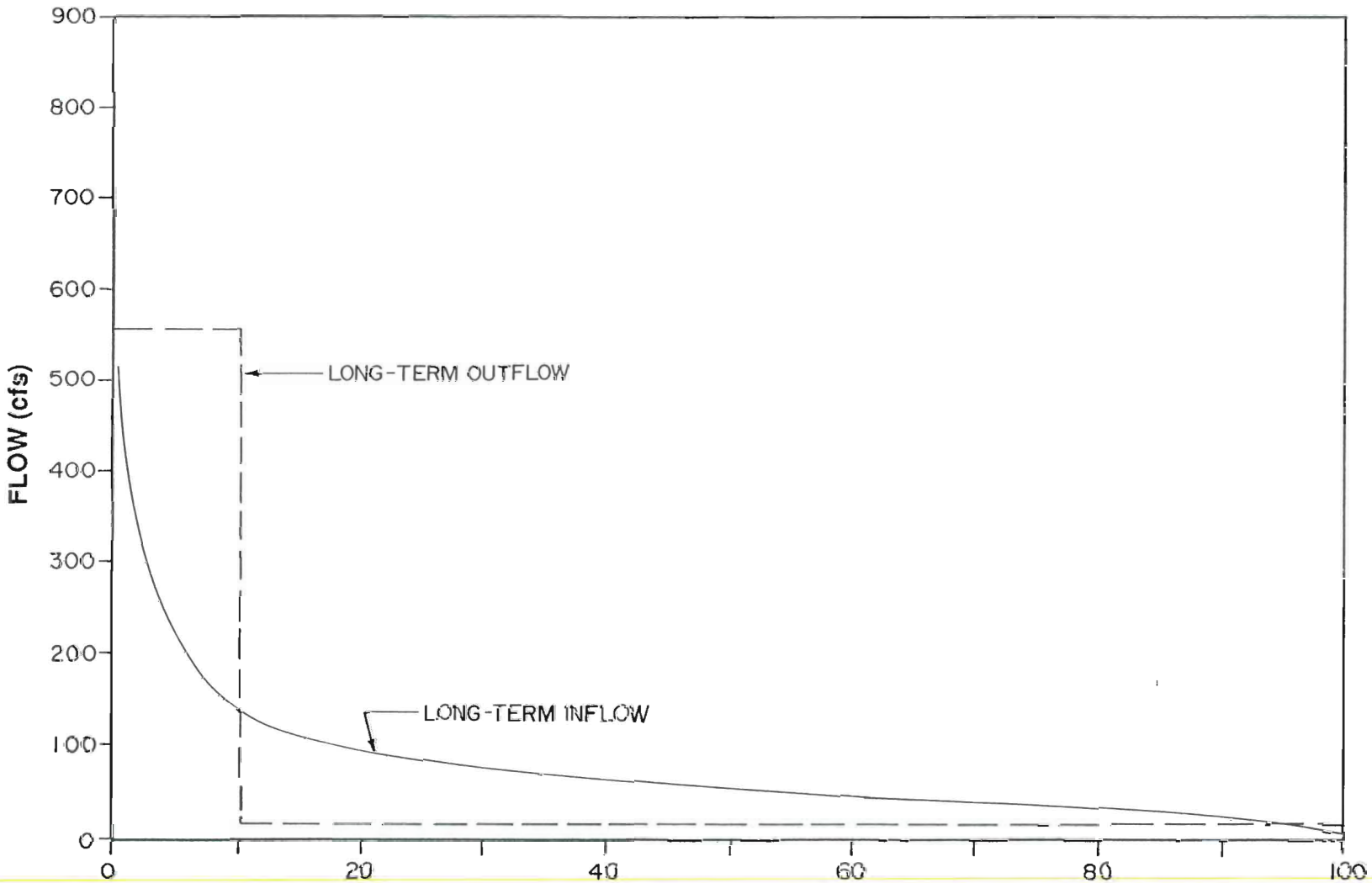
FIGURE 9
ESTIMATED FLOW DURATION CURVE
MONTH OF JUNE
MESSALONSKEE LAKE DAM

NOTE: DOES NOT INCLUDE EVAPORATION LOSS.
SEE TEXT, SECTION III.C.



NOTE: DOES NOT INCLUDE EVAPORATION LOSS.
SEE TEXT, SECTION III.C.

FIGURE 10
ESTIMATED FLOW DURATION CURVE
MONTH OF JULY
MESSALONSKEE LAKE DAM



NOTE: DOES NOT INCLUDE EVAPORATION LOSS. SEE TEXT, SECTION III.C.

FIGURE 11
ESTIMATED FLOW DURATION CURVE
MONTH OF AUGUST
MESSALONSKEE LAKE DAM

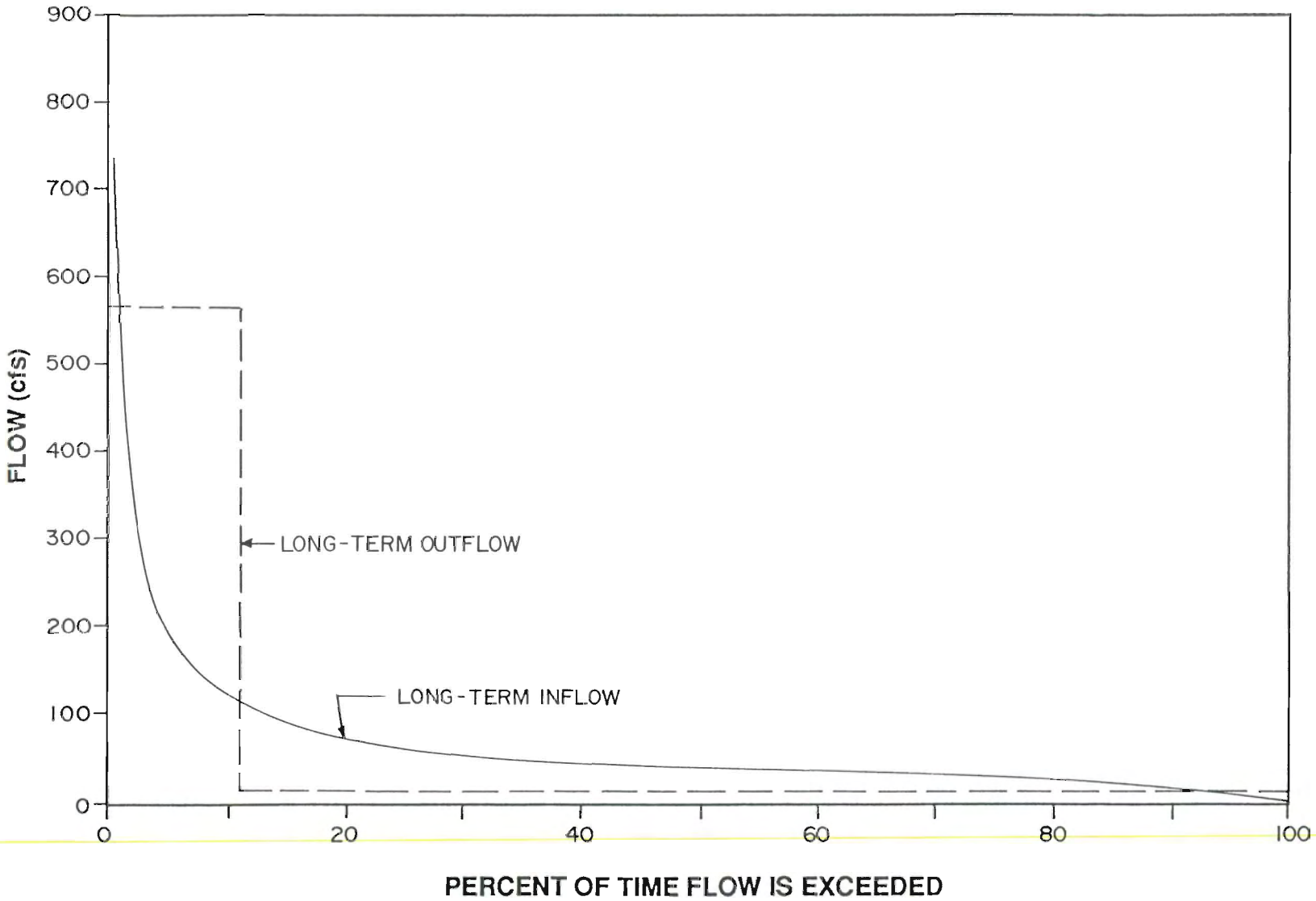


FIGURE 12
ESTIMATED FLOW DURATION CURVE
MONTH OF SEPTEMBER
MESSALONSKEE LAKE DAM

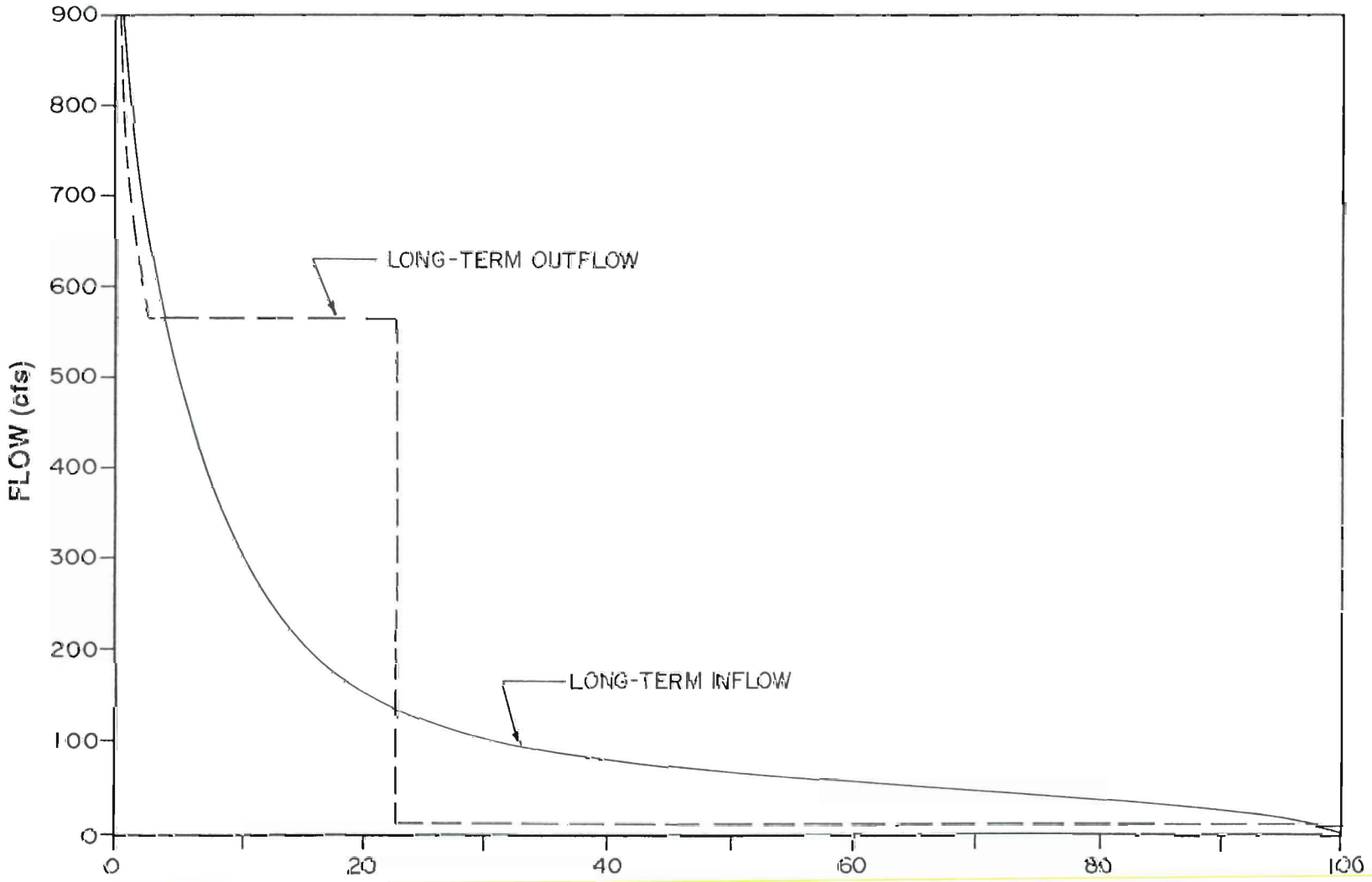


FIGURE 13
ESTIMATED FLOW DURATION CURVE
MONTH OF OCTOBER
MESSALONSKEE LAKE DAM

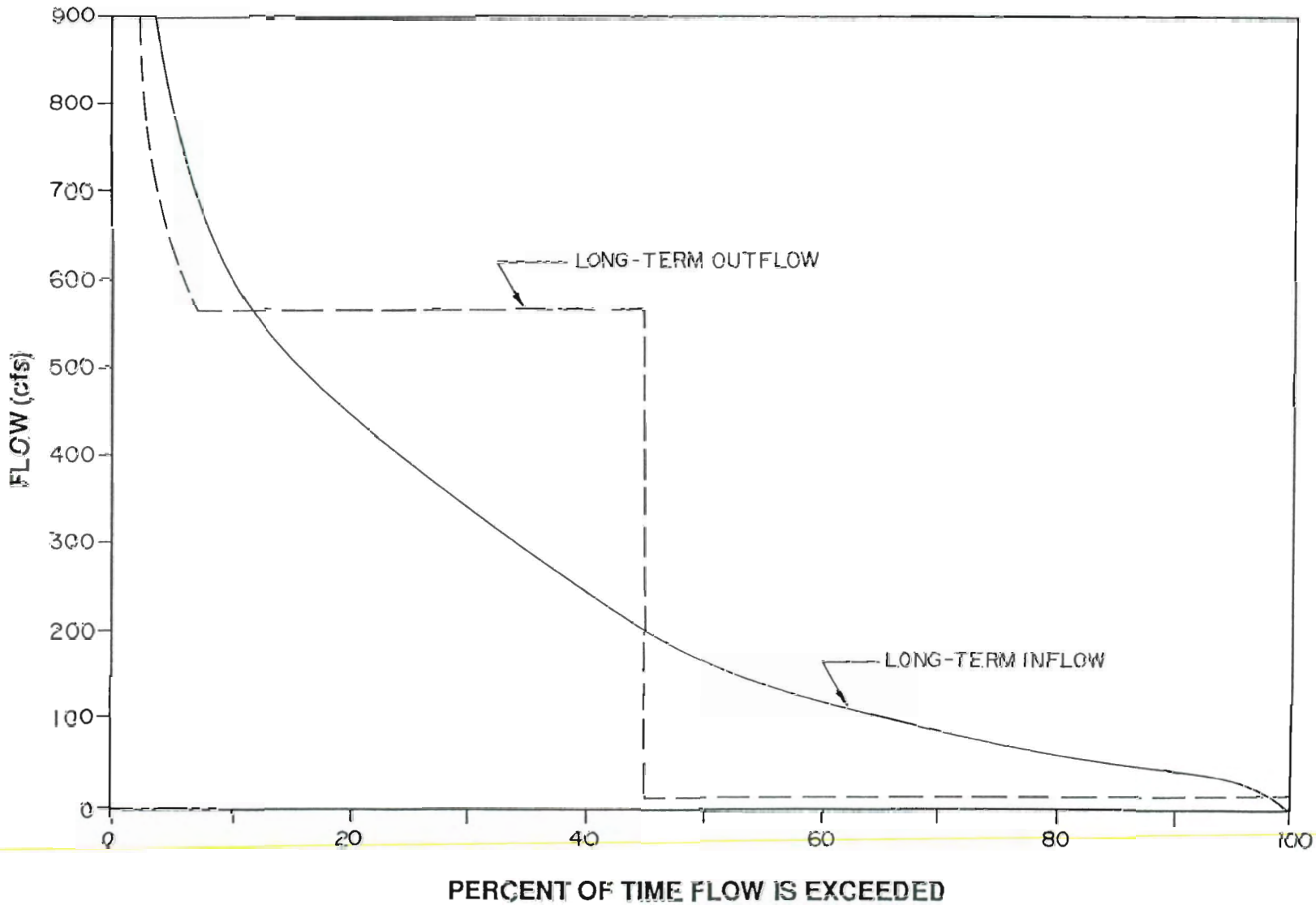


FIGURE 14
ESTIMATED FLOW DURATION CURVE
MONTH OF NOVEMBER
MESSALONSKEE LAKE DAM

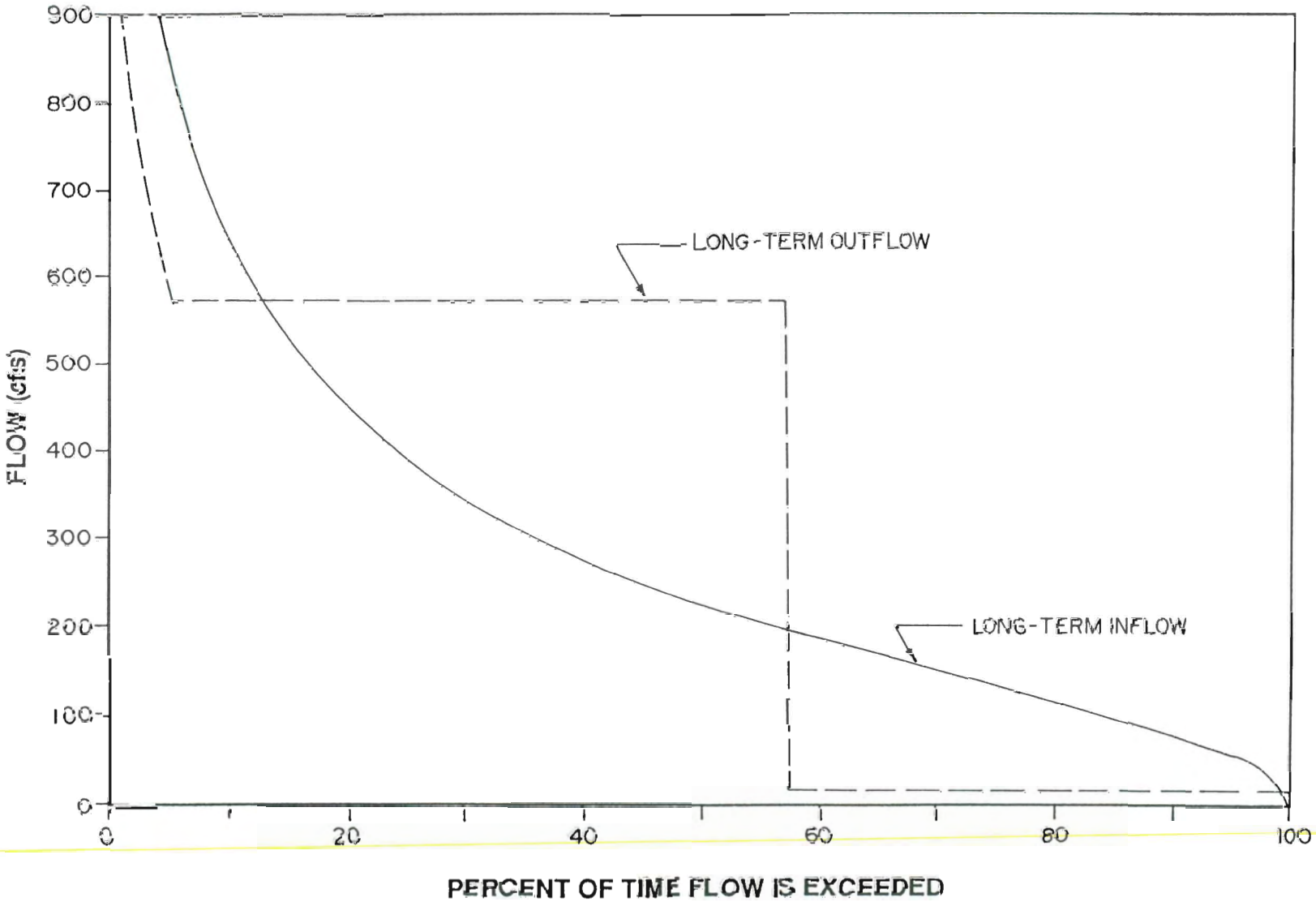
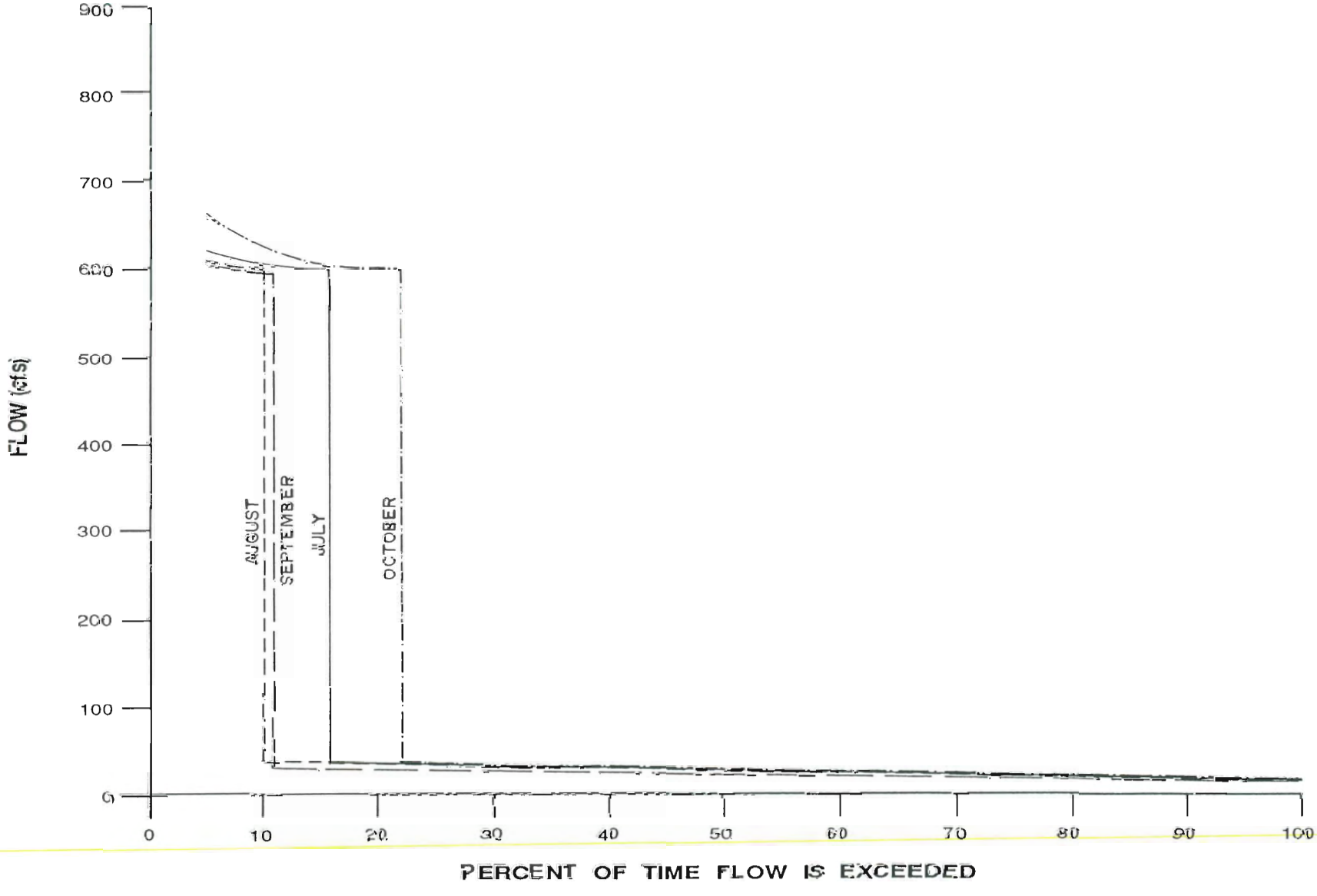


FIGURE 15
ESTIMATED FLOW DURATION CURVE
MONTH OF DECEMBER
MESSALONSKEE LAKE DAM



NOTE: DOES NOT INCLUDE EVAPORATION LOSS.
SEE TEXT, SECTION III.C.

FIGURE 15
ESTIMATED FLOW DURATION CURVES
AUTOMATIC AND UNION GAS PROJECTS FOR
JULY, AUGUST, SEPTEMBER, OCTOBER

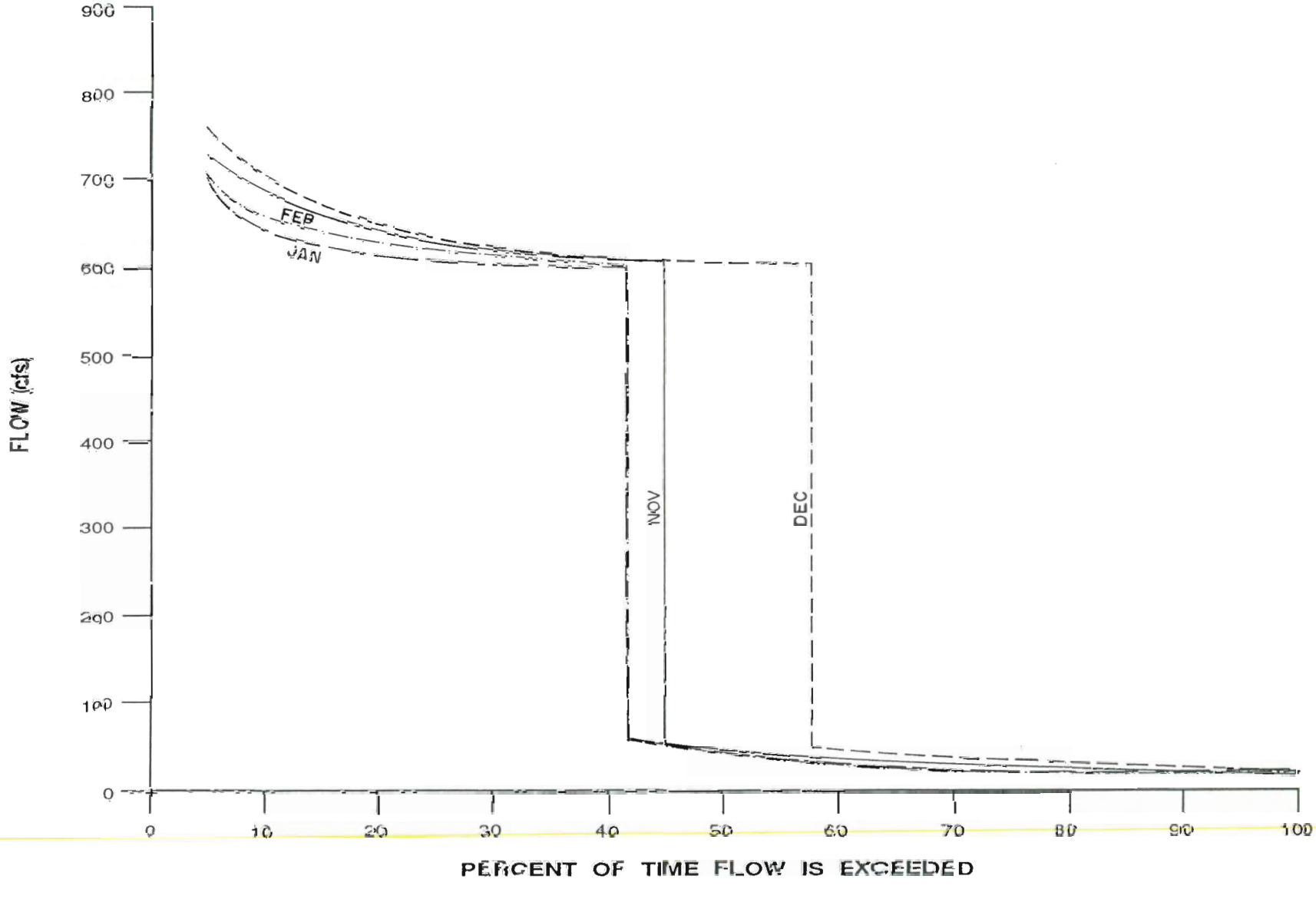
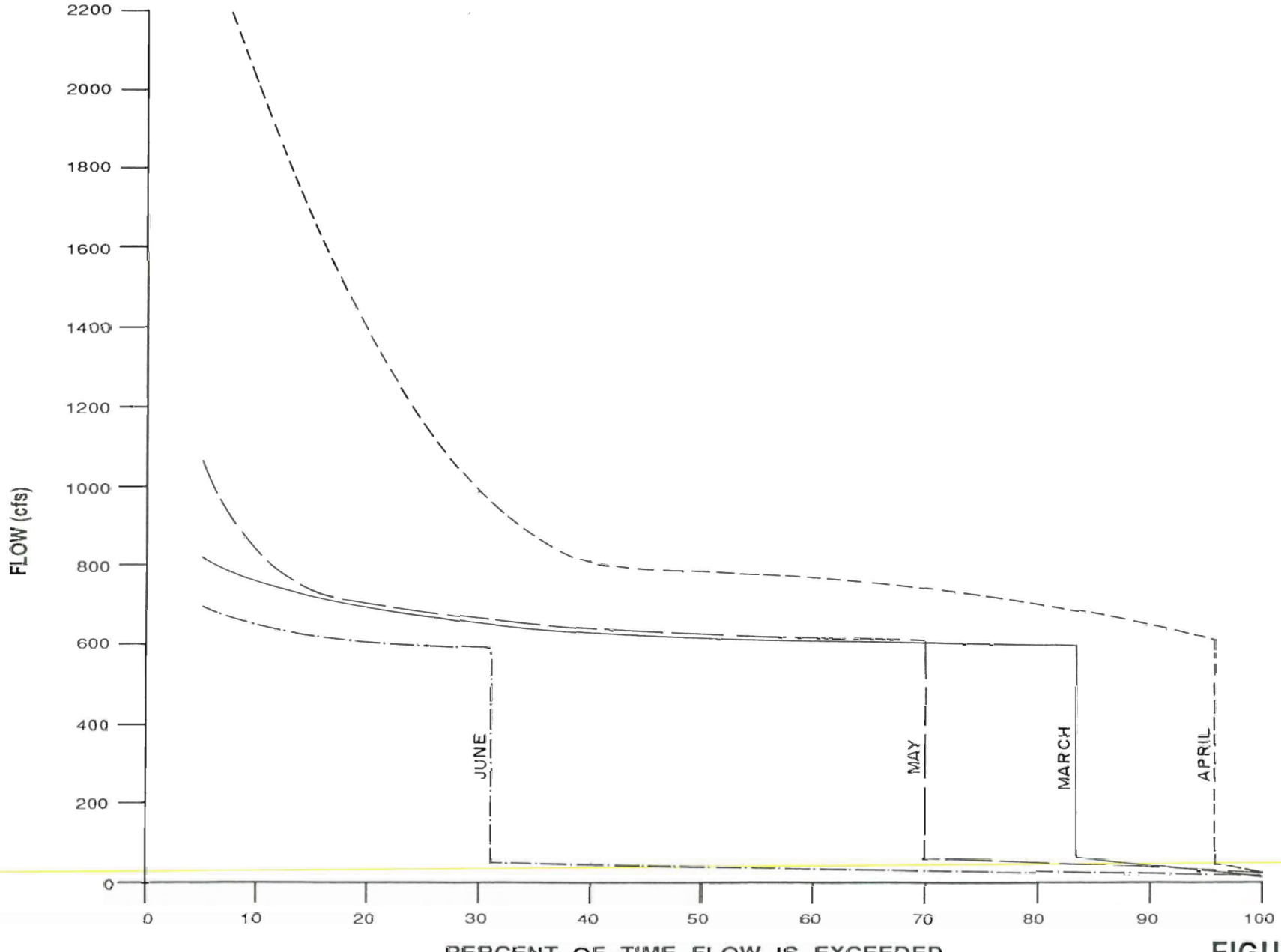
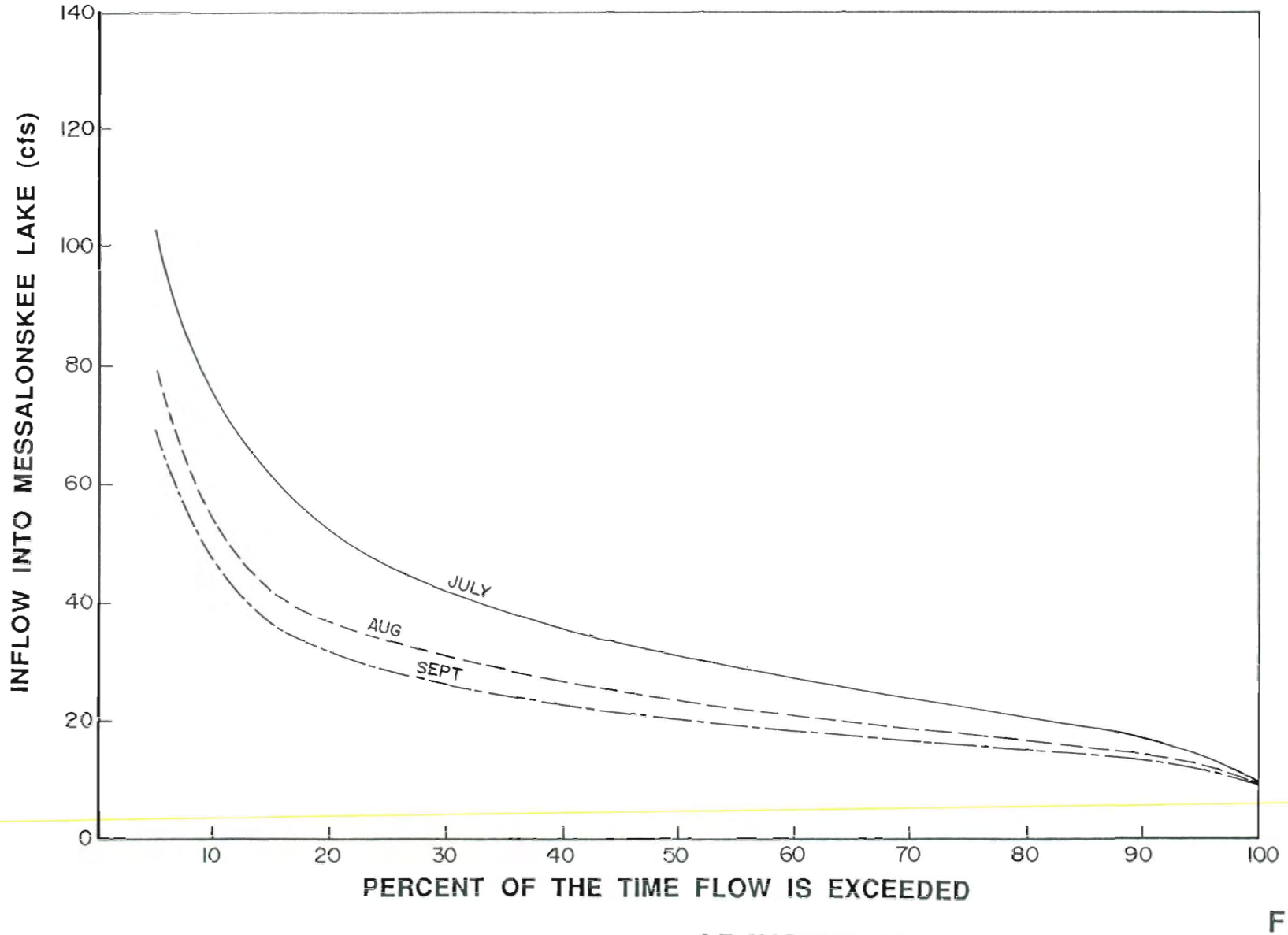


FIGURE 17
ESTIMATED FLOW DURATION CURVES
AUTOMATIC AND UNION GAS PROJECTS FOR
NOVEMBER, DECEMBER, JANUARY, FEBRUARY



NOTE: DOES NOT INCLUDE EVAPORATION LOSS. SEE TEXT, SECTION III.C.

