Pre-Application Document

VOLUME I of I

Lawrence Hydroelectric Project

(FERC No. 2800)

June 16, 2023

Prepared by:
HDR

Prepared for:
Essex Company, LLC,
a subsidiary of Patriot Hydro, LLC

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List of Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
µS/cm	micro siemens per centimeter
ACHP	Advisory Council on Historic Preservation
AIR	Additional Information Request
AIS	aquatic invasive species
APE	area of potential effects
B.P.	before present
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMR	Code of Massachusetts Regulations
CSOs	combined sewer overflows
CUI	Controlled Unclassified Information
CWA	Clean Water Act
DHAC	FERC's Division of Hydropower Administration & Compliance
DLA	Draft License Application
DO	dissolved oxygen
DPS	distinct population segments
EA	Environmental Assessment
EFH	essential fish habitat
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ESA	Endangered Species Act
Essex	Essex Company, LLC
FERC or Commission	Federal Energy Regulatory Commission
FLA	Final License Application
fnu	Formazin Nephelometric Unit
FPA	Federal Power Act
GLSD	Greater Lawrence Sanitary District
HAPC	habitat areas of particular concern
HP	horsepower
Hz	hertz
ILP	Integrated Licensing Process
IPaC	Information for Planning and Consultation
IPANE	Invasive Plant Atlas of New England
ISR	Initial Study Report
kV	kilovolt
KVA	kilovolt-amps
LHA	Lawrence Hydroelectric Associates
LMRLAC	Lower Merrimack River Local Advisory Committee
m	meter
m3/s	cubic meters per second
MA	Massachusetts
MACRIS	Massachusetts Cultural Resource Information System
MADEP	Massachusetts Department of Environmental Protection

Mass CZM	Massachusetts Office of Coastal Zone Management
MassGIS	Massachusetts Bureau of Geographic Information
MassWildlife	Massachusetts Division of Fisheries and Wildlife
MDPW	Massachusetts Department of Public Works
MESA	Massachusetts Endangered Species Act
mg/L	milligrams per liter
MHC	Massachusetts Historical Commission
MIPAG	Massachusetts Invasive Plant Advisory Group
MRTC	Merrimack River Technical Committee
MRWC	Merrimack River Watershed Council
MW	megawatts
MWh	megawatt hours
NAI	Normandeau Associates, Inc.
NEFMC	New England Fishery Management Council
NEPA	National Environmental Policy Act
NGOs	non-governmental organizations
NGVD29	National Geodetic Vertical Datum of 1929
NH	New Hampshire
NHDES	New Hampshire Department of Environmental Services
NHDFG	New Hampshire Department of Fish and Game
NHESP	Natural Heritage & Endangered Species Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NTU	Nephelometric Turbidity Units
NWI	National Wetland Inventory (USFWS)
NWIS	National Water Information Systems
OSRP	Open Space and Recreation Plan
PAD	Pre-Application Document
PLC	Programmable Logic Controller
PLP	Preliminary Licensing Proposal
ppt	parts per thousand
Project	Lawrence Hydroelectric Project
PSP	Proposed Study Plan
PURPA	Public Utility Regulatory Policies Act of 1978
REA	Ready for Environmental Analysis
RM	river miles
ROR	run-of-river
RPM	revolutions per minute
RSP	Revised Study Plan
RTE	rare, threatened, or endangered
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SD1	Scoping Document 1
SD2	Scoping Document 2

SHPO	State Historic Preservation Officer
SRHP	State Register of Historic Places
TCPs	Traditional Cultural Properties
TMDL	total maximum daily load
UMRLAC	Upper Merrimack River Local Advisory Committee
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Department of Agriculture Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USR	Updated Study Report
WQC	Water Quality Certificate

1 Introduction and Background

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Project or Lawrence Project). The Project was licensed by the Federal Energy Regulatory Commission (FERC or Commission) on December 4, 1978 (with an effective date of December 1, 1978), and the license expires on November 30, 2028. The Lawrence Project is located on the Merrimack River in the City of Lawrence in Essex County, Massachusetts.

The Project is currently licensed by the Commission under the authority granted to FERC by Congress through the Federal Power Act (FPA), 16 United States Code (USC) §791(a), *et seq*., to license and oversee the construction and operation of non-federal hydroelectric projects on jurisdictional waters and/or federal lands. In accordance with FERC's regulations at 18 Code of Federal Regulations (CFR) §16.9(b), Essex must file an application for a new license for the Project on or before November 30, 2026.

As described in this Pre-Application Document (PAD) and the associated Notice of Intent (NOI), Essex is pursuing a new FERC license for the Project using the Commission's default Integrated Licensing Process (ILP), as defined in 18 CFR Part 5. Based upon an analysis of available resources, Essex believes that the ILP will be the most effective process for this relicensing and will provide a structured framework to evaluate resources that may be of interest to stakeholders that are relevant to this relicensing proceeding.

Pursuant to 18 CFR § 5.8 of the Commission's regulations, following FERC's review of this PAD and associated NOI, FERC will issue notice of the commencement of the licensing proceeding and request comments on the PAD within 60 days of the PAD and NOI being filed. Within 30 days of that notice, FERC will conduct a scoping meeting and site visit of the Lawrence Project.

2 Purpose of Pre-Application Document

The filing of this PAD and the associated NOI marks the formal start of the relicensing process for the Lawrence Project. The purpose of the PAD is to provide a description of the existing Project facilities and operations and other relevant and reasonably available information related to the Project areas. Further, the PAD is intended to assist the Commission, resource agencies, Indian Tribes, non-governmental organizations (NGOs), and other interested parties in identifying potential resource areas of interest and informational needs; to develop study requests; and to establish the information necessary to analyze the license applications (18 CFR §5.6(b)).

2.1 Search for Existing, Relevant, and Reasonably Available Information

Essex has undertaken an extensive search to identify and review information that is reasonably available and relevant to the Project. A significant number of resource-specific references and information sources were identified, reviewed, researched, and analyzed in preparation of this PAD. These efforts consisted of the following four primary activities:

1. A PAD Information Questionnaire was sent to approximately 170 parties on April 20, 2023, requesting the identification of any information related to the Project, the Project vicinity, and the region;
2. An extensive review was made of Essex's files and available documentation, including reports and correspondence relating to the previous licensing proceeding, as well as subsequent FERC Orders, amendments, and other germane information on the FERC docket;
3. Research was conducted using publicly available sources and databases; and
4. A review was performed of the Massachusetts and Federal Comprehensive Plans relevant to the Project.

A copy of the PAD Information Questionnaire and associated distribution list is provided in Appendix A. A total of thirteen parties responded to the questionnaire either by email or with a completed paper copy of the questionnaire—both types of responses are included in Appendix B of this PAD. Essex reviewed each of the returned PAD Information Questionnaires and identified documents believed to be potentially relevant to the Project. Based on their availability, these documents have been acquired and/or reviewed and relevant information summarized in the various resource-oriented sections of this PAD.

2.2 Description of the Consultation Process Prior to Submittal of the PAD

Essex has performed preliminary consultation with potential stakeholders in support of preparing this PAD to obtain available information, to determine the potential relationship between stakeholders' interests and Project operations, and to identify potential information gaps and study needs in advance of the formal relicensing process. Essex's preliminary consultation began with the identification of parties that may have an interest in the Project. Based on the information obtained during this process, 170 parties consisting of the primary resource agencies and NGOs were sent a request for existing, relevant, and reasonably available information regarding the Project and the surrounding environment. Section 6 provides additional details regarding the consultation performed to date and responses to the PAD information request.

Additionally, Essex has conducted initial consultation with the Massachusetts Division of Fisheries and Wildlife (MassWildlife) and the U.S. Fish and Wildlife Service (USFWS) regarding rare, threatened, and endangered species, which is discussed below in Section 5.7. In addition, Essex consulted with the Massachusetts Office of Coastal Zone Management (Mass CZM) regarding the Project's location relative to the State's coastal zone but has not received a response. A stakeholder list of approximately 170 parties has been used as the distribution list for the PAD.

Since 2020, Essex has consulted with interested parties including the Massachusetts State Historic Preservation Officer (SHPO), City of Lawrence, Lawrence Historical Commission, GroundWorks Lawrence, Lawrence Community Works, USFWS, and other interested parties in support of a license amendment to modify the Project boundary. Although the amendment application was dismissed without prejudice by the Commission on July 13, 2022, the consultation performed in support of this effort provided additional information regarding the resource areas associated with the Project and additional insights into stakeholder interests.

3 Process Plans, Schedules, and Protocols

3.1 Process Plan and Schedule

Essex proposes to use the Commission's ILP in support of obtaining a new license for the Project. As presented in Table 3.1-1, Essex has prepared an ILP Process Plan and Schedule based on the Commission's ILP.

Table 3.1-1 Lawrence Project ILP Process Plan and Schedule

Activity/ Regulation	Responsible Parties	Time Frame	Estimated Due Date
File Notice of Intent (NOI) and Pre-Application Document (PAD) (18 CFR §5.5, 5.6)	Essex Company, LLC (Essex)	Within 5-5.5 year prior to license expiration	June 16, 2023
Initial Tribal Meetings (18 CFR §5.7)	FERC	No later than 30 days of filing NOI/PAD	July 16, 2023
Issue Notice of Commencement of Proceeding and Scoping Document (SD1) (18 CFR §5.8)	FERC	Within 60 days of filing NOI/PAD	August 15, 2023
Scoping Meetings and Project Site Visit (18 CFR §5.8(b)(viii))	FERC	Within 30 days of Notice of NOI/PAD and SD1	September 14, 2023
File Comments on PAD/SD1, and Study Requests (18 CFR §5.9)	Stakeholders	Within 60 days of Notice of NOI/PAD and SD1	October 14, 2023
Issue Scoping Document 2 (SD2), if necessary (18 CFR §5.10)	FERC	Within 45 days of deadline for filing comments on PAD/SD1	November 28, 2023

Activity/ Regulation	Responsible Parties	Time Frame	Estimated Due Date
File Proposed Study Plan (PSP) (18 CFR §5.11(a))	Essex	Within 45 days of deadline for filing comments on PAD/SD1	November 28, 2023
PSP Meeting (18 CFR §5.11(e))	Essex	Within 30 days of filing PSP	December 28, 2023
File Comments on PSP (18 CFR §5.12)	Stakeholders	Within 90 days of filing PSP	February 26, 2024
File Revised Study Plan (RSP) (18 CFR §5.13(a))	Essex	Within 30 days of deadline for comments on PSP	March 27, 2024
File Comments on RSP (18 CFR §5.13(b))	Stakeholders	Within 15 days following filing of RSP	April 11, 2024
Issue Director's Study Plan Determination (18 CFR §5.13(c))	FERC	Within 30 days of filing RSP	April 26, 2024
File Any Study Disputes (18 CFR §5.14(a))	Mandatory Conditioning Agencies		May 16, 2024
Select Third Dispute Resolution Panel Member (18 CFR §5.14(d))	Dispute Panel		May 31, 2024
Convene Dispute Resolution Panel (18 CFR §5.14(d)(3))	Dispute Panel		June 5, 2024
File Comments on Study Disputes (18 CFR §5.14(i))	Essex		June 10, 2024
Dispute Resolution Panel Technical Conference (18 CFR §5.14(j))	Dispute Panel		June 15, 2024
Issue Dispute Resolution Panel Findings (18 CFR §5.14(k))	Dispute Panel		July 5, 2024
Issue Director's Study Dispute Determination (18 CFR §5.14(l))	FERC		July 25, 2024
First Study Season (18 CFR §5.15(a))	Essex		Spring – Fall 2024

Activity/ Regulation	Responsible Parties	Time Frame	Estimated Due Date
File Initial Study Report (ISR) (18 CFR §5.15(c)(1))	Essex	Pursuant to the Commission-approved study plan or no later than 1 year after Commission approval of the study plan, whichever comes first	April 26, 2025
ISR Meeting (18 CFR §5.15(c)(2))	Licensee Stakeholders	Within 15 days of filing ISR	May 11, 2025
File ISR Meeting Summary (18 CFR §5.15(c)(3))	Essex	Within 15 days of ISR Meeting	May 26, 2025
File Disagreements/Requests to Amend Study Plan (18 CFR §5.15(c)(4))	Stakeholders		June 25, 2025
File Responses to Disagreements/Amendment Requests (18 CFR §5.15(c)(5))	Essex		July 25, 2025
Issue Director's Determination on Disagreements/Amendments (18 CFR §5.15(c)(6))	FERC		August 24, 2025
Second Study Season (if necessary) (18 CFR §5.15(a))	Essex		Spring – Fall 2025
File Updated Study Report (USR) (if necessary) (18 CFR §5.15(f))	Essex	Pursuant to the approved study plan or no later than 2 years after Commission approval, whichever comes first	April 26, 2026
USR Meeting (if necessary) (18 CFR §5.15(f))	Essex / Stakeholders	Within 15 days of filing USR	May 11, 2026
File USR Meeting Summary (if necessary) (18 CFR §5.15(f))	Essex	Within 15 days of USR Meeting	May 26, 2026
File Disagreements/Requests to Amend Study Plan (18 CFR §5.15(f))	Stakeholders		June 15, 2026
File Responses to Disagreements/Amendment Requests (18 CFR §5.15(f))	Essex		July 15, 2026
Issue Director's Determination on Disagreements/Amendments (18 CFR §5.15(f))	FERC		August 14, 2026

Activity/ Regulation	Responsible Parties	Time Frame	Estimated Due Date
File Preliminary Licensing Proposal (PLP) or Draft License Application (DLA) (18 CFR §5.16(a)-(c))	Essex	No later than 150 days prior to the deadline for filing the Final License Application	July 3, 2026
File Comments on PLP or DLA (18 CFR §5.16(e))	Stakeholders	Within 90 days of filing PLP or DLA	October 1, 2026
File Final License Application (FLA) (18 CFR §5.17)	Essex	No later than 24 months before the existing license expires	November 30, 2026
Publish Public Notice of FLA Filing (18 CFR §5.17(d)(2))	Essex	Within 14 days of FLA filing	December 14, 2026
Issue Public Tendering Notice of FLA (18 CFR §5.19(a))	FERC	Within 14 days of FLA filing	December 14, 2026
Issue Decision on outstanding prefiling Additional Information Requests (AIRs) (if necessary) (18 CFR §5.19(d))	FERC	Within 30 days of FLA filing	December 30, 2026
Issue Notice of FLA Deficiency (if necessary) (18 CFR §5.20(a)(2))	FERC	Within 30 days of FLA filing	December 30, 2026
Issue AIRs (if necessary) (18 CFR §5.21))	FERC		~January 2027
Issue Notice of Application Accepted for Filing and Soliciting Motions to Intervene and Protests	FERC		~January 2027
File Motions to Intervene or Protests	Stakeholders	Within 60 days of Notice of Application Accepted for filing	~ February 2027
File Response to AIRs	Essex	Per schedule required by FERC	~ March 2027
Issue Notice of Acceptance and Ready for Environmental Analysis (REA) (18 CFR §5.22)	FERC	Upon determination of a complete application	~ June 2027
File Amendments to FLA, if necessary	Essex	Within 30 days of Notice of REA	~July 2027
Submit Application for Water Quality Certificate (WQC) (18 CFR §5.23(b))	Essex	Within 60 days of Notice of REA	~August 2027

Activity/ Regulation	Responsible Parties	Time Frame	Estimated Due Date
File with FERC proof of submittal of WQC (18 CFR §5.23(b))	Essex	Within 60 days of Notice of REA	~August 2027
File Comments, Interventions, Preliminary Terms and Conditions (18 CFR §5.23(a))	Stakeholders	Within 60 days of Notice of REA	~August 2027
File response to Comments and Preliminary Terms and Conditions (18 CFR §5.23(a))	Essex / Stakeholders	Within 105 days of Notice of REA	~September 2027
Issue Environmental Assessment (EA) (18 CFR §5.24(a))	FERC	Within 120 days of due date for response to comments to Preliminary Terms and Conditions (i.e., 225 days after Notice of REA)	~January 2028
File Comments on EA (18 CFR §5.24(c))	Essex / Stakeholders	Within 30 or 45 days of EA (per Notice of EA)	~ March 2028
File Modified Mandatory Prescriptions or Terms and Conditions (18 CFR §5.24(d))	Stakeholders	Within 60 days of due date for comments on EA	~ May 2028
Issue WQC	Massachusetts Department of Environmental Protection (MADEP)	Within 1 year of receipt of WQC application	~ August 2028
Issue New License	FERC		~ November 2028

[1] If the due date falls on a weekend or holiday, the due date is the next following business day.
[2] Approximate dates identified by "~".
[3] Darker shaded milestones are applicable only if study disputes or formal disagreements are filed with FERC.