FIGURE 18
ESTIMATED FLOW DURATION CURVES AUTOMATIC AND UNION GAS PROJECTS FOR MARCH, APRIL, MAY, JUNE



NOTE: ADJUSTED FOR 8 cfs INFLOW FROM LONG POND TO SIMULATE CURRENT WATER MANAGEMENT PRACTICES.

FIGURE 19
ADJUSTED FLOWS INTO MESSALONSKEE LAKE FOR JULY, AUGUST, SEPTEMBER

APPENDIX

Appendix 1

Water Level Order #L-011097-36-A-N

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE HOUSE STATION 17 AUGUSTA, MAINE 04333

BOARD ORDER
IN THE MATTER OF

SALMON LAKE Oakland and Belgrade	)	MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT
GREAT POND Rome and Belgrade	)	
LONG POND Rome Belgrade and Mt. Vernon Kennebec County	)	
WATER LEVEL ORDER #L-011097-36-A-N	)	FINDINGS OF FACT AND ORDER

Pursuant to the provisions of Title 38, M.R.S.A., Section 840, the Board of Environmental Protection has considered a public petition to establish a water level regime for SALMON LAKE, GREAT POND and LONG POND, with its supportive data, staff summary, agency review comments, public hearing transcript, comments from the public, and other related materials on file and finds the following facts:

1. PETITION AND HEARING

On May 30, 1985, the Board received a petition from the selectpersons of Belgrade, owners of the dams to establish a water level regime for Salmon Lake, Great Pond and Long Pond. A public hearing, in response to this petition was held in Belgrade, Maine on August 7, 1985.

2. SETTING

Salmon Lake, Great Pond and Long Pond water levels are controlled by outlet dams (State ID#'s 457, 455, 452 respectively). All three dams are jointly owned by the Towns of Belgrade and Rome. A summary of the dams' characteristics is provided in Table 1. None of the dams have fish passage facilities.

In addition to Salmon Lake and Great and Long Ponds, other major water bodies in the Belgrade Lakes watershed, include East and North Ponds, and Messalonskee Lake (Snow Pond) (see Figure attached). The entire watershed drains via Messalonskee Stream into the Kennebec River at Waterville. Being a chain of lakes, water levels on these water bodies are best controlled when they are managed as a system and operated in a coordinated manner. The watershed is primarily forest with some agriculture and rural residential and village areas. There are over 800 residences around the three lakes, the vast majority of which are seasonal, and numerous commercial establishments including marinas and fishing camps.

3. HISTORIC WATER LEVELS

The three dams were built in the late 1800's - early 1900's. Central Maine Power Company had ownership until 1980, when all three dams were sold to the Belgrade Development Corp., of which Thomas Blackburn was the sole stockholder. Between 1983 and 1985 the towns of Belgrade and Rome jointly acquired ownership of the three dams. The dams are currently operated and maintained by the Belgrade Area Dams Committee (BADC) established by the Interlocal Agreement for the management of the Belgrade Area dams.

TABLE I

BELGRADE LAKES DAMS

	Surface Area (acres)	Watershed Area (sq. mi.)	Spillway Elevation (above msl, feet)	Dam height (feet)	Dam length (feet)	Dam type	Gate type(#)	Gate dimensions (feet)
SALMON LAKE	667	8.5	278.0	9	160 (10 foot spillway)	concrete/ earth	taintor(1)	9' 10" x 7'6"
GREAT POND	8,228	82.9	247.7	14	212 (66 foot spillway)	concrete/ stone/earth	taintor(2)	9' x 9' 7" 9' x 9' 7"
LONG POND	2,718	121.0	238.1	7	190 (107 foot spillway)	stone/wood	lift(2)	6'10" x 6'7" 6'10" x 6'1

SALMON LAKE Oakland and Belgrade	)	2 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT
GREAT POND Rome and Belgrade	)	
LONG POND Rome Belgrade and Mt. Vernon Kennebec County	)	
WATER LEVEL ORDER #L-011097-36-A-N	)	FINDINGS OF FACT AND ORDER

For the last 30 - 40 years of their ownership CMP was operating the dams principally for recreational uses and to prevent flooding. They accomplished this goal by maintaining water levels at or near the spillway crest during the summer months and drawing the lake down semi-annually, usually achieving lowest levels during mid to late October and again in mid to late March. The degree of drawdown was dependent on weather and other factors, but was typically in the range of 1.3, 2.4, and 1.1 feet below spillway for Salmon Lake, Great Pond and Long Pond respectively.

In August, 1980, in response to a petition signed by greater than 10% of the littoral proprietors on the three lakes, and after conducting a public hearing, the Soil and Water Conservation Commission established a water level regime for Salmon Lake and Great and Long Ponds. The Commission's orders are summarized as follows:

a. The dam owner shall attain a maximum water level on June 1. Once this level is reached, the dam should not be manipulated between June 1 and September 10th except to assure the maximum level is not exceeded. Maximum levels (corrected) are:

Salmon Lake	- 278.25 feet above msl	- .25 feet above spillway
Great Pond	- 247.95 feet above msl	- .25 feet above spillway
Long Pond	- 238.35 feet above msl	- .25 feet above spillway

b. On September 15th, the dam owner will commence a drawdown to a level of one foot below spillway height. This level should be stable by October 31st and maintained as stable as possible through ice out.

During the Blackburn years the dams were not as actively managed as during CMP's ownership. The result was widely fluctuating water levels, culminating with water levels on Great Pond in June, 1984 equivalent to a 100 year flood.

Since taking over the operation and maintenance of the dams, the Belgrade Area Dams Committee has developed a water levels management plan for the three lakes. The BADC's Management Plan was developed after reviewing historical water levels data, flow discharge curves, flood studies, precipitation and evaporation data, etc. and after consultation with the Department of Environmental Protection and the Department of Inland Fisheries & Wildlife among others. The Plan was promulgated at three public meetings, including the DEP sponsored public hearing and has received almost unanimous public support. The BADC's management plan is

more comprehensive than the SWCC order and the Committee feels will serve the residents of Belgrade and Rome with more responsible water level management. The BADC would like to be able to implement more extensive drawdowns during the fall/winter period; provide for minimum flow out of Salmon Lake; manage summer water levels; and set minimum level summer goals.

Therefore, the BADC, through the offices of the Selectpersons of Belgrade and Rome, has requested that the Board of Environmental Protection revise the SWCC order to accommodate their proposed management plan.

Caculated flood levels are presented below:

	SPILLWAY	FLOOD		
		10 YR.	50 YR.	100 YR.
SALMON	278.0	278.7	279.1	279.2
GREAT POND	247.7	248.4	248.8	249.0
LONG POND	238.1	240.0	241.2	241.8

4. WATER LEVEL CONSIDERATION

A. Public Rights of Access and Use

SALMON LAKE

Salmon Lake is connected via a thoroughfare to McGrath Pond. Public access to both water bodies is via McGrath Pond. Water levels lower than 1 foot below spillway might interfere with passage between the two ponds.

GREAT POND

The Bureau of Parks and Recreation maintains a public boat launching facility on Great Pond. It is located in a relatively shallow area. Extreme lowering of water levels could make this facility unusable. The U.S. Postal Service operates a mail boat on Great Pond. The delivery route has 86 stops and runs from June 1 until September 30th. At 8 inches below spillway the mailboat would not be able to land at several docks. After Labor Day, the mail carrier can switch to a smaller craft due to fewer deliveries, thereby gaining access to the shallower docks. The mail carrier finds the BADC proposal acceptable.

SALMON LAKE Oakland and Belgrade	)	4 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT
GREAT POND Rome and Belgrade	)	
LONG POND Rome Belgrade and Mt. Vernon Kennebec County	)	
WATER LEVEL ORDER #L-011097-36-A-N	)	FINDINGS OF FACT AND ORDER

LONG POND

Long Pond is divided into north and south basins by a constriction of the lake in what is known as Castle Island. Castle Island is the site of a commercial fishing establishment renting boats and cabins. It is also an area much affected by both flooding and low water conditions. At 1 foot above spillway, docks begin to be inundated; at the 1.4 foot level the lowest cabin has water at its doorstep. At the 10 year flood level most of the island has water on it. The Bureau of Parks and Recreation has a boat launch facility south of the Castle Island causeway. At times of low water, passage at the throroughfare is very difficult. The owner of Castle Island claims that at 0.5 feet below spillway propellers are damaged and other problems arise.

B. Public Safety

Public safety was not found to be an issue of significant impact.

C. Fish and Wildlife Habitat; Water Quality

The primary focus of fishery management is for brown trout/black bass/white perch at Salmon Lake, and landlocked salmon/black bass/white perch for both Great and Long Ponds. Since sufficient, high quality spawning and nursery habitat is lacking, the cold water sport fisheries of these waters are based on an annual stocking program. The warmwater sport fisheries are sustained through natural reproduction. Maintenance of stable water levels (±1 foot) in the spring and early summer is important to successful fishery management of all three of these waters. The water level management plan proposed by BADC does not threaten the gamefish populations of the Belgrade Lakes.

A primary focus regarding wildlife is the maintenance and stabilization of water levels during the nesting and brood rearing season for waterfowl, including loons. To this end, water levels should become stabilized as soon after ice out as reasonably possible and maintained stable until at least July 1.

Relative to fall drawdown, it is desirable to achieve a stable water level a few weeks prior to ice-in if possible. This allows aquatic furbearers such as muskrat and beaver to establish lodges and food stockpiles before mobility is restricted by ice cover. Water level stability should be maintained through the winter.

SALMON LAKE Oakland and Belgrade GREAT POND Rome and Belgrade LONG POND Rome Belgrade and Mt. Vernon Kennebec County WATER LEVEL ORDER #L 011097-36-A-N	)	5 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT FINDINGS OF FACT AND ORDER

Both Great and Long Ponds have good to excellent water quality. Salmon Lake has had periodic algal blooms in recent years. Extreme high water would mean increased shoreline erosion and possible inundation of septic systems in low lying areas. In each case the results would be increased movement of nutrients into the lake.

Salmon Lake was the recipient of a federal lake restoration grant to reverse a cultural eutrophication problem. Virtually all the restoration effort went toward reducing non-point runoff of phosphorus into the lake. When water quality in the lake is eutrophic, generally from August into October, flushing is virtually nonexistant; therefore, no net export of nutrients occurs to improve lake water quality. Flushing of eutrophic water would accelerate Salmon Lake's recovery. Removal of large amounts of nutrients could be accomplished if the dam gate were opened any time significant amounts of nutrients accumulate in the epilimnion of the lake.

D. Erosion

In all three lakes erosion is only a problem at extremely high water levels. Within the ranges proposed in the BADC management plan, erosion will not be a significant problem.

E. Accommodation of Precipitation and Runoff

Twenty years of data (1969-1980) show that CMP used to drawdown Salmon Lake and Great and Long Ponds in the fall/winter period an average maximum of 1.3, 2.4 and 1.1 feet below spillway respectively.

The SWCC water level order currently restricts drawdown to 1 foot below spillway for each of the dams.

The public concensus is that during CMP's ownership flooding was not a serious problem. Since the time of the SWCC Order (1980), flooding has been a much more serious problem. The BADC management plan calls for a maximum drawdown potential of 1.5, 2.5, 2.5 feet below spillway for Salmon Lake, Great Pond and Long Pond respectively. The requested drawdown period would be from Labor Day to April of the following year.

F. Public and Private Water Supplies

None of the lakes serves as a public water supply. However, numerous lake residents do use lake water for domestic purposes. There are no known problems with water supplies on Salmon Lake. Water supply problems are expected if water levels should drop under 2.5 feet below spillway in both Great and Long Ponds.

G. Hydropower Considerations

CMP owns and operates four hydropower stations on Messalonskee Stream, below the Belgrade Lakes, including Snow Pond. CMP's only concern relative to water levels in the upstream lakes is that personnel in their dispatching department be notified whenever the gates are to be opened or closed so that they can maintain the level of Snow Pond accordingly.

H. Downstream Flows

Salmon Lake is connected to Great Pond by Hatchery Brook, a small outlet stream approximately 1/2 mile in length. In order to maintain aquatic life in the stream, a minimum instantaneous of 1 CFS is required at all times.

Great Pond and Long Pond are separated by a water stretch that is really more an extension of Long Pond than it is a distinct stream. Given this physical arrangement there is no need for establishing a minimum flow from Great Pond.

Long Pond drains into Messalonskee Lake via Belgrade Stream. However water levels in Messalonskee Lake are such that Belgrade Stream is primarily an extension of the lake back up to the Long Pond dam. As such minimum flows are not necessary for aquatic life in Belgrade Stream. Minimum flows are needed, however, further down the watershed due to the presence of the Oakland Sewage Treatment Plant which is located on Messalonskee Stream downstream from the Belgrade Lakes. The Environmental Protection Agency has requested State Certification of a draft NPDES Permit for the Oakland Wastewater Treatment Facility to discharge 0.48 MGD of treated municipal and industrial wastewater to Messalonskee Stream.

The existing draft permit requires continued secondary treatment of Oakland's wastewater. The permit limitations contain a sliding scale to maintain a minimum stream flow wastewater dilution ratio of 16.9:1. This action was specified to avoid instream toxicity induced by the discharge as determined by a DEP effluent toxicity test. At the allowable discharge of 0.48 MGD, a stream flow of 11.8 cfs is required to avoid instream toxicity. On a proportional watershed area basis, a minimum release of 8 CFS from the Long Pond watershed (121 square miles), combined with an additional 4 CFS from the Snow Pond watershed (121+56 square miles) will give the necessary 12 CFS.

SALMON LAKE Oakland and Belgrade	)	MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT
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THEREFORE, the Board ORDERS that water level regimes be established for Salmon Lake, Great Pond and Long Pond, and that all necessary actions be undertaken by the owner, lessee of the dams to insure compliance with the water level regimes with the following conditions:

SALMON LAKE

1. The dam owner shall drawdown the lake following Labor Day to achieve a water level of between 1 and 1.5 feet below spillway crest (277.0 - 276.5 msl) by November 1st.

   Drawdown may begin prior to Labor Day to enhance water quality restoration of Salmon Lake. Commencement of drawdown shall not begin unless secchi disk transparencies due to algae are less than 2.0 meters, or total average phosophorus levels in the upper two meters in the main basin of the lake exceed 15 mg/l. Any drawdown prior to Labor Day to enhance Water Quality restoration must receive approval from the DEP's Division of Environmental Evaluation and Lakes Studies before it may begin.

2. Between November 1 and April 1, the dam shall be managed to mitigate seasonal flooding by maintaining sufficient in-lake capacity to accommodate winter/spring runoff. During this period water levels should be maintained as close to between 1.0 and 1.5 feet below spillway crest as possible. Water levels shall not go below 1.5 feet below spillway crest.

3. Following April 1, the lake level shall be gradually raised to a target level of between 0.0 and 0.2 feet above spillway crest, on June 1st. During this time the water level shall not exceed 0.5 feet above spillway crest.

4. Between June 1 and Labor Day, the lake shall be maintained as close to the spillway crest as possible, and shall not exceed 0.3 feet above spillway crest.

5. A minimum instantaneous flow of 1 cfs shall be maintained in the outlet stream at all times. This condition shall have precedence over all others in the order.

6. A permanently mounted lake level gauge, marked in tenths of a foot (0.1) shall be installed at the dam. The gauge shall be placed such that the spillway crest corresponds to either 0.0 or 278.0 on the gauge. The gauge shall be installed by November 30, 1985.

7. The dam owner shall include in their written Water Management Plan the following:

SALMON LAKE Oakland and Belgrade	)	8 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT
GREAT POND Rome and Belgrade	)	
LONG POND Rome Belgrade and Mt. Vernon Kennebec County	)	
WATER LEVEL ORDER #L-011097-36-A-N	)	FINDINGS OF FACT AND ORDER

A. The designation of a person or persons to be responsible for the operation of the dam. This person(s) will open and close the dam gates and will maintain a written record of lake levels and gate opening status. The record shall be maintained on a daily basis during time of rapid water level change and on a weekly basis at all other times.

B. A procedure whereby downstream riparian landowners will be alerted as far in advance as possible to likely flooding or sudden releases of water.

C. A procedure for obtaining advance meteorological and runoff information relative to lake levels.

D. A protocol describing how the dam is to be operated under a variety of likely water level/meteorological occurrences. The protocol should take into account the ability of the dam to pass water and downstream capacities. The protocol should be updated continuously as experience is gained in managing the Salmon Lake water levels. As the plan is updated copies of any change will be sent to the Department of Environmental Protection.

E. A procedure for maintaining the required minimum downstream flow.

The Water Management Plan shall be submitted for review and approval of the Commissioner no later than February 1, 1986.

8. The owner of a dam shall be responsible for securing and complying with all applicable federal, state and local licenses, permits, authorizations, conditions, agreements and orders required for any activities undertaken in compliance with the terms of this order.

9. A copy of this order, and any amendments or modifications thereto, shall be incorporated as part of the deed for any dam impounding the body of water for which a water level regime as established by this order, and shall be henceforth transferred as part of said deed.

10. Any dam repairs, modifications or remedial actions which may result in conditions temporarily in violation of this order may be performed with prior written approval of the Commissioner of the Department of Environmental Protection.

GREAT POND

1. The dam owner shall drawdown the lake following Labor Day to achieve a water level of between 1.5 and 2.0 feet below spillway crest (246.2 - 245.7 msl)., by November 1st.

SALMON LAKE Oakland and Belgrade	)	9 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT
GREAT POND Rome and Belgrade	)	
LONG POND Rome Belgrade and Mt. Vernon Kennebec County	)	
WATER LEVEL ORDER #L-011097-36-A-N	)	FINDINGS OF FACT AND ORDER

2. Between November 1 and April 1, the dam shall be managed to mitigate seasonal flooding by maintaining sufficient in-lake capacity to accommodate winter/spring runoff. During this period water levels should be maintained as close to between 1.5 and 2.0 feet below spillway crest as possible. Water levels shall not go below 2.5 feet below spillway crest.

3. Following April 1, the lake level shall be gradually raised to a target level of between 0.0 and 0.2 feet above spillway crest, on June 1st. During this time the water level shall not exceed 0.7 feet above spillway crest.

4. Between June 1 and Labor Day, the lake level shall be maintained in coordination with the levels on Long Pond and as close to the spillway crest as possible. Lake levels shall not exceed 0.3 feet above spillway crest during this period.

5. A permanently mounted lake level gauge, marked in tenths of a foot (0.1) shall be installed at the dam. The gauge shall be placed such that the spillway crest corresponds to either 0.0, or 247.7 on the gauge. The gauge shall be installed by November 30, 1985.

6. The dam owner shall include in their written Water Management Plan the following:

   A. The designation of a person or persons to be responsible for the operation of the dam. This person(s) will open and close the dam gates and will maintain a written record of lake levels and gate opening status. The record shall be maintained on a daily basis during time of rapid water level change and on a weekly basis at all other times.

   B. A procedure whereby downstream riparian landowners will be alerted far in advance as possible to likely flooding or sudden large releases of water.

   C. A procedure for obtaining advance meteorological and runoff information relative to lake levels.

   D. A protocol describing how the dam is to be operated under a variety of likely water level/meteorological occurances. The protocol should take into account the ability of the dam to pass water and downstream capacities. The protocol should be updated continuously as experience is gained in managing the Great Pond water levels. As the plan is updated copies of any change will be sent to the Department of Environmental Protection.

SALMON LAKE
Oakland and Belgrade

GREAT POND
Rome and Belgrade

LONG POND
Rome Belgrade and Mt. Vernon
Kennebec County

WATER LEVEL ORDER
#L-011097-36-A-N

10 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT

FINDINGS OF FACT AND ORDER

The Water Management Plan shall be submitted for review and approval of the Commissioner no later than February 1, 1986.

7. The owner of a dam shall be responsible for securing and complying with all applicable federal, state and local licenses, permits, authorizations, conditions, agreements and orders required for any activities undertaken in compliance with the terms of this order.

8. A copy of this order, and any amendments or modifications thereto, shall be incorporated as part of the deed for any dam impounding the body of water for which a water level regime as established by this order, and shall be henceforth transferred as part of said deed.

9. Any dam repairs, modifications or remedial actions which may result in conditions temporarily in violation of this order may be performed with prior written approval of the Commissioner of the Department of Environmental Protection.

LONG POND

1. The dam owner shall drawdown the lake following Labor Day to achieve a water level of between 1.5 and 2.0 feet below spillway crest (236.6 - 236.1 msl), by November 1st.

2. Between November 1 and April 1, the dam shall be managed to mitigate seasonal flooding by maintaining sufficient in-lake capacity to accommodate winter/spring runoff. During this period water levels should be maintained as close to between 1.5 and 2.0 feet below spillway crest as possible. Water levels shall not go below 2.5 feet below spillway crest.

3. Following April 1, the lake level shall be gradually raised to a target level of between 0.0 and 0.3 feet above spillway crest, on June 1st. During this time the water level shall not exceed 1.4 feet above spillway crest.

4. Between June 1 and Labor Day, the lake shall be maintained as close to the spillway crest as possible, and shall not exceed 0.5 feet above spillway crest.

5. A minimum instantaneous flow of 8 cfs shall be maintained at all times, below the Long Pond (Wings Mills) Dam, to mitigate toxicity problems in Messalonskee Stream. This flow may be provided by leakage and/or discharge over or through the dam. Stream flow in Messalonskee Stream will be checked periodically by the DEP to verify the presence of 12 cfs in the stream.

6. A permanently mounted lake level gauge, marked in tenths of a foot (0.1) shall be installed at the dam. The gauge shall be placed such that the spillway crest corresponds to either 0.0 or 238.1 on the gauge. The gauge shall be installed by November 30, 1985.

SALMON LAKE Oakland and Belgrade	)	11 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT
GREAT POND Rome and Belgrade	)	
LONG POND Rome Belgrade and Mt. Vernon Kennebec County	)	
WATER LEVEL ORDER #L-011097-36-A-N	)	FINDINGS OF FACT AND ORDER

7. The dam owner shall include in their written Water Management Plan the following:

   A. The designation of a person or persons to be responsible for the operation of the dam. This person(s) will open and close the dam gates and will maintain a written record of lake levels and gate opening status. The record shall be maintained on a daily basis during time of rapid water level change and on a weekly basis at all other times.

   B. A procedure whereby downstream riparian landowners, and the Central Maine Power Company will be alerted far in advance as possible to likely flooding or sudden large releases of water.

   C. A procedure for obtaining advance meteorological and runoff information relative to lake levels.

   D. A protocol describing how the dam is to be operated under a variety of likely water level/meteorological occurances. The protocol should take into account the ability of the dam to pass water and downstream capacities. The protocol should be updated continuously as experience is gained in managing the Long Pond water levels. As the plan is updated copies of any change will be sent to the Department of Environmental Protection.

   E. A procedure for maintaining the required minimum downstream flow.

   The Water Management Plan shall be submitted for review and approval of the Commissioner no later than February 1, 1986.

8. The owner of a dam shall be responsible for securing and complying with all applicable federal, state and local licenses, permits, authorizations, conditions, agreements and orders required for any activities undertaken in compliance with the terms of this order.

9. A copy of this order, and any amendments or modifications thereto, shall be incorporated as part of the deed for any dam impounding the body of water for which a water level regime as established by this order, and shall be henceforth transferred as part of said deed.

SALMON LAKE Oakland and Belgrade GREAT POND Rome and Belgrade LONG POND Rome Belgrade and Mt. Vernon Kennebec County WATER LEVEL ORDER #L-011097-36-A-N	)	12 MAINE DAM INSPECTION, REGISTRATION and ABANDONMENT ACT FINDINGS OF FACT AND ORDER

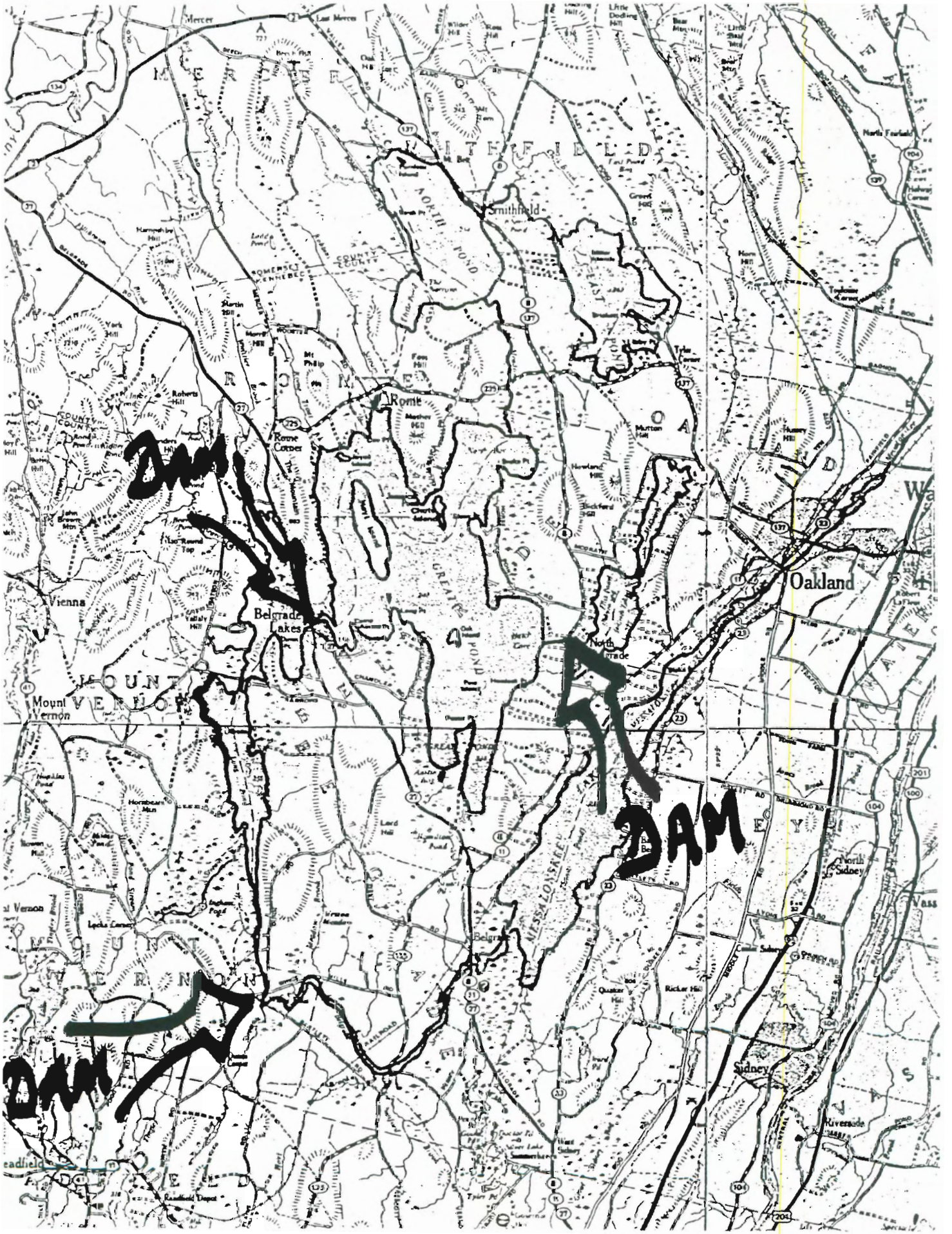
10. Any dam repairs, modifications or remedial actions which may result in conditions temporarily in violation of this order may be performed with prior written approval of the Commissioner of the Department of Environmental Protection.

DONE AND DATED AT AUGUSTA, MAINE, THIS 30TH OF OCTOBER, 1985.

BOARD OF ENVIRONMENTAL PROTECTION

BY: _____
Samuel Zaitlin, Chairman

PLEASE NOTE ATTACHED SHEET FOR APPEALS PROCEDURES....


Smithfield
Rome
Belgrade Lakes
Vienna
Mount Vernon
Oakland
North Sidney
Sidney
Riverside
DAM
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STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE HOUSE STATION 17 AUGUSTA, MAINE 04333

DEPARTMENT ORDER

IN THE MATTER OF

CENTRAL MAINE POWER COMPANY	)	
SIDNEY, BELGRADE, OAKLAND, WATERVILLE	)	MAINE WATER QUALITY PROGRAM;
KENNEBEC COUNTY, MAINE	)	FEDERAL CLEAN WATER ACT
MESSALONSKEE PROJECT	)	
#L-17585-33-D-N	)	WATER QUALITY CERTIFICATION
#L-17585-32-D-N (APPROVAL)	)	

Pursuant to the provisions of 38 M.R.S.A. Section 464 et seq. and Section 401 of the Federal Water Pollution Control Act (a.k.a. Clean Water Act), the Department of Environmental Protection has considered the application of CENTRAL MAINE POWER COMPANY with its supportive data, agency review comments, and other related materials on file and FINDS THE FOLLOWING FACTS:

1. APPLICATION SUMMARY

a. Application: The applicant proposes the continued operation of the existing Messalonskee Project, located on Messalonskee Stream in the Towns of Sidney, Belgrade, Oakland, and the City of Waterville, Kennebec County, Maine (See Exhibit 1).

b. Existing Project Features: The project consists of a water storage dam and 4 discrete hydroelectric generating facilities. The only commonality between the projects is that they are all operated to utilize flow provided by the uppermost dam, the Messalonskee Lake Dam.

Messalonskee Lake Development: The Messalonskee Lake Dam was rebuilt in 1992. The dam consists of a 54-foot long, 7-foot high concrete spillway dam with a crest elevation of 231.9 feet, plus 3.5 foot high flashboards, and a gatehouse section containing two 12-foot wide, 10.75 foot high, taintor gates (See Exhibit 2). The normal full pond level of Messalonskee Lake is at elevation 235.4 feet, has a surface area of 3,600 acres and an estimated 3,400 acre-ft of usable storage at a 1 foot drawdown. This dam is operated to maintain the level of Messalonskee Lake and provide storage for the 4 downstream hydro stations.

Oakland Development: Oakland consists of a dam, intake structure, penstock, powerhouse, and impoundment (See Exhibit 3). The dam is a gravity structure measuring 115 feet in length which includes a spillway and a gated section. The total head of the dam is 67.3 feet. The crest of the spillway is at elevation 207.1 feet. The intake is integral with the dam and has trashracks upstream of the gates. Water flows through the intake and into a 10-foot-diameter fiberglass and steel penstock. The concrete surge tank is 21 feet high. The powerhouse is a concrete structure measuring 38 feet 10 inches square. The powerhouse contains a single vertical Francis turbine rated at 2,800 kW at a head of 67.3 feet. The maximum hydraulic capacity of the unit is 590 cfs. The impoundment formed by the dam is 1,900 feet long, has a normal surface elevation of 207.1 feet, and has a surface area of 10 acres. The bypass reach that is created by the penstock is approximately 500 feet long and the substrate is exposed ledge.

Rice Rips Development: Rice Rips is located 1.9 miles downstream from Oakland. It consists of a dam, an intake structure, penstock, surge pond, powerhouse, and impoundment (See Exhibit 4). The dam is a concrete Ambursen dam measuring 220 feet in length and has an intake section, a hinged flashboard section, an overflow spillway section, and two earthen embankments. The flashboards are 5 feet high with a crest elevation of 139.1 feet. The concrete intake section is integral with the dam and conveys water to the 10-foot-diameter penstock of wood stave construction. The penstock is 2,292 feet long and empties into a surge pond that is 150 feet in diameter. Water flows from the surge pond into the concrete powerhouse which measures 42.5 feet by 30.5 feet. The powerhouse contains a single, vertical Francis turbine rated at 1,600 kW at a head of 42.4 feet. The maximum hydraulic capacity of the unit is 630 cfs. The impoundment formed by Rice Rips dam is approximately 1.6 miles long, has a normal surface elevation of 139.1 feet, and has a surface area of 87 acres. The bypass that is created by the penstock is approximately 2400 feet in length and consists of coarse and cobble/gravel substrate.

Automatic Development: Automatic is approximately 5 miles downstream of Rice Rips and consists of a dam with integral powerhouse and an impoundment (See Exhibit 5). The dam is a concrete gravity structure measuring 80 feet in length. The dam has a spillway section, a gated section, and a non-overflow section. The dam is also equipped with flashboards that are 1.9 feet high. The crest of the spillway is at elevation 92.4 feet. The powerhouse contains 1 horizontal Francis turbine rated at 800 kW at a head of 23 feet. The maximum hydraulic capacity of the turbine is 615 cfs. The impoundment formed by Automatic is approximately 4.5 miles long, has a normal surface elevation of 94.3 feet, and has a surface area of approximately 68 acres.

Union Gas Development: Union Gas is the furthest downstream of the Messalonskee Project generating facilities (See Exhibit 6). Union Gas consists of a dam, an adjacent powerhouse, and an impoundment. The dam has an earthen section and a stone masonry structure consisting of a non-overflow section, a gated section, a spillway and an intake section. Total length of the dam is 343 feet. The spillway has a crest elevation of 67.6 feet. The dam is equipped with flashboards that are 1.5 feet in height. The powerhouse contains a single vertical Francis turbine rated at 1,500 kW at a head of 37.8 feet. The maximum hydraulic capacity of the unit is 660 cfs. The impoundment formed by Union Gas is approximately 1.5 miles in length, has a normal surface elevation of 69.1 feet, and a surface area of 25 acres. The usable storage of the impoundment is estimated to be 30 acre-feet at a 1.3 foot drawdown.

c. Existing Project Operation: As previously discussed, the Messalonskee Project consists of a water storage dam and four hydroelectric generating facilities. The Messalonskee Lake water storage development is operated to provide water releases of approximately 570 cfs to the four downstream hydro stations. This is the most efficient flow for overall generation at the four stations. Once flow is released from Messalonskee Lake, each station is manually brought on-line by a traveling operator. During the summer months the 570 cfs is passed downstream until Messalonskee Lake is

drawn down by 0.5 foot; at that lake level, the gates are closed and the lake begins to refill with inflow. During the winter months the lake is drawn down by 1.0 foot. Water flow from the upstream lakes is controlled by DEP water level order L-11097-36-A-N, dated October 30, 1985. Historically, during periods when generation flows were not being released, only leakage flows were passed downstream from Messalonskee Lake. Leakage was estimated at 12-15 cfs. In 1992 the Messalonskee Lake Dam was rebuilt and two new gates were installed. The gates are capable of passing the historical leakage flow.

When inflow to Messalonskee Lake is greater than 570 cfs, the projects are essentially operated run-of-river. All water that does not go through the turbines is passed as spillage.

When inflow to Messalonskee Lake is less than 570 cfs, the project cycles. Generation releases will generally occur daily from mid-September through early June. For the first part of this period, September through February, the generation cycle usually lasts either 8 or 16 hours per day. From February into June, the cycles are usually longer, lasting either 16 or 24 hours. During the remainder of the year, mid-June through mid September, there may only be sufficient inflow to generate for a single 8-hour cycle per week. These generation periods are dependent upon inflow into Messalonskee Lake. After the generation flow ceases, the four generation stations are taken off-line. The first three hydro stations below Messalonskee Lake operate run-of-river, with outflow equaling inflow. The fourth project, Union Gas Development, has a computer controlled water level management system which automatically brings the station on-line when its impoundment level is full and automatically goes off-line when the impoundment has been drawn down 1.3 feet. When Messalonskee Lake is cycled, the lake level fluctuates by 0.5 feet during the summer months and 1.0 foot during the winter months.

d. Summary of Proposal: The applicant proposes to operate the project in accordance with several measures for the protection or enhancement of, or mitigation of impacts on, public resources. These measures include:

- Maintaining water levels in each of the project impoundments to within one foot of full pond elevation, except Messalonskee Lake which will be limited to a 6-inch fluctuation during the summer months, 1.0 foot during the winter, and Union Gas impoundment which will fluctuate up to 1.3 feet below normal full pond elevation;

- Providing a year-round minimum flow of 15 cfs through the Project including the Rice Rips bypass;

- Initiating a new downramping sequence at the Union Gas Development;

- Implementing the provisions of the "Messalonskee Lake Waterfowl Management Plan";

- Developing a new improved picnic site/day use area below the Messalonskee Lake Dam;

- Installing an informational/interpretive sign at the Oakland Development, and installing project identification signs at all of the projects;
- Investigating the need for establishing a "green belt/multi use" area along the east side of Messalonskee Stream between the Oakland Development and the Rice Rips Development;
- Improving parking at the Rice Rips Development;
- Evaluating the feasibility of creating a carry-in access site to the Rice Rips impoundment;
- Developing a carry-in access at Colby College; and
- Installing a hard surface boat ramp on the Kennebec River.

2. JURISDICTION

Water Quality Certification. The proposed continued operation of the project qualifies as an "activity...which may result in (a) discharge into the navigable water (of the United States)" under the Clean Water Act (CWA), 33 UC 1251 et seq. Section 401 of the CWA requires that any applicant for a federal license or permit to conduct such an activity obtain a certification that the activity will comply with applicable State water quality standards.

All the projects were originally licensed as water power projects under the Federal Power Act (Oakland, including the Messalonskee Lake Dam, Project No. 2559; Rice Rips, Project No. 2557; Automatic, Project No. 2555; and Union Gas, Project No. 2556). All project licenses were issued with an effective date of May 1, 1965, and an expiration date of December 31, 1993. On February 10, 1990, the Federal Energy Regulatory Commission (FERC) granted approval for the licensee to license the four projects as a single project including five hydraulically related developments. FERC assigned the Messalonskee Project FERC No. 2555. The licensee has filed an application to continue to operate the Messalonskee Project. This application is currently pending before FERC. In accordance with FERC Relicensing Regulations, the project developments are currently operating under annual licenses which will be automatically renewed each year until a relicensing decision is made.

The Department of Environmental Protection has been designated by the Governor of the State as the certifying agency for issuance of Section 401 Water Quality Certification for hydropower projects located in whole or in part in organized municipalities subject to the Department's regulatory jurisdiction. The Messalonskee Project is located in whole in the Towns of Sidney, Belgrade, Oakland, and the City of Waterville, which are organized municipalities subject to the Department's jurisdiction.

3. APPLICABLE WATER QUALITY STANDARDS

a. Classification: The waters of the Messalonskee Project are currently designated as follows:

Messalonskee Lake - Class GPA. 38 M.R.S.A. §465-A.

From the outlet of Messalonskee Lake to its confluence with the Kennebec River, including all impoundments except Rice Rips Lake - Class C. 38 M.R.S.A. §467(4)(E)(1)(a).

Rice Rips Lake - Class GPA. 38 M.R.S.A. §465-A.

b. Designated Uses: Class GPA waters shall be of such quality that they are suitable for the designated uses of drinking water after disinfection, recreation in and on the water, fishing, industrial process and cooling water supply, hydroelectric power generation and navigation and as habitat for fish and other aquatic life. The habitat shall be characterized as natural. 38 M.R.S.A. §465-A(1)(A).

Class C waters shall be of such quality that they are suitable for the designated uses of drinking water supply after treatment; fishing; recreation in and on the water; industrial process and cooling water supply; hydroelectric power generation, and navigation; and as habitat for fish and other aquatic life. 38 M.R.S.A. §465(4)(A).

c. Numeric Standards: Class GPA waters do not have numeric standards for dissolved oxygen (DO).

The dissolved oxygen content of Class C waters shall be not less than 5 parts per million or 60% of saturation, whichever is higher. 38 M.R.S.A. §465(4)(B).

d. Narrative Standards: Class GPA waters shall be described by their trophic state based on measures of the chlorophyll "a" content, Secchi disk transparency, total phosphorous content and other appropriate criteria. Class GPA waters shall have a stable or decreasing trophic state, subject only to natural fluctuations and shall be free of culturally induced algal blooms which impair their use and enjoyment. 38 M.R.S.A. §465-A-(1)(B)

Discharges to Class C waters may cause some changes to aquatic life, provided that the receiving waters shall be of sufficient quality to support all species of fish indigenous to the receiving waters and maintain the structure and function of the resident biological community. 38 M.R.S.A. § 465(4)(C).

e. Antidegradation: The Department may only approve water quality certification if the standards of classification of the waterbody and the requirements of the State's antidegradation policy will be met. The Department may approve water quality certification for a project affecting a waterbody in which the standards of classification are not met if the project does not cause or contribute to the failure of the waterbody to meet the standards of classification. 38 M.R.S.A. § 464(4)(F).

4. DISSOLVED OXYGEN

a. Existing Conditions: The water quality in Messalonskee Stream is characterized as poor. Point source and non-point source discharges provide phosphorous loading to the stream which in turn results in

algal blooms. The Oakland waste water treatment facility is the major point source for phosphorous loading into Rice Rips Lake. The bacterial decomposition of dead algae causes significant depletion of dissolved oxygen in the lower levels of the lake. The levels of dissolved oxygen observed have in many instances violated State water quality standards. Water quality problems in Messalonskee Stream and Rice Rips Lake are exacerbated by the existence of the dams which reduce flushing rates and natural reaeration of the water. These reduced flushing rates enhance the residence time of phosphorus which accumulates in bottom sediments. Phosphorus that is in bottom sediments can internally recycle itself, perpetuating phosphorus loading and algal blooms in the stream.

The applicant conducted a study entitled "Hydrologic Analysis of the Messalonskee Stream Drainage". The purpose of the analysis was to provide an understanding of the watershed and examine the availability of water in Messalonskee Stream. This report can be found in Appendix E-V of the application.

The Messalonskee Stream drainage is 210 mi^2 at its mouth. The headwaters of the stream are formed by the Belgrade Lakes. They are North Pond, East Pond, Salmon Lake, Great Pond, Long Pond, and Messalonskee Lake. The drainage area at the outlet of Messalonskee Lake is 177 mi^2. 68% (121 mi^2) of the drainage is above Messalonskee Lake at the Wings Mills Dam, which is the outlet dam on Long Pond.

Operation of the Messalonskee Lake hydro developments is dependent on inflow to Messalonskee Lake. As described under Existing Project Operation (pg. 2), the applicant utilizes the top 0.5 feet of Messalonskee Lake as storage for generation during the summer months (1.0 foot during the winter months). The applicant only utilizes the top 0.5 feet during the summer because camp owners on the lake complain when the water goes lower than that. The top 0.5 feet of lake provides roughly 1,500 acre-feet of storage, which is the equivalent of 25 cfs for one month (exclusive of evaporation).

The hydrologic analysis first estimated flow duration characteristics of Messalonskee Stream in an unregulated state. This was accomplished by reviewing flow information from the Nezinscot and Sheepscot Rivers. Both rivers are unregulated, in close proximity, and have similar drainage areas. The flow duration curves that were developed estimate the unregulated August median inflow to Messalonskee Lake to be 44 cfs. The analysis then accounted for evaporation. The evaporation rate was calculated to be a net loss of 0.7 inches during the month of August. This represents the loss of over 1,100 acre-feet of water, or 18 cfs of continuous flow. Applying this evaporation rate, the estimated unregulated median inflow to Messalonskee Lake in August is 26 cfs.

Once the unregulated flow into Messalonskee Lake was estimated, the effect of the DEP water level order on the availability of flows was examined. The order governs the operation of the dams at Salmon Lake, Great Pond, and Long Pond and requires that all lake levels above Long Pond be maintained as close to their respective spillway crests as possible between June 1 and Labor Day. Because the order maintains water levels for recreational purposes, there is literally no capacity to store the runoff during significant precipitation

events. Based on flow duration curves, the median August flow from the exit of Long Pond is anticipated to be about 15 cfs. However, the order only requires a minimum flow of 8 cfs from the Wings Mills Dam; the rest of the flow is used to maintain stable water levels that may drop due to evaporation. Considering the additional 56 mi^2 of drainage area between Long Pond and Messalonskee Lake and the regulation of flows by the DEP Order, the adjusted August median inflow to Messalonskee Lake is estimated to be 22 cfs. This is the amount of flow available into Messalonskee Lake during the critical summer months.

The 1990 DEP report "Messalonskee Stream Summary", discusses several options for improving the water quality of Messalonskee Stream. These options included increasing minimum flows from Messalonskee Lake; complete source elimination of effluent from the Oakland treatment plant; rerouting the effluent discharge to a location downstream of Rice Rips Lake; and removal of effluent during the summer months. Complete source elimination and rerouting the effluent were ruled out as being too expensive.

The Oakland waste water treatment plant is proposing to seasonally land apply the majority of its discharge on land owned by the applicant. CMP is leasing approximately 60 acres of land to Oakland in order to greatly reduce the amount of effluent that would otherwise be discharged into the Rice Rips impoundment. Based on calculations performed by the Department, it is estimated that approximately 56,000 gallons of waste water can be applied to each acre of land per week. The treatment facility is currently licensed to discharge 480,000 gallons/day.

b. Applicant's Proposal: The applicant proposes to pass a year-round minimum flow of 15 cfs below all four developments and in the Rice Rips bypass.

c. Discussion: The DEP Division of Environmental Assessment (DEA) comments that implementation of a minimum flow of 15 cfs, in combination with the proposed seasonal land application of effluent from the Oakland Waste Water Treatment Plant, should allow Messalonskee Stream to meet Class C dissolved oxygen standards; however, water quality sampling should be conducted in Messalonskee Stream to document attainment of standards.

The Town of Oakland has a pending application with the Department to renew the Town's discharge license for the Oakland Waste Water Treatment Plant. As a condition of that license renewal, the Department is assigning the Town responsibility for conducting water quality sampling in Rice Rips Lake. As a condition of this certification, the Department is assigning the applicant the responsibility for sampling dissolved oxygen in Messalonskee Stream. Based on a review of dissolved oxygen sampling performed by the applicant and the sampling performed by the Town of Oakland, the Department reserves the right, after notice and opportunity for hearing, and upon consideration of the joint responsibility of the Town of Oakland and the applicant, to require structural and/or operational changes at the Oakland Waste Water Treatment Plant and/or the Messalonskee Developments as necessary to meet Class C dissolved oxygen standards.

There is a reasonable assurance that Class C dissolved oxygen standards in Messalonskee Stream will be met if the applicant passes a minimum flow of 15 cfs through all project developments, including the Rice Rips bypass, provided the applicant monitor water quality in Messalonskee Stream. The top 0.5 feet of Messalonskee Lake shall be used for generation flows and to augment natural flows during the summer months as necessary.

5. TROPHIC STATE

a. Existing Conditions: The only significant point source discharge to project waters occurs in Rice Rips Lake. The Oakland waste water treatment plant is licensed to discharge 480,000 gallons per day into the impoundment. Currently the plant is providing the equivalent of tertiary treatment for phosphorus removal.

A September 1992 report prepared by Department biologist Jeff Dennis, indicates the Rice Rips impoundment is not meeting classification as a result of algal blooms in the impoundment. The algal blooms are a result of high phosphorus loading from the Oakland treatment plant, internal recycling of phosphorus from the bottom sediments within the impoundment, reduced flushing due to the presence of dams, and algal washout from Messalonskee stream flow (partially controlled by the applicant), and phosphorus loading from urban and agricultural sources in the direct watershed of the impoundment.

Rice Rips Lake does not meet its GPA classification due to eutrophication from phosphorus loading. The eutrophication results in an increasing trophic state. DEA comments that the only other project water classified GPA, Messalonskee Lake, has a stable or decreasing trophic state.

b. Applicant's Proposals: The applicant proposes to provide a minimum flow of 15 cfs through the Project including the Rice Rips bypass.

c. Discussion: Department staff comments a minimum flow of 15 cfs should be provided below each of the Messalonskee Stream projects in order to increase the flushing in Rice Rips Lake. This minimum flow should also minimize the effect of internal recycling of phosphorus in Rice Rips Lake. It is likely that implementation of a minimum flow of 15 cfs from the Messalonskee Lake Dam, in combination with the proposed seasonal land application of effluent from the Oakland Waste Water Treatment Plant, will allow Rice Rips Lake to meet its assigned GPA classification.

The Town of Oakland has a pending application with the Department to renew the license for the Oakland Waste Water Treatment Facility. As discussed in Section 4, Dissolved Oxygen, the Town of Oakland is proposing to seasonally land apply the majority of its waste water on land owned by the applicant. As a condition of that license renewal, the Department will be requiring the Town to conduct water quality sampling of Rice Rips impoundment to ensure that Class GPA standards are being met. Sampling shall consist of seasonal sampling of temperature, dissolved oxygen, total phosphorus, chlorophyll a, and Secchi depth. Based on the results of this sampling, the Department reserves the right, after notice and opportunity for hearing, and

upon consideration of the joint responsibility of the Town of Oakland and the applicant, to require structural and/or operational changes at the Oakland Waste Water Treatment Plant and/or the Messalonskee Developments as necessary to meet Class GPA standards.

Therefore, in order to meet class GPA narrative standards, a year-round minimum flow of 15 cfs shall be maintained at the outlet of Messalonskee Lake and from each of the downstream developments. The top 0.5 feet of Messalonskee Lake shall, in addition to being used for generation flows, be used to augment natural flows during the summer months as necessary.

6. FISH RESOURCES

a. Existing Resources: Messalonskee Stream has a warm water fish population which includes black bass, pickerel, perch, and sunfish. The stream also has brown trout which were introduced into the waterway as an experiment by the Maine Department of Inland Fisheries and Wildlife (DIF&W). There are no Federally listed threatened or endangered fish species known to occur within the project area. American shad, an anadromous specie can be expected to utilize some of the habitat in the Union Gas Development tailwater. These fish move up from the Kennebec River where the Maine Department of Marine Resources (DMR) stocks them.

Messalonskee Lake contains the same composition of fish species as Messalonskee Stream with the addition of northern pike, landlocked salmon, and rainbow smelt.

There are no upstream or downstream fishways located at any of the hydroelectric developments along Messalonskee Stream. At the outlet of Messalonskee Lake there is a fish screen installed which prevents fish from passing down into Messalonskee Stream. The screen is owned by the Town of Oakland. The applicant periodically cleans the screen when it becomes clogged with leaves and other debris. When the screen becomes clogged it affects flows into Messalonskee Stream and therefore affects generation. The applicant proposes to continue cleaning the screen as needed.

Based on requests from state fisheries agencies, the applicant conducted several studies aimed at evaluating impacts of project flows and flow fluctuations and impoundment water level practices on fish habitat.

"Fishery Resources of the Messalonskee Project" is presented in Appendix E-IX of the application. Surveys of the impoundments and free flowing stretches of stream were conducted at all five developments. Three sections of the stream noteworthy of discussion are the Rice Rips bypass, the Automatic impoundment, and the stretch of stream below the Union Gas Development. The Rice Rips bypass is approximately 2,400 feet long and receives only leakage flows (estimated at 12-15 cfs) from the dam. The rest of the flow from the dam passes through a penstock prior to reaching the Rice Rips powerhouse. Automatic impoundment is a 4.5 mile riverine stretch which starts below the Rice Rips powerhouse. The stretch below the Union Gas Development is approximately 5,000 feet long before it enters the Kennebec River. All of these areas have been targeted by

the Maine Department of Inland Fisheries and Wildlife as providing suitable habitat for adult brown trout. The Automatic impoundment is used by trout during the summer months when water temperatures are too high in the Rice Rips bypass. The area below Union Gas has also been identified by DMR as having habitat for various life stages of American shad.

"Rice Rips Bypass Channel Habitat Based Flow Study" is presented in Appendix E-X of the application. The study evaluated adult brown trout habitat in the 2,400 foot stretch of Messalonskee stream below the Rice Rips Development. Currently the bypass receives only leakage flows from the Rice Rips dam estimated at 12-15 cfs. As discussed below under Existing Management Plans, DIF&W wants to provide flows to optimize adult brown trout habitat during the spring (April 1 - June 15) and fall (Sept 15 - Sept 30) fishing seasons.

Due to the lack of habitat and unsuitable nature of the Oakland Development bypass reach, this area was not studied and no recommendations from the fisheries agencies to provide flows into this reach were made.

By linear measurement, the bypass consists of the following types of habitat: 56.5% riffle; 21.5% pool; and 32.0% riffle/run. The study team evaluated three flows in the bypass: 16.7 cfs, 27 cfs, and 51 cfs. Habitat for this study was based on Weighted Area (WA) which considers both quality and quantity of habitat. Although the study concluded that adult brown trout habitat is maximized at 27 cfs, 16.7 cfs provides approximately 94% of the maximum habitat for adult brown trout.

"Union Gas Instream Flow Study" is presented in Appendix E-XI of the application. The study incorporated the following components: Instream Flow Incremental Methodology (IFIM) study of the free flowing reach below the Union Gas dam; an assessment of habitat duration; and a ramping study. The IFIM assessed the uppermost 1,300 feet of the reach below the dam under a full range of flows (15 cfs-610 cfs). Adult brown trout and spawning and juvenile shad habitat were examined. The IFIM study concluded that adult brown trout habitat below the project was optimized at a flow of 100 cfs.

The ramping study evaluated impacts operational flows were having on fish and other aquatic life below the Union Gas dam. Changes in flow between 100% and 70% gate settings have little impact during both start-up and shut down. However, flow changes between 70% and 0% gate openings during operating shutdown result in an abrupt change in flow with rapid declines in water levels below the project. An area approximately 1/3 acre in size becomes dewatered once the project is shutdown.

b. Existing Management Plans: Since 1986, DIF&W has managed the waters of the Messalonskee Project for an accessible urban brown trout fishery. The two locations of specific interest to DIF&W are the Rice Rips bypass and the Union Gas development tailwater. The program is only experimental and natural reproduction of brown trout is not anticipated in Messalonskee Stream. An evaluation of the program will be conducted by DIF&W in the near future.

c. Applicant's Proposals: The applicant proposes the following measures to mitigate impacts to or otherwise enhance the fisheries resources of the Messalonskee Project.

- Providing a year-round minimum flow of 15 cfs below Messalonskee Lake Dam and through all four projects including the Rice Rips bypass;
- Restricting water level fluctuations of Messalonskee Lake (with cycling) to within 0.5 feet of full pond during the period June 1-August 31, and within 1.0 foot of full pond during the remainder of the year;
- Maintaining water levels in the Oakland, Rice Rips and Automatic impoundments (operated run-of-river) within 1.0 foot of full pond, year-round; and maintaining water levels in the Union Gas Development (with cycling) to within 1.3 feet of full pond elevation;
- Continuing to clean the fish screen at the outlet of Messalonskee Lake; and
- Implementing a new downramping sequence at the Union Gas Development.

d. Discussion: Based on the results of the bypass study and the IFIM, DIF&W recommends a minimum flow of 25 cfs through the Rice Rips bypass and a minimum flow of 100 cfs or inflow, whichever is less, below each of the projects. DIF&W comments that brown trout will utilize Rice Rips bypass during the spring, early summer, and fall months when water temperatures are cooler. During the summer months the brown trout will probably move into the Automatic impoundment where there is suitable year-round habitat.

As previously discussed in Sections 4 & 5, a minimum flow of 15 is necessary to enhance and maintain chemical water quality in Messalonskee Stream and Rice Rips Lake. It is staff's finding that a flow of 15 cfs is also adequate to protect fish resources in the bypass. It is also staff's finding that a minimum flow does not need to be provided in the Oakland Development bypass.

The Union Gas Project currently operates with a leakage flow of approximately 15 cfs and a maximum flow of 610 cfs. At 15 cfs (leakage) 76% of the peak Weighted Usable Area (WUA) for brown trout is available and at 600 cfs (maximum station discharge) 73% is available. American shad habitat is optimized at a flow of approximately 300 cfs. During normal station operation, 73% to 100% of WUA for brown trout is realized at all times. This percentage of WUA will increase with the implementation of a 15 cfs minimum flow during the summer months.

The applicant's proposals to maintain water levels in Messalonskee Lake, Rice Rips Lake, and the Oakland, Automatic, and Union Gas impoundments will be beneficial to the fish resources of the project waters.

The applicant reviewed the results of the downramping study that was conducted below the Union Gas development and has proposed to implement a new downramping sequence at the project. As inflow to the Union Gas impoundment decreases, the wicket gate openings close from 100% open to 70%. The gates are held at 70% until the pond drops 0.7 feet. At this level, the unit gradually downramps at 1% gate closure/minute, from 70% down to about 40% while the pond drops the additional 0.6 feet. This sequence allows ample time for fish moving in the area to redistribute themselves while water levels decrease in the tailrace. State fisheries agencies agree with the applicant's proposal. DMR and DIF&W are in agreement that this new sequence will minimize fish stranding.

The applicant's proposals to provide a minimum flow of 15 cfs below all of the project developments, including 15 cfs in the Rice Rips bypass, restrict water level fluctuations in Messalonskee Lake, Rice Rips Lake, and the Oakland, Automatic, and Union Gas impoundments, and to implement a new downramping sequence at the Union Gas development appear to be adequate to achieve and maintain suitability of the project waters affected by the project as habitat for fish and other aquatic life.

7. WETLANDS AND WILDLIFE

a. Existing Resources: In January of 1991, the applicant prepared a report entitled "Wetlands, Botanical and Wildlife Resources of the Messalonskee Project". This report is presented in Appendix E-VII of the application. The purpose of the study was to document the presence of these resources within the project, evaluate the effects of water level management on those resources, and evaluate opportunities for resource enhancement.

The most significant resources identified within the project area are in and surrounding the wetlands at the southern end of Messalonskee Lake. There are approximately 700 acres of inland deep water marsh and approximately 500 acres of oligotrophic lakeside bog. Loons, mink, river otter, muskrat, and beaver all utilize these wetlands for food and nesting habitat. The wetland is also recognized as a valuable migratory resting and staging area for waterfowl. The southern end of the lake is a Registered Critical Area due to the presence of the uncommon black tern. It is reported that this area is the largest and only continuously used nesting site in Maine for this bird.

The only rare plant species documented during the study was the rush aster. This was also found at the southern end of Messalonskee Lake.

b. Applicant's Proposals: Under normal operating conditions, the applicant proposes to restrict water level fluctuations in Messalonskee Lake to within 0.5 feet of full pond during the summer months and within 1.0 foot of full pond the remainder of the year to provide flood control benefit.

The Oakland, Rice Rips, and Automatic impoundments will continue to be operated to restrict water level fluctuations to within 1.0 foot of full pond. Union Gas will continue to be operated to restrict water level fluctuations to within 1.3 feet of full pond elevation.

c. Discussion: DIF&W's overriding concern is providing and maintaining stable water levels to insure maximum waterfowl nesting and production. Of primary concern are the wetlands and water levels in Messalonskee Lake. DIF&W has also raised questions regarding the apparent loss of emergent marshland and whether declines in uncommon black tern numbers are related.

In response to DIF&W's comments, the applicant has prepared the "Messalonskee Lake Waterfowl Management Plan". The plan provides for management and maintenance of waterfowl nesting and brood-rearing habitat within the project area. The plan includes a specific survey of black tern use in Messalonskee Lake and provisions for consulting with state and federal resource agencies. The applicant proposes to conduct wetland assessments and waterfowl surveys within 2 years of the issuance of a new FERC license for the project. DIF&W agrees with the applicant's proposed Waterfowl Management Plan.

The applicant's proposals to restrict water level fluctuations in all the project impoundments and manage waterfowl through the "Messalonskee Lake Waterfowl Management Plan" appear to be adequate to protect and maintain wetlands and wildlife in Messalonskee Lake and all other project impoundments.

8. RECREATION IN AND ON THE WATER

a. Existing Facilities and Use: Messalonskee Lake receives the most recreational use of any of the other water bodies within the project boundaries. Existing recreational facilities include various hard-surface boat launch facilities on Messalonskee Lake; day-use sites; unimproved fishing sites along Messalonskee stream; a carry-in boat access facility at North Street Park in Waterville; several informal carry-in access sites along the stream; two nature trails below the Automatic project; and the Couture Field Boat Launch, a hard-surface boat ramp installed by the applicant in 1989 on the Kennebec River near the Union Gas Development.

Recreational use in the project area is significant. Throughout the year the waters of the project receive use by boaters, swimmers, water skiers, fisherman, snowmobilers, cross county skiers, ice fishermen, hunters, and trappers.

b. Existing Management Plans: In 1989, the applicant developed a Comprehensive Recreational Facilities Plan which was designed to meet current and anticipated public recreational needs at CMP-owned hydro and water storage projects. The plan analyzes recreational needs on a local and regional basis.

The Maine Bureau of Parks and Recreation's 1988 Statewide Comprehensive Outdoor Recreation Plan (SCORP), has identified unmet recreational needs in this area of the state. Some of those needs include horseback riding, camping, ski touring, picnicking, bicycling, inland swimming, nature interpretation, and boat access.

c. Applicant's Proposals: The applicant proposes the following recreational enhancements to the project area:

- Maintaining the water level of Messalonskee Lake to within 0.5 feet of full pond throughout the summer recreation season, and to within 1.0 feet during the winter months;
- Providing a minimum flow of 15 cfs through the Rice Rips bypass to support DIF&W's efforts to develop a recreational fishery for adult brown trout;
- Developing a new improved picnic site/day use area below the Messalonskee Lake Dam (Site 5 on Exhibit 7);
- Installing an informational/interpretive sign at the Oakland Development, and installing project identification signs at all of the projects;
- Investigating the need for establishing a "green belt/multi use" area along the east side of Messalonskee Stream between the Oakland Development and the Rice Rips Development;
- Developing a carry-in site at Colby College (Site 8 on Exhibit 7);
- Evaluating the feasibility of creating a carry-in access site to the Rice Rips impoundment; and
- Installing a hard surface boat ramp on the Kennebec River (Site 12 on Exhibit 7). This was completed by the applicant in 1989.

d. Discussion: The Maine Department of Conservation (DOC) comments that the applicant's recreational proposals will enhance public use opportunities within the project area. DOC also comments the applicant should monitor water oriented public use and review recreation development potential needs with DOC in accordance with FERC Form 80 requirements.

The applicant's proposals, as outlined above, appear to be adequate to achieve and maintain suitable use of waters affected by the project for recreation in and on the water, provided a minimum flow of 15 cfs is maintained in the Rice Rips bypass during the period June-September to establish a recreational fishery for brown trout.

8. HYDROELECTRIC POWER GENERATION

a. Existing Energy Generation: The project generates an average of 22,999,000 kilowatt-hours (kWH) of electricity annually. This is equivalent to the energy that would be produced by burning 43,807 barrels of oil or 10,657 tons of coal each year. Project power is fed into the transmission and distribution system of the applicant for use by its customers.

b. Existing Energy Policies/Plans: The State of Maine has developed a comprehensive energy plan (Final Report of the Commission on Comprehensive Energy Planning, May 1992) with the goal of meeting the State's energy needs with reliable energy supplies at the lowest possible cost, while ensuring that energy production and use are

consistent with a healthy environment and a vibrant economy. Specifically, the Plan establishes the following targets for Maine's energy future:

- Reduce the State's level of dependence on oil from 50 percent to at least match the national average of 43 percent by the year 2000, with further reductions to at least the 30 percent level by 2010;
- Increase the percentage of renewable energy resources in the State's primary energy mix from 30 percent to 40 percent by the year 2000, and to at least 50 percent by 2010;
- Increase statewide energy efficiency relative to 1990 levels by 25 percent by the year 2000 and by at least 50 percent by 2010; and
- Work to stabilize long-term energy prices, in balance with Maine's other energy-related goals, with a specific emphasis on enhancing Maine's competitive position relative to New England and the U.S.

With respect to renewable energy, the Plan recommends that Maine actively encourage the development of wind and solar energy resources and support the continued utilization and further development, where appropriate, of the State's renewable, indigenous hydro and biomass energy resources.

c. Applicant's Proposal: The applicant proposes to provide a year-round minimum flow of 15 cfs below each of the project developments including the area known as the Rice Rips bypass. The agency recommended year-round minimum flow of 100 cfs or inflow below each of the projects would result in a 22% loss in generation annually.

d. Discussion: As proposed, the Messalonskee Lake Project will continue to provide cost-effective indigenous renewable electricity to the customers of Central Maine Power Company.

BASED on the above Findings of Fact, and the evidence contained in the application and supporting documents, and subject to the Conditions listed below, the Department makes the following CONCLUSIONS:

1. The continued operation of the project will result in the affected surface waters being suitable for all Class GPA and Class C designated uses provided that:

   i. A minimum flow of 15 cfs is passed from the Messalonskee Lake Dam and all other downstream developments, including 15 cfs in the Rice Rips bypass;

   ii. Water levels in Messalonskee Lake are maintained within 0.5 feet of full pond during the period June 1-August 31 and within 1.0 feet during the remainder of the year (with cycling); water levels in Oakland, Rice Rips, and Automatic impoundments are maintained within 1.0 foot of their respective full pond elevations (operated as run-

of-river); and water levels in the Union Gas impoundment are maintained within 1.3 feet of full pond elevation (with cycling);

iii. The new downramping sequence is implemented below the Union Gas development;

iv. The "Messalonskee Lake Waterfowl Management Plan" is implemented; and

v. Recreational facility improvements/enhancements are made in accordance with the applicant's proposals.

2. The continued operation of the project will result in Class C dissolved oxygen standards being met in the affected waters provided that a minimum flow of 15 cfs is passed from all project developments, and the applicant conduct dissolved oxygen sampling in Messalonskee Stream.

3. The continued operation of the project will result in Class GPA and Class C narrative standards for aquatic life being met provided that a minimum flow of 15 cfs is provided below all project developments including 15 cfs in the Rice Rips bypass, water levels in Messalonskee Lake are maintained within 0.5 feet between June 1-August 31, Oakland, Rice Rips, and Automatic impoundments are maintained within 1.0 feet of their full pond elevations, and Union Gas is maintained within 1.3 feet of full pond elevation.

4. The continued operation of the project will comply with the State's antidegradation policy provided that the project is modified and operated in accordance with the conclusions reached above.

THEREFORE, the Department GRANTS certification that there is a reasonable assurance that the continued operation of the Messalonskee Project, as described above, will not violate applicable water quality standards, SUBJECT TO THE FOLLOWING CONDITIONS:

1. MINIMUM FLOWS

A. Except as temporarily modified by approved maintenance activities, emergencies beyond the applicant's control, as defined below, or upon mutual agreement between the applicant and Department, the applicant shall discharge an instantaneous minimum flow of 15 cfs through all project developments, including the Rice Rips bypass, at all times.

The top 0.5 feet of Messalonskee Lake shall, in addition to being used for generation flows, be used to augment natural flows to meet the 15 cfs minimum flow requirement.

B. Operating emergencies beyond the applicant's control include, but may not be limited to, equipment failure or other abnormal condition, and orders from local, state, or federal law enforcement or public safety authorities.

C. The applicant shall, in accordance with the schedule established in a new FERC license for the project, submit plans for providing and

monitoring the minimum flows required by Part A of this condition. These plans shall be reviewed by and must receive approval of the DEP Bureau of Land and Water Quality.

2. WATER LEVELS

A. Except as temporarily modified by (1) approved maintenance activities (2) inflows to the project area, (3) by operating emergencies beyond the applicant's control, as defined below, (4) by flashboard failure, or (5) upon mutual agreement between the applicant and Department, the following water levels shall be maintained:

Messalonskee Lake (cycling)	Within 0.5 feet of full pond from 6/1-8/31 and within 1.0 feet from 9/1-5/31;
Oakland, Rice Rips, ~~and Automatic~~ (run-of-river)	Within 1.0 feet of full pond elevations;
Union Gas (cycling)	Within 1.3 feet of full pond elevation.

B. Operating emergencies beyond the applicant's control include, but may not be limited to, equipment failure or other temporary abnormal condition, and orders from local, state, or federal law enforcement or public safety authorities.

C. The applicant shall, in accordance with the schedule established in a new FERC license for the project, submit plans for providing and monitoring the water levels in each of the project impoundments as required by Part A of this condition. These plans shall be reviewed by and must receive approval of the DEP Bureau of Land and Water Quality.

3. WATER QUALITY SAMPLING

A. The applicant shall sample dissolved oxygen, temperature, and chlorophyll a in Messalonskee Stream. The applicant shall also record flow out of the Messalonskee Lake dam and identify periods of generation during sampling. The Department will review the results of this sampling in conjunction with sampling being performed by the Oakland Waste Water Treatment Plant in Rice Rips Lake.

B. Within 6 months following the issuance of a new FERC license for the project, the applicant shall submit a water quality sampling plan to the Department for review and approval.

C. If it is determined, based on a review of the sampling discussed in Part A of this condition and the sampling performed by the Oakland Waste Water Treatment Plant, that Messalonskee Stream is not meeting Class C standards for dissolved oxygen or Rice Rips Lake is not meeting Class GPA standards for trophic state, the Department reserves the right, after notice and opportunity for hearing, and upon consideration of the joint responsibility of the Town of Oakland and the applicant, to require such reasonable structural and/or operational changes to the Oakland Waste Water Treatment Plant or the Messalonskee Project as are deemed necessary to meet applicable Class C or Class GPA standards, except that no changes to the Messalonskee

Project will be required until at least 5 years have passed from the effective date of a new FERC license for the project.

4. DOWNRAMPING

The applicant shall implement the new downramping sequence at the Union Gas development as outlined in the supporting documentation for the application for 401 certification.

5. WATERFOWL NESTING

A. The applicant shall implement the provisions of the "Messalonskee Lake Waterfowl Management Plan" and begin conducting wetland assessments and waterfowl surveys within 2 years of the issuance of a new FERC license for the project.

B. The applicant shall consult with the Maine Department of Inland Fisheries and Wildlife regarding the findings of the wetland assessments and waterfowl surveys. The results of these assessments and the applicant's proposals for maintaining or enhancing wetlands and waterfowl nesting shall be submitted to the DEP Bureau of Land and Water Quality. After reviewing the results, any applicant proposals, and DIF&W comments, the Department shall order such continuation or modification of water levels established by this approval as is deemed necessary and appropriate to protect nesting waterfowl.

6. RECREATIONAL FACILITIES

A. The applicant shall maintain and improve recreational facilities and public access within the project boundaries including: installing project identification signs at all projects, evaluating the feasibility of a 'green belt/multi use' area between the Oakland and Rice Rips Development, improving parking at the Rice Rips Development, evaluating the feasibility of creating a carry-in access site to the Rice Rips impoundment, ~~and improving parking at the Automatic Development.~~

B. The applicant shall, in accordance with the schedule established in a new FERC license for the project, submit a schedule for implementing Part A of this condition. This schedule shall be reviewed by the Department of Conservation and the DEP Bureau of Land and Water Quality and must be approved by the DEP Bureau of Land and Water Quality.

7. LIMITS OF APPROVAL

This approval is limited to and includes the proposals and plans contained in the application and supporting documents submitted and affirmed to by the applicant. All variances from the plans and proposals contained in said documents are subject to the review and approval the Department prior to implementation.

8. COMPLIANCE WITH APPLICABLE LAWS

CENTRAL MAINE POWER COMPANY	19	MAINE WATER QUALITY PROGRAM;
SIDNEY, BELGRADE, OAKLAND, WATERVILLE)		FEDERAL CLEAN WATER ACT
KENNEBEC COUNTY, MAINE)		
MESSALONSKEE PROJECT)		
#L-17585-33-D-N)		WATER QUALITY CERTIFICATION
#L-17585-32-D-N (APPROVAL))		

The applicant shall secure and appropriately comply with all applicable federal, state and local licenses, permits, authorizations, conditions, agreements and orders required for the operation of the project.