3.2 Scoping Meeting and Site Visit

In accordance with the ILP schedule presented in Section 3.1, FERC will issue a notice of commencement of proceeding and issue SD1 on or about August 15, 2023. Pursuant to 18 CFR §5.8(b), FERC will hold a Scoping Meeting on or about September 14, 2023, in accordance with its responsibilities under the National Environmental Policy Act (NEPA). The Scoping Meeting will be held at a location to be selected by FERC in the general vicinity of the Project. FERC will issue a public notice regarding the Scoping Meeting that will include the meeting date, meeting location, and additional instructions for attending the meeting. Essex and FERC will also hold a site visit (likely concurrent with the Scoping Meeting). Interested parties are invited to participate in the meeting and site visit.

3.3 ILP Participation

Essex has provided this PAD to representatives of relevant agencies, local governments, Indian Tribes, NGOs, and members of the public included on the distribution list attached to the cover letter transmitting this PAD. Any party that desires to be added to or removed from the distribution list should send a request to:

Mr. Kevin Webb
Hydro Licensing Manager
Patriot Hydro, LLC
670 N Commercial Street
Suite 204
Manchester, NH 03101
(978) 935-6039
kwebb@patriothydro.com

Ms. Kelsey Iffert
Project Manager
HDR, Inc.
231 Salina Meadows Parkway
Suite 210
Syracuse, NY 13212
(315) 706-5176
Kelsey.Iffert@hdrinc.com

3.4 Proposed Communication Protocols

During the course of the relicensing process, communication will take place through public meetings, conference calls, and written correspondence. In order to establish the formal consultation record, all phases of formal correspondence require adequate documentation. The intent of the communication protocol is to provide a flexible framework for the dissemination of information and for documenting consultation among all participants in the Project relicensing. The communication protocol will remain in effect until issuance of the Project's new license by the Commission.

Preliminary consultation with local NGOs and stakeholders identified the likely engagement with Spanish speaking stakeholders during the relicensing. Therefore, Essex anticipates providing summaries of the Essex-prepared relicensing documents in Spanish. These Spanish summaries will be made available with their parent documents by the methods described below. Essex will consult with participants through the course of the relicensing and reevaluate this approach as needed.

3.4.1 Distribution of Relicensing Materials

Documents filed with the Commission will be available from FERC's eLibrary at www.ferc.gov/docs-filing/elibrary.asp by searching under Docket P-2800. Essex will notify the distribution list when a document is available on FERC's eLibrary.

Essex is proposing to develop a relicensing website for the public to download primary licensing documents. Essex intends for the website to be available for stakeholder use by the FERC Scoping Meeting (September 2023).

Additionally, participants can request electronic or hard copies of documents. All requests for electronic or hard copies of relicensing documents should be sent to Kevin Webb or Kelsey Iffert using the contact information provided in Section 3.3 and should clearly indicate the document name, publication date (if known), and FERC Project No. 2800. A reproduction charge and postage costs may be assessed for hard copies requested by the public. Federal, state, and tribal entities will not be subject to document processing or postage fees.

Certain documents are restricted from general distribution. These documents include: (1) those covered under the FERC's regulations protecting Critical Energy Infrastructure Information/Controlled Unclassified Information (CEII/CUI) (18 CFR §388.113); (2) archaeological survey reports or other information identifying the locations of historic properties; and (3) reports that contain information regarding the locations of rare, threatened, or endangered (RTE) species.

3.4.2 FERC Communication

The identified FERC staff member to contact for questions or comments regarding this relicensing is Amanda Gill. For questions related to FERC communications, please contact Amanda Gill at (202) 502-6773, or at amanda.gill@ferc.gov.

All communications to FERC regarding the Project's relicensing must reference the Project number (P-2800). FERC strongly encourages paperless electronic filing of comments and interventions through its eFiling or eComment systems. Information and links to these systems can be found at the FERC webpage http://www.ferc.gov/docs-filing/ferconline.asp. In order to eFile comments and/or interventions, interested parties must have an eRegistration account. After preparing the comment or motion to intervene go to www.ferc.gov and select the eFiling link. Select the new user option and follow the prompts. Users are required to validate their account by accessing the site through a hyperlink sent to the registered email account.

An additional method to eFile comments is through the "Quick Comment" system available via a hyperlink on the FERC homepage. "Quick Comments" do not require the users to have a subscription; the comments are limited to 6,000 characters and all information must be public. Commenters are required to enter their names and email addresses. They will then receive an email with detailed instructions on how to submit "Quick Comments." Stakeholders without internet access may submit comments to FERC at the address below via hard copy, but should be aware that documents sent to FERC by regular mail can be subject to docket-posting delays:

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

4 Project Location, Facilities, and Operations

4.1 Authorized Agent

The exact name, business address, telephone number, and email address of each person authorized to act as an agent for Essex is listed below.

Mr. Kevin Webb
Hydro Licensing Manager
Patriot Hydro, LLC
670 N. Commercial Street, Suite 204
Manchester, NH 03101
(978) 935-6039
kwebb@patriothydro.com

Mr. Richard Malloy
Senior Compliance Advisor –
Licensing & Fisheries
Patriot Hydro, LLC
670 N. Commercial Street, Suite 204
Manchester, NH 03101
(508) 308-8534
rmalloy@patriothydro.com

4.2 Project Location

The Lawrence Project is located on the Merrimack River in the City of Lawrence in Essex County, Massachusetts, as shown below in Figure 4.2-1. The Project is the first dam on the Merrimack River, approximately 29 river miles (RM) from the Atlantic Ocean, and is located approximately 11 RM downstream of the Lowell Hydroelectric Project (FERC No. 2790). Figure 4.2-1 presents the approximate FERC Project Boundary and Figure 4.2-2 presents the Project facilities. The Project's current detailed FERC Project Boundary is presented in the Project's Exhibit K drawings (also known as Exhibit G), which are presented in Appendix C.

Through this relicensing proceeding, Essex will propose to modify the Project Boundary around the Project's impoundment consistent with FERC regulations. In preparation of this PAD, Essex reviewed the existing Exhibit K drawings which show the Project Boundary is drawn to the boundary of "Flowage Rights" at the 50 foot National Geodetic Vertical Datum (NGVD29) contour.[1] However, Essex believes the appropriate Project Boundary is shown on Exhibit K as "Normal Water Level" because the full extent of the flowage rights acquired by Essex prior to the construction of the Essex Dam was never exercised, i.e., the dam was constructed lower than its original intent so as not to impact upstream water power development in Lowell.

[1] Unless otherwise noted, all elevations in this PAD reference the National Geodetic Vertical Datum of 1929 (NGVD29), also known as the USGS mean sea level datum.

Figure 4.2-1 Project Location and Facilities

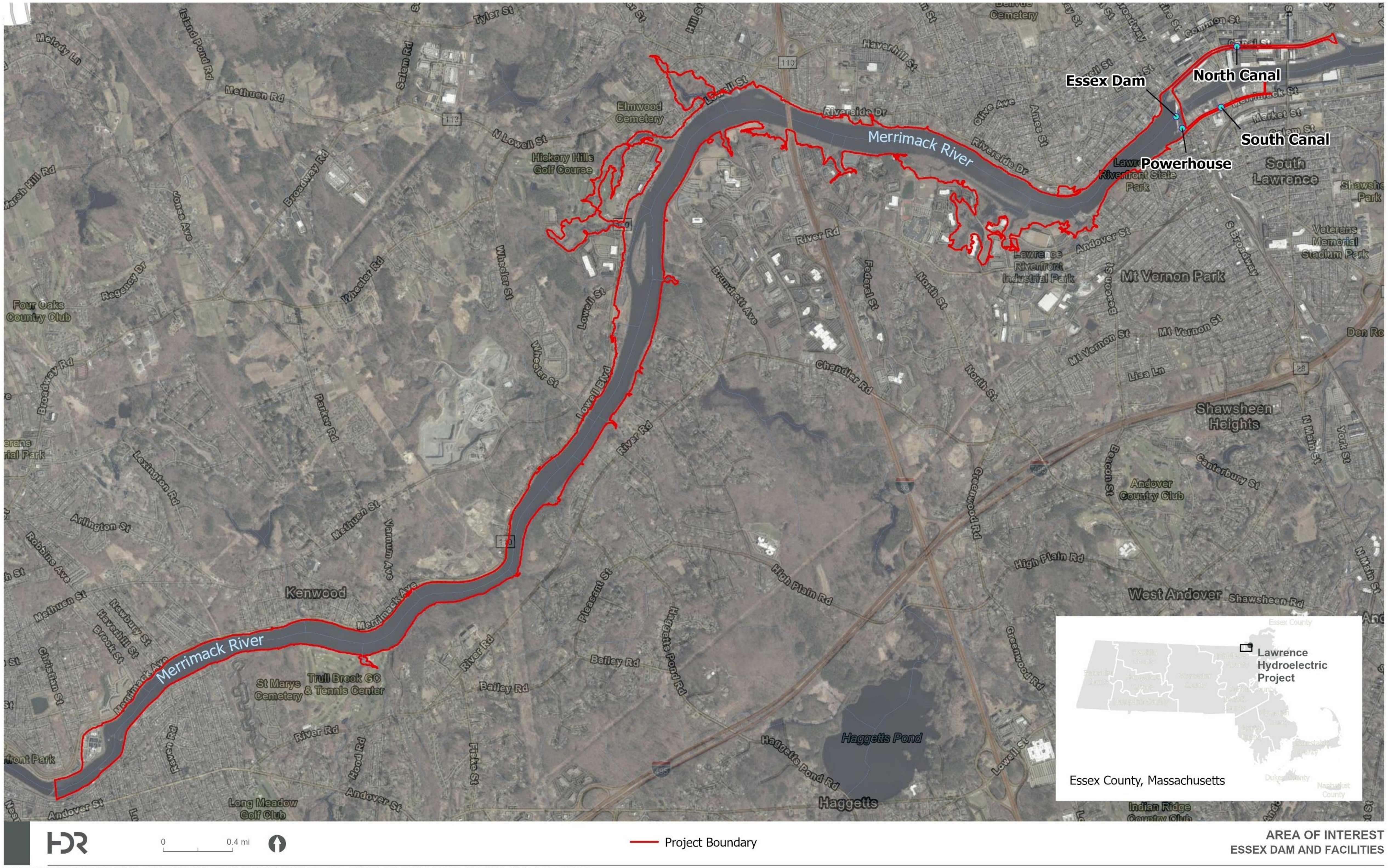

Figure 4.2-2 Project Facilities

4.3 Lawrence Project Facilities

The Lawrence Project works consist of: (1) the 35-foot-high by 900-foot-long gravity Essex Dam of stone masonry construction (also known as the Great Stone Dam), with a five-foot-high pneumatic crest gate system mounted on the spillway crest; (2) a 9.8-mile-long impoundment having a surface area of 655 acres at a normal water elevation of 44.17 feet NGVD29 at the top of the crest gates, and gross storage capacity of approximately 19,900 acre-feet; (3) a powerhouse located at the end of a small forebay adjacent to the south abutment of the Essex Dam, containing two 8.4 megawatt (MW) generating units, and a tailrace channel extending into the Merrimack River channel; (4) fish passage facilities integral with the powerhouse, including a fish elevator and downstream fish bypass, and an eel ladder at the right abutment of the dam; (5) the North Canal, approximately 5,300 feet long by 95 feet wide by 15 feet deep, originating at the north abutment of the dam and paralleling the Merrimack River downstream of the Essex Dam; (6) the South Canal, approximately 2,750 feet long by 35 feet wide by 10 feet deep, originating the south abutment of the Essex Dam and generally paralleling the Merrimack River downstream of the Essex Dam; (7) a single-circuit, underground/underwater 23.0-kilovolt (kV) transmission line[2] to the Massachusetts Electric Company's[3] Lawrence No. 1 substation; and (8) appurtenant facilities.

Below are details providing the physical description of the Project. A summary of these Project features is provided in Table 4.3-1, and shown above in Figure 4.2-2.

4.3.1 Essex Dam

The Essex Dam, also known as the Great Stone Dam, is a 900-foot-long gravity structure constructed of stone masonry. The dam is 35 feet in height from the crest elevation to the downstream foundation bedrock. The spillway crest is topped by an Obermeyer pneumatic crest gate system with three independently controllable zones. Each 300-foot-long zone consists of fifteen 20-foot-long, hinged, steel panel sections supported by a tubular rubber air bladder. Restraining straps attached to each gate panel prevent the panels from being raised above the approved five-foot effective height above dam crest (Lawrence Hydroelectric Associates [LHA] 2008).

4.3.2 Project Impoundment

The Project's impoundment has a surface area of 655 acres and gross storage capacity of approximately 19,900 acre-feet at the impoundment's normal elevation of 44.17 feet NGVD29. As the Project is operated in a run-of-river (ROR) mode, there is no useable storage capacity. The 9.8-mile-long impoundment is bordered by urban development and forested shoreline.

[2] On December 30, 1983, Ordering Paragraph (B)(ii) of the license was revised by the Commission to change the description of the transmission line to an underground/underwater 23.0 kV transmission line. However, FERC's subsequent revisions of Ordering Paragraph (B) (ii) of the license do not incorporate this change.
[3] Massachusetts Electric Company is doing business as National Grid.

4.3.3 Intake Forebay

River flows are directed to the powerhouse via a short intake forebay located adjacent to the south abutment of the dam. The forebay is approximately 170 feet long by 80 feet wide. The exit channel for the Project's fish lift system is located on the river left side of the forebay.

4.3.4 Powerhouse

The Project powerhouse is a 72-foot-wide by 128-foot-long building constructed of concrete and contains the Project's two generating units. The structure is approximately 90 feet high. The intake for the turbines is integral with the powerhouse and includes trashracks with 6-inch clear spacing.

4.3.5 Turbines and Generators

The powerhouse contains two horizontal, double-regulated Kaplan bulb turbines. Each turbine is rated at 11,260 horsepower (HP), operating at a speed of 128.6 revolutions per minute (RPM) at a rated head of 26.5 feet. Each unit's bulb contains a horizontal shaft, air-cooled, synchronous generator directly connected to the turbine shaft. Each generator is rated at 8,842 kilovolt-amperes (kVA), 0.95 power factor, 4,160 volts, 3-phase, 60 hertz (Hz), 80 degrees Celsius (ºC) temperature rise (LHA 1983). The generating units are each rated at 8.4 MW with a minimum and maximum hydraulic capacity of approximately 600 cubic feet per second (cfs) and 4,000 cfs, respectively (Essex 2020a). The Project has a total installed, authorized capacity of 16.8 MW.

4.3.6 North Canal

The North Canal originates at the Essex Dam impoundment, upstream of the northern abutment of the Essex Dam. The North Canal is approximately 95 feet wide and 15 feet deep, extending parallel to the Merrimack River for a distance of approximately 5,300 feet (FERC 1978). The North Canal flows are controlled by the North Canal Gatehouse located near the canal entrance opposite of the Essex Dam. The North Canal is capable of carrying controlled flows up to 3,000 cfs (LHA 1977). At the terminus of the North Canal is a gated spillway known as the "Lower Locks." Several historical mills are located along the North Canal.

4.3.7 South Canal

The South Canal originates at the south abutment of Essex Dam, adjacent to the entrance of the intake canal. The South Canal is approximately 35 feet wide and 10 feet deep, extending parallel to the Merrimack River for a distance of approximately 2,750 feet (FERC 1978). The South Canal flows are controlled by the South Canal Gatehouse located near the canal entrance. Approximately 1,000 feet downstream from Essex Dam along the South Canal are the former Aquamac Project (FERC No. 2927) and the Merrimac Paper Company Project (FERC No. 2928). The South Canal discharges to the Merrimack River via an underground conduit. Several historical mills are located along the South Canal.

4.3.8 Tailrace

Flows from the Project's powerhouse discharge to the Merrimack River via an approximately 130 foot long by 100 foot wide tailrace channel. The tailrace channel is bordered on the river side by bedrock and the concrete remains of a former fish ladder, and on the land side by bedrock and undeveloped lands leading to the south abutment of the Route 28 (Broadway) bridge.

4.3.9 Fish Passage Structures

Upstream passage is provided by the fish lift hopper system, with the entrances located at the downstream (northwest) side of the powerhouse. The fish lift replaced a former fish ladder that had been constructed at the Essex Dam prior to the original licensing and development of the Project. The fish lift system has a designed total operational flow (both entrances) of 200 cfs with 50 cfs supplied through the upper fishway channel and the remaining 150 cfs supplied through floor diffusers in the lower fishway attraction channel. The collection gallery has two entrances located in the tailrace. Entrance 1, located on the northwest side of the powerhouse, or river-left of the tailrace, is the fishway's primary entrance. The second entrance, located on river-right in the tailrace, was closed following an evaluation of internal efficiency in 1996. With entrance 1 (primary)open, the attraction flow is approximately 100 cfs, which attracts fish into the crowding channel. A set of pneumatic gates trap and crowd the fish into the elevator bay, which then lifts the fish into the holding channel. Monitoring of fish passage is performed by Essex, supplemented by video recording at the exit flume counting window (Essex 2019a). The fish lift is typically operated from late April through mid-July. The final operation schedule is determined in consultation with resource agencies throughout each season. Upstream fish passage lifts generally occur hourly between 8:00 a.m. to 4:00 p.m. daily during operational periods and maintains operations from river flows of 500 cfs to 25,000 cfs (LHA 1999). In early 2022, a trapping facility was installed within the upper lift fishway to facilitate the trapping, sorting and trucking of migratory species to upper potions of the Merrimack River watershed by the Merrimack River Technical Committee[4] (MRTC). Periodic modification(s) to the original fishway design have been implemented in consultation with the MRTC.

The downstream fish bypass facility is a concrete bypass chute that is typically operated annually from April 1 through July 15 and from September 1 through November 15, on a 24-hour basis. The bypass gate is mechanically driven and operates to provide surface spill from the forebay, providing 2% of turbine flow (Essex 2019a).

The upstream eel passage system is located adjacent to the powerhouse at the toe of Essex Dam. The eel passage system consists of an eel ramp and a 120-gallon, flow-through, plastic collection box. The ramp consists of four switch-backed, concrete ramp sections of various lengths that total approximately 40 feet and a slope that does not exceed 40 degrees. Ramp sections are fitted with 18-inch Milieu plastic elver substrate (1-inch stud spacing) on all ramp

[4] The Merrimack River Technical Committee (MRTC) oversees and guides the diadromous fishery restoration efforts throughout the Merrimack River basin. It consists of representatives from the U.S. Fish & Wildlife Service (USFWS); the National Marine Fisheries Service (NMFS); the New Hampshire Fish and Game Department (NHFG); the Massachusetts Division of Marine Fisheries (MDMF); and the Massachusetts Division of Fisheries and Wildlife (MDFW).

surfaces. The ramp is supplied with water by a 300-gallon-per-minute, submersible pump located in the headpond. A distribution valve system allows flow balancing between the tank and ramp attraction water. An enclosed attraction flow pipe is available if high flows damage the ramp or regular flow pipe (Essex 2019a). Eel ramp operation occurs annually between May 1 and September 30 (Essex 2014). Additionally, a permanent eel elevator is being installed at the left abutment of Essex Dam, which will supplement the existing eel ramp. The passage device will consist of a collection/transport hopper connected to an integral ramp at the dam toe. The hopper will ascend on a metal rail system mounted to the North abutment and dump into a holding tank located on the top of the abutment.

4.3.10 Transmission

Energy produced by the Lawrence Project travels approximately 2,500 feet via a 23 kV, underground/underwater power line to the existing Lawrence substation No. 1 of the Massachusetts Electric Company (d/b/a National Grid).

The single-line diagram for the Project is included in Appendix D.

4.3.11 Recreational Facilities

Essex filed a Recreation Plan with the Commission on June 30, 1977, supplemented on November 15, 1977, and January 27, 1978. The plan was approved by FERC in the 1978 Order Issuing Major License. On March 6, 1992, Essex filed an application to amend the Recreation Plan, which was subsequently approved by FERC on August 1, 1995. This application was supplemented with filings on July 16, 1993, November 9, 1994, and April 26, 1995. Further clarifications were made in the Order Amending Order Approving Revised Exhibit R issued September 8, 1995. The Recreation Plan provides for recreational access to the North Canal restored gatekeeper’s Carriage House, which includes a visitor center with a concrete parking area, video displays, lighting, seating, display panels, and other interactive exhibits. Tours are provided by appointment only. These facilities are discussed in greater detail in Section 5.8.

Table 4.3-1 Lawrence Project Features List

Description	Number or Fact
Project Total Capacity	16.8 MW
Project River Mile	29
Impoundment	
Normal Surface Area	655 acres
Normal Surface Elevation	44.17 feet NGVD29
Useable Storage Capacity	0 acre-feet
Maximum Storage Capacity	19,900 acre-feet
Essex Dam	
Spillway Length	900 feet
Spillway Crest Elevation	39.17 feet NGVD29
Non-overflow Length	0 feet
Intake Canal	
Intake Canal	170 feet long

Description	Number or Fact
Trashracks	6-inch clear-spacing
Powerhouse	
Construction Type	Concrete
Dimensions	72 feet wide by 128 feet long
Turbines	
Number	2
Type	Horizontal Kaplan bulb units
Rating	8.4 MW (each)
Maximum Hydraulic Capacity	4,000 cfs (each)
Minimum Hydraulic Capacity	600 cfs (each)
Gross Head	26.5 feet
Transmission Line	
Transmission Line	2,500-foot-long, underwater/underground, 23-kV transmission line

4.4 Description of Project Operations

4.4.1 Operations During a Normal Year

The Project operates in a ROR mode. The crest gate control system works in concert with the powerhouse pond level control system to maintain the impoundment water level (Essex 2020a). Under normal operations the Project's turbines are operated in automatic pond level control mode, with the control setpoint established at the top of the crest gates (± 44.2 feet). When river flows are within the hydraulic capacity of the turbines (8,000 cfs or less), the pond level control system adjusts the turbines' output to maintain the impoundment level at the control setpoint, thereby matching inflow and maintaining ROR operation. Separately, the crest gate system also has an automatic pond level control system which regulates the elevation of each of the system's three zones to control the upstream impoundment water level. If inflow increases and the turbines are operating at their maximum available capacity, the water level at the dam will begin to rise above the normal pond level. The crest gate control system will sense the initial rise in the pond level and respond by incrementally lowering the crest gate panels to maintain at the normal pond level. If inflow then begins to decrease, the crest gate control system will sense the resulting drop in the water level and will start to raise the crest gate panels. Thus, these two control systems work together to minimize impoundment level fluctuations so that inflows into the Project's impoundment approximate outflows. The Project's crest gate system operational scheme Crest Gate System Operation Plan (LHA 2008). is summarized below in Table 4.4-1.[5]

[5] The scheme provided here reflects current operations, and is more conservative than the scheme proposed in the Licensee's Crest Gate System Operation Plan (LHA 2008), which allowed the headpond level to rise one foot before the crest gate system would begin to be lowered.

Table 4.4-1 Pneumatic Crest Gate System Operational Scheme

Approximate River Flow (cfs)	Crest Gate Status	Target Pond Level (ft NGVD)	Unit Operation
0 – 8,000	Full elevation	44.2 (Normal pond)	Pond level control
8,001 – 52,000	Crest gate lowers as flow over the spillway increases, maintaining water level at normal pond	± 44.2 ft	Full available output
>52,000	Fully lowered	Rises above 44.2 ft as flows over spillway increase	Full available output

Article 32 of the current license requires Essex to maintain a continuous downstream minimum flow of 951 cfs, unless the reservoir surface elevation is reduced below the crest of the dam; thereupon, the minimum flow equals inflow to the reservoir (FERC 1978). By operating the project in a ROR mode the Licensee meets and exceeds the requirements of Article 32 at all times, by maintaining outflow equal to inflow and by maintaining the impoundment level at or above the top of the crest gates.

Essex is proposing to continue to operate the Project in a run-of-river mode, consistent with current operations.

4.4.2 Operations During High Flow and Adverse Flow Periods

During periods when inflow exceeds the maximum hydraulic capacity of the Project's main turbines (8,000 cfs combined), the Project normally operates at maximum capacity, and any excess flows are discharged over the spillway. Under extreme flood conditions, the crest gate system is fully lowered using manual or automatic control to pass excessive river flows and is adjusted up to restore normal pond height after any high-flow or flood event has receded.

Under low inflow conditions, Project operations are adjusted to ensure that fish passage flow requirements are maintained. The Project's turbines can only be operated when there is sufficient inflow to operate one of the turbines at its minimum hydraulic capacity of approximately 600 cfs.

4.5 Generation and Outflow Records

Annual and monthly average energy generation for the period of 2012-2022 is provided in

Table 4.5-1. The monthly average energy production is 5,955 megawatt hours (MWh) for the past five years. Project inflow and outflow records are provided in Section 5.3 (Water Resources), and Project flow duration curves are provided Appendix E.

Table 4.5-1 Lawrence Annual and Average Monthly Generation 2012-2022 (MWh)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	9,331	7,934	9,706	6,278	9,101	7,848	2,578	3,614	2,750	5,357	6,638	6,998	6,511
2013	7,733	7,070	9,230	8,237	7,070	7,661	8,006	5,141	4,291	3,226	4,133	6,048	6,487
2014	6,324	5,557	8,322	5,871	7,752	5,486	6,019	3,960	2,419	4,863	6,357	7,011	5,828
2015	7,546	5,823	7,185	7,733	5,695	5,976	4,630	2,404	1,897	4,162	4,867	6,797	5,393
2016	7,891	7,718	9,134	8,716	6,932	3,340	1,814	1,181	436	1,854	3,586	6,163	4,897
2017	8,438	6,107	8,012	7,330	8,726	7,918	6,616	2,871	3,061	2,174	7,488	7,328	6,339
2018	7,961	6,065	9,560	6,736	9,896	3,986	2,546	3,440	3,015	4,196	6,920	9,324	6,137
2019	9,303	7,313	8,489	8,028	7,666	7,301	5,620	2,740	2,290	3,650	4,168	5,726	6,024
2020	6,933	7,640	7,769	7,093	7,566	2,761	3,306	1,152	736	2,676	3,756	4,770	4,680
2021	8,388	6,037	8,228	8,959	7,313	4,099	8,235	7,931	6,544	4,713	7,995	9,638	7,340
2022	8,477	7,529	8,209	9,393	8,354	4,376	1,719	1,142	1,941	2,940	3,230	8,525	5,486
Average	8,118	6,904	8,641	7,782	7,825	5,523	4,644	3,234	2,671	3,619	5,376	7,121	5,955

4.6 Dependable Capacity

Dependable capacity is generally defined as the amount of load a hydroelectric plant can carry under adverse hydrologic conditions during a period of peak demand; for example, during the hot, dry conditions typical of August in the Project area. The estimated dependable capacity is also determined by any minimum or fish passage flow requirements included in the existing license. Under the Project’s current license, the dependable capacity is estimated to be 2.4 MW during peak summer season.

4.7 Grid Interconnection

Power is transferred from the Project’s transformers via a 2,500-foot-long, 23.0-kV underground/underwater transmission line to an interconnect with the existing Lawrence substation No. 1 of the Massachusetts Electric Company (d/b/a National Grid).

4.8 Current License Requirements and Compliance History

The Lawrence Project received its FERC license on December 4, 1978, and commenced operation in 1981. Since issuance of the original license in 1978, various articles have been revised. The major milestones related to the Lawrence Project license are listed in Table 4.8-1.