9. EFFECTIVE DATE

This water quality certification shall be effective on the date of issuance of a new hydropower project license by the Federal Energy Regulatory Commission (FERC) and shall expire with the expiration of the FERC license.

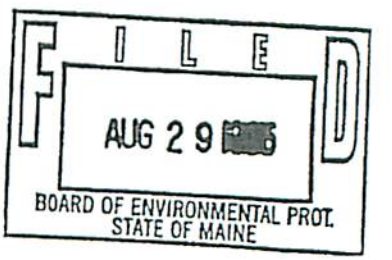
DONE AND DATED AT AUGUSTA, MAINE, THIS 28th DAY OF AUGUST, 1995.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

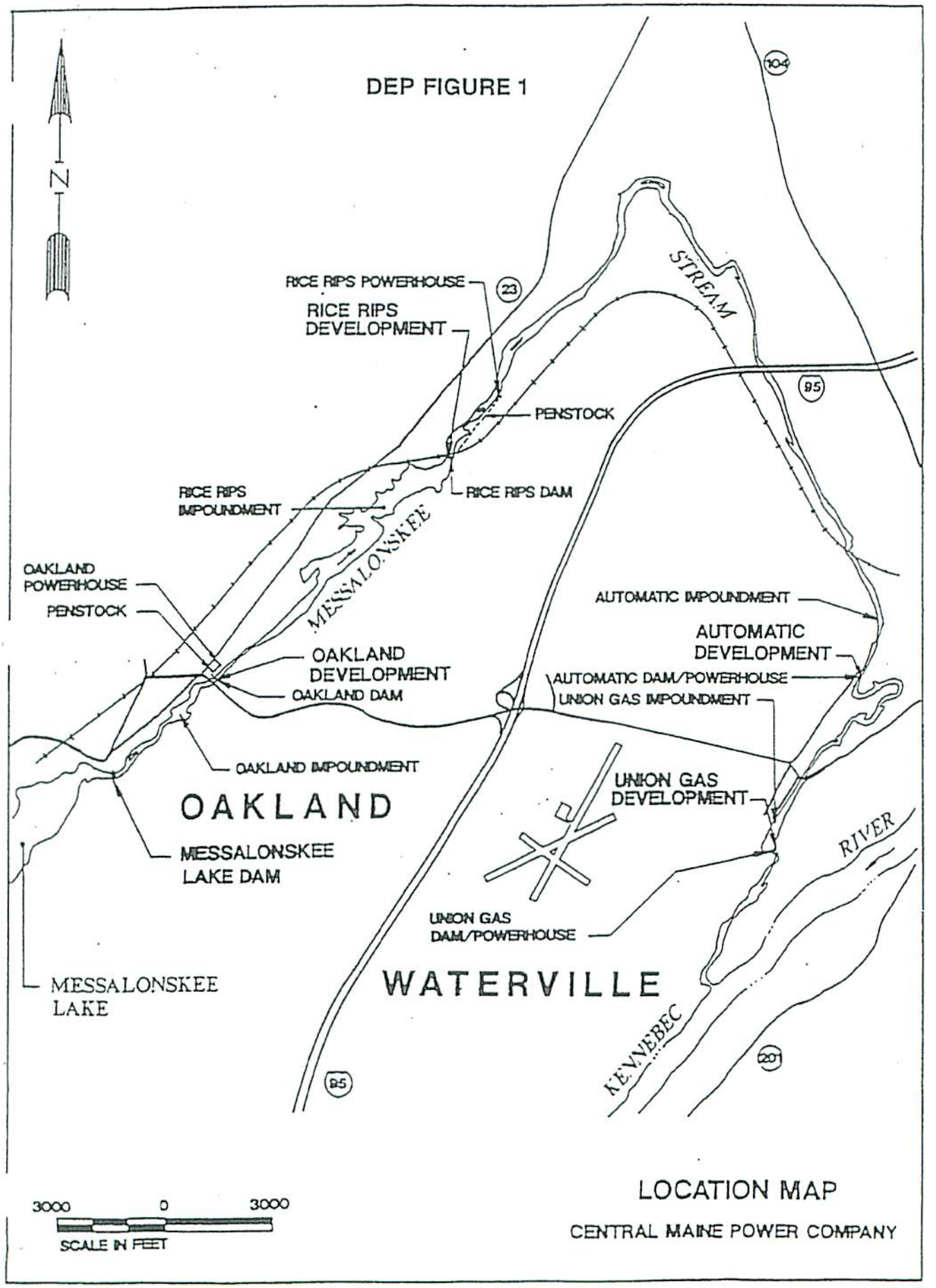
By: _____
EDWARD O. SULLIVAN, Commissioner

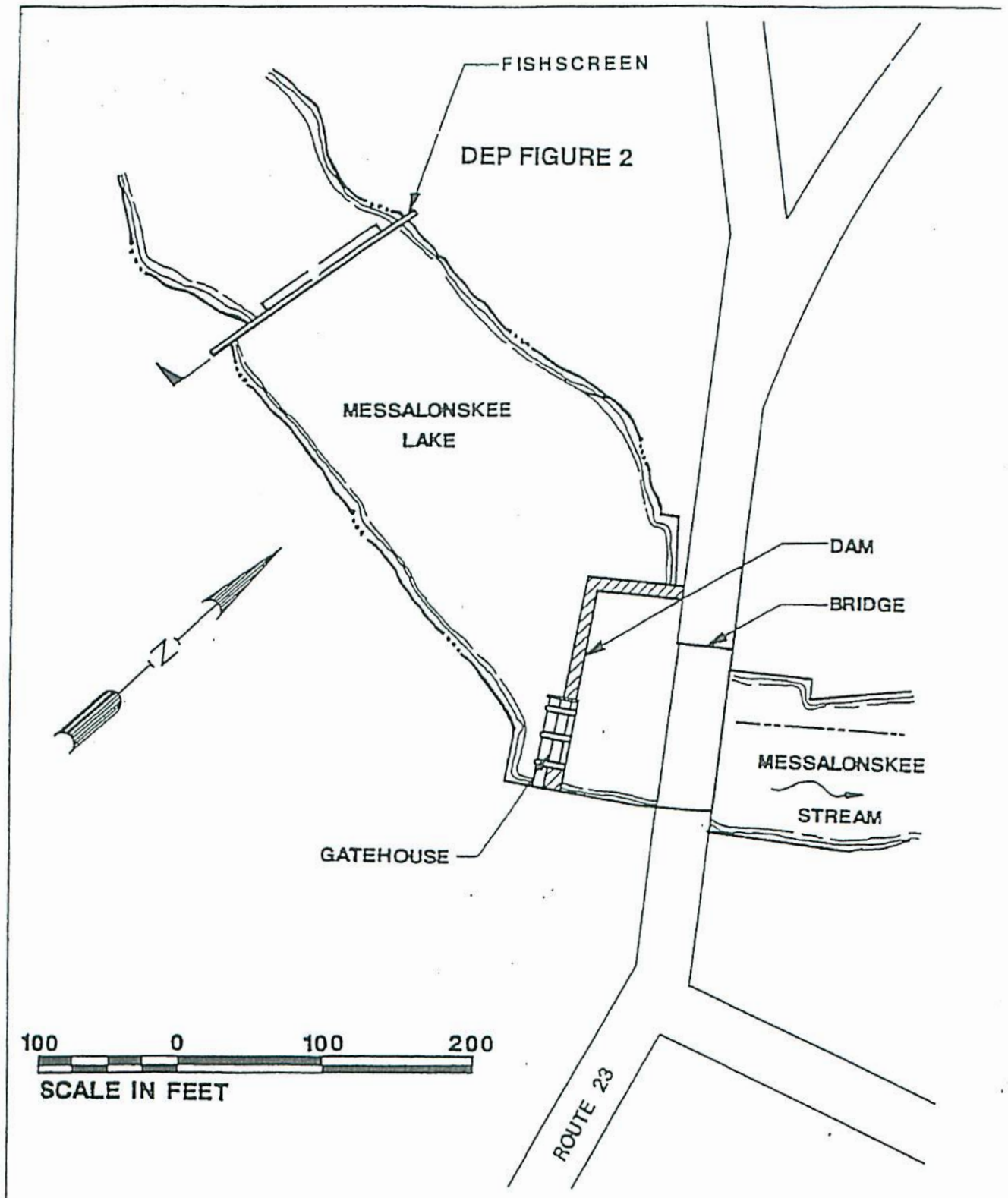
PLEASE NOTE ATTACHED SHEET FOR APPEAL PROCEDURES

Date of initial receipt of application 11/25/91.
Last date application withdrawn and refiled 11/16/94.
Date application accepted for processing 11/16/94.



Date filed with the Board of Environmental Protection


DEP FIGURE 1
N
RICE RIPS POWERHOUSE
RICE RIPS DEVELOPMENT
PENSTOCK
RICE RIPS IMPOUNDMENT
RICE RIPS DAM
STREAM
MESSALONSKEE
OAKLAND POWERHOUSE
PENSTOCK
OAKLAND DEVELOPMENT
OAKLAND DAM
OAKLAND IMPOUNDMENT
OAKLAND
MESSALONSKEE LAKE DAM
MESSALONSKEE LAKE
AUTOMATIC IMPOUNDMENT
AUTOMATIC DEVELOPMENT
AUTOMATIC DAM/POWERHOUSE
UNION GAS IMPOUNDMENT
UNION GAS DEVELOPMENT
UNION GAS DAM/POWERHOUSE
WATERVILLE
RIVER
KENNEBEC
104
23
95
201
3000 0 3000
SCALE IN FEET
LOCATION MAP
CENTRAL MAINE POWER COMPANY



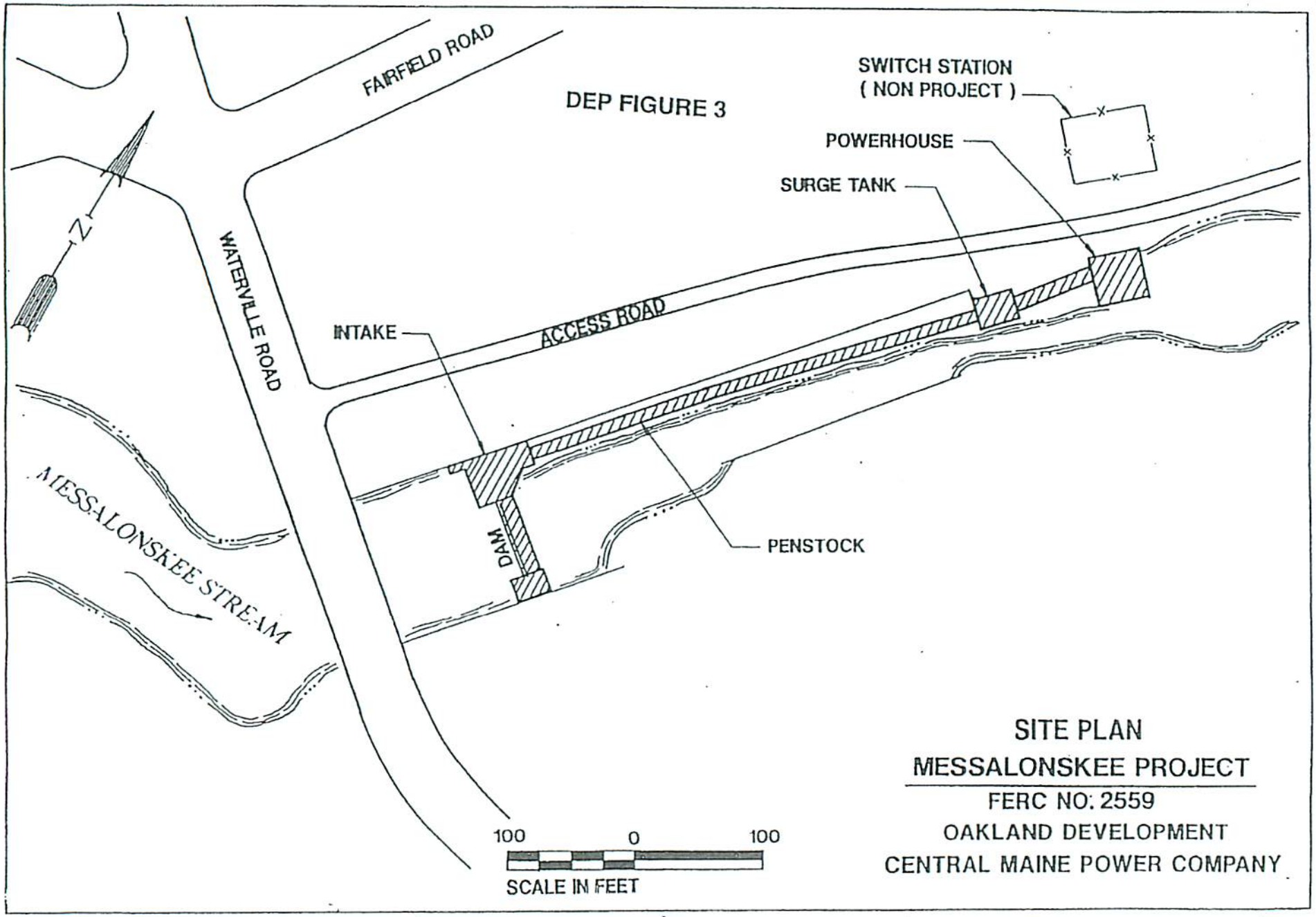
SITE PLAN

MESSALONSKEE PROJECT

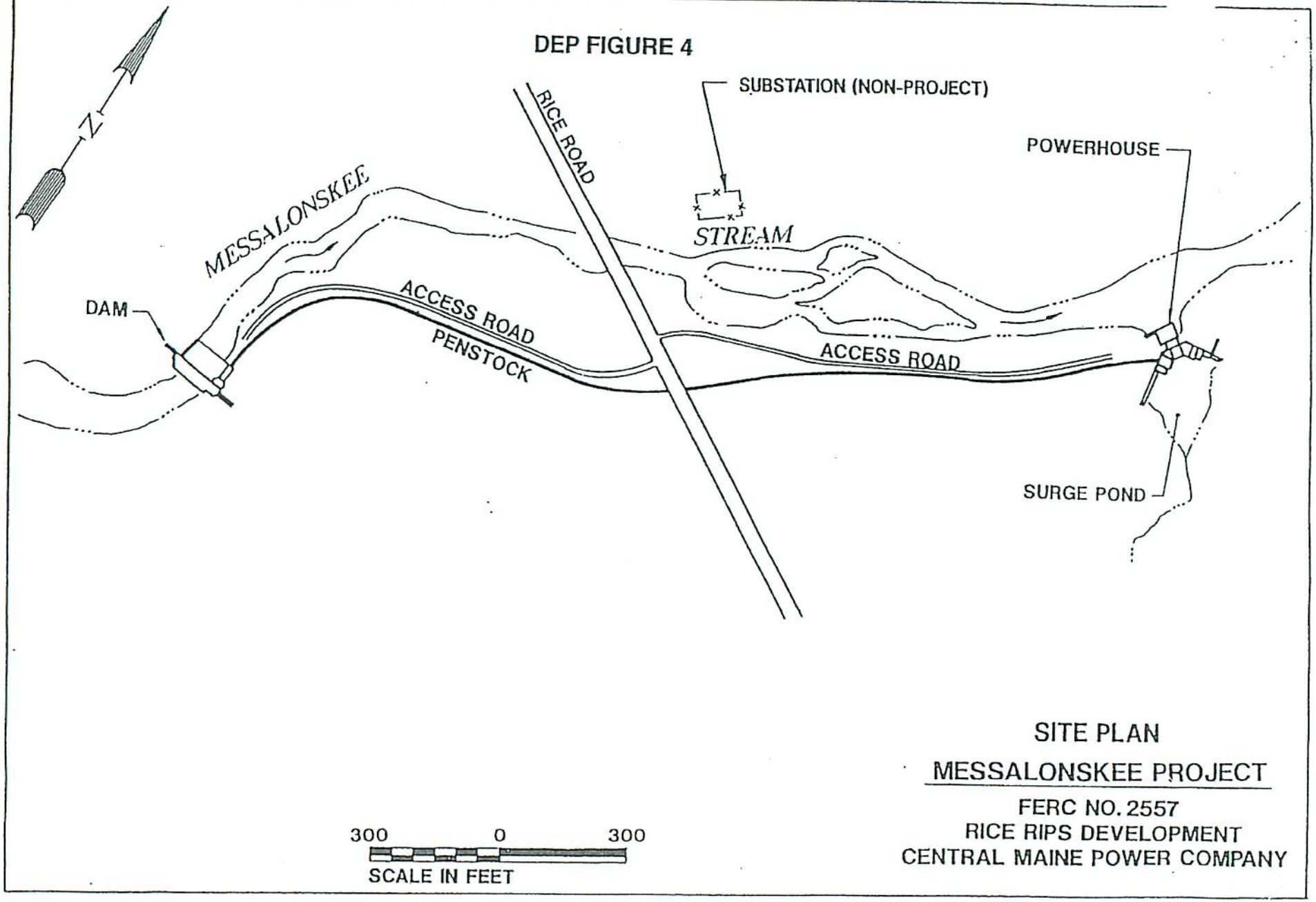
FERC NO: 2559

MESSALONSKEE LAKE DAM

CENTRAL MAINE POWER COMPANY


DEP FIGURE 3
FAIRFIELD ROAD
SWITCH STATION
(NON PROJECT)
POWERHOUSE
SURGE TANK
N
WATERVILLE ROAD
ACCESS ROAD
INTAKE
DAM
PENSTOCK
MESSALONSKEE STREAM
100 0 100
SCALE IN FEET
SITE PLAN
MESSALONSKEE PROJECT
FERC NO. 2559
OAKLAND DEVELOPMENT
CENTRAL MAINE POWER COMPANY

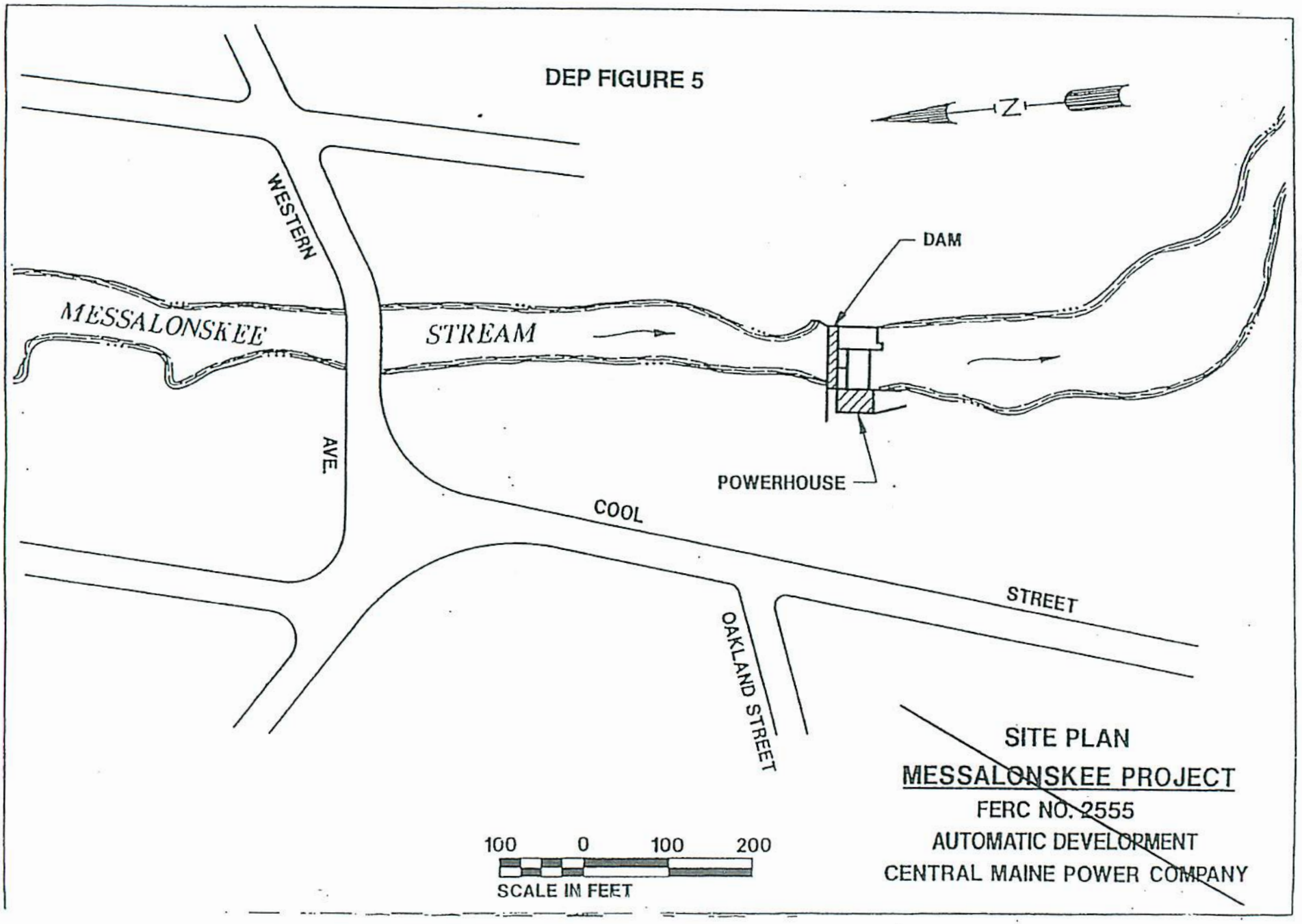
DEP FIGURE 4

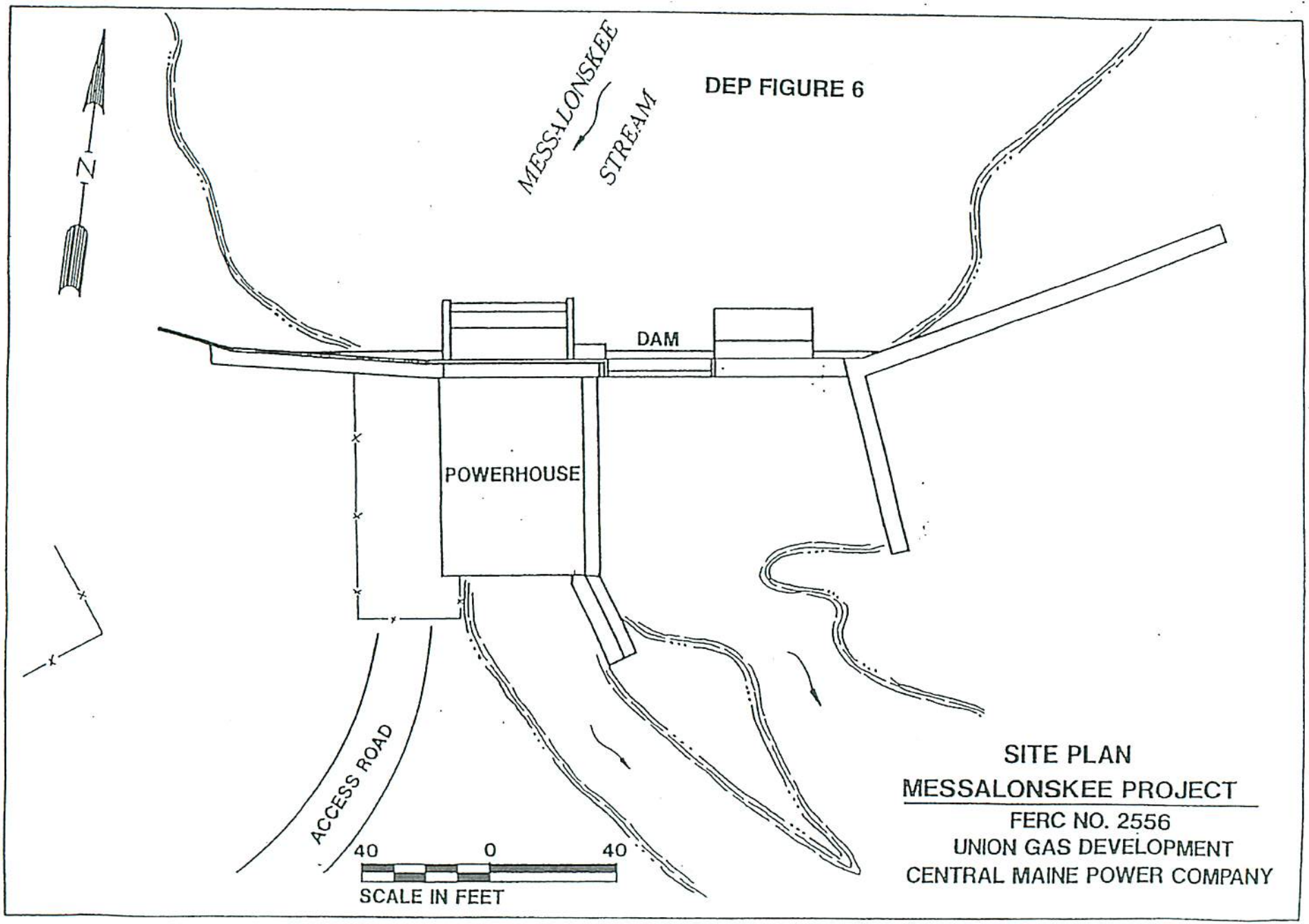


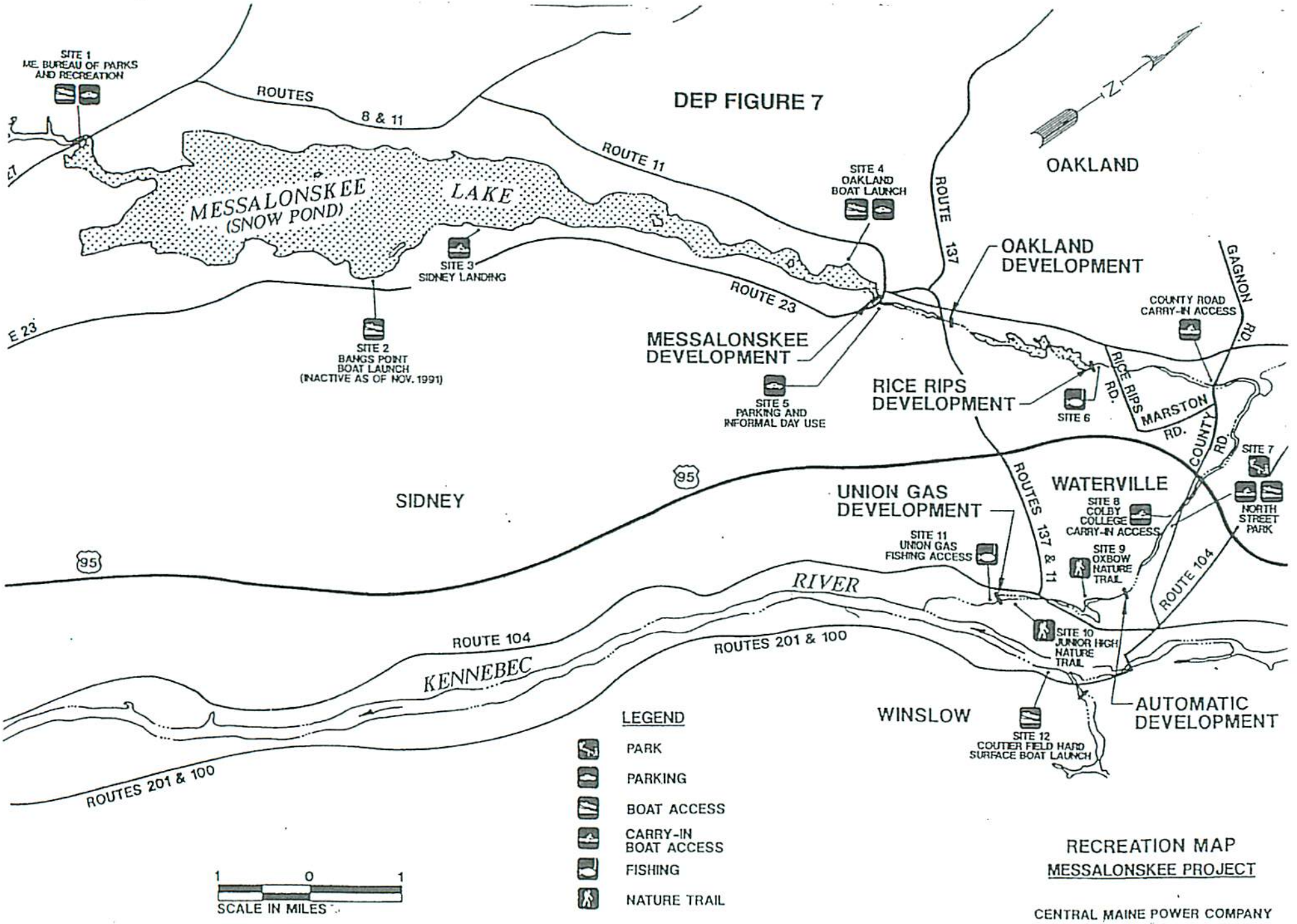
SITE PLAN

MESSALONSKEE PROJECT

FERC NO. 2557
RICE RIPS DEVELOPMENT
CENTRAL MAINE POWER COMPANY


DEP FIGURE 5
N
WESTERN
AVE.
MESSALONSKEE
STREAM
DAM
POWERHOUSE
COOL
STREET
OAKLAND STREET
100 0 100 200
SCALE IN FEET
SITE PLAN
MESSALONSKEE PROJECT
FERC NO. 2555
AUTOMATIC DEVELOPMENT
CENTRAL MAINE POWER COMPANY


DEP FIGURE 6
MESSALONSKEE
STREAM
N
DAM
POWERHOUSE
ACCESS ROAD
40
0
40
SCALE IN FEET
SITE PLAN
MESSALONSKEE PROJECT
FERC NO. 2556
UNION GAS DEVELOPMENT
CENTRAL MAINE POWER COMPANY


DEP FIGURE 7
SITE 1
ME. BUREAU OF PARKS AND RECREATION
ROUTES 8 & 11
ROUTE 11
MESSALONSKEE LAKE
(SNOW POND)
SITE 3
SIDNEY LANDING
SITE 2
BANGS POINT
BOAT LAUNCH
(INACTIVE AS OF NOV. 1991)
E 23
ROUTE 23
SITE 4
OAKLAND
BOAT LAUNCH
ROUTE 137
OAKLAND
OAKLAND
DEVELOPMENT
GAGNON RD.
COUNTY ROAD
CARRY-IN ACCESS
MESSALONSKEE
DEVELOPMENT
SITE 5
PARKING AND
INFORMAL DAY USE
RICE RIPS
DEVELOPMENT
SITE 6
RICE RIPS RD.
MARSTON RD.
COUNTY RD.
SITE 7
95
SIDNEY
UNION GAS
DEVELOPMENT
ROUTES 137 & 11
WATERVILLE
SITE 8
COLBY
COLLEGE
CARRY-IN ACCESS
NORTH
STREET
PARK
SITE 11
UNION GAS
FISHING ACCESS
SITE 9
OXBOW
NATURE
TRAIL
ROUTE 104
RIVER
ROUTE 104
ROUTES 201 & 100
KENNEBEC
SITE 10
JUNIOR HIGH
NATURE
TRAIL
AUTOMATIC
DEVELOPMENT
WINSLOW
SITE 12
COUTIER FIELD HARD
SURFACE BOAT LAUNCH
ROUTES 201 & 100
LEGEND
PARK
PARKING
BOAT ACCESS
CARRY-IN
BOAT ACCESS
FISHING
NATURE TRAIL
1 0 1
SCALE IN MILES
RECREATION MAP
MESSALONSKEE PROJECT
CENTRAL MAINE POWER COMPANY

MESSALONSKEE STREAM HYDRO, LLC
c/o ESSEX HYDRO ASSOCIATES, L.L.C.
55 UNION STREET, 4TH FLOOR
BOSTON, MASSACHUSETTS 02108 USA

TELEPHONE: +617-367-0032
FAX: +617-367-3796
E-MAIL: mshllc@essexhydro.com

September 10, 2010

Ms. Gail Wippelhauser
Marine Resource Scientist
Maine Department of Marine Resources
#172 State House Station
Augusta, ME 04333

Re: Messalonskee Stream American eel passage

Dear Ms. Wippelhauser,

As you are aware, on May 9th, 2010 Messalonskee Stream Hydro, LLC ("MSH") applied to the Low Impact Hydropower Institute ("LIHI") for certification as a low impact hydropower facility. As part of the application process, on June 7, 2010 you were contacted by my colleague Mr. Stephen Hickey in regards to the adequacy of MSH's Union Gas, Rice Rips and Oakland hydro station's ("the MSH stations") fish passage facilities (see Appendix 1). As we have discussed, please find below our proposal to address your concerns regarding the lack of upstream and downstream passage for American eel, the only diadromous species that have historically used Messalonskee Stream.

MSH proposes to work cooperatively with the Maine Department of Marine Resources ("MDMR") and the United States Fish and Wildlife Service ("USFWS") to address eel passage at the MSH stations.

In regards to upstream passage of American eel, MSH proposes to first address the Union Gas hydro station, the furthest downstream station on the Messalonskee Stream. In the spring of 2011 MSH would work with MDMR to determine the optimum location for installation of an eel ramp based upon an investigation of the tailrace area and observations of elver behavior. MSH then would install the ramp as early as is feasible on a best efforts basis. MSH suggests that MDMR install and maintain a trapping and counting box similar to that maintained at the Benton Falls project to assess the actual upstream eel migration in 2011 and subsequent years. MSH, MDMR, and USFWS would monitor American eel passage rates at the facility and assuming a successful run at the Union Gas project and the installation of upstream American eel passage at Automatic Station, the next upstream hydro station owned by the Kennebec Water District, MSH would then propose to work with MDMR and USFWS to design and install upstream eel passage facilities at the Rice Rips and Oakland projects.

With respect to downstream eel passage MSH proposes to provide MDMR and USFWS with project drawings showing details of each of the three project intakes. MSH then will work with the agencies to determine appropriate measures that need to be

taken to assure reasonable downstream eel passage. Such measures, if necessary, might include limited nighttime operation or modified bypass flow regimes during critical migration times. It is expected such measures would begin to be implemented in the fall of 2011.

You will note that MSH has provided Mr. Fred Ayer a copy of this letter that we hope responds to your July 13th comments regarding the adequacy of fish passage at the Messalonskee Stream Hydro projects.

If you have any questions, please give either Steve Hickey or me a call (617-367-0032) or send an e-mail, sjh@essexhydro.com or tarpey@massgravity.com.

Very truly yours,

MESSALONSKEE STREAM HYDRO, LLC
By: Concord Hydro Associates
Sole Member
By: Essex Hydro Associates, L.L.C.
General Partner

Thomas A. Tarpey
Executive Vice President

Cc: F. Ayer
J. Warner

Wippelhauser, Gail <Gail.Wippelhauser@maine.gov> Tue, Jul 30, 2019 at 10:59 AM
To: george zink <georgezink14@live.com>, "Steven_Shepard@fws.gov" <Steven_Shepard@fws.gov>
Cc: Robert Thornton <rthornton@essexhydro.com>, "dsherman@essexhydro.com" <dsherman@essexhydro.com>

Hi Skip.

Thanks for the report and attached efficiency data. The Maine Department of Marine Resources considers the upstream eel passage at the Oakland headowrks to be a permanent facility.

Congratulations on completing and testing all the upstream eel passage on Messalonskee Stream.