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Table 4.8-1 Lawrence Project License Major Milestones

Date	Title	FERC citation	Notes
December 30, 1983	Order Approving As-Built Exhibits K, L & M	25 FERC ¶ 62,426	Assumed title
January 29, 1985	Order approving Lawrence Hydro Associates/Essex Company water supply agreement with North Reading, MA	30 FERC ¶ 62,101	Title from eLibrary description
July 9, 1985	Order approving change in land rights for Great Stone Dam Project	32 FERC ¶ 62,013	Title from eLibrary description
October 26, 1992	Order Approving Functional Design Drawings	61 FERC ¶ 62,076	Approved downstream fish bypass design
June 10, 1994	Order Approving Change in Land Rights	67 FERC ¶ 62,233	Approves transfer of 3 lots to City, for urban renewal
August 1, 1995	Order Approving Revised Exhibit R	72 FERC ¶ 62,074	Recreation Plan
September 8, 1995	Order Amending Order Approving Revised Exhibit R	72 FERC ¶ 62,215	Recreation Plan
July 20, 2000	Order Approving and Modifying Fish Passage Plan	92 FERC ¶ 62,040	CFPP
June 28, 2001	Order Approving Flashboard Maintenance Agreement and Modifying Fish Passage Plan	95 FERC ¶ 62,279	Per CFPP
June 29, 2001	Order Modifying Previous Order Approving and Modifying Fish Passage Plan	95 FERC ¶ 62,295	Requires cost-effectiveness report for installing new lift hopper.
October 8, 2004	Order on Rehearing … and Modifying Annual Charges Billing Procedures	109 FERC ¶ 61,040	Blanket order on annual charges billing
June 19, 2007	Order Amending License	119 FERC ¶ 62,243	Approves installation of Obermeyer crest gates on dam, modifies project description accordingly
November 7, 2008	Order Certifying Incremental Hydropower Generation for Production Tax Credit	125 FERC ¶ 62,130	6.7% PTC for crest gate, starting December 31, 2008
November 18, 2011	Order Approving Exhibit L Drawing	137 FERC ¶ 62,155	Approves as-built Exhibit L-3 of dam with crest gate
March 27, 2015	Order Approving Transfer of Licenses	150 FERC ¶ 62,210	Transfers license from Lawrence Hydroelectric Associates and Essex Company to Essex Company, LLC

4.8.1 Current License Requirements

FERC issued the current Project license to Lawrence Hydroelectric Associates on December 4, 1978 (Appendix E). The current license is effective for a term of 50 years, with an effective date of December 1, 1978, and expiring on November 30, 2028. The license was amended on December 3, 1981, to add new standard Article 43 and to delete Article 35 to give the Licensee authority to grant permission for certain uses of Project lands and waters and to convey certain interests in Project lands, without prior Commission approval. Additionally, the license was amended on June 19, 2007, to replace the original wooden flashboards with a pneumatic crest gate system.

The licensed Project is subject to the terms and conditions set forth in Form L-2 (October 1975), “Terms and Conditions of License for Unconstructed Major Project Affecting Navigable Waters of the United States” except Article 20. Project operations are also subject to specific license articles stated in the 1978 license order and associated amendments. The Project is additionally subject to a WQC that was issued by the Commonwealth of Massachusetts Water Resources Commission on July 5, 1978 (Appendix E).

Essex has assumed responsibility of complying with all of the requirements of the original license, as well as all subsequent orders, amendments, and WQC pursuant to Section 401 of the Clean Water Act (CWA) issued to-date which are contained in Appendix E. In accordance with the FERC license, Essex implements measures to protect and enhance the natural and recreational values of the Project to mitigate Project-related impacts. A summary of the most applicable of these articles related to Project operations and environmental measures is provided below. A complete set of the articles of the license are presented in Appendix F.

Article 17 (Ordered December 4, 1978): requires the licensee to construct, maintain, and operate or arrange for recreational facilities.

Article 29 (Ordered December 4, 1978; Approved May 16, 1979): requires the licensee to cooperate with the Massachusetts SHPO in order to avoid any adverse impact on identified historic structures at the project.

Article 30 (Ordered December 4, 1978; Approved October 26, 1992): requires the Licensee to file a revised Exhibit S to include functional design drawings of the fish lift and passage facilities at the Project.

Article 31 (Ordered December 4, 1978; Approved July 20, 2000, June 28, 2001, June 29, 2001): requires the Licensee to conduct an operational study to determine the effectiveness of the fish passage facilities in assisting the migration of anadromous fish.

Article 32 (Ordered December 4, 1978): requires the Licensee to maintain a continuous minimum flow of 951 cfs unless and until the reservoir water surface elevation is reduced below the crest of the dam; thereupon, the minimum flow shall equal the inflow to the reservoir.

Article 33 (Ordered December 4, 1978): requires the Licensee to monitor or arrange for the monitoring of the fish lift and passage facilities to determine the presence of threatened or endangered fish species and, if any are found, implement measures to protect and conserve any such species.

4.8.2 Compliance History

Essex has operated the Project in accordance with the FERC license with no violations. In accordance with the license, under Article 32, the Project operates in a ROR mode and fulfills the minimum flow requirement.

On June 7, 2017, the City of Lawrence, Conservation Law Foundation, Groundwork Lawrence, Inc., Lawrence Community Works, Inc., 60 Island Street LLC, Everett Mills Real Estate LLC, GES Realty LLC, and Pacific Mills Acquisition LLC (Complainants) filed a complaint against the Licensee alleging multiple violations of its FERC license. On May 16, 2019, FERC's Division of Hydropower Administration & Compliance (DHAC) conducted a site visit. Subsequently, DHAC issued a response to the complaint on August 8, 2019, finding no violation of the license. On September 9, 2019, Complainants filed a Request for Rehearing, which was subsequently denied on March 19, 2020.

Following a Regional Engineer's inspection of the Project on August 4, 1998, FERC requested operational data from June 1 through August 31, 1998. In response, Lawrence Hydroelectric Associates (LHA) provided the operational data in a letter dated October 13, 1998. On December 7, 1998, FERC concluded the Project was operated in a manner consistent with the minimum flow requirements of Article 32.

4.9 Current Net Investment

The current net investment in the Project is $41,402,976 as of March 31, 2023. This should not be interpreted as the fair market value.

4.10 Potential for New Project Facilities

At this time, Essex is not considering constructing new Project facilities or modifying the Project's existing Project facilities or operations. However, as economic conditions continue to change, Essex periodically performs evaluations of Project facilities for potential upgrades and will continue to do so into the future. Any potential new or modified facilities would be subject to consultation with the resource agencies and other stakeholders.

4.11 Public Utility Regulatory Policies Act (PURPA) Benefits

In accordance with 18 CFR §5.6(e), Essex is not seeking rights under Section 210 of the Public Utility Regulatory Policies Act of 1978 (PURPA) for the Project at this time and, therefore, no additional information is required. Essex reserves the right to exercise any rights available to it under PURPA in the future.

5 Description of Existing Environment and Resource Impacts

5.1 Description of the River Basin

The Merrimack River Basin extends from the White Mountain region of northern New Hampshire to southeastern Massachusetts (Figure 5.1-1). The Merrimack River Basin has a total drainage area of approximately 5,010 square miles and is the fourth largest river basin in New England (Massachusetts Executive Office of Energy and Environmental Affairs [MEOEEA] 2001). The majority of the watershed lies within New Hampshire (3,800 square miles)

(MEOEEA 2001). The drainage area of the Lawrence Project has a gross drainage area of 4,672 square miles and a net drainage area of 4,460 square miles after accounting for the 214-square-mile watershed attributed to the Boston and Worcester water supply (U.S. Geological Survey [USGS] 2023a).

The 115-mile-long Merrimack River is formed by the confluence of two major rivers, the Pemigewasset and Winnipesaukee, in Franklin, New Hampshire. From the confluence, it flows southward for approximately 78 miles in New Hampshire, turns abruptly eastward at the New Hampshire-Massachusetts border, and flows in a northeasterly direction for approximately 40 miles before draining into the Atlantic Ocean near Newburyport, Massachusetts. The final 22 miles of the river, downstream of Haverhill, Massachusetts, are tidally influenced (U.S. Army Corps of Engineers [USACE] 2003, New Hampshire Department of Environmental Services [NHDES] 2019).

5.1.1 Major Land Use

The area around the Merrimack River, originally occupied by Native Americans, became populated by European settlers in the 17th century. Beginning in the 1800s, the Merrimack River Basin shifted from predominantly agricultural and forested lands to an industrial setting. During this time, several urban areas formed along the Merrimack River, supported by the emerging water-powered textile mills of the Industrial Revolution (National Park Service [NPS] undated-b). The cities forged by the Industrial Revolution remain as major urban cities today, including Manchester and Nashua in New Hampshire, and Lowell, Lawrence, and Haverhill in Massachusetts (USACE 2003).

Currently, land use in the Merrimack River Basin is predominantly forest, covering approximately 77% of the watershed area. These forested areas are primarily used for timber harvesting and recreation. Developed areas are the next major land use, covering approximately 11% of the watershed area. These developed lands include residential, industrial and commercial, transportation, and urban land uses. The remaining land use in the watershed is agriculture (6%), surface water (4%), wetland (1%), and exposed rock or beaches (0.02%) (USACE 2003).

The Merrimack River Basin supports 200 communities and 2.6 million people and is the primary drinking water source for about 500,000 people in Massachusetts and New Hampshire (U.S. Environmental Protection Agency [USEPA] 2022a). Land use is also discussed in further detail in Section 5.5.2.

Land use within the Project boundary is primarily open water, followed by developed land, woody wetlands, and deciduous forest. Table 5.1-1 lists the land uses in the Project boundary. Figure 5.1-2 depicts major land use in the vicinity of the Project.

Table 5.1-1 Land Use Within the Project Boundary

Description	Acreage	Percent of total
Open Water	703.9	64.45%
Developed, Open Space	49.2	4.51%
Developed, Low Intensity	66.8	6.12%

Description	Acreage	Percent of total
Developed, Medium Intensity	60.2	5.52%
Developed, High Intensity	39.1	3.58%
Barren Land	1.9	0.17%
Deciduous Forest	52.6	4.83%
Evergreen Forest	8.0	0.73%
Mixed Forest	6.9	0.63%
Shrub/ Scrub	0.2	0.01%
Grassland/ Herb	5.8	0.53%
Pasture/ Hay	1.4	0.13%
Woody Wetlands	90.7	8.30%
Emergent Herbaceous Wetlands	5.4	0.49%
Total	**1,092.1**	**100.00%**

5.1.2 Major Water Use

The Merrimack River is used for recreation, fishing, and hydropower generation in addition to supporting numerous public and industrial water users. Many municipalities use the river as a potable water source, including Merrimack, Litchfield, Hollis, Milford, Nashua, Hudson, and Pelham of New Hampshire and Tyngsborough, Dracut, Methuen, Lawrence, Lowell, Andover, North Reading, and Tewksbury of Massachusetts (USEPA 2020). Recreational use of the river includes paddling, boating, swimming, fishing, rowing, and others (Alliance of Climate and Environmental Stewards [ACES] 2022).

5.1.3 Dams and Diversions within the Basin

There is a total of five hydroelectric developments comprising three separate Projects on the Merrimack River that are licensed by FERC. In New Hampshire, there are four USACE flood storage dams within the Merrimack River Basin. Table 5.1-2 presents information on the five hydroelectric developments on the Merrimack River. All the hydroelectric facilities on the Merrimack River operate in ROR mode.

Table 5.1-2 FERC-regulated Developments on the Merrimack River

Facility	FERC Project #	Licensee	River Mile	Generation Capacity (MW)
Garvins Falls (Merrimack River Project)	1893	CRP NH Garvins Falls, LLC	87	12.3
Hooksett (Merrimack River Project)	1893	CRP NH Hooksett, LLC	81	1.6
Amoskeag (Merrimack River Project)	1893	CRP NH Amoskeag, LLC	73	16
Lowell	2790	Boott Hydropower, LLC	40	15
Lawrence	2800	Essex Company, LLC	29	16.8

5.1.4 Tributary Rivers and Streams

Outside of the Pemigewasset and Winnipesaukee Rivers, four tributaries contribute to the Merrimack River flow: the Contoocook, Piscataquog, Nashua, and Concord Rivers (USACE 2003, MEOEEA 2001). The Merrimack River Watershed and Major Subbasins are shown below in Figure 5.1-1. Several other smaller streams flow into the Merrimack River within the Project boundary, including Fish Brook, Griffin Brook, Sawyer Brook, Nickel Mine Brook, Trout Brook, Bartlett Brook, and other unnamed tributaries. The Spicket River flows south to the North Canal outlet and into the Merrimack River approximately 1 mile downstream of the Essex Dam. The Shawsheen River flows into the Merrimack River approximately 1.5 miles downstream of the Essex Dam.