Gail Wippelhauser, Ph. D.
Marine Resources Scientist
Maine Department of Marine Resources
#172 State House Station
Augusta, ME 04333

Phone: 207-624-6349

email: gail.wippelhauser@maine.gov

From: george zink [mailto:georgezink14@LIVE.COM]
Sent: Friday, June 14, 2019 10:40 AM
To: Wippelhauser, Gail <Gail.Wippelhauser@maine.gov>; Steven_Shepard@fws.gov
Cc: Robert Thornton <rthornton@essexhydro.com>; dsherman@essexhydro.com
Subject: Exit pipes for Oakland Headworks and Snow Pond upstream eel passage

[Quoted text hidden]

2018 Snow Pond Outlet Upstream Eel Passage Report

Prepared by
George Zink

Table of Contents

Introduction

Snow Pond Outlet is the control gates and dam at the outflow of Messalonskee Lake and is the beginning of Messalonskee Stream. It is located in the town of Oakland Maine. It is owned and operated by the Messalonskee Stream Hydro LLC . (MSH); 55 Union St. 4th Floor, Boston, Massachusetts.

There are two Tainter gates and a minimum flow gate on river right and wooden flashboards on river left that regulate flows from the Lake into the stream that feeds the Oakland Hydro station first and the remaining stations along the stream to the confluence with the Kennebec River. This is the last obstacle for upstream migrating eels before reaching the lake. The dam is 9ft. tall from water to base of flashboards and is wet across the concrete due to leakage in and around the flashboards.

View from river left side

Observations

In 2017 night observations, Eels were observed at the footing below the dam on river left, and although not viewed climbing the concrete, were found along the length of the bottom flashboards. No activity was seen along or around the gates. Varying gate levels cause strong currents to pass along the river right side of the stream leaving the area below the flashboards relatively calm. Predators including; trout, pike, and snapping turtles, were viewed fishing along the dam footings below the flashboards.

Methods

Construction

The design, dimensions, and assembly of the ramp sections are consistent with those completed at the downstream projects, 12ft. long, 2ft. wide cable tray, divided into two 1ft. trays, one covered in Enkamat, the other in wooden pegs in a staggered "Plinko" pattern. Due to the stable water conditions below the flashboards, all ramps were made with the same materials as break away wooden entrance ramps weren't considered necessary.

It was decided that two 12 ft. entrance ramps would be used here to allow eels to climb from both sides. These were connected to a 3ft. by 3ft. transition tank at the top of the concrete dam and supported along the wall with metal brackets. The ramps are set at 30° incline. The top ramp is set at a 90° angle from the two entrance ramps, is 9ft. long

and set at 30° incline with a terminal end bolted to the top. This end hangs over the flashboards above the head pond.

A pump that is located in the head pond supplies attraction flows and holding tanks with water. Plumbing is connected to the catch tanks from the terminal end. The holding tanks are located on the top of the dam.

Verification

Testing consisted of both night time observations and collecting, subsampling and enumerating total catch. Eels using the ramps were diverted into holding tanks, weighed, with a subsample taken for length and individual weight so an average weight could be determined for an overall number of eels. This data was recorded daily. Night time observations were also done to make sure eels were not attempting to pass upstream in other sections of the headworks and to monitor predators.

Operations

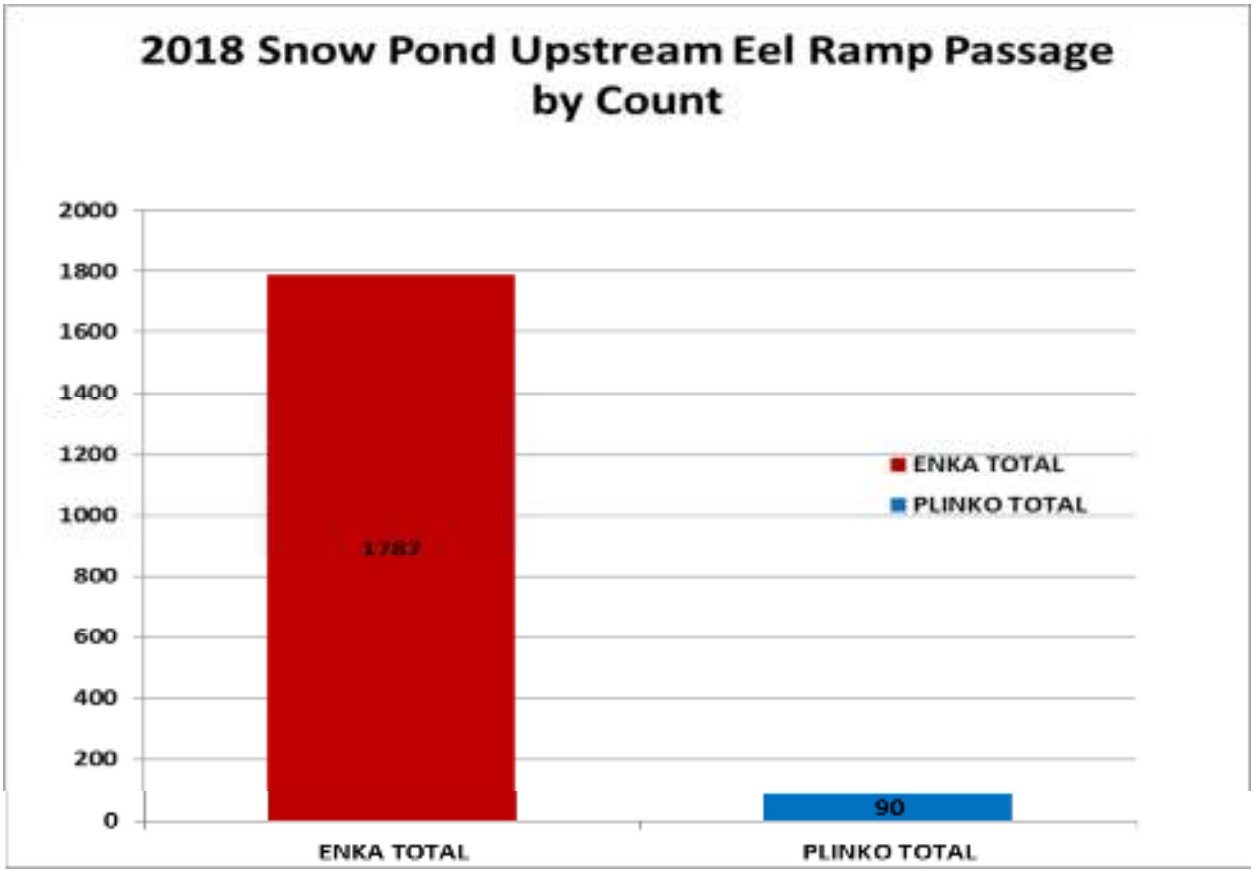
The system was started up on June 14, 2018. The first catch was collected and sampled on June 15, 2018. The system operated until October 4, 2018. The holding pens were checked daily and, pulled, emptied, and reset as necessary. Daily catches were weighed. A subsample was measured, counted, and weighed at least once a week. After the peak of the run, holding pens were checked every two or three days. All eels were released into the head pond after

being sampled. The passageway was shut down on July 16, 2018 to July 20, 2018 for efficiency testing.

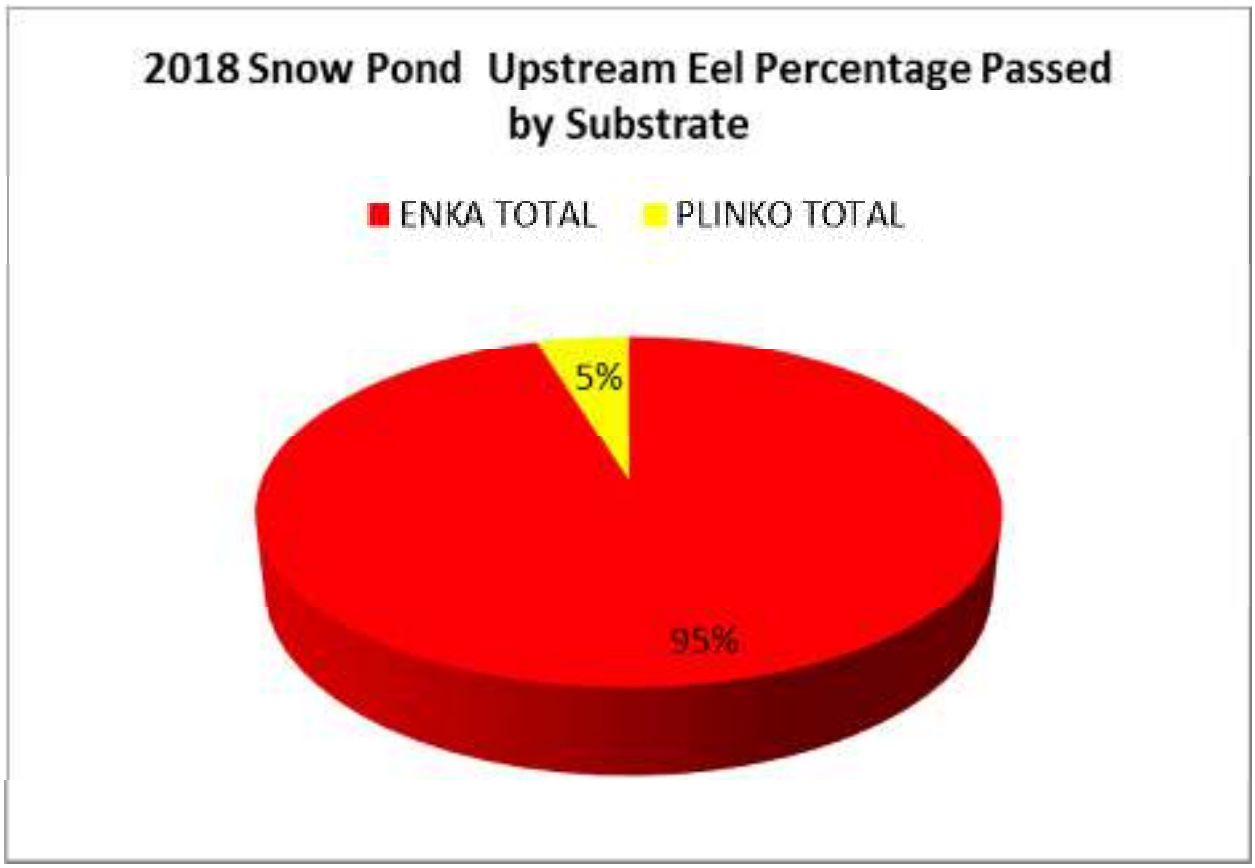
Night time observations were conducted once on June 21, 2018, once on July 16, 2018, twice on August 12, 2018 and August 27, 2018.

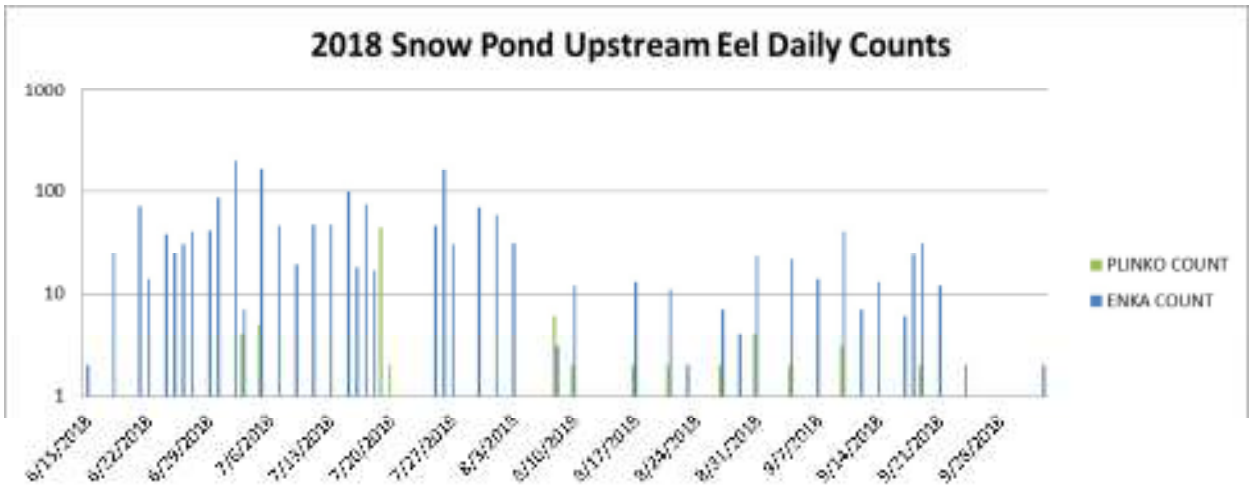
Results

The Snow Pond passageway, the most upstream passageway, passed 1,787 eels on the Enkamat side, and 90 eels on the Plinko side, totaling 1,877 eels passed in 2018. The smallest eel measured was 9.6 centimeters and the largest eel passed was 37.2 centimeters long.



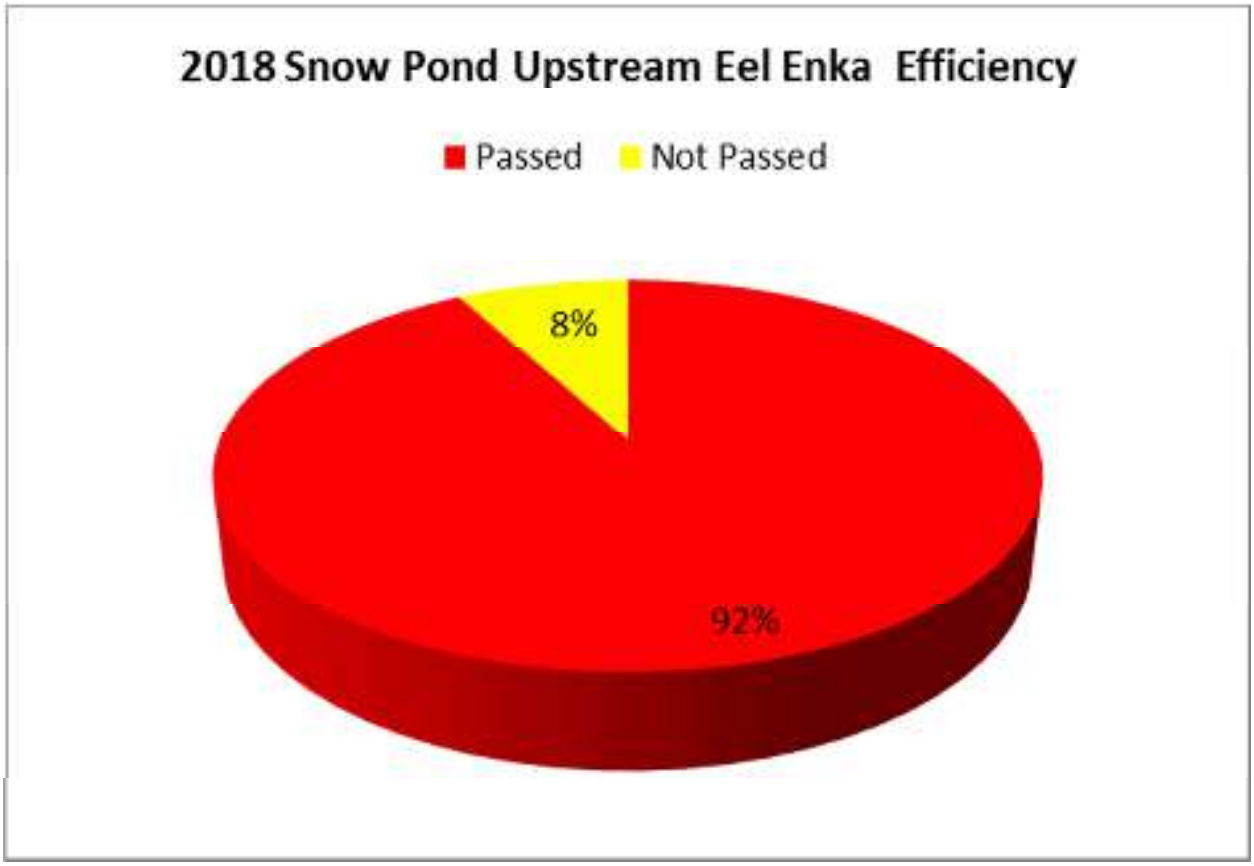
2018 Sample and Catch Data Snow Pond						
DATE	ENKA CATCH (g)	PLINKO CATCH (g)	ENKA COUNT	PLINKO COUNT	SMALLEST (cm)	LARGEST (cm)
6/15/2018	2.2	0	2	0	11.1	12.5
6/18/2018	45.6	0	25	0	9.6	13.5
6/21/2018	135.7	0	72	0	0	0
6/22/2018	24.8	0	14	0	0	0
6/24/2018	78.2	0	39	0	10.9	15.8
6/25/2018	54.6	0	25	0	0	0
6/26/2018	63.5	1.7	31	1	0	0
6/27/2018	79.6	0	41	0	0	0
6/29/2018	81.3	0	42	0	0	0
6/30/2018	169.8	0	88	0	0	0
7/2/2018	341.7	0	203	0	10	14.6
7/3/2018	9.1	6.9	7	4	11.2	12.6
7/5/2018	281.7	5.6	168	5	10.1	12.2
7/7/2018	108.6	1.4	47	1	11.1	15.5
7/9/2018	43	0	19	0	0	0
7/11/2018	107.6	1.9	48	1	11	17.7
7/13/2018	118	9.6	48	1	0	0
7/15/2018	171.1	0	102	0	10.1	15.3
7/16/2018	36.1	0	18	0	0	0
7/17/2018	109.6	0	75	0	9.7	15
7/18/2018	24.7	0	17	0	11	16.9
7/19/2018	0	959	0	45	16.3	37.2
7/20/2018	0	36.7	0	2	18.8	28.4
7/26/2018	240	0	165	0	0	0
7/25/2018	68	0	47	0	0	0
7/27/2018	55.5	0	31	0	11.3	14.3
7/30/2018	126.8	0	70	0	0	0
8/1/2018	107.9	0	60	0	0	0
8/3/2018	57.4	16.7	32	1	0	0
8/6/2018	0	15.2	0	1	24.3	24.3
8/8/2018	8.2	20.8	3	6	10.3	21.8
8/10/2018	26.8	12.5	12	2	0	0
8/17/2018	19.3	4.3	13	2	0	0
8/21/2018	23.2	2.5	11	2	0	0
8/23/2018	4.6	0	2	0	0	0
8/27/2018	14.2	3.6	7	2	11.1	14.2
8/29/2018	7.8	1.4	4	1	0	0
8/31/2018	40.2	11.9	23	4	0	0
9/4/2018	49.1	2.6	22	2	10.6	15.3
9/7/2018	26.7	0	14	0	0	0
9/10/2018	134.4	8.1	41	3	0	0
9/12/2018	16.7	3.3	7	1	0	0
9/14/2018	28.9	10.6	13	1	0	0
9/17/2018	30.1	0	6	0	0	0
9/18/2018	50.1	0	24	0	10.5	14.6
9/19/2018	66.3	11.2	32	2	0	0
9/21/2018	12.9	0	12	0	0	0
9/24/2018	4.2	0	2	0	0	0
9/28/2018	2.1	0	1	0	0	0
10/3/2018	3.2	0	2	0	0	0
Totals	**3311**	**1148**	**1787**	**90**	**9.6**	**37.2**

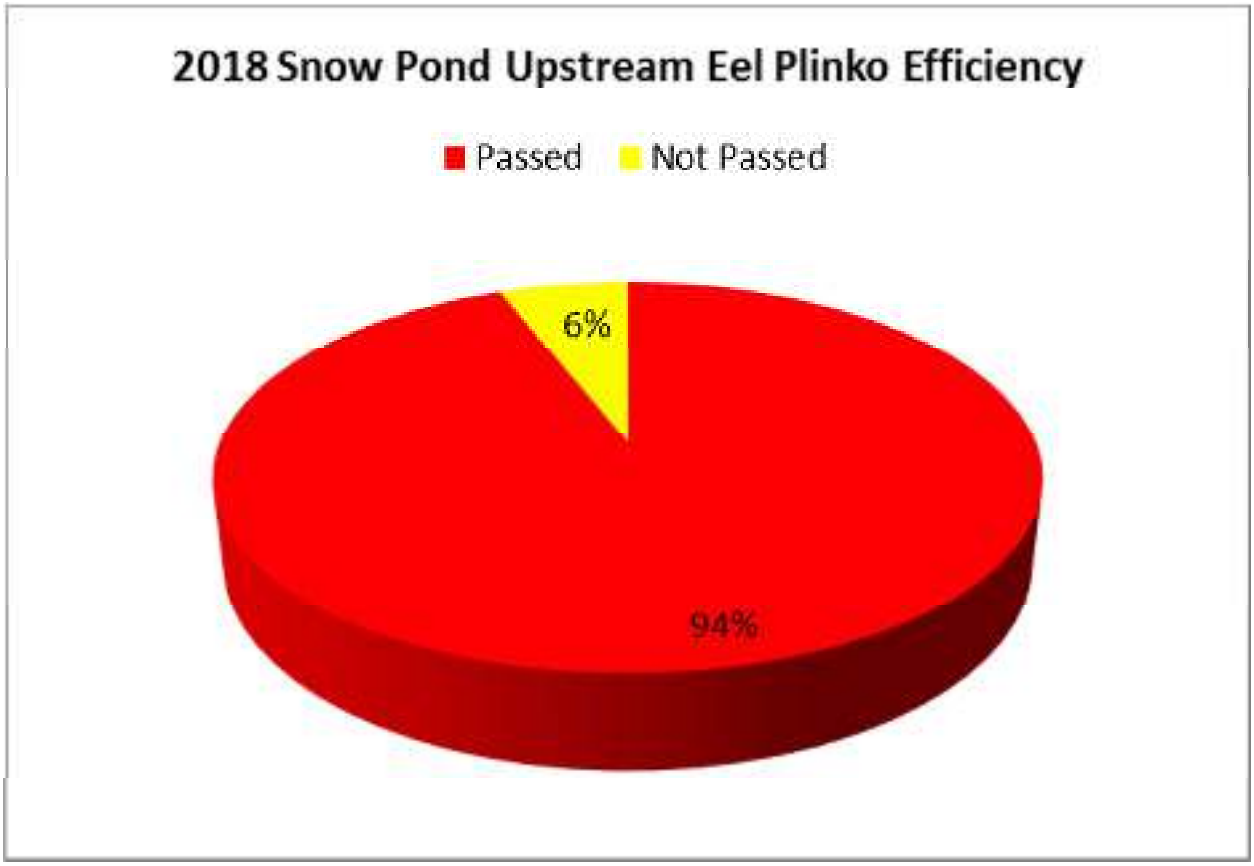

2018 Snow Pond Upstream Eel Percentage Passed by Substrate
ENKA TOTAL
PLINKO TOTAL
5%
95%


2018 Snow Pond Upstream Eel Daily Counts
1000
100
10
1
PLINKO COUNT
ENKA COUNT

Efficiency Test

An efficiency test, consisting of 100 eels placed on the Enkamat side and 50 eels placed on the Plinko side, was requested by the Maine Dept. of Marine Resources. Eels would be allowed to climb overnight and counted, measured and weighed the following morning. Eels were caught, counted, and placed on the ramps. This test was made on the Enkamat side first, starting on July 17th, and it ran for two nights. The result was 92% efficiency. On July 19th, the Plinko side test started and ran for two nights, resulting in a 94% passage efficiency.





Discussion

Night observations during 2017 found eels at the base of the footing and support wall that separates the control house and flashboards. They were also seen along the top of the concrete at the base of the flashboards. Eels were not seen near the control gates or minimum flow gate on the river right side. Varying gate levels cause strong currents to pass along the river right side. Predators were seen fishing along the dam footing below the flashboards. Because of this and the calmer flows, the area along the river left was selected for the upstream passage. Twin entrance ramps were added to cover this area. Pond levels are kept below the top of the flashboards and with the automated gates, spill over is rare.

The top of the passageway is approximately 14ft. to the left of the control house platform allowing eels exiting the ramp a calm entrance into deeper water, away from the pull of open gates.

The daily catch counts in 2018 were light during the season due to the dry weather all summer. The first night observations were spent looking for eels along the dam and most were found at the base of the river right entrance ramp. Eels were not seen anywhere along the control gates or the control house platform.

At this time it is requested that this interim eel passageway be considered a permanent upstream eel ramp.

Feel free to contact me with any questions or comments.

George Zink

(508) 274-4943

Georgezink14@live .com

Site Review

On August 1, 2018 Maine Dept. of Marine Resources Scientist Gail Wippelhauser inspected the Snow Pond upstream eel passage site.

Steve Shephard of U.S. Fish and Wildlife Service reviewed the Snow Pond passageway on August 17, 2018.

On October 10, 2018 Jason Bartlett Maine Dept. of Marine Resources Scientist, reviewed the Snow Pond passageway.

2017 Oakland Upstream Eel Passage Report
Phase 2
Messalonskee Stream Hydro L.L.C.

Prepared by
George Zink

Table of Contents

Introduction

Oakland Hydro Station is approximately .5 Miles downstream of the outlet of Snow Pond, on Messalonskee Stream. It is located in the town of Oakland Maine. It is owned and operated by the Messalonskee Stream Hydro LLC . (MSH); 55 Union St. 4th Floor, Boston, Massachusetts.

Oakland is the first station on Messalonskee Stream below the outlet of Snow Pond. This site is located on the Oakland Cascade which has an elevation drop of approximately 80 ft. The headworks are approximately 75 yds. upstream of the top of the cascade and supplies minimum flow to the stream and water to the station through a penstock.

The passage construction has been divided into two phases over two years. This first phase required, locating and building the entrance and ramps, diverting eels from the tailrace area on the south side, along the west side of the building, up to the north side of the building. All eels were diverted to a trap and holding pens for sampling. This construction and passage data are covered in the 2016 Oakland Upstream Eel Passage Report.

The work done in 2017 continued the upstream passage from the north side of the generation building, up to the base of the surge tower where eels were trapped and counted. When efficiency tests were completed, the exit pipe system was built along the west side of the surge tower and the penstock, to the river flowage under the penstock. Eels can swim to the headworks from this point.

Methods

Construction

The second stage construction started on May 16, 2017. The design, dimensions, and assembly of the ramp sections are consistent with the lower completed ramp; 12ft. long, 2ft. wide cable tray, divided into two 1ft. trays, one covered in Enkamat, the other in wooden pegs in a staggered "Plinko" pattern.

A 90° section was attached to the end of the ramp that was completed in 2016, along the west side.

90° section on northwest corner being attached

This 90° brings the passageway along the north side of the generation building, connected to a ramp section, cut to nine ft. and set at a 10° incline. A second 90° was attached setting the passageway direction back to the north and in alignment with the surge tower base.

North side generation building

The 90°s are level and, along with the shallow incline of the nine-foot ramp, gives the migrators a resting area before the long climb ahead on the next portion of the system. This transitional assemblage was also heavily bracketed to accommodate the weight of the upper ramps.

The next part of the passageway is a 60ft. section set at 30° and consisting of five 12ft pieces.

Beginning of 60ft section

This part of the passageway was supported on temporary bracing until permanent brackets were constructed and the ramp aligned. Additional bracing was added to eliminate swaying or shifting and in anticipation of the snow load. A terminal end was attached to the top end and due to tight spacing a work platform was assembled on the level approximately 6ft. below the top. The holding tanks and a work bench were set up there. Plumbing from the terminal end to the tanks was connected. Water supply for the attraction and exit systems was supplied by a heavy-duty pump located above the headworks and plumbed through a 1 1/2in. pipe to the top of the ramp. The passageway was started up on June 28, 2017.

Top piece being lowered into position

Permanent brackets being installed

View of brackets and bracing

Work platform

Terminal end

Water supply

The exit system build was started on September 5, 2017 with the addition of a 3ft. section added to the top of the ramp in order to gain enough height for good flow into the 4in. PVC pipe utilized for the exit. The terminal end was modified to allow both the Enkamat and the Plinko side to exit into the same pipe. A temporary single catch tank was hooked up in order to continue the eel count. The 10ft. sections were hung along the west side of the surge tower heading to the north. Beyond the tower wall the pipe was angled over toward the penstock to be connected to the concrete support saddles in order to be both protected from high flows and securely anchored. The pipe runs to the first pool of flowing water under the penstock. The catch tank was attached at this end to test the entire system. At the terminal end of the ramp a y pipe was fitted to allow an additional water supply to be plumbed into the PVC pipe due to the length of the exit system. The pipe is descending 10° from the terminal end to the end of the tower. It is set at 5° from there to the end of the pipe.

The flow under the penstock starts at the headworks and runs separate from the spill of the dam to the cascade. This penstock area flowage is separated from the minimum flow by an old granite block wall. This flow allows migrating eels to travel a series of protected connected pools from the end of the exit pipe to the headworks.

The Oakland passageway is 135 long, with three 90° turns, one 180° turn, and a 62ft. rise from the entrance to the top of the terminal end. The exit pipe system is 90ft long.

Exit pipe along Tower wall starting at terminal end with additional water supply

North side of tower showing exit pipe angled to penstock

Pipe along penstock

Exit pipe into catch tank

Operations

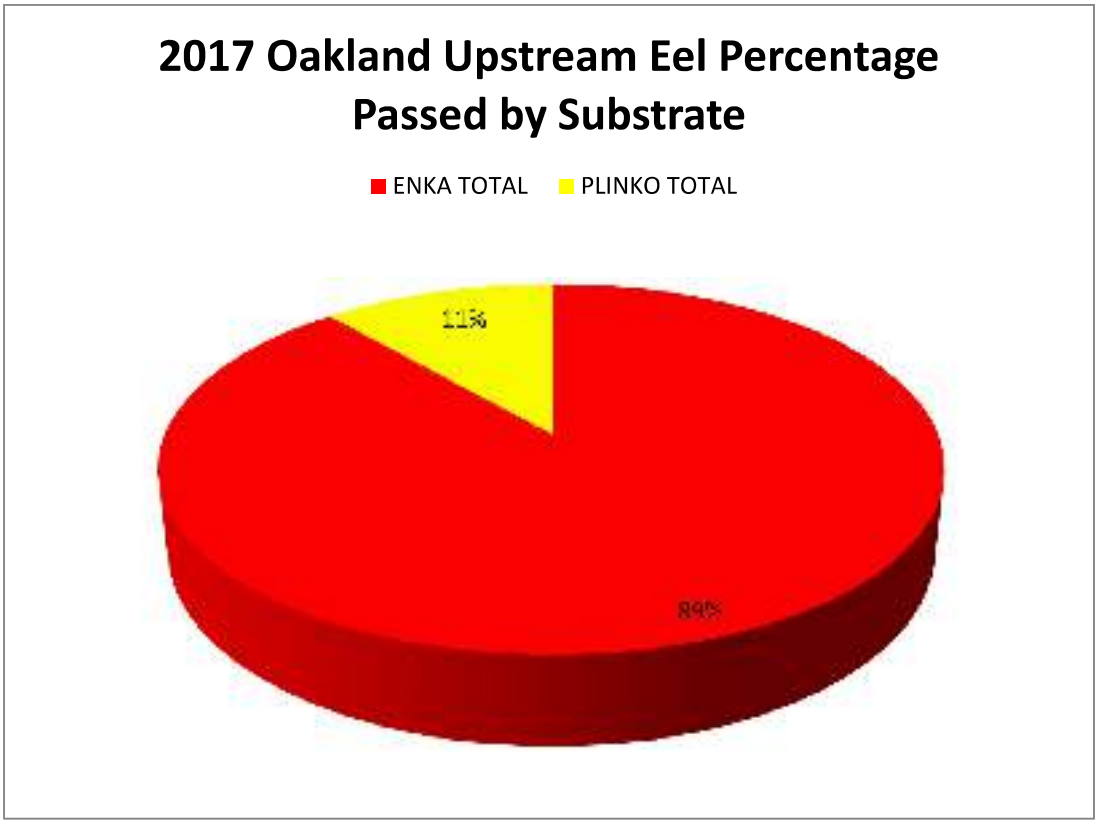
The system was started up on June 28, 2017 and the first catch collected and sampled on June 29, 2017. The system operated until October 5, 2017. The holding pens were checked daily and, pulled, emptied, and reset as necessary. Daily catches were weighed. A subsample was measured, counted, and weighed at least once a week. After the peak of the run, holding pens were checked every two days. Approximately 5,900 eels were released into the head pond. About 1,500 went into the reach between the headworks and the top of the cascade and the rest of the seasons catch into Snow Pond. The passageway was shut down in the middle of July for 4 days and again for 3 days in August for efficiency testing.