Figure 5.1-1 Merrimack River Watershed and Major Subbasins

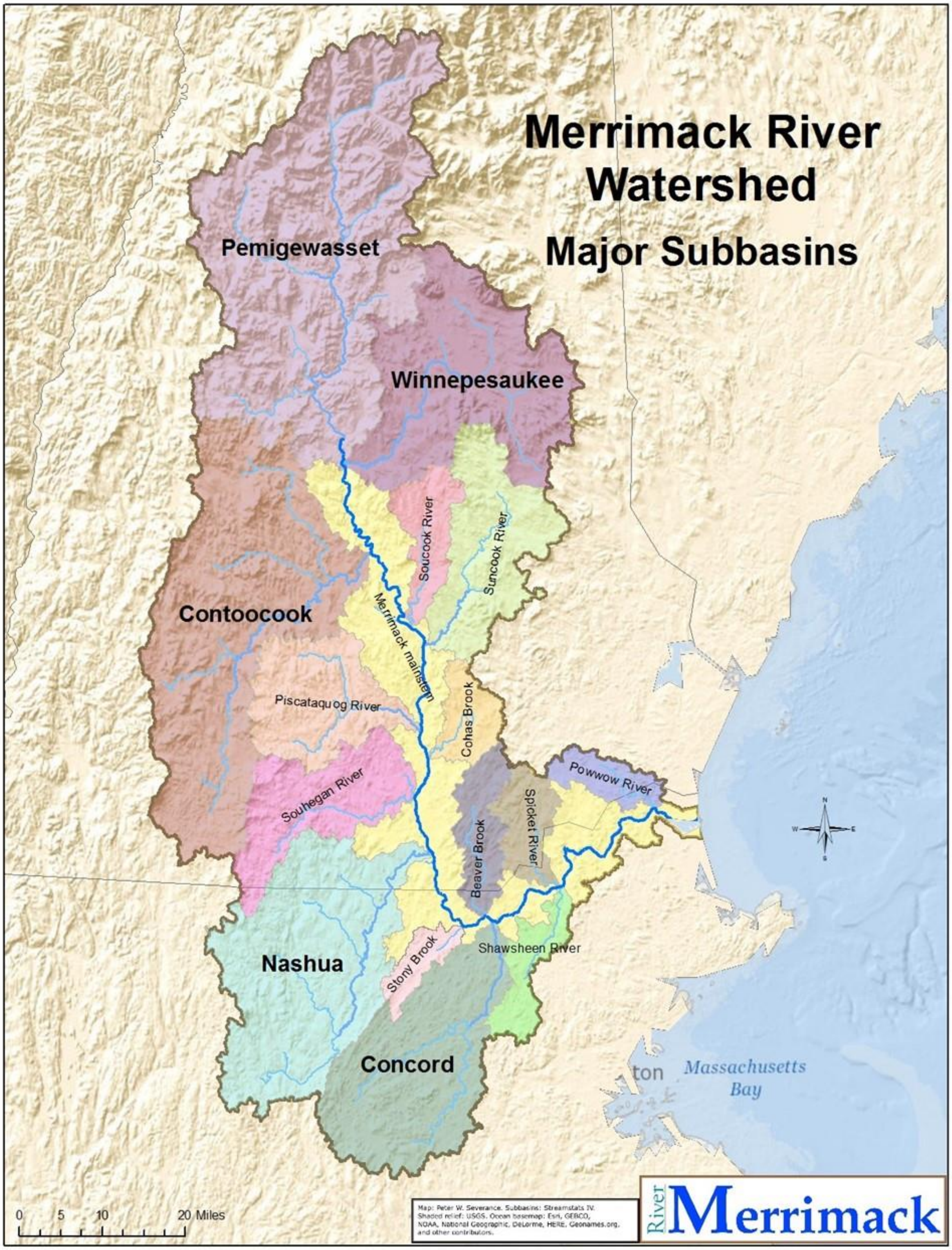
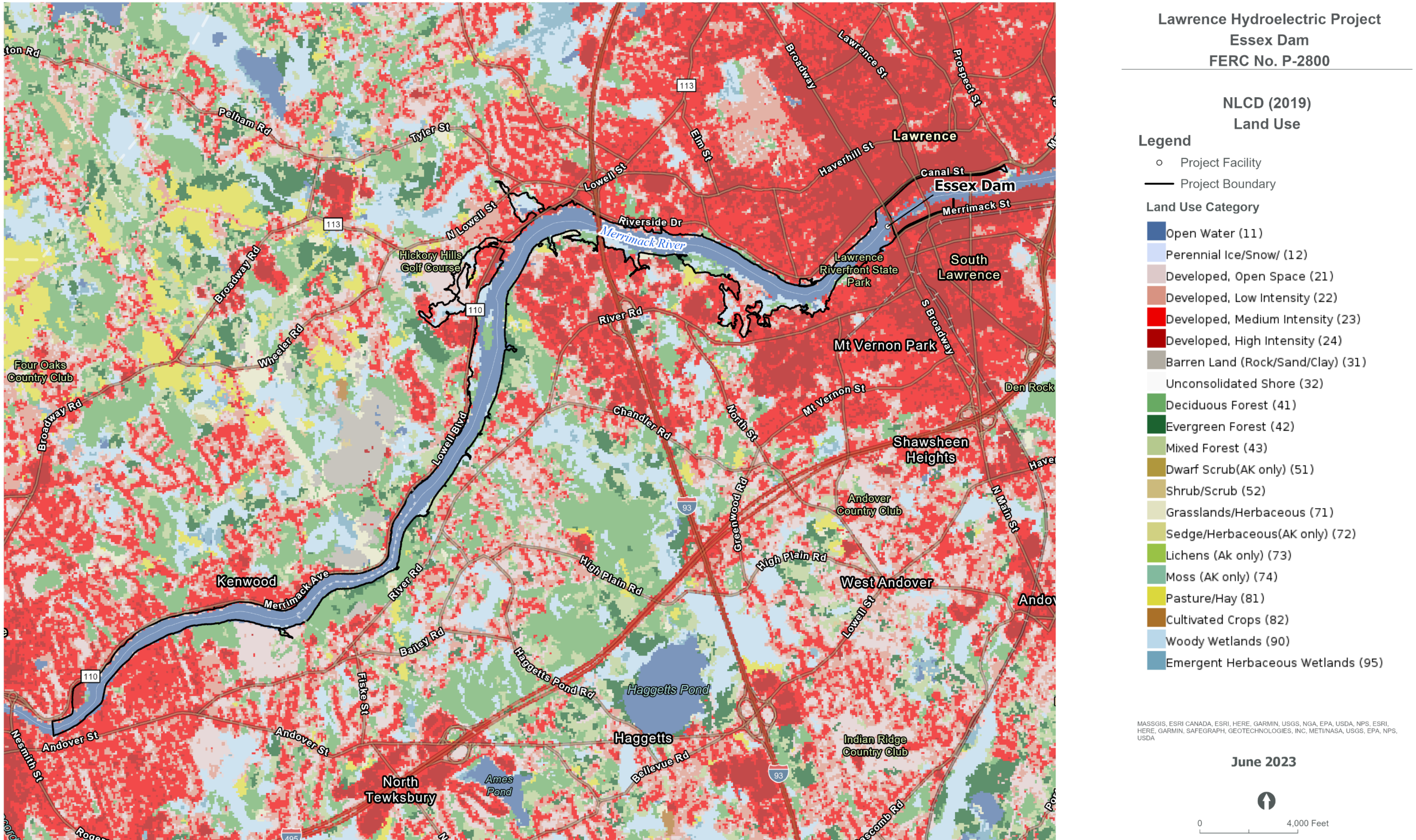


Figure 5.1-2 Land Use in the Project Vicinity



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5.2 Geology

5.2.1 Physiography and Topography

The terrain of the Merrimack River Basin ranges from steep, rugged conditions of the Northern New Hampshire White Mountain region to the estuarine coastal basin of northeastern Massachusetts. The Merrimack River Basin is located in the New England Province, which is further divided into the White Mountains, the New England Uplands, and the Seaboard Lowlands sections. The majority of the Merrimack River Basin is located in the New England Uplands, characterized by rolling hills and narrow valleys and elevations ranging from below 1,000 feet to above 2,000 feet. The Project is located in the Seaboard Lowlands, which is less hilly than the New England Upland area and has a topographical relief limited to less than 200 feet in most places (Flanagan et al. 1999). The local relief at the Project is generally characterized as low, open hills.

The USEPA has further defined ecoregions that share similarities in ecosystems and in the type, quality, and quantity of environmental resources (Griffith et al. 2009). The Project is located within the Gulf of Maine Coastal Plain ecoregion of the Northeastern Coastal Zone. This region is characterized by rolling plains with hills with glacial drumlins being common. Some ponds, small lakes, wetlands, low and moderate gradient streams, and large rivers with sand, gravel, boulder, and bedrock substrates exist in this ecoregion. As shown in Figure 5.2-1, the local relief is mostly between 100 and 600 feet (Griffith et al. 2009).

5.2.2 Bedrock Geology

The Project is located within the New Hampshire-Maine Sequence and Avalon Belt Geologic Province. The New Hampshire-Maine Sequence covers eastern Connecticut, central Massachusetts, eastern New Hampshire, and central Maine and is principally Silurodevonian metasedimentary rocks and Silurodevonian and younger igneous rocks (principally granite). The Avalon Belt is localized in eastern Massachusetts, Rhode Island, and coastal Connecticut and is principally Precambrian granite and granitic gneiss and metasedimentary rocks of the Precambrian to Ordovician age. The Avalon Belt is intruded by Ordovician to Devonian granites (Robinson and Kapo 2003). The bedrock geology in the Gulf of Main Coastal Plain ecoregion is generally described as Devonian, Silurian, and Ordovician granite; Devonian and Silurian metapelite, metasandstone, granofels, and quartzites; Precambrian gneiss, schist, and amphibolite; and some Permian biotite granite (Griffith et al. 2009).

The bedrock in the vicinity of the Project is composed of metamorphic gneiss and igneous granite. The Project is founded on the Merrimack Belt which extends across the northern border of Massachusetts and New Hampshire. The Merrimack Belt in the vicinity of the Project is composed primarily of calc-granofels of the Silurian Berwick Formation and Paleozoic intrusive mafic rocks of Ayer Granite. Immediately south of the City of Lawrence is the Nashoba Zone, which is defined from the Merrimack Belt by the Clinton-Newbury fault system. The formation of stratified rock within the area of the Nashoba Zone that borders the Project boundary is Silurian and Ordovician Andover Granite intrusive rock (Hatch 1991).

5.2.3 Surficial Geology

Surficial materials in the general vicinity of the Project are glaciofluvial ice-contact sediments, being mostly sand and gravel with lesser silt that form a continuous cover on underlying rocks less than 100 feet in thickness. In addition to glaciofluvial ice-contact sediments are glacial till sediments, predominantly sandy till less than 100 feet in thickness, and alluvial deposits (Soller et al. 2009). The surface geology in the Merrimack Valley is characterized as Quaternary sandy till, ice contact sand and gravel, lake sand and pebbles (Griffith et al. 2009). In the Project area beneath the floodplain of the Merrimack River are floodplain alluvium deposits, which is characterized as sand, gravel, silt, and some organic material that is stratified and well sorted to poorly sorted. The floodplain alluvium deposits overly thick glacial stratified deposits. Deposits adjacent to the Project boundary are primarily course deposits and thin till, with a lesser extent of thick till, swamp deposits, and artificial till. Course deposits are characterized as gravel, sand and gravel, and sand. Thin till is characterized as less than 10 to 15 feet of non-sorted, non-stratified matrix of sand, some silt, and little clay containing scattered pebbles, cobbles, and boulder clasts. Large boulders are common. The deposits are loose to moderately compact, generally sandy, commonly stony (Stone et al. 2019).

There are no mapped oil, gas, or mineral resources within the Project boundary (USGS undated). Permitted/reclaimed mines for stone, sand, and gravel exist in the vicinity of the Project, including the Brox Quarry (stone), Dracut Pit and Mill (sand and gravel, construction), and Rocco Zambino and Sons, Inc. Pit (sand and gravel, construction). Several mine features are located adjacent to the impoundment near the Nickel Mine Conservation Land and Brox Industries.

5.2.4 Project Area Soils

Soil types within the Project boundary are variable and reflect the diversity of parent materials, local topography, and physiographic position of landforms. The Project boundary soils primarily consist of sandy loams, loamy sands, and silt loams including Belgrade very fine sandy loam, Saco variant silt loam, Udorthents, Winooski very fine sandy loam, Unadilla very fine sandy loam, Deerfield loamy fine sand, and Windsor loamy sand. Some human-altered map units include urban land. Mapped soils in the Project boundary are presented below in Figure 5.2-2, Figure 5.2-3, and Figure 5.2-4.

5.2.5 Shoreline and Stream Banks

The shoreline around the impoundment is relatively low and flat with some small hills (less than 200 feet), composed primarily of forest, developed land, and woody wetlands as described in Section 5.1.1 and Section 5.6. Residential properties commonly occur along the length of the impoundment, particularly near the cities of Lawrence and Lowell. In the immediate vicinity of the Project, the shoreline is low and flat and composed primarily of urban development. There is no evidence of erosion, slumping, or slope instability around the natural shoreline of the Project.

5.2.6 North and South Canals

In their response to the PAD Questionnaire, Groundwork Lawrence and Merrimack River Watershed Council (MRWC) noted concern for the condition of the North Canal. Groundwork Lawrence provided the Condition Assessment of Canal Walls Report by Woodard and Curran (2019). Essex reviewed this document in preparation of this PAD.

As reported to the Commission in 2020 a sinkhole formed at the South Canal Wasteway and was repaired. On January 3, 2023, Essex notified FERC that a separate sinkhole formed at the South Canal Wasteway, and FERC authorized its repair on April 6, 2023.

5.2.7 Seismicity

Based on data provided from the USGS/National Earthquake Information Center, there have been four reported earthquakes in the general area of the Project (within 25 miles) exceeding a 3.0 on the Richter scale since reporting began in 1900 (Table 5.2-1) (USGS 2023b).

Table 5.2-1 Earthquakes Within 25 miles of the Project (>3.0 magnitude) since 1900

Distance from Project (miles)	Magnitude	Date	Latitude	Longitude
22	3.0	10/15/1985	42.493°N	71.502°W
21	3.0	1/27/2000	43.000°N	71.180°W
14	3.1	1/10/1999	42.840°N	70.980°W
13	3.0	1/10/1999	42.840°N	70.995°W

Source: USGS 2023b.

Figure 5.2-1 Topography in the vicinity of the Lawrence Project

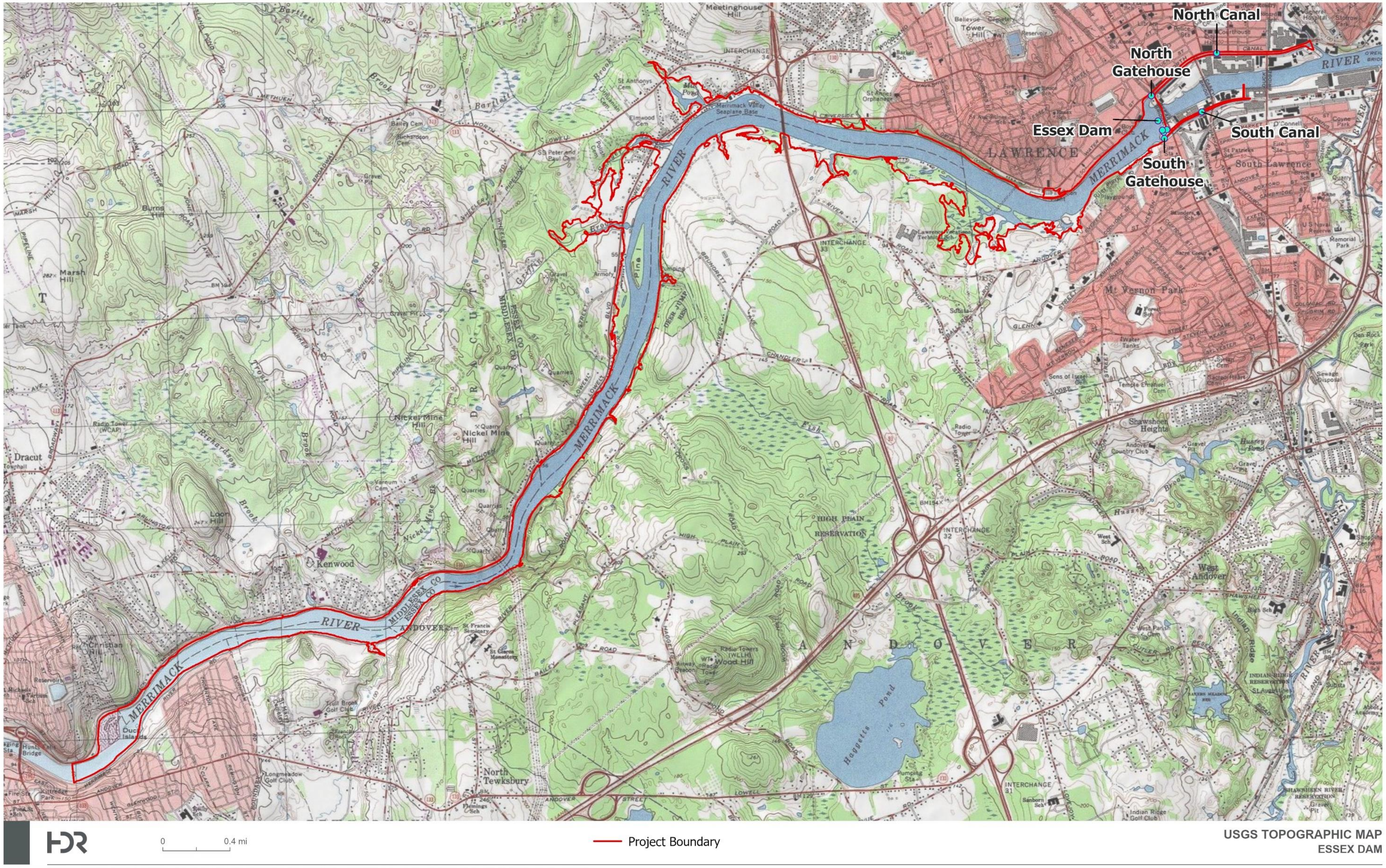


Figure 5.2-2 Mapped Soils in the Lawrence Project Boundary

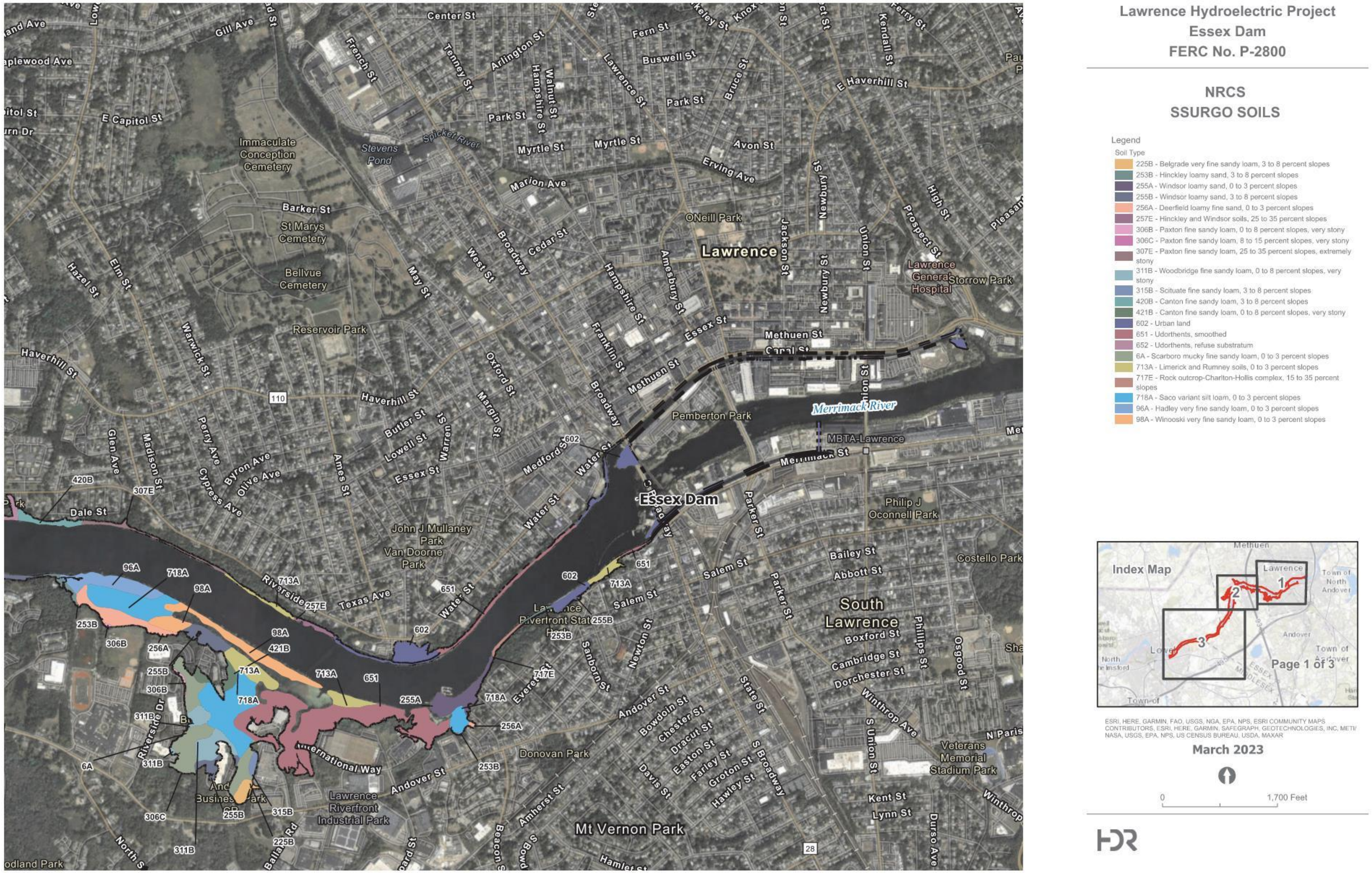


Figure 5.2-3 Mapped Soils in the Lawrence Project Boundary

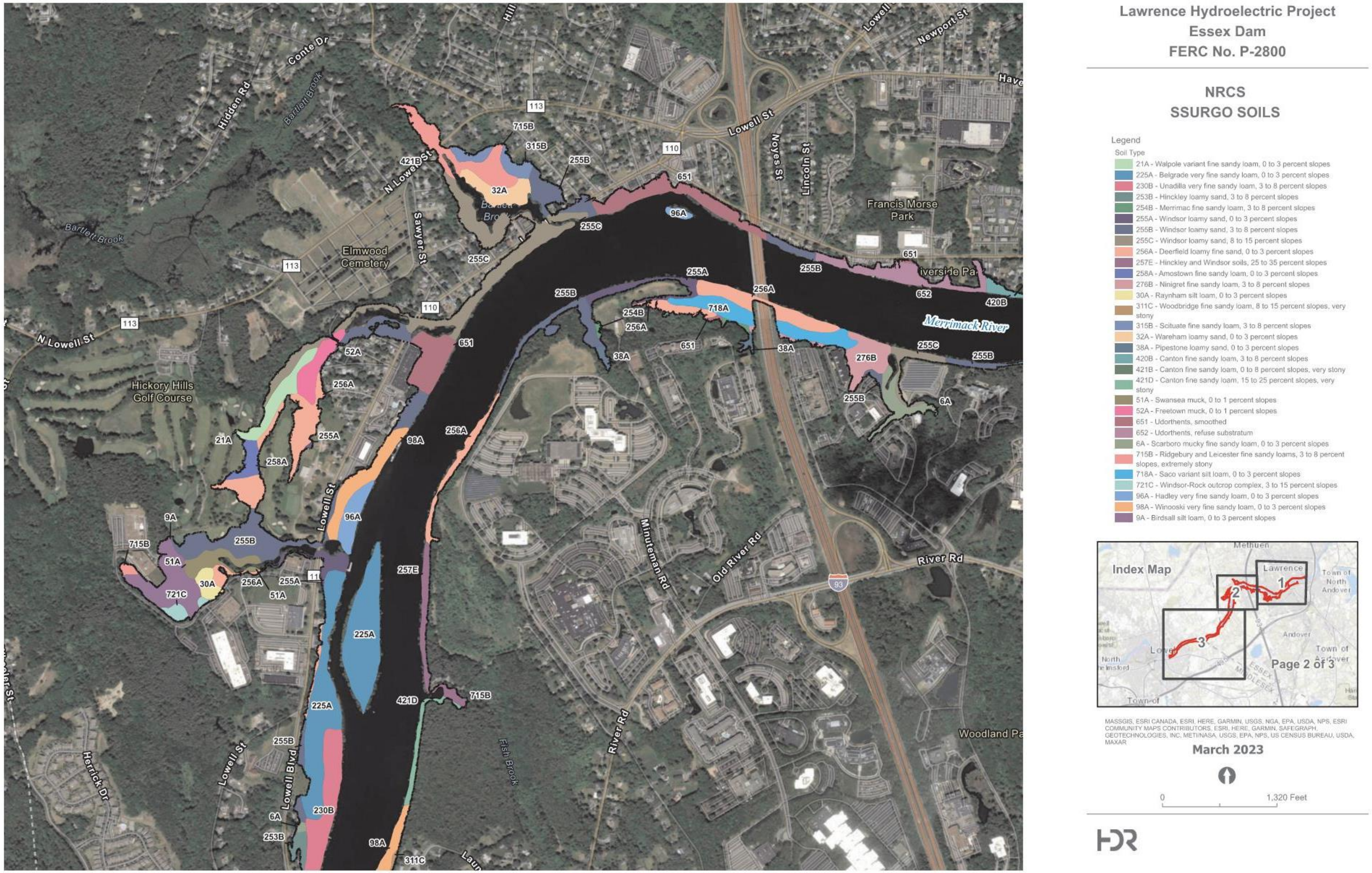
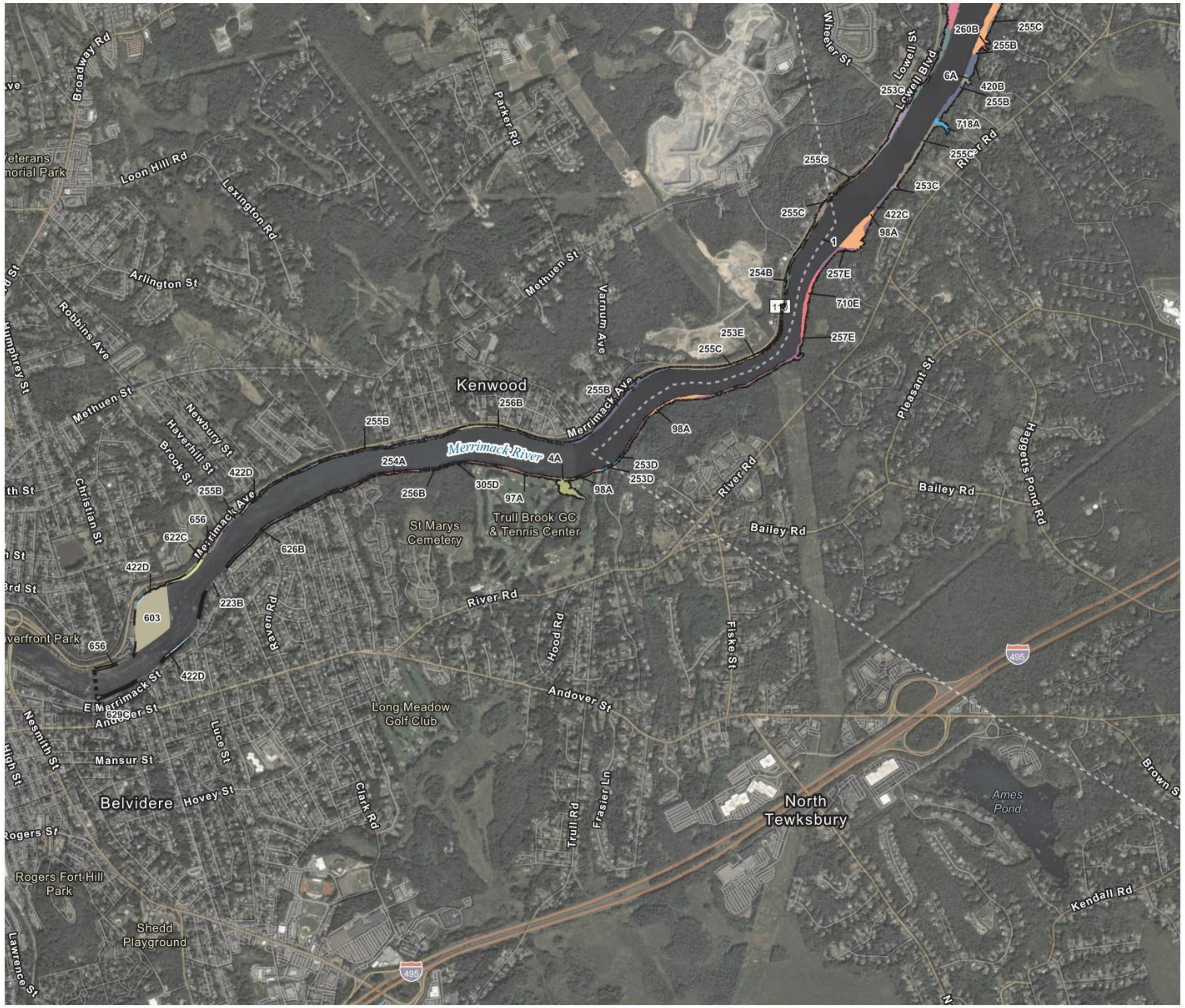


Figure 5.2-4 Mapped Soils in the Lawrence Project Boundary



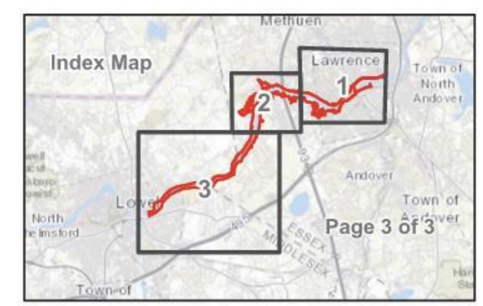
Lawrence Hydroelectric Project
Essex Dam
FERC No. P-2800

NRCS
SSURGO SOILS

Legend

Soil Type

- 223B - Scio very fine sandy loam, 3 to 8 percent slopes
- 230B - Unadilla very fine sandy loam, 3 to 8 percent slopes
- 253B - Hinckley loamy sand, 3 to 8 percent slopes
- 253C - Hinckley loamy sand, 8 to 15 percent slopes
- 253D - Hinckley loamy sand, 15 to 25 percent slopes
- 253E - Hinckley loamy sand, 25 to 35 percent slopes
- 254A - Merrimac fine sandy loam, 0 to 3 percent slopes
- 254B - Merrimac fine sandy loam, 3 to 8 percent slopes
- 255B - Windsor loamy sand, 3 to 8 percent slopes
- 255C - Windsor loamy sand, 8 to 15 percent slopes
- 256B - Deerfield loamy fine sand, 3 to 8 percent slopes
- 257E - Hinckley and Windsor soils, 25 to 35 percent slopes
- 260B - Sudbury fine sandy loam, 3 to 8 percent slopes
- 305D - Paxton fine sandy loam, 15 to 25 percent slopes
- 311C - Woodbridge fine sandy loam, 8 to 15 percent slopes, very stony
- 420B - Canton fine sandy loam, 3 to 8 percent slopes
- 422C - Canton fine sandy loam, 8 to 15 percent slopes, extremely stony
- 422D - Canton fine sandy loam, 15 to 35 percent slopes, extremely stony
- 4A - Rippowam fine sandy loam, 0 to 3 percent slopes
- 603 - Urban land, wet substratum
- 622C - Paxton-Urban land complex, 3 to 15 percent slopes
- 626B - Merrimac-Urban land complex, 0 to 8 percent slopes
- 629C - Canton-Charlton-Urban land complex, 3 to 15 percent slopes
- 656 - Udorthents-Urban land complex
- 6A - Scarboro mucky fine sandy loam, 0 to 3 percent slopes
- 710E - Canton and Charlton fine sandy loams, 15 to 35 percent slopes, extremely stony
- 718A - Saco variant silt loam, 0 to 3 percent slopes
- 97A - Suncook loamy sand, 0 to 3 percent slopes
- 98A - Winooski very fine sandy loam, 0 to 3 percent slopes



ESRI, HERE, GARMIN, FAO, USGS, NGA, EPA, NPS, ESRI, HERE, GARMIN, SAFEGRAPH, GEOTECHNOLOGIES, INC, METI/NASA, USGS, EPA, NPS, US CENSUS BUREAU, USDA, MAXAR

March 2023

0 2,000 Feet

HDR

5.3 Water Resources

5.3.1 Drainage Area

The Lawrence Project is in the Merrimack River Basin which extends from the White Mountain region of northern New Hampshire to southeastern Massachusetts. The Merrimack River Basin has a total drainage area of approximately 5,010 square miles and is the fourth largest river basin in New England (MEOEEA 2001). The majority of the watershed lies within New Hampshire (3,800 square miles) (MEOEEA 2001). The Lawrence Project has a gross drainage area of 4,674 square miles and a net drainage area of 4,460 square miles after accounting for the 214 square mile watershed attributed to the Boston and Worcester water supply.