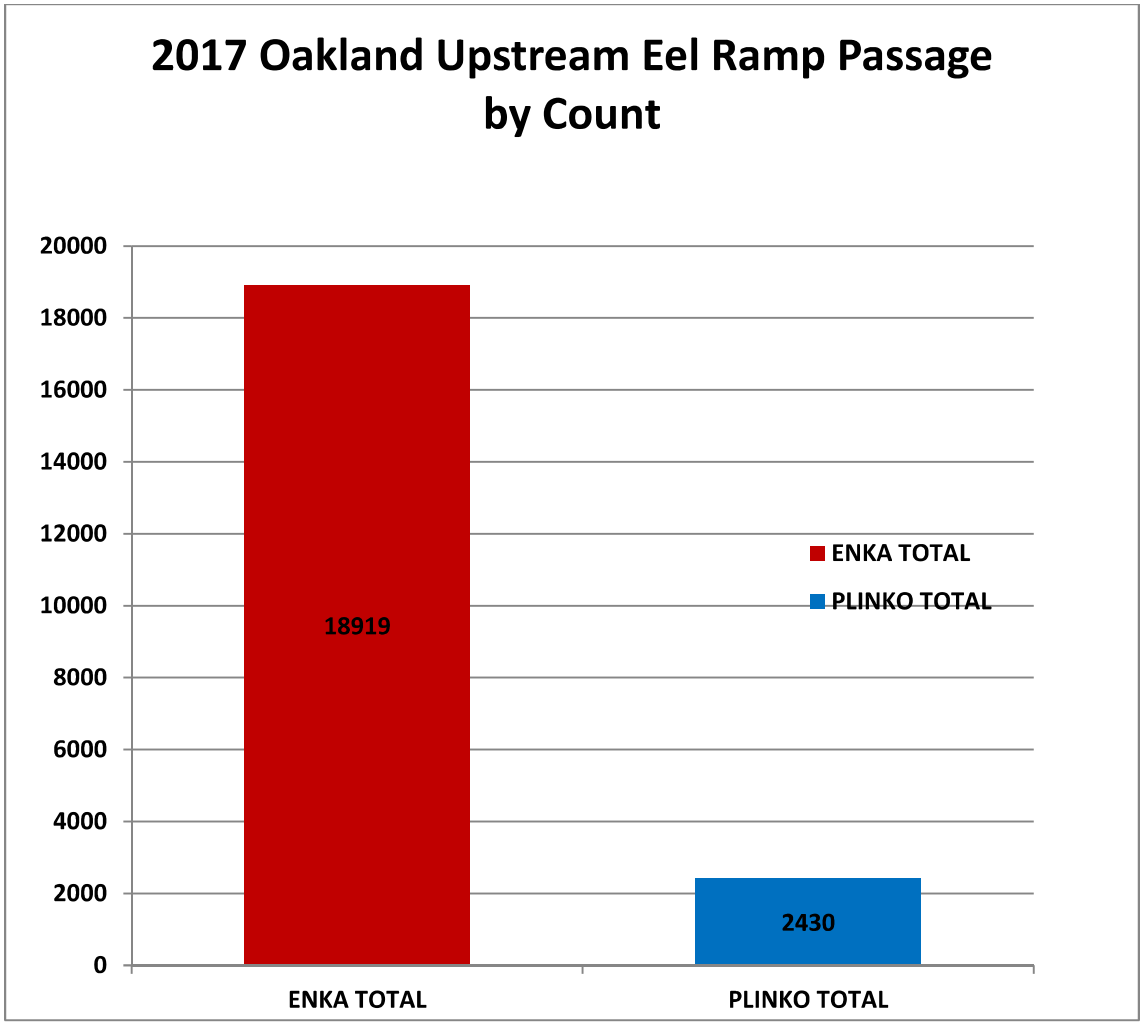
Results

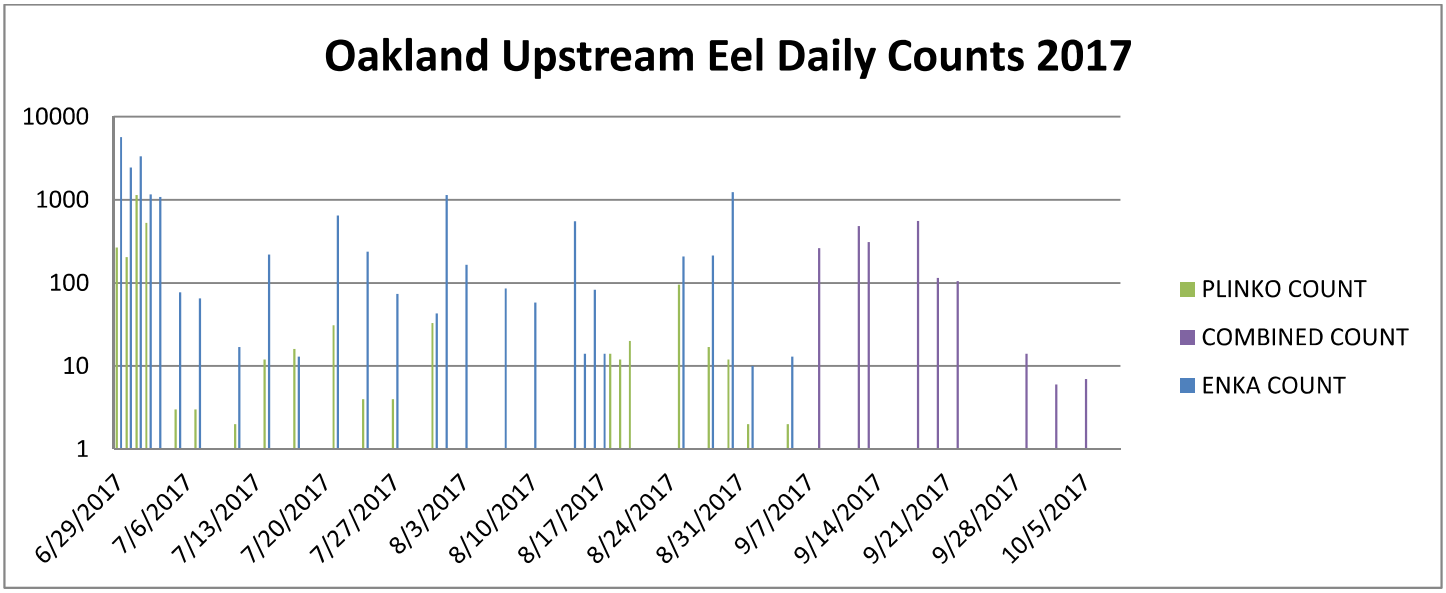
The passageway passed 18,919 eels on the Enkamat side, 2,430 on the Plinko side, and 1,860 from the combined catch. This totaled 23,209 eels passed in 2017. The largest eel passed was 48.0 centimeters long and the smallest was 9.8 centimeters. With the 7,878 on the Enkmat side and 916 on the Plinko side from 2016, the Oakland Passageway has had a total of 32,003 eels travel through.

2017 Sample and Catch Data Separate Substrates						
DATE	ENKA CATCH (g)	PLINKO CATCH (g)	ENKA COUNT	PLINKO COUNT	SMALLEST (cm)	LARGEST (cm)
6/29/2017	11158	807	5664	266	9.8	28.5
6/30/2017	4836	622	2455	205	0	0
7/1/2017	6610	3475	3355	1147	0	0
7/2/2017	2295	1607	1164	530	0	0
7/3/2017	1539	0	1084	0	10.3	14.2
7/5/2017	109.3	18.5	77	3	0	0
7/7/2017	92.3	12.2	65	3	0	0
7/11/2017	26.7	2.6	17	2	10.4	14.7
7/14/2017	344	15	219	12	0	0
7/17/2017	25	157	13	16	0	0
7/21/2017	1280	305	650	31	0	0
7/24/2017	467	43	237	4	0	0
7/27/2017	144.8	39.4	74	4	10.2	26.8
7/31/2017	85	322	43	33	0	0
8/1/2017	2252	0	1143	0	0	0
8/3/2017	299.4	0	166	0	10.2	15.1
8/7/2017	154.8	0	86	0	0	0
8/10/2017	110.8	0	58	0	10.2	15.4
8/14/2017	1058.2	0	554	0	0	0
8/15/2017	39	0	14	0	0	0
8/16/2017	206.9	0	83	0	9.9	19.2
8/17/2017	34.2	0	14	0	11.5	17.4
8/18/2017	0	28.6	0	14	11.1	17.3
8/19/2017	0	22.8	0	12	10.8	14.5
8/20/2017	0	41.2	0	20	10.7	17.2
8/25/2017	322.6	3530	208	95	10.1	15.1
8/28/2017	396	632	213	17	11.7	48
8/30/2017	2306	119	1240	12	0	0
9/1/2017	19	6	10	2	0	0
9/5/2017	37	111	13	2	0	0
Total	36248	11916.3	18919	2430		

2017 Sample and catch Data Combined Substrates				
DATE	COMBINED CATCH (g)	COMBINED COUNT	SMALLEST (cm)	LARGEST (cm)
9/8/2017	2377	263	0	0
9/12/2017	4371	484	11.2	42.6
9/13/2017	2813	311	0	0
9/18/2017	5020	555	0	0
9/20/2017	1130	115	10.9	31.2
9/22/2017	1034	105	0	0
9/29/2017	238	14	10.6	34.2
10/2/2017	62	6	0	0
10/5/2017	53	7	11.3	33.7
Total	17098	1860		

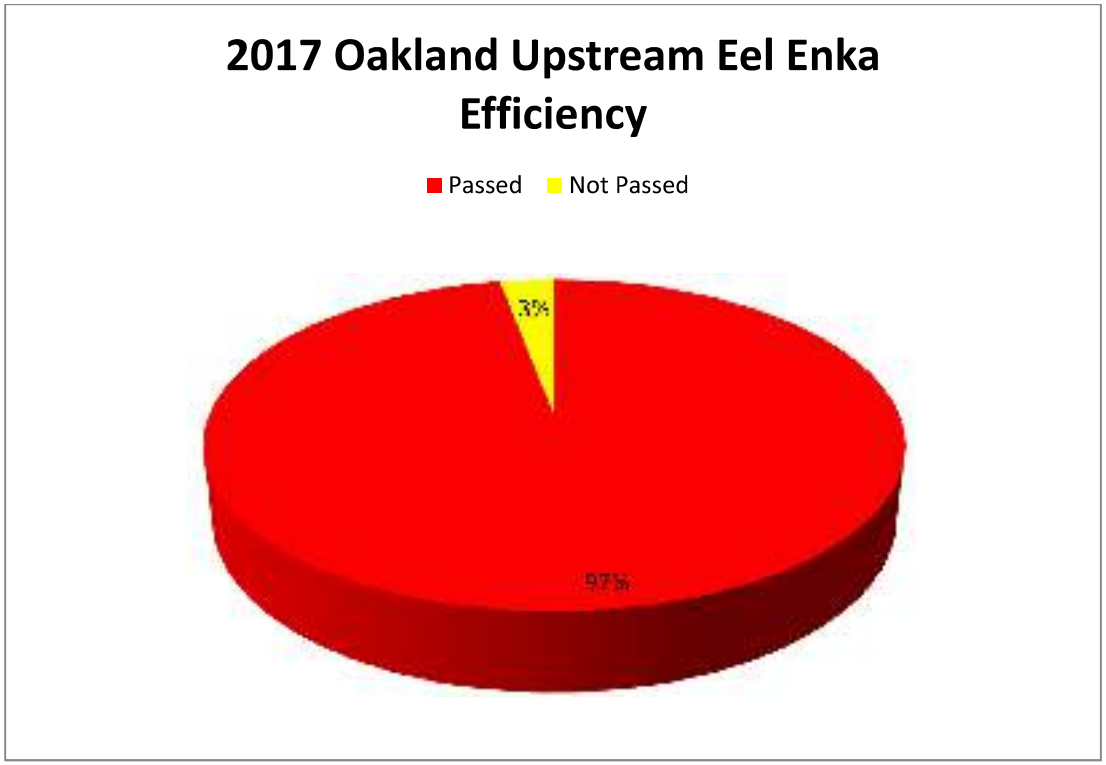


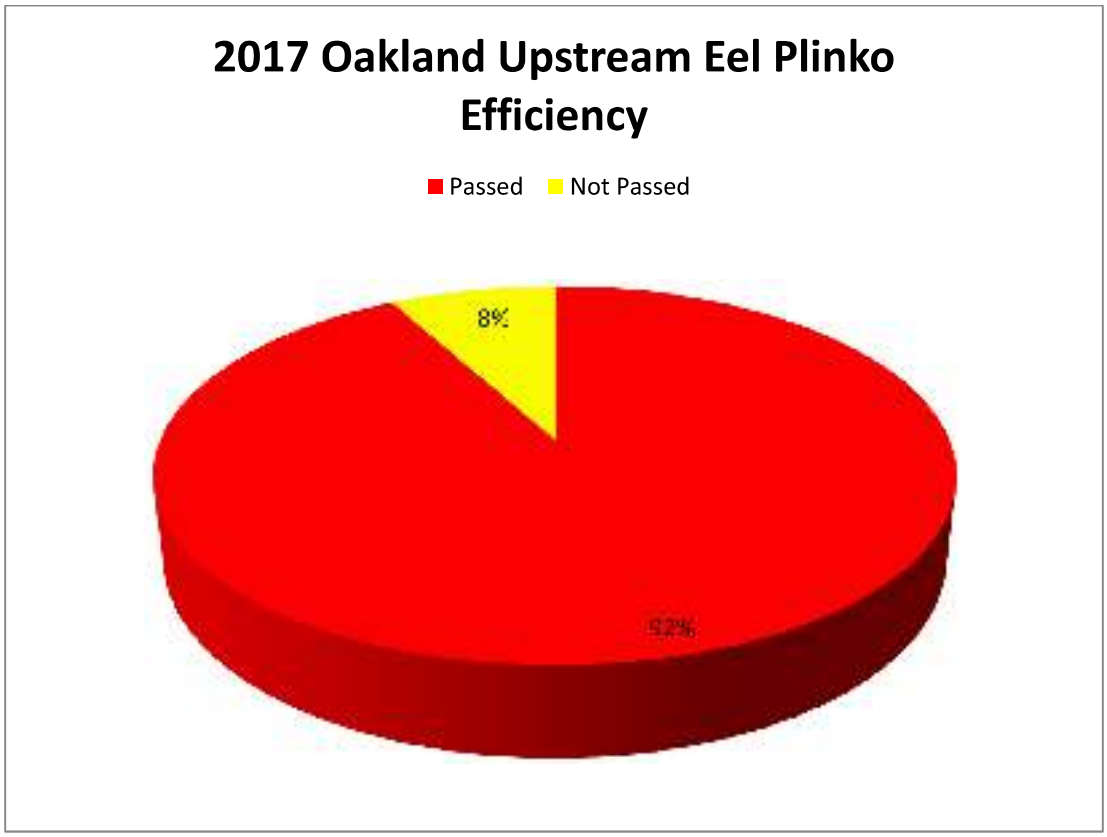

2017 Oakland Upstream Eel Ramp Passage by Count
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
18919
2430
ENKA TOTAL
PLINKO TOTAL
ENKA TOTAL
PLINKO TOTAL


Oakland Upstream Eel Daily Counts 2017
10000
1000
100
10
1
6/29/2017
7/6/2017
7/13/2017
7/20/2017
7/27/2017
8/3/2017
8/10/2017
8/17/2017
8/24/2017
8/31/2017
9/7/2017
9/14/2017
9/21/2017
9/28/2017
10/5/2017
PLINKO COUNT
COMBINED COUNT
ENKA COUNT

Efficiency Test

An efficiency test was requested by the Maine Dept. of Marine Resources consisting of 100 eels placed on the Enkamat side and 50 eels placed on the Plinko side. These eels would be allowed to climb overnight and counted, measured and weighed the following morning. Two small holding pens were built and anchored to the top of the entrance ramps. Eels were caught, counted, and placed in the pens. Attempts were made on the Enkamat side first starting on July 31st, again on August 3, August 14, and finally on August 16 the test was successful. The long length of the ramp system allowed eels to burrow into the Enkamat and rest. This kept giving false 100%+ results, so the entrance was blocked and ramp was run until no eels were found in the tanks. As a result of this discovery, the efficiency tests were allowed to also run for three days on the Enkamat side and two days for the Plinko side The Enkamat side was 97% efficient. On August 20th, the plinko side test resulted in a 92% passage.


2017 Oakland Upstream Eel Enka Efficiency
Passed
Not Passed
3%
97%


2017 Oakland Upstream Eel Plinko Efficiency
Passed
Not Passed
8%
92%

Eels climbing Enkamat side of terminal end

Site review

On July 13, 2017 Maine Dept. of Inland Fisheries & Wildlife area biologist Jason Seiders reviewed the eel ramp site and future ramp sites, upon invitation, when applying for a fish collectors permit. We discussed and agreed that the large catch could be stocked directly into Snow Pond after numbers required to test the headworks and Snow Pond control dam were utilized.

On August 30, 2017 Maine Dept. of Marine Resources eel scientist Jason Bartlett reviewed the Oakland eel passage site.

On September 15, 2017 Maine Dept. of Marine Resources Scientist Gail Wippelhauser inspected the Oakland eel passage site.

Correspondences

: george zink [mailto:georgezink14@LIVE.COM]
Sent: Thursday, November 30, 2017 1:53 PM
To: Steven_Shepard@fws.gov; Wippelhauser, Gail <Gail.Wippelhauser@maine.gov>
Cc: dsherman@essexhydro.com; Elise Anderson <eanderson@essexhydro.com>
Subject: Oakland upstream eel passage

Hello All,

Interim upstream eel passage for the Oakland Hydro Project was started in 2016. Because of the size of the passage required for the site, the construction was split into two phases to be finished in 2017. A progress report (2016 Oakland Upstream Eel passage Report) was sent to all on November 18, 2016. As noted, 7,878 eels on the Enkamat side and 916 eels on the Plinko side were collected, sampled and passed upstream.

Construction for 2017 was completed on June 28, 2017 with 18,919 eels on the Enkamat side and 2430 on the Plinko side with 1860 eels combined collected from the exit pipe system. The last sample was collected on October 5, 2017.

An efficiency test for the Enkamat side was completed on August 17, 2017, with 97% passage. The Plinko side test was completed on August 20, 2017 with 92% passage. Data sheets are attached.

The completed upstream ramp is 135 feet long with three 90° turns and one 180° turn. It rises 62 feet from the entrance to the terminal collection at the top. The exit pipe is 4 inch PVC, 90 feet long.

Over the two seasons, 31,993 eels were passed and efficiency tests were completed. It is requested that this ramp system be considered a permanent upstream eel passageway. An e-mail reply, at your leisure, is requested. As always questions, comments, or site visits from the agencies are welcomed. Feel free to contact me. A detailed report will follow.

Skip Zink

Monday 3/12/2018 1:45pm

Skip:

I finally have some leisure to reply to this email.

For the record, I visited the site with you on September 15, 2017 and inspected the completed upstream eel passage. I commend you on designing and installing a passage at this very difficult site. Thank you for providng the results of the effectivess test and attached data sheets. I am very pleased with the number of eels that passed upstream at Oakland over the two year period and the passage efficiency. The Department of Marine Resources recommends that this ramp system be considered as the permanent upstream eel passage facility as the Oakland Project.

Gail Wippelhauser, Ph. D.
Marine Resources Scientist
Maine Department of Marine Resources
#172 State House Station
Augusta, ME 04333

Phone: 207-624-6349 Fax: 207-624-6501
email: gail.wippelhauser@maine.gov

Please contact me with any comments or questions

Skip Zink

508-274-4943,

georgezink14@live.com

2015 Rice Rips Upstream Eel passage Report

Messalonskee Stream Hydro L.L.C.

Prepared by

George Zink

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Introduction

Rice Rips Head Works is 1.75 Miles downstream of the outlet of Snow Pond, on Messalonskee Stream. It is located in the town of Oakland Maine. It is owned and operated by the Messalonskee Stream Hydro LLC . (MSH); 55 Union St. 4th Floor, Boston, Massachusetts.

The head works controls the water level to the bypass reach and supplies water to the penstock that runs ¾ mile to the hydro station. After 2013 observations, a site was selected to install a temporary upstream eel passage along the penstock support wall below the minimum flow control gates. It is in a place where the wall widens out in the stream and out of direct flow from the gates. There are two concrete decks above, on river right, at the entrance of the penstocks. The lower deck provided enough area for a catch barrel system and space to work up and weigh samples. Construction began on June 2nd 2014 and the ramp system was operating on June 18th. This catch system ran successfully for the 2014 season and, after consulting with the agencies, it was decided to continue the construction up to the second deck. After testing, a permanent exit pipe into the headpond would be built.

Construction was completed on June 3rd 2015 and the first eels were trapped on June 11th. Efficiency testing began on July 27th and was completed August 6th. The exit into the headpond was installed on September 3rd.

Methods

Construction

The ramp extension followed the dimensions of the lower section. Components consisting of two twelve inch aluminum trays attached to a twelve foot long by two foot wide cable tray covered with Enkamat on one side and wooden pegs in a staggered Plinko pattern on the other side. Brackets were made to attach the ramp along the wall. Three sections were connected and set at a thirty-six degree angle up to the top rail on the lower deck.

The first new section is six feet long and set at a ten degree angle. A support bracket is anchored to the deck and attached to the upstream end.

The next ramp is twelve feet long and is set at thirty-four degrees. It attaches to the supported end and rests on the concrete of the upper deck.

A ninety degree section is then attached and leveled with a support bracket. The attraction water and trap plumbing was then attached. Two catch barrels were temporarily connected for the collection of samples.

After samples and testing were completed, an exit system consisting of four inch, schedule 40, PVC piping was connected to the terminal end of the ramp to allow eels to gain access to the headpond. This piping carries eels across the minimum flow gates, down the concrete support wall, and into the water at the top of dam. The submerged pipe is angled at forty-five degrees and is fourteen feet long.

Piping across minimum flow gate

Fourteen ft. submerged exit pipe

Operations

The full length passageway was operated in the same manner as in 2014. Flows were adjusted for each side with the Enkamat side having water enough to keep the entire width of the substrate wetted to cascade evenly down the entire length. The Plinko side was set so that a steady flow also spread across the width of the ramp but with enough volume to maintain a depth of 20 to 25 millimeters at the pegs. Excess water from the spray bar was used on the exit side to wash eels down the PVC pipe into the

catch barrels, and to wash eels into the headpond via the four inch pipe.

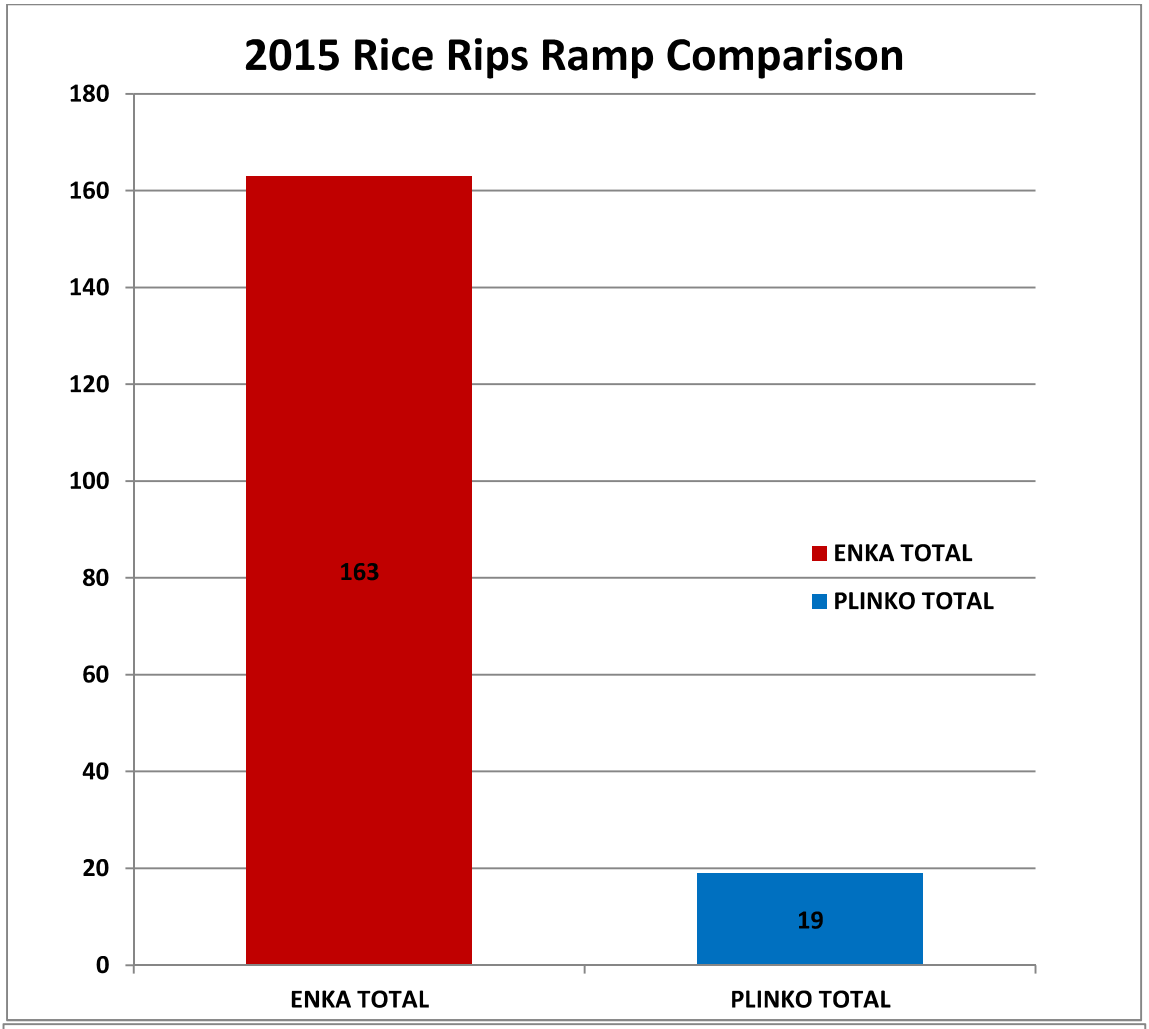
Penstock leakage was utilized as additional attraction flow at the bottom of the ramp. A curved double section of aluminum was secured across the ramp to disperse water at the entrance.

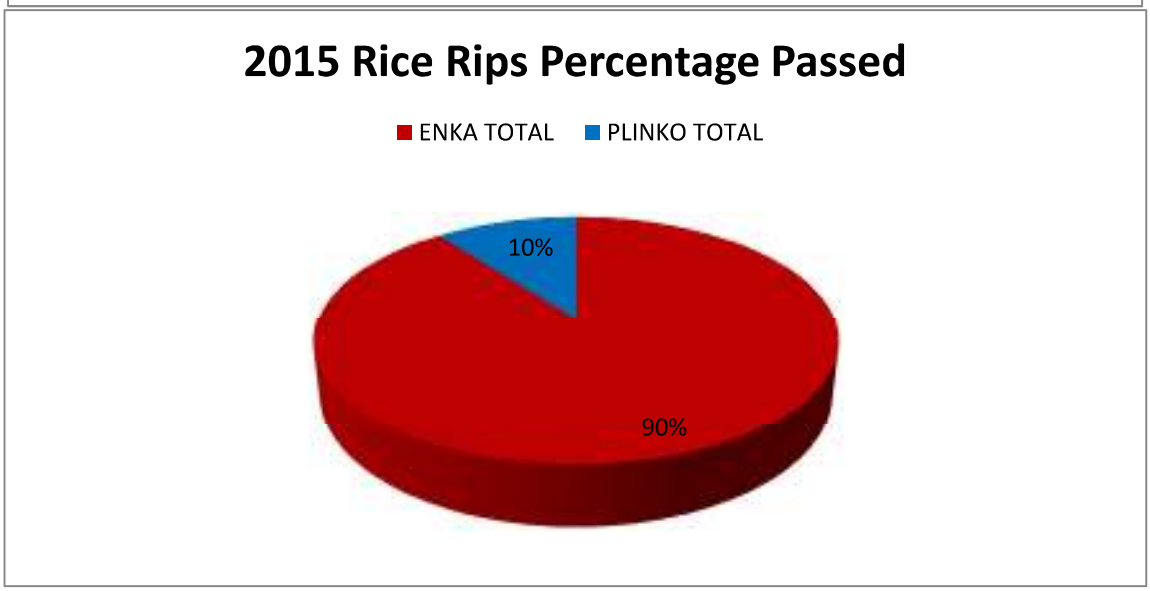
Samples were collected from June 11th until August 13th and were collected every three days on average. An efficiency test was completed on the Enkamat side on July 27th and on the Plinko side on August 4th,5th, and 6th.

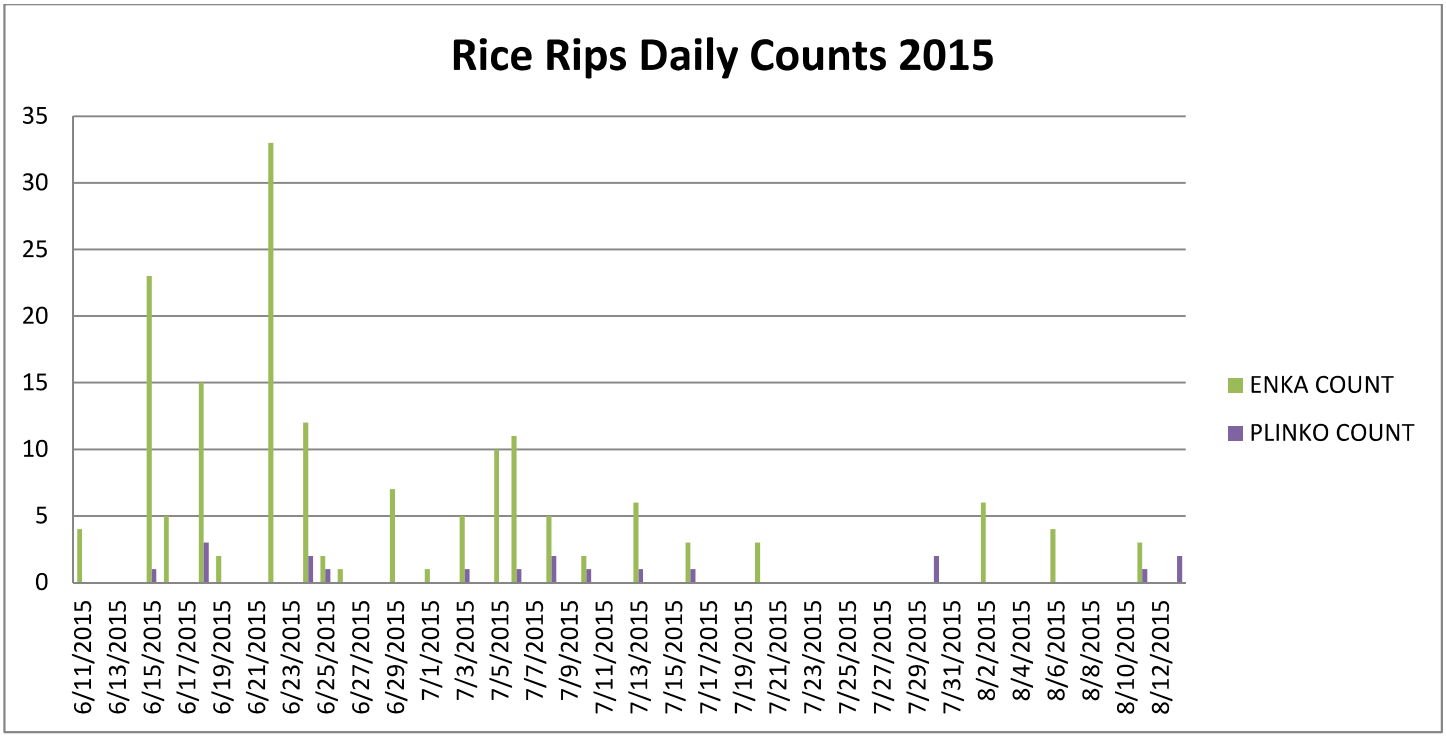
Results

The Enkamat ramp passed a total of 163 eels weighing 337.3 grams, while the Plinko ramp passed a total of 19 eels weighing 245.1 grams. The smallest eel was 9.8 centimeters in length with the largest eel being 34.8 centimeters long.

		2015 Sample and Catch Data				
DATE	ENKA CATCH (g)	PLINKO CATCH (g)	ENKA COUNT	PLINKO COUNT	SMALLEST (cm)	LARGEST (cm)
6/11/2015	12.2	0	4	0	10.7	15.1
6/15/2015	24.9	6.1	23	1	9.7	27.1
6/16/2015	10.3	0	5	0	9.8	12
6/18/2015	32.4	6.1	15	3		
6/19/2015	4.2	0	2	0	11.2	12.8
6/22/2015	19	0	33	0	11.6	14.7
6/24/2015	23.8	2.6	12	2	8.7	12.9
6/25/2015	3.9	1.7	2	1	10.1	13.6
6/26/2015	2.3	0	1	0	13.4	13.4
6/29/2015	16.9	0	7	0	10.1	16.2
7/1/2015	2.1	0	1	0	14.1	14.1
7/3/2015	13.6	1.8	5	1	10.1	15.5
7/5/2015	19.6	0	10	0	10	16
7/6/2015	29.2	4.7	11	1	11.8	16.4
7/8/2015	22.8	29.1	5	2	11.2	23.2
7/10/2015	4.8	17.6	2	1	14.6	24.1
7/13/2015	26.1	31.1	6	1	11.2	26.2
7/16/2015	8.7	20.8	3	1	11.9	25.1
7/20/2015	9.1	0	3	0	13.8	15.3
7/30/2015	0	35.7	0	2	15.3	26.6
8/2/2015	11	0	6	0	10.1	13.1
8/6/2015	8.9	0	4	0	10.5	12.8
8/11/2015	31.5	12.1	3	1	16.5	31.5
8/13/2015	0	75.7	0	2	23.1	34.8
Totals	337.3	245.1	163	19		


2015 Rice Rips Ramp Comparison
180
160
140
120
100
80
60
40
20
0
163
19
ENKA TOTAL
PLINKO TOTAL
ENKA TOTAL
PLINKO TOTAL


2015 Rice Rips Percentage Passed
ENKA TOTAL
PLINKO TOTAL
10%
90%



Discussion

The passageway was operational for a week before the first sample was collected. Throughout the sample season counts were light. Night observations were made on June 8th, 15th, and 29th to see if eels were anywhere along the dam. While eels were found scattered along the base of the dam in small numbers, no large concentrations were seen gathered or attempting to climb elsewhere.

One possible contribution to the low numbers was the construction of a bridge in Waterville over Messalonskee Stream. A barge spanning the width of the stream was in the water the entire time the passageway was being evaluated. The passageway at M4 Automatic is located just below this bridge and access was flooded out for most of the season.

Below is the email correspondence with Maine DMR in regard to their approval of the eel passage at Rice Rips being considered as permanent.

Correspondences:

From: Wippelhauser, Gail [mailto:Gail.Wippelhauser@maine.gov]
Sent: Tuesday, February 23, 2016 3:38 PM
To: 'george zink'; Steven_Shepard@fws.gov
Cc: Andrew Locke; Dave Sherman
Subject: RE: Snow Pd. report and Rice Rips Upstream Efficiency test

Hi Skip.

I reviewed the efficiency test and agree that the interim eel passage at Rice Rips be considered permanent passage. I concur with your proposal to install piping to direct eels into the head pond in place of the holding trap.

It appears that Snow Pond and Messalonskee Lake are totally or nearly devoid of eels at this time.

Gail Wippelhauser, Ph. D.
Marine Resources Scientist
Maine Department of Marine Resources
#172 State House Station
Augusta, ME 04333

Phone: 207-624-6349 Fax: 207-624-6501
email: gail.wippelhauser@maine.gov

From: george zink [mailto:georgezink14@live.com]
Sent: Wednesday, January 13, 2016 3:30 PM
To: Steven_Shepard@fws.gov; Wippelhauser, Gail
Cc: Andrew Locke; Dave Sherman
Subject: Snow Pd. report and Rice Rips Upstream Efficiency test

Happy New Year,

Please find the 2015 downstream report for Snow Pd./Messsalonskee L. attached. This season was pretty much a repeat of last year, with no eels being caught or observed. The heavy leaf invasion came in November and plugged the trap several times. Maintenance crews were looking for impinged eels on intake racks at hydro sites below the lake as an indication of eels passing but none were observed.

I have included the efficiency tests for Rice Rips upstream eel passage with a request for your review and comments in order to finish up the annual report. I had sent it In early August but with the heavy workloads and having a verbal OK, I neglected to pursue an official follow up. An e-mail reply will suffice, thank you. A final report will follow.

Thank you for your attention to this,

Skip

2014 Automatic Hydro Station Upstream Eel Passage Report

Messalonskee Stream Hydro L.L.C.

Prepared by

George Zink

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Introduction

The M4 Automatic Hydro Site is the fourth dam on the Messalonskee Stream system approximately two miles upstream, from the confluence with the Kennebec River. It is located in the city of Waterville, Maine, owned by the Kennebec Water District, and operated by Messalonskee Stream Hydro LLC. (MSH); 55 Union St. 4th Floor, Boston, Massachusetts.

In the spring of 2012 night time observations were conducted to locate upstream migrating eels, (see M4 Automatic nighttime observations Report), followed by the building, installation, and monitoring of a temporary passage, (see 2012 Automatic Hydro Station Upstream Eel Passage Study). It was decided to build and install an interim passage in the same location that the temporary passage was located in the 2012 study. The interim passage was constructed in 2013 along the inside of the river left Tainer gate bay up to a walkway. A catch system was put in place to monitor the season passage results. (see 2013 Automatic Hydro Station Upstream Eel Passage Report)

Due to high river flows this system took most of the migration season to complete, As a result it only operated for approximately three weeks. At the end of August of 2013 the entrance ramps had broken free and were not recovered until flows allowed in late September. After consulting with Maine Dept. of Marine Resources it was agreed that the system would be upgraded, monitored and tested in 2014. This report covers these activities and the results.

Methods

Construction

In early May 2014, the entrance ramps were checked for damages and minor repairs to the Enkamat ramp were performed. On May 22nd the ramps were set in place and an additional three anchors consisting of ¾ inch

threaded rod were drilled and glued into the shale outcropping. One was set in the shale at 4 feet and the other two are set at 2½ feet.

Entrance ramps reset with additional anchors

This appeared to work well in the month of June and early July until the High flows during hurricane Arthur. The entrance ramps were still anchored, but had been moved out of alignment with the rest of the passageway. When flows abated, the anchors were unbolted, ramps were realigned, and additional 3/8 inch threaded anchors were drilled and glued into place and a hold down bracket was added to the top of the entrance ramps. This upgrade has weathered the high flows of the heavy August rains without any visible damage or misalignments.

View of bracket and additional anchors

The other ongoing problem has been with the spray bar continuously plugging with silt and vegetation. This affects attraction and cuts down on enough oxygenated water to the catch barrels. We added a separate circulation pump to the barrels to prevent any lack of fresh river flow, but the spray bars had to be cleaned daily. We modified a 1 inch ninety degree fitting that has been cut to allow a wide dispersal of water that spreads over the surface of the ramp. We have monitored this on both the Enkamat and Plinko sides for ease of maintenance and effect on eel movement. The eels have not appeared hindered by the new system in their approach or passage under the flow and all the spray bar problems are gone.

Modified 90° fitting

A head pond exit pipe consisting of three, 8 foot long, 4 inch diameter PVC was assembled and runs along the river left wall from the top of the walkway to the inside of a small shale outcropping which provides an eddy. This allows migrating eels to orient to the head pond out of the pull of the river. Weighed catch and sub samples were introduced via this system with a steady supply of water from the circulation pump.

Head pond exit pipe location

The trap at the terminal end of the ramp consists of two 30 gallon barrels, one each for the two ramp substrates, connected via PVC pipe. Screened drains are connected to a common over flow pipe. Water is supplied by a ¾ hp. pump that supplies attraction and a ½ hp. pump that was added this season for circulation in the barrels and flow for the exit pipe.

Operations

The rate of flow was set for the Enkamat side as it was last season. A spray bar at the peak of the terminal end keeps the entire width of the substrate wetted with enough water to cascade evenly down the entire length. This also acts as attraction at the entrance.

The Plinko side was set so that a steady flow also spread across the width of the ramp but with enough volume to maintain a depth of 20 millimeters at the transition pools and allow eels to swim up between the pegs. This was similar to the flows used last year.

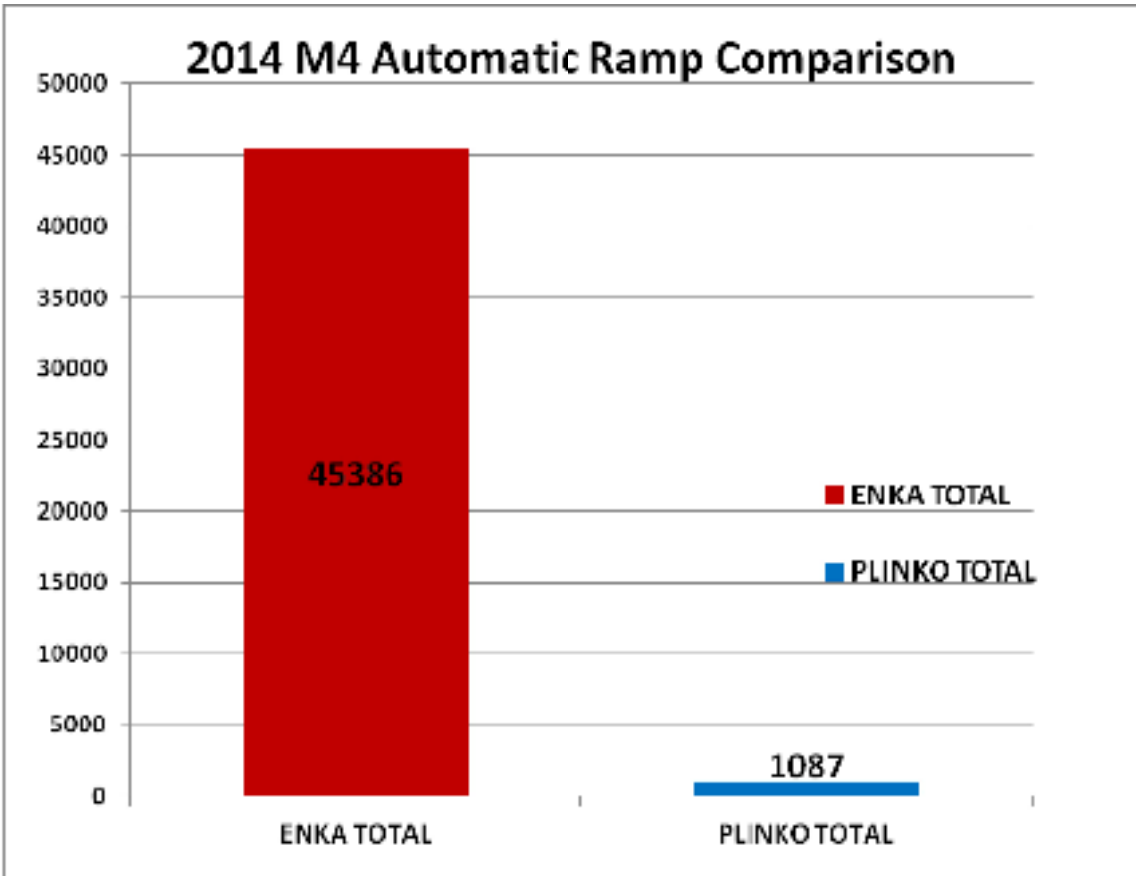
Excess water from the spray bars was used on the exit side to wash eels down the 4 inch PVC pipe into the holding tanks. Once beyond the ninety degree curve in the terminal end, eels were unable to come back down the ramp. Spray bars were checked daily and cleaned as necessary until the aforementioned modifications were made then it was inspected at least twice weekly. The new setup functioned for the rest of the season without needing cleaning. The terminal end was covered with fiberglass screening to prevent eels from escaping and allow observation. The holding tanks were checked daily and reset as necessary. Daily catches were weighed. A subsample was measured, counted, and weighed at least once a week. All eels were released into the head pond through the new exit pipe.

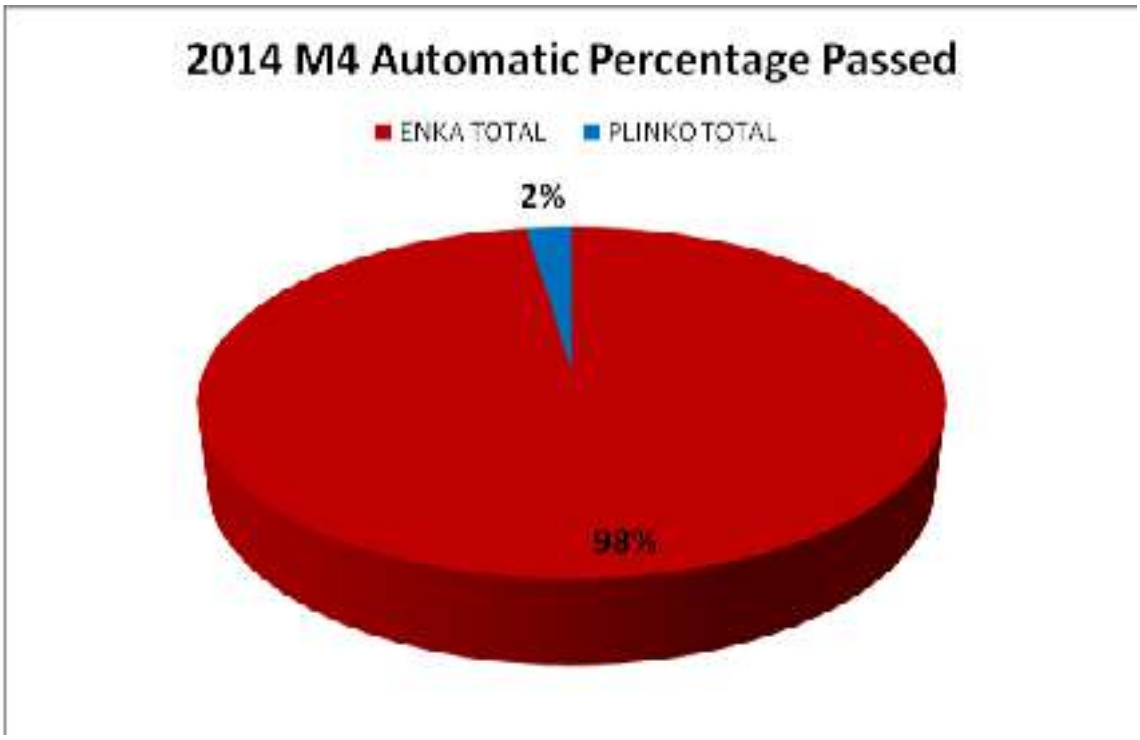
The system was started on May 30th and ran continuously until July 3rd when damage occurred from hurricane Arthur. Temporary repairs were performed and the system restarted on July 13th. Permanent repairs were completed and the system was back operating on July 22nd.

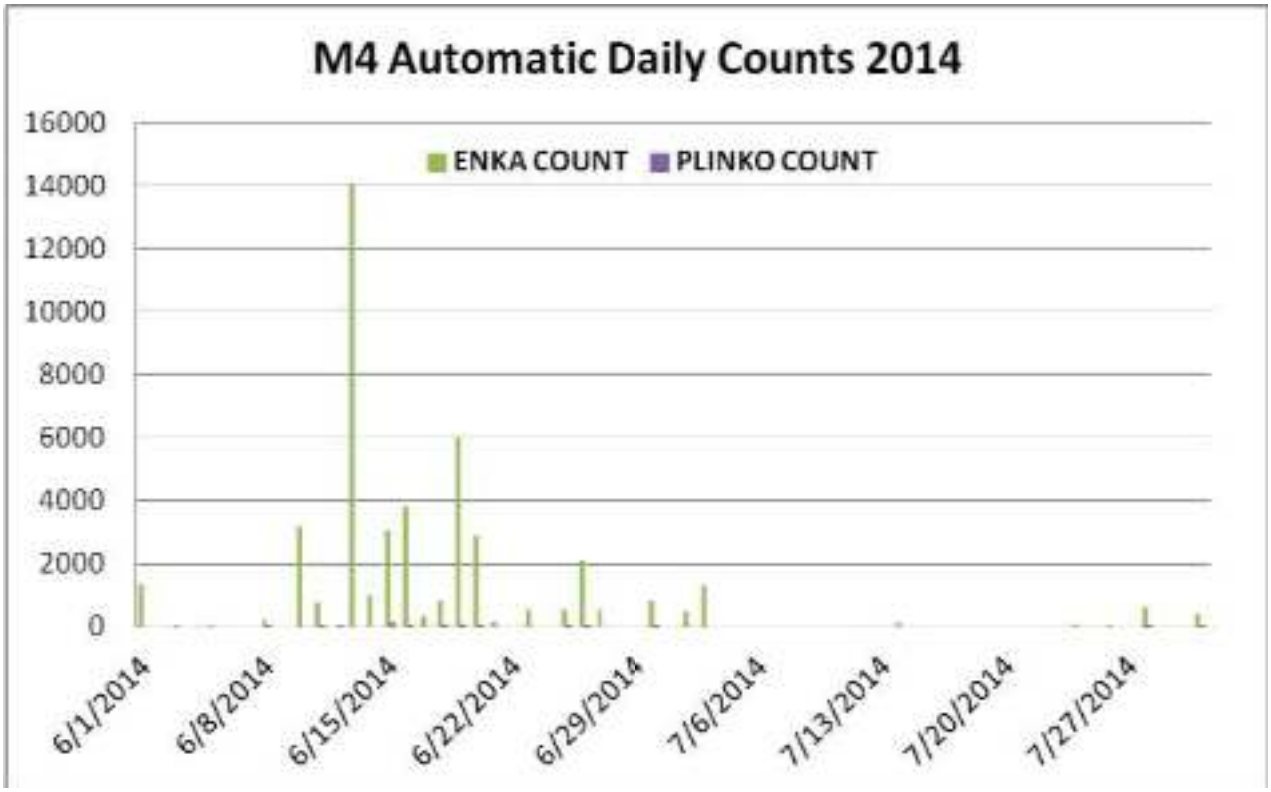
Results

The first eels were captured on June 1st and the last catch was on July 31st after consulting with Maine Dept. of Marine Resources and US fish and Wildlife Services. The Enkamat side passed a total of 45,386 eels weighing a total of 66,540 grams and the Plinko side passed a total 1,087 eels weighing a total of 5,331.2 grams. The smallest eel sampled was 8.3 centimeters and the largest was 38.4 centimeters in length.

		2014 Sample and Catch Data				
DATE	ENKA CATCH (g)	PLINKO CATCH (g)	ENKA COUNT	PLINKO COUNT	SMALLEST (cm)	LARGEST (cm)
6/1/2014	544.2	0	1350	0	9	17.1
6/3/2014	2.7	0	2	0		
6/5/2014	30.1		17		9.1	14.8
		8.9		1		19.8
6/8/2014	345	122.1	195	21	13.3	19.8
6/10/2014	4249.8		3195		8.5	13.1
		558		76	9.8	19.8
6/11/2014	952.8	2.1	787	1	8.3	13.4
6/12/2014	0	35.9	0	5		
6/13/2014	17010		14058			
	0	545.2		115	9.3	28.1
6/14/2014	1854.6		1002		9.3	15.9
		942.2		318	8.5	19.1
6/15/2014	5668	366	3063	124		
6/16/2014	7118	257	3848	87		
6/17/2014	493.6		312		8.8	15.8
		169.9		11	10.7	29.7
6/18/2014	1274	678	806	105	9.2	29.9
6/19/2014	9457	638	5985	94		
6/20/2014	4571	119	2893	6		
6/21/2014	272.5	0	175	0	8.6	17.5
6/23/2014	819	0	525	0		
6/25/2014	839	18.9	538	1		24.4
6/26/2014	3297	108	2113	6		
6/27/2014	1091.6	0	549	0	8.7	19.9
6/30/2014	1643	42	826	5		
7/2/2014	592.6		511		9.5	14.4
		187.2		14	10	36.3
7/3/2014	1538		1326			
		229.4		45	8.6	38.4
7/14/2014	136	0	117	0		
7/24/2014	262.8		97		8.5	19.6
		16.5		10	8.4	15
7/26/2014	197.7		87		9.1	18
		47.9		5	9.9	23.7
7/28/2014	1353	43	599	13		
7/31/2014	927	196	410	24		
Totals	66540	5331.2	45386	1087		


2014 M4 Automatic Ramp Comparison
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
45386
1087
ENKA TOTAL
PLINKO TOTAL
ENKA TOTAL
PLINKO TOTAL

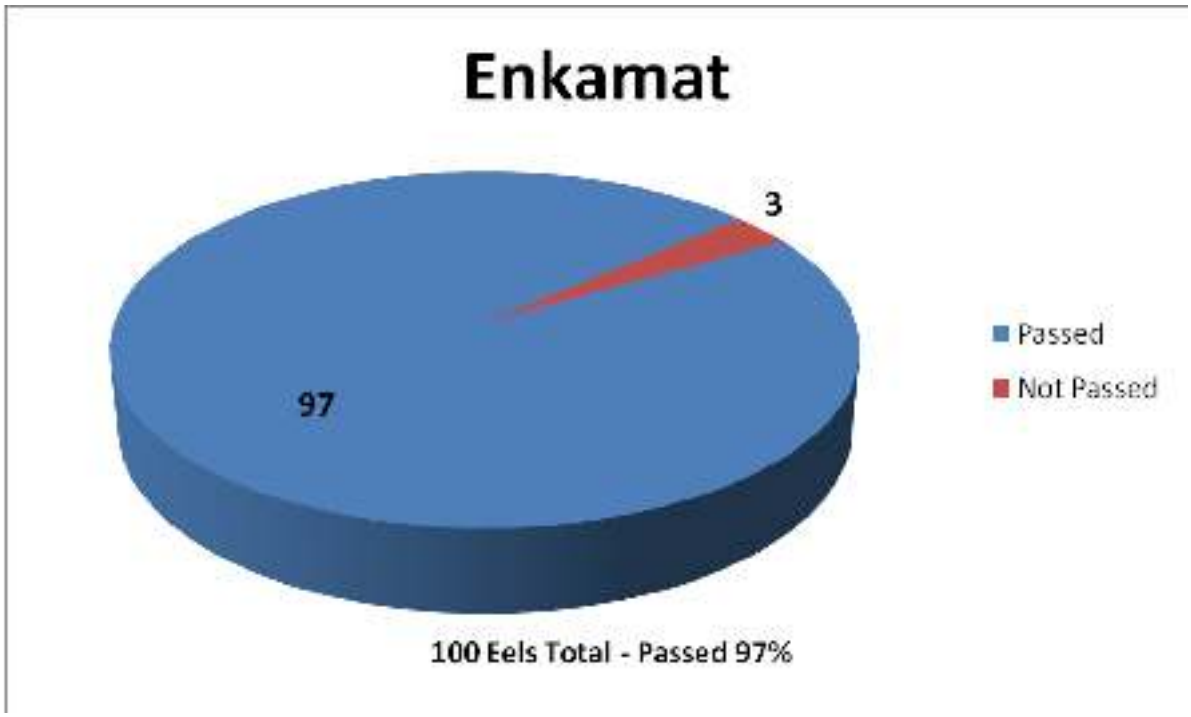

2014 M4 Automatic Percentage Passed
ENKA TOTAL
PLINKO TOTAL
2%
98%

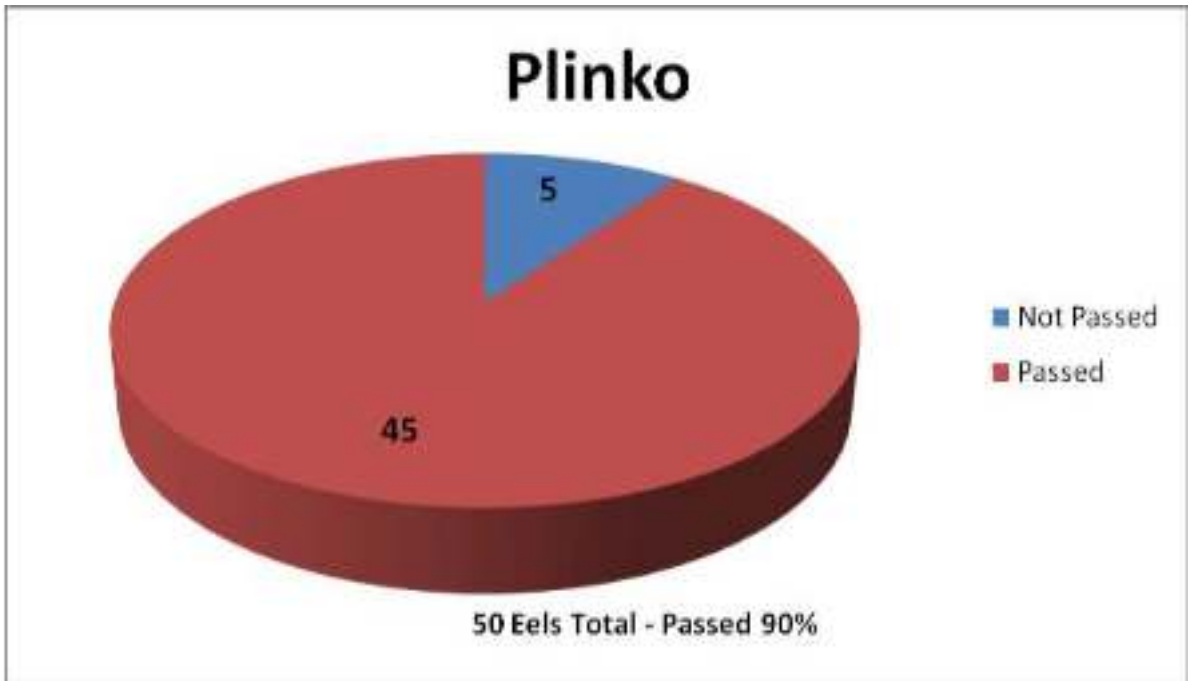


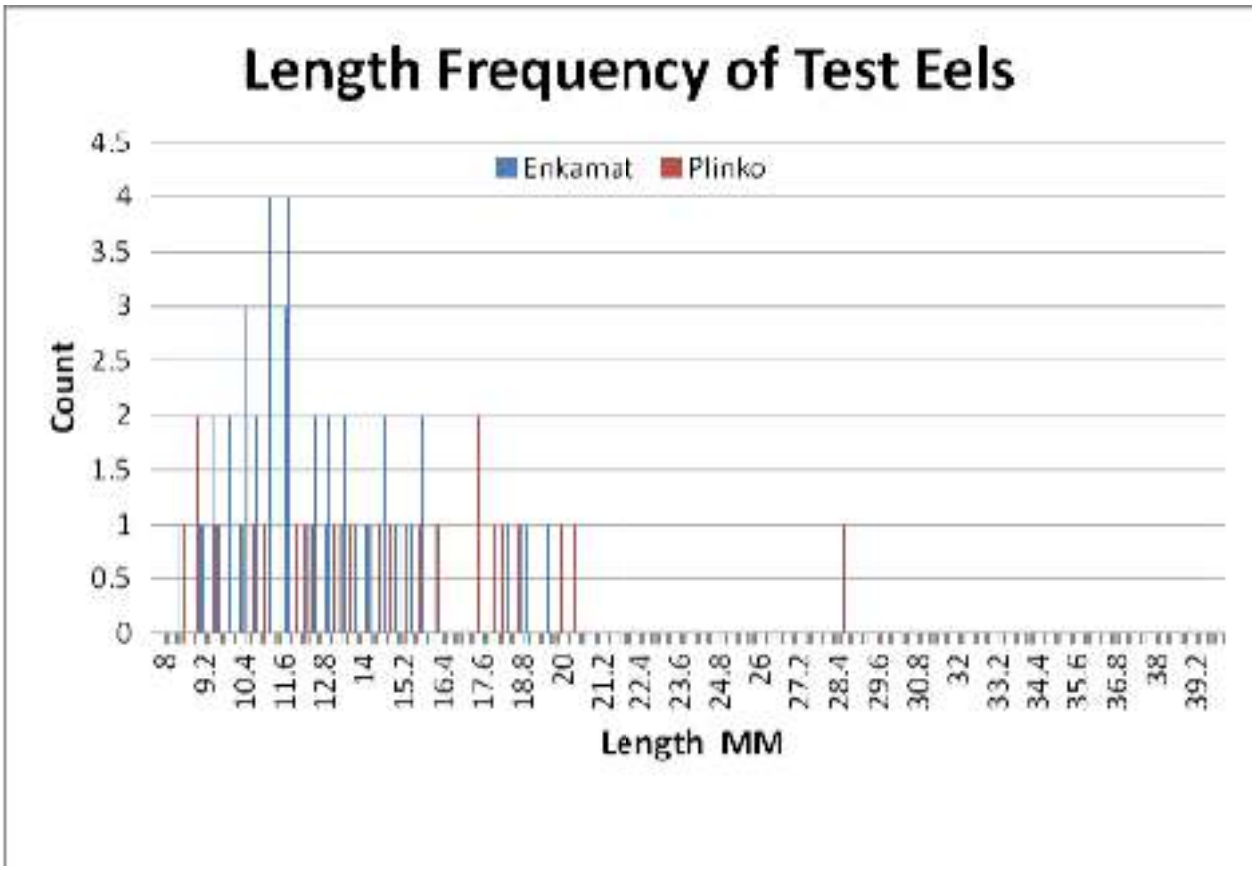
Efficiency Test

An efficiency test was requested by the Maine Dept. of Marine Resources consisting of 100 eels placed on the Enkamat side and 50 eels placed on the Plinko side. These eels were allowed to climb overnight and counted, measured and weighed the following morning. Two small holding pens were built and anchored to the top of the entrance ramps. Eels were caught, counted, and placed in the pens. On July 2nd the first attempt was made. The Enkamat holding pen malfunctioned and eels escaped almost immediately. The Plinko pen worked, so the test for that side was continued. On July 3rd the count for the plinko side was 45 with 44 measured and weighed and the 45th eel escaping during the work up. This resulted in a 90% passage on the Plinko side.

High water prevented repeating the test on the Enkamat side until July 23rd when 100 eels were placed in the holding pen. The following morning 97 eels were worked up giving a 97% passage on the Enkamat side.


Enkamat
3
97
Passed
Not Passed
100 Eels Total - Passed 97%


Plinko
5
45
Not Passed
Passed
50 Eels Total - Passed 90%



Site Review

On July 29th Dr.Gail Wippelhauser from Maine Dept. of Marine Resources visited the M-4 Automatic site. She reviewed construction and operations. We agreed that monitoring the catch would end on July 31st, that the catch barrels and related plumbing could be removed, a permanent connection from the terminal end to the head pond be connected, the screening covering the terminal end and spray bar system be removed and an aluminum cover be installed, and that the long threaded anchor rods be cut to the height of the passageway sides.

All these changes have been done except for cutting the anchor rods. This will be done when water levels allow.

Permanent exit pipe and terminal end cover in place

Correspondences:

From: george zink [mailto:georgezink14@live.com]
Sent: Thursday, July 24, 2014 3:11 PM
To: Steven_Shepard@fws.gov; Wippelhauser, Gail
Cc: Steve Hickey; Dave Sherman
Subject: M-4 Automatic Efficiency test

Hello all,

The efficiency test for M-4 Automatic Hydro Site was started on July 2, 2014 with 50 eels placed on the Plinko side of the interim eel passage and 100 eels on the Enkamat side. The Enkamat side failed immediately with eels escaping under the holding trap. The Plinko side was double checked and the test was continued on that side. Eels were set on the ramp at 19:15 and the holding pen was checked at 07:15 on July 3,2014. These eels were measured and weighed with the exception of one eel that escaped the net and ended up in the head pond. The delay in completing the test on the Enkamat side was due to high water and damage to the ramp entrance. This was repaired and the Enkamat test was started at 19:30 on July 23, 2014. The holding pen was checked at 07:15 on July 24,2014 and eels measured and weighed. The result was 97 out of 100 passed up the Enkamat side and 45 out of 50 on the Plinko side. The field data sheets are attached, please review and reply if this is acceptable.
With the completion of this test, and the 2014 seasonal data to be completed, we would request that the interim eel passage at M-4 be considered permanent passage. Please feel free to send any comments or questions.

Skip Zink

From: Wippelhauser, Gail
Sent: Monday, July 28, 2014 12:19 PM
To: 'george zink' ; Steven_Shepard@fws.gov
Cc: Steve Hickey ; Dave Sherman
Subject: RE: M-4 Automatic Efficiency test

DMR agrees that the interim eel passage at M-4 be considered permanent passage.

Gail Wippelhauser, Ph. D.
Marine Resources Scientist
Maine Department of Marine Resources
#172 State House Station
Augusta, ME 04333
Phone: 207-624-6349 Fax: 207-624-6501
email: gail.wippelhauser@maine.gov

From: Shepard, Steven
Sent: Tuesday, July 29, 2014 2:58 PM
To: george zink
Cc: Gail Wippelhauser ; Steve Hickey ; Dave Sherman
Subject: Re: M-4 Automatic Efficiency test

The Service agrees that the tests demonstrate efficient passage through the eel passage structures and we do not object to changing the designation of these facilities from interim to permanent.

~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
Steven Shepard, C.F.P.
U.S. Fish & Wildlife Service
17 Godfrey Drive, Suite 2
Orono, Maine 04473
Voice: 207-866-3344 x116
Cell: 207-949-1288
steven_shepard@fws.gov
~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~

Messalonskee Stream Hydro L.L.C.

Union Gas Upstream Eel Passage Report

Completed Eel Passage

Prepared by

George Zink

Table of Contents

Introduction

The Union Gas Hydro project is owned and operated by Messalonskee Stream Hydro L.L.C. (MSH); 55 Union St. 4th Floor, Boston, Massachusetts. It is located on Messalonskee Stream in the city of Waterville, Maine. It is the fifth dam on the stream and the lowest on the system, approximately 1 mile above the confluence of the stream and the Kennebec River.

The Maine Department of Marine Resources has made observations for upstream migrating eels over several years and has recommended that a passageway be located on the river left side of the spillway. Eels can be seen climbing up the ledges directly below the pool at the base of the spillway, at various stages of flow.

Ledges below spillway from river left

View from top of dam.

Because of this continually changing water level, throughout the season, eels approach this area from multiple climbing points on the ledges and in turn, reach the corner from various directions before staging in order to attempt to pass. Eels were not seen attempting to climb anywhere else along the dam.

It was decided to start the passage ramp at the edge of the apron and follow the retaining wall up at a reasonable incline to a point where it can be reversed and continue over the top of the wall and across the dam. The exit into the head pond would then be on the still water side of the bullnose where the eels would be able to swim upstream without being caught in the flow to pull them over the flashboards. This also keeps all but the entrance ramps out of the potential flood zone.

Eels attempting to pass.

Methods

Ground Work

The corner has the granite blocks that were once used as dam facing, stacked from the corner downstream along the retaining wall. This makes habitat for eels but several blocks need to be broken up and removed in order to make the entrance ramps approach angles more reasonable. This work was the first thing to be done so that the length of the ramps and the height of the corner pool could be established. The entrance ramps had to be placed so that flow from the spillway would not wash them out.

View from the top of dam of granite stacked in the corner.

Breaking up of granite blocks.

Block being moved out of corner.

Corner after granite removal.

Components

Once the stone work was finished, individual components were then designed with the lower corner pool being the first and subsequently the base. This corner pool would be the first resting pool and would guide eels into a 90° turn after climbing the short entrance ramps. It would also maintain a divide between the Enkamat substrate designed to pass elvers and the staggered peg side designed to pass larger, yellow eels. This side was named the Plinko passage. A divided passage was built because of the established success in passing eels up to the mid twenty centimeter range on the Enkamat substrate with a slow to moderate flow of attraction water and the success of passing larger yellow eels on the staggered peg substrate with much higher attraction flows. Both sides of the corner pool were covered in Enkamat in order to give the eels a substrate to gain purchase

and be able to rest on as needed. This substrate also slows down and spreads the flow of water to help make water levels in the turns more manageable.

Corner pool with dimensions.

The corner pool was constructed from wood and painted with an exterior paint since it is at the lowest section of the ramp and may be exposed to high flows. If lost, a replacement can be built and installed in a short period of time. Hinges were installed on the back brace along with eyebolts on the front to allow for adjustments to level pool.

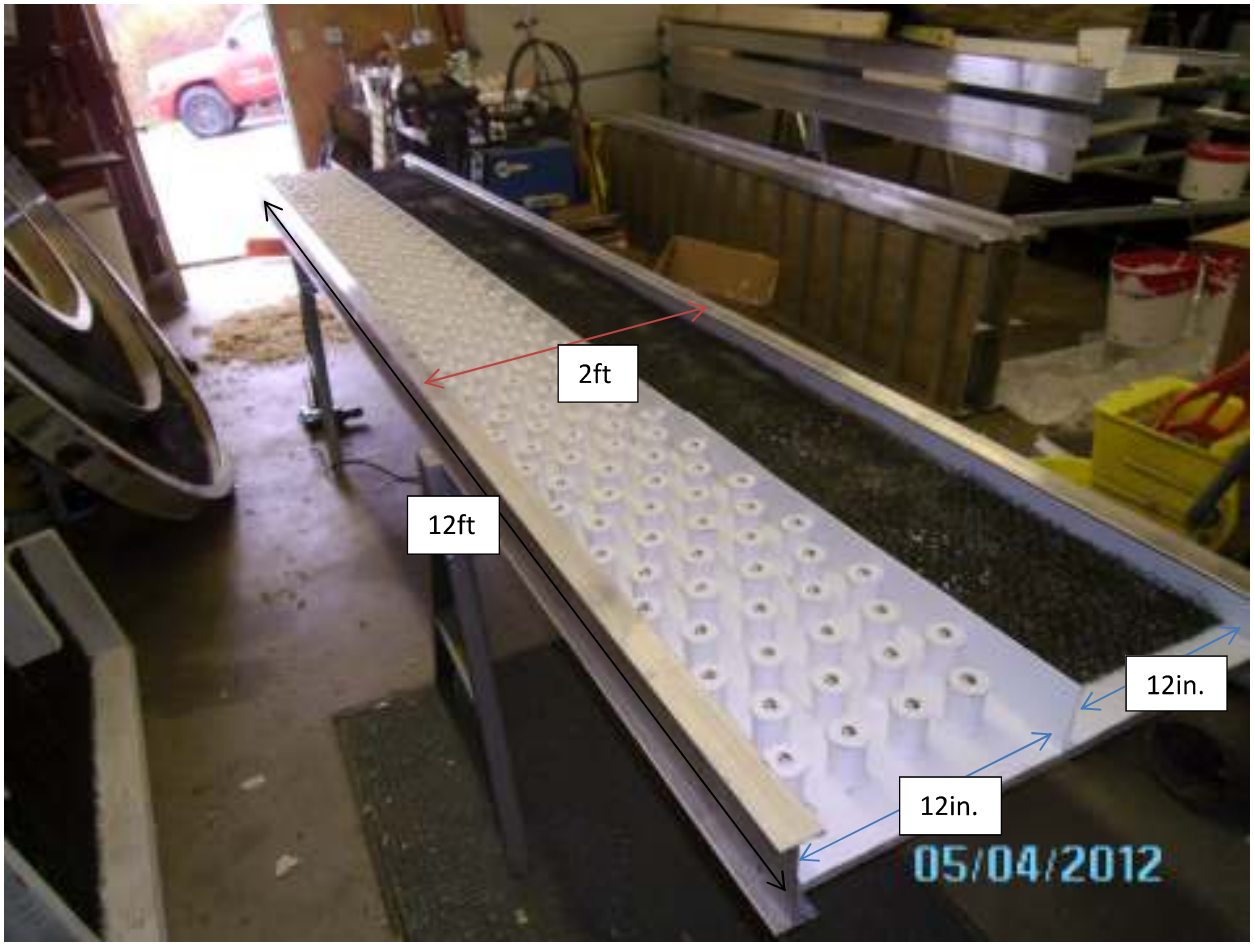
Back view of corner pool showing hardware installed.

The ramps were designed to carry weight, be self-supportive, stand up to the elements, guide, and contain the eels. This was accomplished by using several components assembled together to make a working system. The structural skeleton is aluminum cable tray that was designed to carry the weight of electric and electronic wiring through-out generation facilities, mills, and commercial buildings. It is lightweight, strong, and has hardware to adapt to installation in multiple configurations. ½ in. plywood was screwed to the cable tray cross braces to give support and rigidity to the base. Powder coated, rolled aluminum was used to form the trays that the climbing substrates would be attached to. Enkamat 7220 was glued to the formed tray for the elver sized eels to climb. The tray for the yellow eels to pass was assembled using hardwood spools 2 1/8in. tall by 1 1/2in. diameter, coated with an exterior paint and anchored with stainless steel

screws to the folded aluminum tray in an alternating pattern of rows forming a staggered series of columns. The Enkamat and staggered peg trays set inside the cable tray and are interlocked at the middle partition.

Powder coated aluminum trays being formed.

Assembling of staggered peg tray. In the view above the Enkamat covered tray can be seen in place as well as the partition between trays.



Completed section with dimensions. Under side of completed section in background shows cable tray cross bracing and plywood.

The route the passageway takes required a 180° transition and also serves as a resting pool. This was made with two 90° cable trays with a section welded in between and a middle divider. Both sides were covered with Enkamat that helps with controlling water flow and gives the eels a resting substrate. This unit will be the middle of the passageway and connect the ramps coming up from the corner pool to the ramps going up to the top of the dam.