5.3.2 Stream Flow Characteristics

River flows for the Lawrence Project were determined by a proration of flows of USGS Gage 01100000 Merrimack River BL Concord River at Lowell, MA (located 9.4 miles upstream of the Project dam) by the ratio of drainage areas between the USGS Gage and Lawrence Project. The drainage area of the USGS Gage is 4,635 square miles however 214 square miles are attributed to the Boston and Worcester water supply and, therefore, the USGS Gage has an effective drainage area of 4,421 square miles. The Lawrence Project has a gross drainage area of 4,674 square miles and a net drainage area of 4,460 square miles after accounting for the 214 square miles watershed attributed to the Boston and Worcester water supply.

Prorated flow data from October 1923 to September 2021 were used to calculate the mean, maximum, minimum, and exceedances. Monthly average flows range from 3,143 cfs to 19,416 cfs (Table 5.3-1). The highest daily average flow recorded during the period of record was 162,420 cfs and the lowest daily average flow was 216 cfs. Inflow data for the Merrimack River is provided in Table 5.3-1.

Table 5.3-1 Summary of Annual and Monthly Flows from October 1923 through September 2021

Month	Minimum (cfs)	90% Exceedance (cfs)	Average (cfs)	10% Exceedance (cfs)	Maximum (cfs)
January	367	2,852	7,624	13,518	47,314
February	636	3,176	7,646	13,518	47,112
March	1,422	5,206	12,953	23,606	162,420
April	2,512	8,603	19,416	32,484	83,530
May	672	4,822	11,746	20,176	92,105
June	407	2,240	6,698	12,721	60,025
July	251	1,352	3,879	7,397	34,401
August	235	1,079	3,143	6,073	31,778
September	221	1,019	3,203	5,751	119,041
October	216	1,311	4,666	9,606	52,660

Month	Minimum (cfs)	90% Exceedance (cfs)	Average (cfs)	10% Exceedance (cfs)	Maximum (cfs)
November	322	2,119	7,147	14,325	66,784
December	381	2,862	8,356	16,545	45,901
Annual	216	1,705	8,031	17,755	162,420

Source: USGS 2023c.

5.3.3 Flow Duration Curves

Annual and monthly flow duration curves have been developed using the upstream USGS gage (USGS Gage No. 01100000) for the period of record of 1923 to 2021. The flow duration curves can be found in Appendix E of this PAD.

5.3.4 Existing and Proposed Uses of Project Waters

Pursuant to the Massachusetts Water Management Act, the Massachusetts Department of Environmental Protection (MADEP) regulates the amount of water withdrawn from ground and surface water resources to ensure adequate supplies for current and future water needs (MADEP 2023a). The USEPA is the permitting authority in Massachusetts for issuing National Pollutant Discharge Elimination System (NPDES) permits, which are required whenever a municipality, industry, or other entity wishes to discharge pollutants to a surface water of the United States (MADEP 2023b). In Massachusetts, NPDES permits are typically co-issued by the USEPA and MADEP (MADEP 2023b).

Available registrations and permits were reviewed. Four regulated water withdrawals were identified from the Merrimack River within the Lawrence Project boundary. These withdrawal users were identified as the Tewksbury Water Treatment Facility (Permit #9P31329501), the Andover Water Treatment Facility (Permit #9P31300901), the Lawrence Water Treatment Facility[6] and the Methuen Water Treatment Facility.[6]

The USEPA is the permitting authority in Massachusetts for issuing National Pollutant Discharge Elimination System (NPDES) permits, which are required whenever a municipality, industry, or other entity wishes to discharge pollutants to a surface water of the United States (MADEP 2023c). In Massachusetts, NPDES permits are typically co-issued by the USEPA and MADEP (MADEP 2023c). Available NPDES permits were reviewed for the Project vicinity in Massachusetts (MADEP 2023d, MADEP 2023e, USEPA 2023).

Three active NPDES permits were identified within the Project vicinity, which were issued for the Greater Lawrence Sanitary District (Permit No. MA0100447), Andover Water Treatment Plant (Permit No. MAG640058), and Lawrence Hydroelectric Facility (Permit No. MAG250948). On June 8, 2023, a Notice of Intent was submitted for the Lawrence Hydroelectric Project for authorization to discharge under the NPDES hydroelectric generating facility General Permit (HYDROGP) for the Commonwealth of Massachusetts (MAG360000) (Permit No. MAG360023) (USEPA 2023).There are five authorized

[6] The permit number for this facility is unknown.

combined sewer overflows (CSOs) within the Project vicinity under NPDES Permit No. MA0100447. The five CSOs are permitted for the Greater Lawrence Sanitary District (GLSD) in the Merrimack River Segment MA84A-04 (CSO outfalls #002, 003, 004, and 005) and the Spicket River Segment MA84A-10 (CSO outfall #006) (USEPA 2019). The CSO outfalls associated with the GLSD are one of five areas along the Merrimack River with CSOs: Manchester and Nashua, NH, and Lowell, GLSD, and Haverhill, MA (Merrimack River Watershed Council [MRWC] 2022). The total annual CSO volume, in million gallons, from the five areas is summarized in Table 5.3-2. In 2021, the CSO volume from GLSD near the Project was 93 million gallons (Table 5.3-2).

Table 5.3-2 Total Annual CSO Volume (million gallon)

Year	Haverhill	GLSD	Lowell	Nashua	Manchester	Total
2013	32	34	200	44	257	**566**
2014	43	6	278	51	322	**701**
2015	8	13	113	6	157	**296**
2016	21	36	118	10	131	**316**
2017	31	26	108	10	227	**401**
2018	50	93	292	18	364	**816**
2019	44	58	285	19	160	**565**
2020	15	50	157	5	154	**380**
2021	48	93	447	17	217	**822**
Average	**32**	**45**	**222**	**20**	**221**	**540**
Percent (%)	**6**	**8**	**41**	**4**	**41**	

Source: MRWC 2022.

5.3.5 Existing Instream Flow Uses in the Project Area

Existing instream flow uses of the Merrimack River include hydroelectric generation, industrial uses, and recreation (e.g., fishing and boating). There are five FERC-regulated hydroelectric projects on the Merrimack River and two additional projects on the main stem of the Pemigewasset River. The Project is located approximately 11 miles downstream of the Lowell Hydroelectric Project (FERC No. 2790). There are also four USACE flood storage dams within the Merrimack River Basin. Essex does not propose to make any changes to Project facilities or operation that would affect these uses.

Through a number of legal and duly recorded agreements dating back to 1845, Essex granted “mill powers” to landowners along the North and South canals. The mill powers detail the allocation of Merrimack River flow, from the impoundment created by the Essex Dam. Mill powers are the right to draw water from the nearest canal, where one mill power is equivalent to 30 cfs delivered at a head of 25 feet for a period of 12 hours per day.[7]

[7] A typical “mill power” allocation is described here, however the actual water withdrawal varies as each mill’s head, flow and duration were site-specific and agreed upon by the grantors/grantees at inception.

As development in Lawrence has occurred, various mill powers have been transferred or are presently unusable (conveyances demolished, equipment removed, etc.). Originally, about 145 mill powers were assigned throughout Lawrence to power 19th-century mills or businesses.[8] Approximately 133 mill powers are held by Essex for use at the Project powerhouse; about 18 are owned in fee while about 115 mill powers are leased. The City of Lawrence possesses mill powers from the South Canal at its former Merrimac Paper site. A small number of mill powers, presently unused, remain attached to their granted canal-adjacent parcels.

Additional flow of the Merrimack River as seasonally occurs (beyond the mill powers described above) is utilized at the project powerhouse for generation and is termed “surplus waterpower.”

5.3.6 Approved Water Quality Standards

Water quality standards for the Commonwealth of Massachusetts, are contained in the Code of Massachusetts Regulations (CMR) at 314 CMR 4.00: Massachusetts Surface Water Quality Standards. Inland surface waters of Massachusetts are classified by appropriate use Class (A, B, or C) as defined in 314 CMR 4.05. Qualifiers applied to these classifications indicate special considerations and uses applicable to a waterbody segment that may affect the application of criteria or antidegradation provisions. The classification of surface water in Massachusetts is provided in 314 CMR 4.06.

The MADEP’s Division of Water Pollution Control has classified waters within the Project vicinity as Class B with specific qualifiers (Table 5.3-3). As defined in 314 CMR 4.05(3)(b), Class B waters are designed as:

> *[A] habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06(1)(d)6. and (6)(b) as a "Treated Water Supply" these waters shall be suitable as a source of public water supply with appropriate treatment. Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.*

A summary of the standards applicable to Class B waters with the Warm Water qualifier is provided in Table 5.3-4.

Table 5.3-3 Water Quality Classification Applicable to the Lawrence Project

Segment Boundary	Mile Point	Class	Qualifiers
From Pawtucket Dam to Essex Dam, Lawrence	40.6 – 29.0	B	Warm Water[1] Treated Water Supply[2] CSO[3]

[8] Mill power values per location are approximate and represent the best information available at this time. Precise tabulation is confounded by mill powers being attached to land parcels, transferred, recorded (or not) in the local Registry of Deeds, over a time span of 175 years, etc.

From Essex Dam, Lawrence to confluence with the Little River, Haverhill	29.0-21.9	B	Warm Water[1] CSO[3]

Source: 314 CMR 4.06.
[1] In these waters, dissolved oxygen and temperature criteria for warm water fisheries apply.
[2] Denotes those Class B waters that are used as a sources of public water supply after appropriate treatment. These waters may be subject to more stringent site-specific criteria established by the Department as appropriate to protect and maintain the use. See 310 CMR 22.00: *Drinking Water.*
[3]Denotes those waters are identified as impacted by the discharge of CSOs; however, a long-term control plan has not been approved or fully implemented for CSO discharges.

Table 5.3-4 Water Quality Standards for Class B Waters with the Warm Water Qualifier

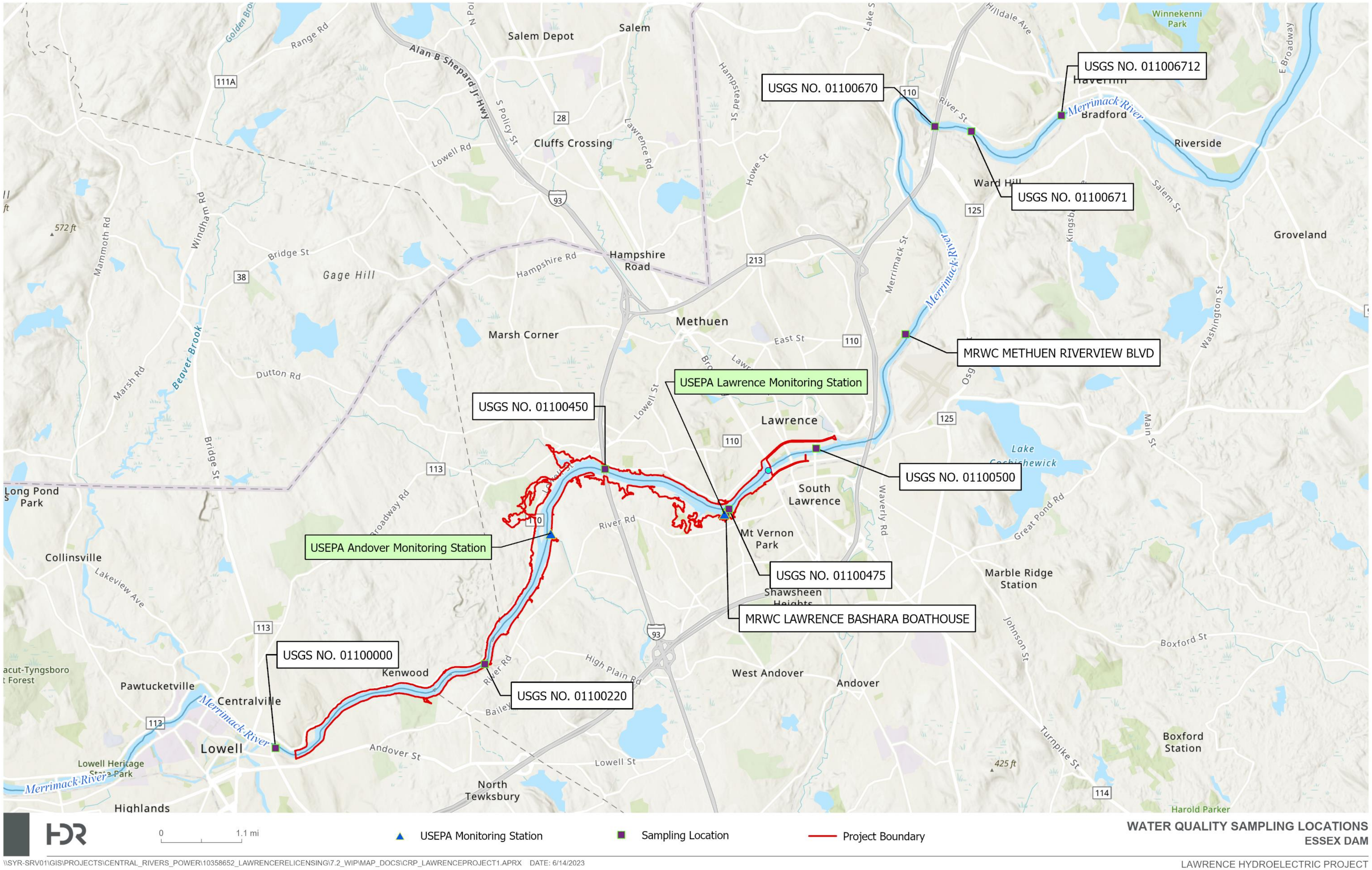
Parameter	Class B Warm Water Standard
Dissolved Oxygen (DO)	Shall not be less than 5.0 milligrams per liter (mg/L) in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
Temperature	Shall not exceed 83 degrees Fahrenheit (°F) (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month). Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any use assigned to this Class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions, or growth of aquatic organisms.
pH	Shall be in the range of 6.5 through 8.3 standard units and not more than 0.5 units outside of the natural background range. There shall be no change from natural background conditions that would impair any use assigned to this Class.
Color and Turbidity	These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class.