Aluminum 180° transition pool

The terminal ends at the top of the ramps were made from aluminum and formed with a slow 90° down turn to ease eels into the point of no return. They taper down from 12in. to 4in. where the 4in. pvc pipes are connected. These pipes carry eels into holding pens located in the headpond. Spray bars were mounted over and in front of these to attract eels and provide flow to the holding pens. One inch pipe was used to connect from the 50 gpm pump in the headpond to the spray bars. Separate valves for each sprayer were used as each side requires a different rate of flow.

Terminal ends, spray bars, and head pond piping.

Two holding pens were constructed so that the Enkamat and Plinko ramps could be operated separately and compared. Each pen was made from a wood frame, with aluminum screen inside and covered with hardware cloth on the outside for protection from wear and predators. A 4in. vent pipe seal was used at the top and a sliding gate exit was installed.

Holding pen showing slide gate and screen mesh.

The entrance ramps were constructed of wood and made as two individual ramps so that the correct placement in the different water depths could be accomplished. The wood frames can be easily rebuilt and replaced in case of loss in high water.

Assembly and Installation

The assembly started with the corner pool as this was where all measurements would be taken for the installation. It needed to be level and allow the migrating eels to turn and start the first long climb. Anchors were drilled and glued into the granite retaining wall. The unit was then shimmed out from the wall and adjusted to line up for the entrance and ascending ramps. Cables and turnbuckles were installed and adjusted. This unit is approximately 6 ft. above water level.

Corner pool installed

Wall brackets were aligned and anchored along a line to where the transition pool would be installed and the aluminum cable trays were bolted together and lowered down to the corner pool over the top of the wall brackets. The assembled ramp is angled at 36°and is 30 ft. long. The lower section was cut and aligned to rest on the corner pool. Clips and hardware were installed to the brackets and all was straightened and aligned. Brackets and hardware were then bolted into place. Joints were then sealed. The transition pool was set into place and bolted to the lower ramp assembly and aligned to follow the ascent to the top of the dam.

Assembled ramps

Transition pool bolted to lower ramp assembly.

View from below showing brackets and assembly.

The second ramp assembly was put together and placed between the transition pool and the top of the dam on temporary supports. It was bolted to the pool's upper end and lined up with the top granite blocks .Permanent brackets were made up and installed. Hardware was set and everything was tightened down in place. This section is angled at 36° and is 32 ft. long.

Top ramp temporarily set in place.

The terminal ends were bolted into place, the 4 in. exit pipes and brackets were installed, and the holding pens were set in the head pond. A 50 gallon per minute pump was set in the water and 1 1/4 in. pipe was plumbed into 1 in. spray bars set over the top of the terminal ends. The sprayers have unions installed so that they can be easily disassembled for cleaning.

Terminal ends with plumbing and exit pipes.

Holding pens, with exit pipes in place, and plumbing from pump.

The last components to be installed were the entrance ramps. These were positioned in areas where eels usually gathered but where the least amount of flow damage would be incurred. The Enkamat side is eight feet long by 12 inches wide. The original Plinko side was eight feet long by twelve inches wide but an extra length was added to finally be twelve feet in order to reach deeper water.

Original Ramp installation

Final Ramp Assembly

Operations

The rate of flow was set for the Enkamat side as it is at similar ramps. A spray bar at the peak of the terminal end keeps the entire width of the substrate wetted with enough water to cascade evenly down the entire length. This also acts as attraction at the entrance.

The Plinko side was set so that a steady flow also spread across the width of the ramp but with enough volume to maintain a depth of 20 to 30 millimeters at the transition pool and allow eels to swim up between the pegs. This was similar to the flows used successfully on European ramps.

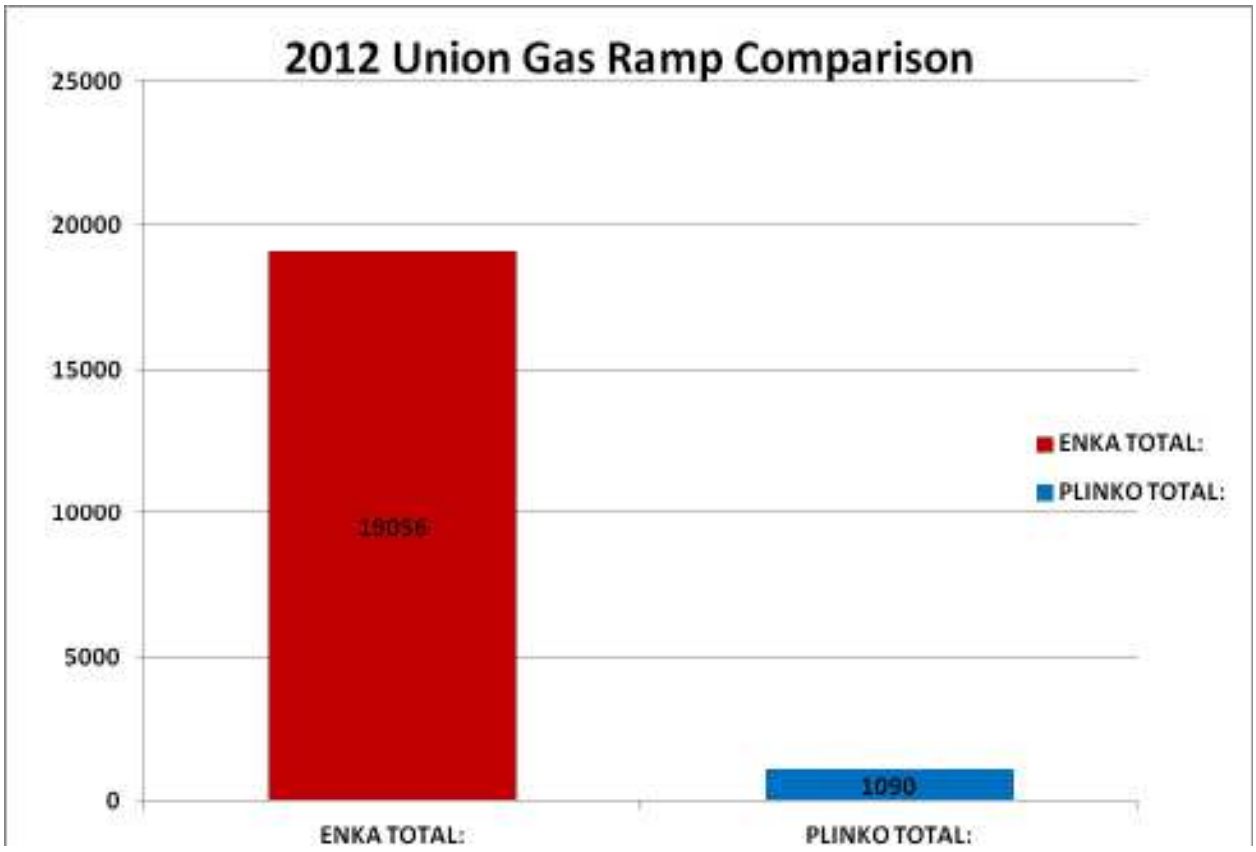
Excess water from the spray bars was used on the exit side to wash eels down the 4 inch PVC pipe into the holding pens. Once beyond the ninety degree curve in the terminal end, eels were unable to come back down the

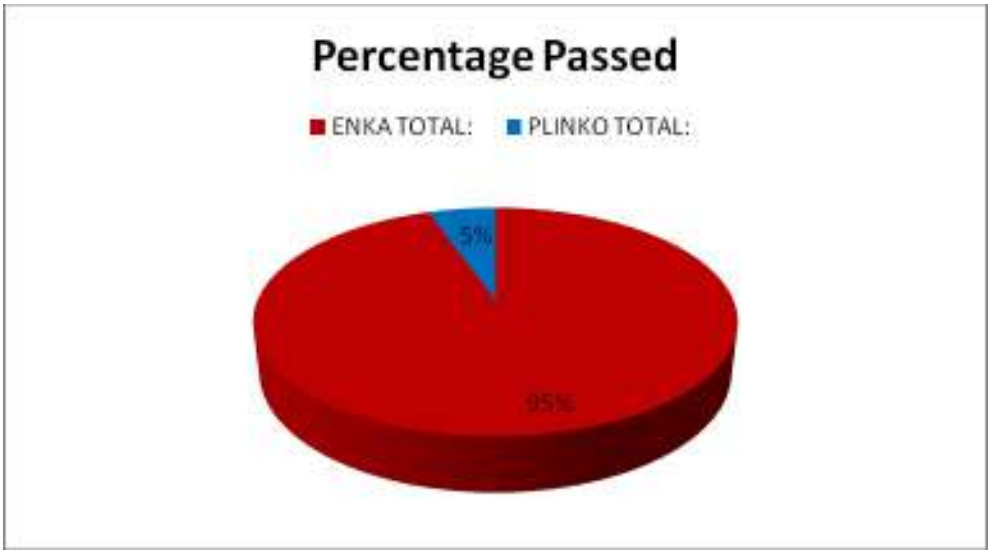
ramp. Spray bars were checked at least twice weekly and cleaned as necessary.

The holding pens were checked daily and, pulled, emptied, and reset as necessary. Daily catches were weighed. A subsample was measured, counted, and weighed at least once a week. All eels were released into the head pond. After the peak of the run, holding pens were checked every two or three days. The passageway was shut down at the end of August.

Results

Eels were first observed in the evening on May 24th in the general area of the ramp entrance. The ramp was finished and became operational on May 25th with the first catch being sampled on May 26th. High water flows prevented passage for a total of 12 days between May 28th to May 30th,from June 4th to June 8th and from June 9th to June 14th. Daily checks and catches continued from June 15th to June 30th. Catches were processed every two to three days for the rest of the season without interruption of operation. Both elvers and yellow eels utilized the Enkamat and Plinko ramps. The Plinko passageway passed the largest eel at 54.3 centimeters. The smallest eel, just 6.7 centimeters, used the Enkamat side. Both ramps were operating simultaneously but the majority of the eels preferred the Enkamat substrate. The count for the Enkamat side totaled nineteen thousand fifty-six eels and the total for Plinko side was one thousand ninety eels for a grand total of twenty thousand one hundred forty-six. The Plinko slide passed five percent of the total eels compared to ninety five percent utilizing the Enkamat Substrate.

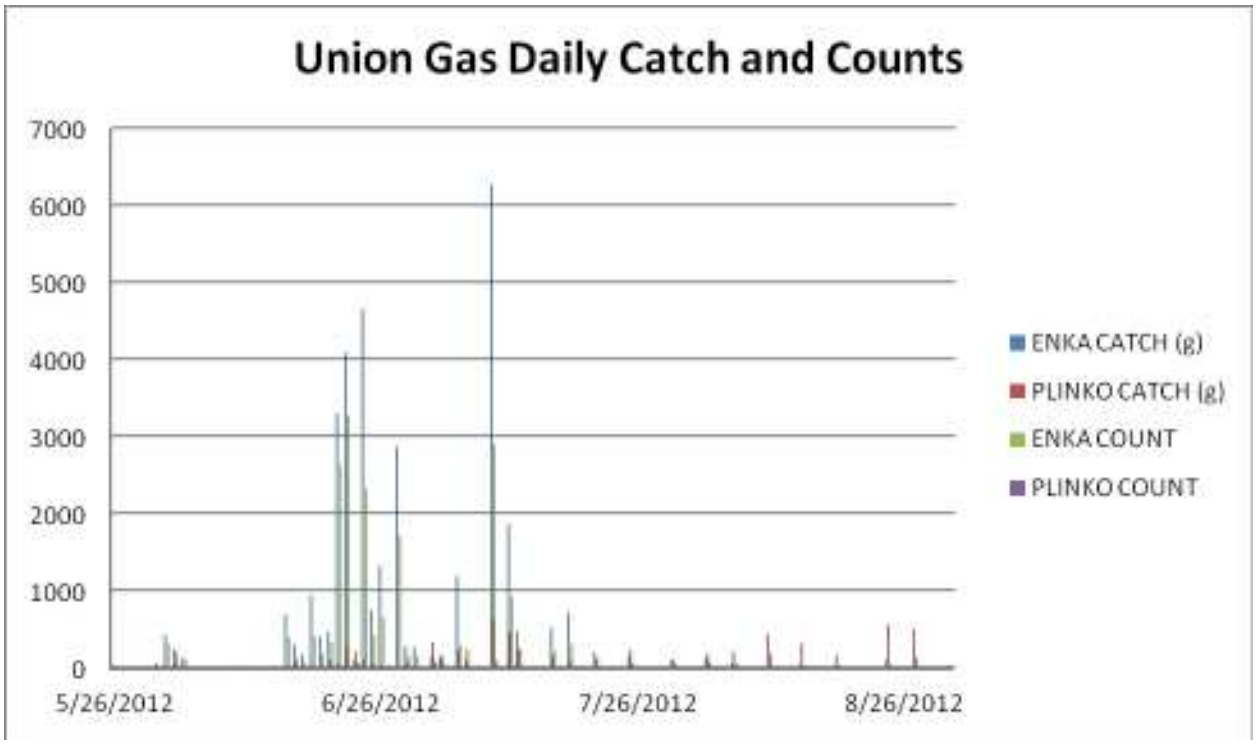

2012 Union Gas Ramp Comparison
25000
20000
15000
10000
5000
0
19056
1090
ENKA TOTAL:
PLINKO TOTAL:
ENKA TOTAL:
PLINKO TOTAL:


Percentage Passed
ENKA TOTAL:
PLINKO TOTAL:
5%
95%

Dialy catch Statistics

DATE	ENKA CATCH (g)	PLINKO CATCH (g)	ENKA COUNT	PLINKO COUNT	SMALLEST (cm)	LARGEST (cm)
5/26/2012	36.1		21			
5/27/2012	5.1		3		10.8	12.4
5/31/2012	65.5		2		11.9	35.6
6/1/2012	430.5		310		8.5	15.1
6/2/2012	242.8	55.3	206	1	8.6	33.6
6/3/2012	128	1.5	108	1		
6/9/2012	5.3		4		10.9	12.3
6/15/2012	696.9		401		9.3	16.8
6/16/2012	303.8	71.6	118	4	9.3	30.6
6/17/2012	175.9		69			
6/18/2012	939	8.3	410	4	8.1	17.1
6/19/2012	410	2.2	179	1		
6/20/2012		104.8		20	8.7	34.2
6/20/2012	468		334		8.3	15.3
6/21/2012		28.8		23	8.3	14
6/21/2012		49.9		2	26.8	29.1
6/21/2012	3302		2642			
6/22/2012	4097		3278			
6/22/2012		265.7		6	10.3	49.8
6/23/2012		213.9		64	8.2	22.4
6/23/2012	101.6		21		9.5	27.8
6/24/2012	4657		2317			
6/24/2012		103.8		6	10.2	27.9
6/25/2012	748		426		9.2	17.5
6/25/2012		48.4		20	9.3	24.3
6/26/2012	1322	27.9	658	1		
6/27/2012	36.8		22		8.8	18.3
6/27/2012		4.8		4	9.3	13.4
6/28/2012	2875	7.6	1722	4		
6/29/2012		71.4		14	8.6	32.5
6/29/2012	276.8		157		8.4	19.9
6/30/2012	272	8.9	155	5		
7/2/2012	138.5		79		8.1	25.1
7/2/2012		332.2		70	8.8	27.5
7/3/2012	136	169	77	36		
7/5/2012	1186.3		298		9.1	23.8
7/5/2012		229.9		17	8.9	34.7
7/6/2012	110	242	28	18		
7/9/2012	6273.8		2905		8	18.3
7/9/2012		622.4		90	10	27.2
7/11/2012		467.3		35	9.5	37.8
7/11/2012	1863.4		913		9.6	19.1
7/12/2012		245.2		31	8.5	30.4
7/12/2012	479.4		230		9.1	22.3
7/16/2012	521.3		230		8.8	17
7/16/2012		148.8		25	11.2	25.2
7/18/2012	715	91	315	15		
7/21/2012	206.1		126		8.8	17
7/21/2012		101.8		23	9.2	26.9
7/25/2012	140.6		65		8.4	19.2
7/25/2012		229.3		40	8.3	37.1
7/30/2012	104		53		8.4	24.6
7/30/2012		101.7		22	8.3	35.1
8/3/2012	128.7		66		8.8	17.3
8/3/2012		182.9		38	8.5	31.1
8/6/2012	65.5		27		8.1	16.3
8/6/2012		208		55	8.1	29.3
8/10/2012		431		177		
8/14/2012	41.6		7			
8/14/2012		315.9		30	9.2	28.7
8/18/2012	31.5	162	5	15		
8/24/2012	106.6		47		6.7	26.8
8/24/2012		558.9		23	7.1	54.3
8/27/2012	13.5		13		7.6	11.8
8/27/2012		504.3		133		
8/31/2012	14.4		9		8.2	16.1
8/31/2012		28.1		17	8.2	17.7

The biggest volume of eels passed from June 15th to July 18th. This is similar to eel passage recorded at other sites in the Kennebec drainage. The individual lengths and weights were also equal to what have been observed in the area.



Discussion

The eel ramp system has been successfully used for upstream passage in Maine as well as other parts of the United States, Canada, Europe, and New Zealand. Usually one substrate has been used at most sites. MSH has decided to provide both types of passage to allow the maximum opportunities for elvers and Yellow eels. The water flow systems need to be operated at different volumes to accommodate the individual designs. Resting pools have been incorporated into areas where direction changed on the ramps. Wooden entrance ramps were installed in order to have a quick turnaround of repairs in case of high flow damage and to be able to adjust for maximum attraction. All the components were designed and fabricated

with a team effort to produce a system that would provide the passage of the most amount of eels.

MSH requests that this system be considered as permanent upstream passage for the Union Gas Hydro site. The amount of eels passed and reliability of operation in conjunction with construction for long term durability should be viewed as a system that works and will work in years to come.

Upon approval, the holding pens would be removed, and the terminal ends will be plumbed into a single exit pipe into the head pond. Regular inspections and maintenance and repairs would be done as required by the operators as part of their regular routine.

We look forward to any and all comments and questions about this system and its operation.

Messalonskee Stream Hydro LLC.,

Union Gas Downstream Eel Passage Study

Aug. 30th - Oct. 30th 2020

In conjunction with

Maine Department of Marine Resources

Prepared by Kurstyn True & Skip (George) Zink

Introduction

The Union Gas Hydro project is owned and operated by Messalonskee Stream Hydro LLC (MSH); 55 Union St. 4th Floor, Boston, Massachusetts. It is located on Messalonskee Stream in the city of Waterville, Maine. It is the fifth dam on the stream and the lowest on the system, approximately 1 mile above the confluence of the stream and the Kennebec River.

The Messalonskee Lake Outlet Dam (Snow Pond) is owned by MSH. It is located in the town of Oakland Maine, and serves as the water control dam to power the hydro sites on Messalonskee Stream. There is a 1" fish rack that was installed by a now nonexistent organization to prevent stocked fish passage into Messalonskee Stream.

Messalonskee Lake Dam (Snow Pond) fish rack upstream side.

In a previous ongoing study, MSH worked with the Maine Department of Marine Resources to operate a downstream eel trap at the Snow Pond fish rack. Observations in recent years by both DMR biologists and operations staff on their maintenance rounds have not revealed a population size of eels that would be expected to be present considering the drainage area.

The proposed study at Union Gas is being conducted as a result of inconclusive data at the Snow Pond downstream eel passage study. Eels collected at Union Gas will contribute to population size data of eels living in the Messalonskee Stream system, and the ability for them to pass downstream to the Kennebec River.

Messalonskee Lake Eel counts		
Date started	Date Ended	Total Eels
9/27/2012	11/15/2012	1
8/28/2013	11/7/2013	4
9/8/2014	11/19/2014	0
9/11/2015	11/13/2015	0
9/1/2016	11/16/2016	2
9/15/2017	11/16/2017	1
8/26/2018	11/7/2018	0

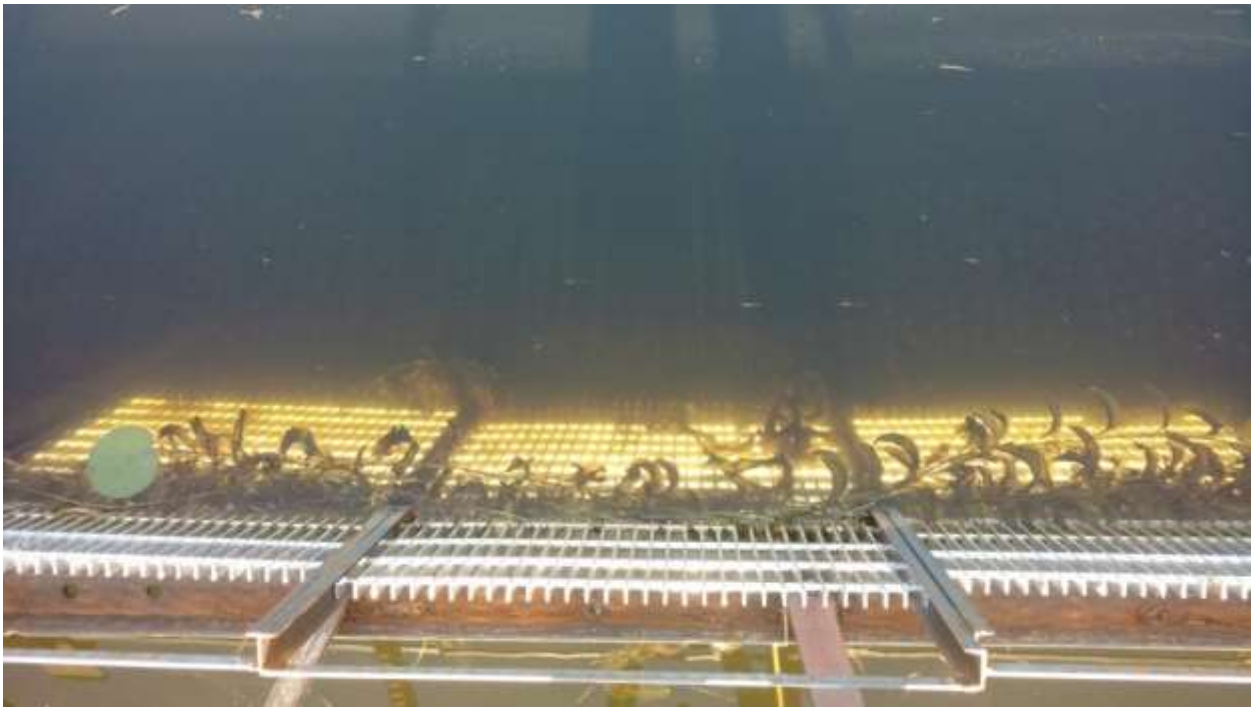
Eel counts from Snow Pond downstream eel passage study

Logistics

On August 4th, 2020 Bob Thornton, Skip Zink, and Andy Hughes met to finalize actions to be taken at Snow Pond considering the fish rack and at Union Gas Station considering the beginning of the downstream eel passage study. The following actions were agreed upon to begin the study.

- An eight hour shutdown from 18:00 to 2:00 of the MSH hydro facilities each night from 8/30/20 to 10/30/20 coordinated with the nightly removal of fish racks at Snow Pond.
- The Snow Pond fish rack will be modified with 11 aluminum 1" racks to accommodate the operations staff nightly removal and replacement.
- The trap from the previous Snow Pond study will be removed and replaced with 1" rack.
- A steel access platform will be lag bolted onto the top of the spillway at Union Gas for the staff to check the eel trap.
- 1" coated screen will be installed along the total length of the flashboards reaching 1ft above the boards to prevent eel passage.
- An eel trap (22"x22"x22") holding pen with screen mesh and ½" screen will be reinforced with 1" coated screen and secured behind the flashboards with a 6" pipe through the flashboard into the headpond.
- A cod finger cone will be used in the transition from the 6"pipe into the trap holding pen.
- An eel release chute will be constructed on the downstream side of the dam, using 6" PVC pipe.

Left: Platform and eel trap installation Right: 1” coated screen installation on flashboard



Snow Pond installation of aluminum 1” racking

Downstream Eel Passage Study Procedure

- The eel trap at Union Gas will be checked daily in the a.m. for silver eels.
- Eel length, count, weather conditions and incidental fish will be recorded.
- Eels will be released using the PVC chute.
- Headpond levels will be maintained to prevent eel passage over the flashboard screen and access to the trap entrance.
- Data will be recorded by hand then transferred to a shared document.

Data and Results

At the conclusion of the study**, a total of 11 silver American Eels** had been trapped, measured, and released. A variety of sizes were captured, suggesting male and female specimens were involved.

Specimen #	Length (cm)	Date
1	32	Sept. 23
2	32	Sept. 25
3	30	Sept.26
4	48	Sept. 27
5	34	Oct. 6
6	32	Oct. 8
7	30	Oct. 11
8	48	Oct. 14
9	54	Oct. 15
10	67	Oct. 15
11	77	Oct. 15

Silver eel lengths collected at Union Gas downstream passage trap

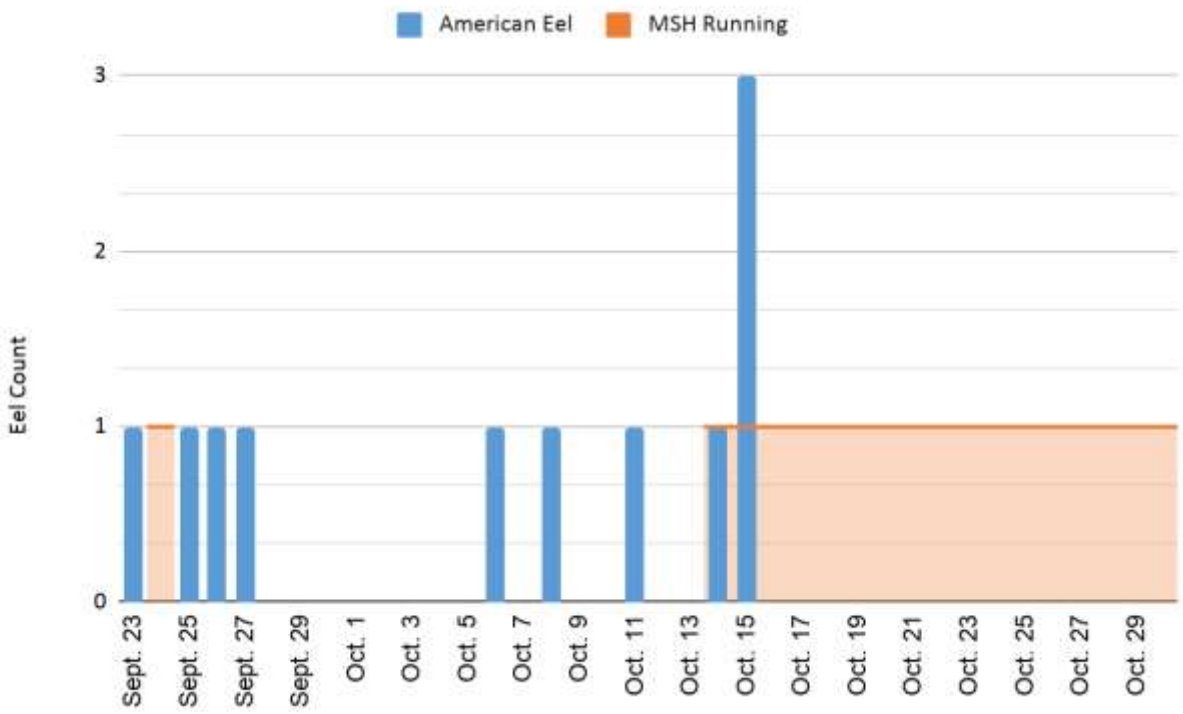
Incidental fish counts:

253 Largemouth bass

24 Redbreast sunfish

12 Smallmouth bass

5 Pumpkinseed sunfish



A comparison of dates when silver eels were trapped and when MSH stations were running.

Conclusion

The decision to move the downstream eel passage study from Snow Pond to Union Gas has yielded more accurate data representing the American eel population in the Messalonskee Stream system. The installation of the ADA angler platform at Snow Pond changed the observed bank flow and efficiency of the eel trap. The deep gate control at Union Gas in conjunction with the design of the spillway trap has provided the best eel count data to date.

All eels were released downstream using the PVC chute to bypass the hydro unit. One mortality was recorded, the individual was dead upon checking the trap, with no apparent injuries.

Any comments or questions are welcome, we look forward to hearing them.

Skip Zink georgezink14@live.com
Kurstyn True truekurstyn@gmail.com

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Maine Ecological Services Field Office
P. O. Box A
East Orland, ME 04431
Phone: (207) 469-7300 Fax: (207) 902-1588
http://www.fws.gov/mainefieldoffice/index.html

In Reply Refer To: February 03, 2021
Consultation Code: 05E1ME00-2021-SLI-0587
Event Code: 05E1ME00-2021-E-01809
Project Name: Rice Rips Hydroelectric Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies the threatened, endangered, candidate, and proposed species and designated or proposed critical habitat that may occur within the boundary of your proposed project or may be affected by your proposed project. This species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC Web site at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the Endangered Species Consultation Handbook at: http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

This species list also identifies candidate species under review for listing and those species that the Service considers species of concern. Candidate species have no protection under the Act but are included for consideration because they could be listed prior to completion of your project. Species of concern are those taxa whose conservation status is of concern to the Service (i.e., species previously known as Category 2 candidates), but for which further information is needed.

If a proposed project may affect only candidate species or species of concern, you are not required to prepare a Biological Assessment or biological evaluation or to consult with the Service. However, the Service recommends minimizing effects to these species to prevent future conflicts. Therefore, if early evaluation indicates that a project will affect a candidate species or species of concern, you may wish to request technical assistance from this office to identify appropriate minimization measures.

Please be aware that bald and golden eagles are not protected under the Endangered Species Act but are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.). Projects affecting these species may require development of an eagle conservation plan: http://www.fws.gov/windenergy/eagle_guidance.html Information on the location of bald eagle nests in Maine can be found on the Maine Field Office Web site: http://www.fws.gov/mainefieldoffice/Project%20review4.html

Additionally, wind energy projects should follow the wind energy guidelines: http://www.fws.gov/windenergy/ for minimizing impacts to migratory birds and bats. Projects may require development of an avian and bat protection plan.

Migratory birds are also a Service trust resource. Under the Migratory Bird Treaty Act, construction activities in grassland, wetland, stream, woodland, and other habitats that would result in the take of migratory birds, eggs, young, or active nests should be avoided. Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm and at:

http://www.towerkill.com; and at:
http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Maine Ecological Services Field Office
P. O. Box A
East Orland, ME 04431
(207) 469-7300

Project Summary

Consultation Code: 05E1ME00-2021-SLI-0587
Event Code: 05E1ME00-2021-E-01809
Project Name: Rice Rips Hydroelectric Project
Project Type: POWER GENERATION
Project Description: Rice Rips LIHI recertification
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@44.5608442,-69.69473270061185,14z

Counties: Kennebec County, Maine

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis*	Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9045

Fishes

NAME	STATUS
Atlantic Salmon *Salmo salar*	Endangered

Population: Gulf of Maine DPS
There is **final** critical habitat for this species. The location of the critical habitat is not available.
Species profile: https://ecos.fws.gov/ecp/species/2097

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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Phone: (207) 469-7300 Fax: (207) 902-1588
http://www.fws.gov/mainefieldoffice/index.html

IPaC Record Locator: 096-98966288 February 03, 2021

Subject: Consistency letter for the 'Rice Rips Hydroelectric Project' project indicating that any take of the northern long-eared bat that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o).

Dear Andrew Locke:

The U.S. Fish and Wildlife Service (Service) received on February 03, 2021 your effects determination for the 'Rice Rips Hydroelectric Project' (the Action) using the northern long-eared bat (*Myotis septentrionalis*) key within the Information for Planning and Consultation (IPaC) system. You indicated that no Federal agencies are involved in funding or authorizing this Action. This IPaC key assists users in determining whether a non-Federal action may cause "take"[1] of the northern long-eared bat that is prohibited under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, any take of the northern long-eared bat that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the Action is not likely to result in unauthorized take of the northern long-eared bat.

Please report to our office any changes to the information about the Action that you entered into IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation.

If your Action proceeds as described and no additional information about the Action's effects on species protected under the ESA becomes available, no further coordination with the Service is required with respect to the northern long-eared bat.

The IPaC-assisted determination for the northern long-eared bat **does not** apply to the following ESA-protected species that also may occur in your Action area:

- Atlantic Salmon Salmo salar Endangered

You may coordinate with our Office to determine whether the Action may cause prohibited take of the animal species listed above.

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[1]Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

Rice Rips Hydroelectric Project

2. Description

The following description was provided for the project 'Rice Rips Hydroelectric Project':

Rice Rips LIHI recertification

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@44.5608442,-69.69473270061185,14z

Determination Key Result

This non-Federal Action may affect the northern long-eared bat; however, any take of this species that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR §17.40(o).

Determination Key Description: Northern Long-eared Bat 4(d) Rule
This key was last updated in IPaC on **May 15, 2017**. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for non-Federal actions is to assist determinations as to whether proposed actions are excepted from take prohibitions under the northern long-eared bat 4(d) rule.

If a non-Federal action may cause prohibited take of northern long-eared bats or other ESA-listed animal species, we recommend that you coordinate with the Service.

Determination Key Result

Based upon your IPaC submission, any take of the northern long-eared bat that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o).

Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?

   No

2. Will your activity purposefully **Take** northern long-eared bats?

   No

3. [Semantic] Is the project action area located wholly outside the White-nose Syndrome Zone?

   Automatically answered
   No

4. [Semantic] Is the project action area located within 0.25 miles of a known northern long-eared bat hibernaculum?

   Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency

   Automatically answered
   No

5. [Semantic] Is the project action area located within 150 feet of a known occupied northern long-eared bat maternity roost tree?

   Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency

   Automatically answered
   No

Project Questionnaire

If the project includes forest conversion, report the appropriate acreages below. Otherwise, type '0' in questions 1-3.

1. Estimated total acres of forest conversion:

0

2. If known, estimated acres of forest conversion from April 1 to October 31

0

3. If known, estimated acres of forest conversion from June 1 to July 31

0

If the project includes timber harvest, report the appropriate acreages below. Otherwise, type '0' in questions 4-6.

4. Estimated total acres of timber harvest

0

5. If known, estimated acres of timber harvest from April 1 to October 31

0

6. If known, estimated acres of timber harvest from June 1 to July 31

0

If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type '0' in questions 7-9.

7. Estimated total acres of prescribed fire

0

8. If known, estimated acres of prescribed fire from April 1 to October 31

0

9. If known, estimated acres of prescribed fire from June 1 to July 31

0

If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type '0' in question 10.

10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?

0

Andrew Locke

From: Kemper, Keel <Keel.Kemper@maine.gov> on behalf of Kemper, Keel
Sent: Friday, January 22, 2021 8:27 AM
To: Andrew Locke
Subject: RE: Threatened & Endangered Species in the vicinity of the Messalonskee Projects

Yes, correct…nothing new identified…

Sand Hill Crane has nested here for sometime now. While very cool, it is not a state regulated species.

KK

G. Keel Kemper
Regional Wildlife Biologist
MDIFW
270 Lyons Road
Sidney, ME 04988
207-287-5369

From: Andrew Locke <alocke@essexhydro.com>
Sent: Thursday, January 21, 2021 5:46 PM
To: Kemper, Keel <Keel.Kemper@maine.gov>
Subject: Threatened & Endangered Species in the vicinity of the Messalonskee Projects

Keel -

I hope this email finds you well.

We are recertifying the Messalonskee projects with LIHI. Are Black Terns (*Chlidonias niger*) still the only state listed endangered species associated with Messalonskee?

Thank you,

Andrew

On Wed, Feb 17, 2016 at 2:36 PM Kemper, Keel <Keel.Kemper@maine.gov> wrote:

> Black Tern (*Chlidonias niger*) is the only state listed endangered species associated with Messalonskee…Thanks