Source: 314 CMR 4.05(3)(b).

5.3.7 Existing Water Quality Data

Prior to the CWA in 1972, the Merrimack River was among the top ten most polluted rivers in the country. Subsequently, there has been numerous water quality monitoring efforts conducted on the Merrimack River in the vicinity of the Project including DO, pH, temperature, specific conductance, turbidity, and other nutrients. Existing water quality data within the Project vicinity are presented here from: (1) two USEPA water quality monitoring sites in the Lower Merrimack River; (2) eight USGS sites upstream and downstream of the Project; and (3) two locations sampled as part of the MRWC's Water Quality Monitoring Program (Figure 5.3-1).

Figure 5.3-1 Water Quality Sampling Locations near the Project



5.3.7.1 USEPA Data in the Project Vicinity

The USEPA deployed two water monitoring stations in the Lower Merrimack River to collect water quality data; one just upstream of the Abe Bashara Boathouse in Lawrence and one near Pine Island in Andover (Figure 5.3-1); both stations were located within the Project impoundment. Every 15 minutes from January 2018 to November 2018 and from June 2019 to October 2019, the Lawrence monitoring station received information from an instrument in the Merrimack River equipped with environmental sensors to measure temperature, DO, specific conductance (conductivity), pH, turbidity, chlorophyll, and phycocyanin (USEPA 2022b). Similarly, the Andover monitoring station collected water quality data from December 2016 to November 2017. The sensors were located approximately 1 meter below the water's surface (USEPA 2022b). Relevant environmental data from the Lawrence station are summarized in Table 5.3-5 and from the Andover station in Table 5.3-6.

Between the two sites, water temperatures were recorded up to 30.3°C, DO concentrations ranged from 0.5 to 15.5 mg/L, pH ranged from 4.5 to 8.1. The average monthly water temperatures were within the state standards (i.e., below 28.3°C), however, discrete temperature measurements were recorded above this standard in some months. Generally, DO concentrations exceed the daily minimum state criterion of 5.0 mg/L. However, discrete DO concentrations were recorded below this threshold in different seasons. Similarly, while pH values were generally within the state standards (i.e., 6.5 to 8.3 standard units), there were times when the recorded pH value was lower than 6.5 standard units.

Table 5.3-5 Surface Water Quality Data Summary from USEPA Lower Merrimack River Monitoring Stations in Lawrence

Month	Dissolved Oxygen (DO) (% Saturation)				DO (mg/L)				Temperature (C)				pH				Specific Conductance (µS/cm)				Turbidity (fnu)			
	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N
January	115.5	95.1	106.7	1674	15.3	9.6	13.6	1674	15.1	2.4	5.2	1674	6.8	6.3	6.6	1674	0.3	0.1	0.2	1674	12.8	1.5	3.8	1674
February	114.7	102.4	107.6	2517	14.7	13.2	13.9	2517	8.4	3.2	4.5	2517	7.6	6.4	6.8	2517	0.3	0.2	0.2	2517	7.1	1.5	2.4	2517
March	112.7	100.4	106.4	2941	13.8	11.9	13.2	2941	8.6	4.6	6.1	2941	7.0	6.5	6.8	2941	0.3	0.2	0.2	2941	6.4	1.3	2.0	2940
April	110.3	98.3	104.0	2865	12.9	10.6	11.9	2865	14.4	6.8	9.3	2865	7.0	6.6	6.7	2865	0.2	0.1	0.2	2865	10.7	1.5	2.8	2865
May	107.6	77.1	93.2	2958	11.3	7.0	9.0	2958	22.3	11.4	17.4	2958	7.4	6.4	6.8	2958	0.3	0.1	0.2	2958	19.4	1.7	3.1	2958
June	123.2	52.7	81.7	3927	10.2	4.5	7.1	3927	24.6	20.5	22.4	3927	8.1	6.5	6.8	3927	0.3	0.2	0.3	3927	178.4	1.5	2.5	3927
July	125.4	40.8	77.5	5890	9.8	3.3	6.2	5890	29.5	23.7	26.6	5890	7.6	6.0	6.7	5890	0.4	0.2	0.2	5890	13.6	1.4	2.2	5890
August	124.8	52.0	80.2	5881	9.9	4.2	6.5	5881	28.4	23.2	25.8	5881	7.8	6.5	6.8	5881	0.3	0.2	0.2	5881	35.7	1.6	2.4	5881
September	105.7	51.1	82.7	5713	9.1	4.2	7.2	5713	27.2	18.2	22.2	5713	7.3	6.5	6.8	5713	0.3	0.2	0.2	5713	8.6	1.4	2.2	5713
October	104.0	58.1	93.0	3538	12.1	5.5	9.4	3538	21.0	8.8	15.2	3538	7.0	6.2	6.7	3538	0.3	0.2	0.2	3538	16.3	1.8	2.6	3538
November	108.9	100.4	104.8	537	12.1	11.4	11.8	537	11.4	8.8	10.0	537	6.6	6.3	6.5	537	0.2	0.1	0.1	537	13.4	2.6	5.5	537
December	115.5	95.1	106.7	1674	15.3	9.6	13.6	1674	15.1	2.4	5.2	1674	6.8	6.3	6.6	1674	0.3	0.1	0.2	1674	12.8	1.5	3.8	1674

[1]Shaded cells do not meet Massachusetts standards.

Table 5.3-6 Surface Water Quality Data Summary from USEPA Lower Merrimack River Monitoring Stations in Andover

Month	Dissolved Oxygen (DO) (% Saturation)				DO (mg/L)				Temperature (C)				pH				Specific Conductance (µS/cm)				Turbidity (fnu)			
	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N	Max	Min	Average	N
January	101.1	90.7	96.8	2941	14.3	12.7	13.6	2941	2.7	0.2	1.3	2941	7.1	6.6	6.9	2941	1.1	0.3	0.5	2941	6.7	0.9	1.9	2941
February	104.7	86.4	94.1	2677	13.7	12.1	13.0	2677	5.7	0.4	1.8	2677	7.1	6.7	7.0	2677	1.1	0.4	0.8	2677	13.7	0.9	2.4	2677
March	103.9	90.8	100.0	2893	15.5	12.0	13.6	2893	6.6	-3.6	2.7	2893	7.1	4.5	6.8	2893	0.8	0.0	0.4	2893	81.8	1.1	2.1	2893
April	110.1	89.6	99.3	2775	13.6	9.6	11.2	2775	16.1	2.3	10.4	2775	7.2	6.8	6.9	2775	0.8	0.2	0.5	2775	10.9	1.0	3.3	2775
May	107.6	32.9	88.0	2939	10.8	2.8	8.7	2939	30.3	11.9	16.2	2939	7.3	5.7	6.8	2939	0.7	0.0	0.4	2939	347.5	0.6	2.1	2939
June	102.4	79.6	93.7	2869	9.8	6.8	8.4	2869	26.4	14.2	21.0	2869	7.0	6.3	6.7	2869	0.4	0.2	0.2	2869	7.7	0.9	2.2	2869
July	110.2	6.1	80.4	2956	9.1	0.5	6.8	2956	30.1	19.4	24.0	2956	7.1	5.8	6.5	2956	0.3	0.1	0.2	2956	19.7	0.5	3.2	2956
August	133.3	74.8	93.4	2953	10.8	6.3	7.8	2953	26.7	21.8	24.4	2953	8.0	6.6	6.9	2953	0.3	0.2	0.3	2953	3.2	1.3	1.7	2953
September	120.6	74.6	90.5	2863	10.3	6.7	8.0	2863	25.0	19.3	21.3	2863	7.9	6.4	6.8	2863	0.3	0.2	0.2	2863	4.6	1.0	1.6	2863
October	110.9	29.7	86.8	2748	10.1	2.8	8.2	2748	21.6	13.9	18.0	2748	7.4	6.3	6.8	2748	0.4	0.1	0.3	2748	7.6	1.2	2.2	2748
November	98.9	16.6	73.9	1149	12.2	1.7	8.4	1149	21.7	5.7	11.3	1149	6.9	5.3	6.4	1149	0.5	0.1	0.2	1149	6.1	2.5	3.6	1149
December	100.2	65.5	92.7	2235	14.2	7.7	12.8	2235	11.1	0.7	2.2	2235	7.2	6.4	6.9	2235	0.8	0.2	0.5	2235	5.5	1.0	2.1	2235

[1]Shaded cells do not meet Massachusetts standards.

5.3.7.2 USGS Data in the Project Vicinity

The USGS National Water Information Systems (NWIS) Mapper was queried for water quality data in the vicinity of the Project on the Merrimack River (USGS 2023d). There were numerous active and inactive sites near the Project on the main stem of the Merrimack River and its tributaries. A summary of USGS water quality data locations within the Project vicinity on the main stem of the Merrimack River are summarized in Table 5.3-7. Additional information about other USGS water quality monitoring locations can be accessed on the USGS NWIS Mapper.

Table 5.3-7 USGS Water Quality Data Locations on the Main Stem of the Merrimack River

Site Name	USGS Site Number	Distance from Project	Status	Years of Water Quality Data	Samples
Merrimack River below Concord River at Lowell, MA	01100000	9.4 Miles Upstream	Active	1953 - 2023	312
Merrimack River at Lawrence, MA	01100500	0.72 Mile Downstream	Active	2020 - 2023	15
Merrimack River near Haverhill, MA	011006712	9.7 Miles Downstream	Active	2020 - 2023	5
Merrimack River near Power Lines, Methuen, MA	01100220	6.0 Miles Upstream	Inactive	2020	10
Merrimack River at I93, near Methuen, MA	01100450	2.5 Miles Upstream	Inactive	1973 – 1974	2
Merrimack River at Abe Bashara Boat House Lawrence, MA	01100475	0.74 Mile Upstream	Inactive	2020	13
Merrimack River at I495, near Haverhill, MA	01100670	7.57 Miles Downstream	Inactive	1973 – 1974	2
Merrimack River DS Stanley Island, Haverhill, MA	01100671	8.08 Miles Downstream	Inactive	2020	5

Source: USGS 2023d.

Water quality data from each the USGS locations are summarized in Table 5.3-8 to Table 5.3-13 and includes turbidity (Table 5.3-8), pH (Table 5.3-9), specific conductance (Table 5.3-10), temperature (Table 5.3-11), DO measured in% saturation (Table 5.3-12), and DO measured in mg/L (Table 5.3-13) for each site. The sampling year(s) do not directly coincide between sites. Data at these sites were not collected at the same time. Additionally, not all sites collected each individual parameter. The applicable USGS locations are included in the following tables.

The two locations closest to the Project Dam were USGS 01100500 (0.72 mile downstream) and USGS 01100475 (0.74 mile upstream) and generally had pH values within state standards. However, isolated events measured at USGS 01100500 where average pH values were 6.4 standard units in January and 6.1 standard units in October (i.e., 6.5 to 8.3 standard units). Temperature (°C) readings were within state standards at both sites (i.e., below 28.3°C) with an average monthly range from 12.7°C to 27.4°C at USGS 01100475 and 1.5°C to 24.7°C at USGS 01100500. DO concentrations (mg/L) at both sites exceed the daily minimum state criterion of 5.0 mg/L. Turbidity data at these sites appears to remain stable with a maximum at both sites of 2.1 Nephelometric Turbidity Units [NTU] and a minimum of 1.3 NTU (Table 5.3-8). Specific conductivity (micro siemens per centimeter [µS/cm]) also was stable at both sites with an average monthly range of 172 to 325 µS/cm at USGS 01100475 and 173 to 315 µS/cm at USGS 01100500. There are no quantiative standards for turbidity or specific conductivitiy in Massachusetts.

Table 5.3-8 Turbidity (NTU) Collected from USGS Water Quality Data Locations on the Main Stem of the Merrimack River

Month	Turbidity (NTU)																											
	USGS 01100000				USGS 01100220				USGS 01100475				USGS 01100500				USGS 01100671				USGS 011006712				TOTAL			
	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	**Max**	**Min**	**Avg**	**N**
January	3.4	1.0	2.0	3	--	--	--	--	--	--	--	--	1.8	1.6	1.7	11	--	--	--	--	1.7	1.7	1.7	1	**3.4**	**1.0**	**1.8**	**15**
February	1.4	1.2	1.3	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**1.4**	**1.2**	**1.3**	**2**
March	1.9	1.9	1.9	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**1.9**	**1.9**	**1.9**	**1**
April	2.2	1.5	1.9	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**2.2**	**1.5**	**1.9**	**2**
May	2.6	1.4	2.0	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**2.6**	**1.4**	**2.0**	**2**
June	1.7	1.7	1.7	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**1.7**	**1.7**	**1.7**	**2**
July	4.3	2.0	3.4	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**4.3**	**2.0**	**3.4**	**3**
August	2.5	1.7	2.2	3	--	--	--	--	1.3	1.3	1.3	1	1.3	1.3	1.3	1	--	--	--	--	1	1	1	1	**2.5**	**1.0**	**1.7**	**6**
September	3.2	2.6	2.8	3	1.6	1.4	1.5	2	2.1	2.1	2.1	1	2	2	2	1	0.3	0.3	0.3	1	1.9	1.9	1.9	1	**3.2**	**0.3**	**2.0**	**9**
October	2.5	1.6	2.0	3	--	--	--	--	1.4	1.4	1.4	1	2.1	1.7	1.9	2	--	--	--	--	2.6	2.0	2.3	2	**2.6**	**1.4**	**2.0**	**8**
November	15.0	1.7	8.4	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**15.0**	**1.7**	**8.4**	**2**
December	3.2	1.6	2.4	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**3.2**	**1.6**	**2.4**	**2**

Table 5.3-9 pH Collected from USGS Water Quality Data Locations on the Main Stem of the Merrimack River

Month	pH																																			
	USGS 01100000				USGS 01100220				USGS 01100450				USGS 01100475				USGS 01100500				USGS 01100670				USGS 01100671				USGS 011006712				TOTAL			
	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	**Max**	**Min**	**Avg**	**N**
January	7.4	5.9	6.8	15	--	--	--	--	--	--	--	--	--	--	--	--	6.6	6.2	6.4	11	--	--	--	--	--	--	--	--	6.8	6.8	6.8	1	**7.4**	**5.9**	**6.6**	**27**
February	7.5	5.6	6.8	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**7.5**	**5.6**	**6.8**	**13**
March	7.4	5.9	6.7	16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**7.4**	**5.9**	**6.7**	**16**
April	7.3	6.0	6.7	16	--	--	--	--	6.9	6.9	6.9	1	--	--	--	--	--	--	--	--	6.4	6.4	6.4	1	--	--	--	--	--	--	--	--	**7.3**	**6.0**	**6.7**	**18**
May	7.6	6.0	6.9	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**7.6**	**6.0**	**6.9**	**15**
June	7.7	6.4	7.0	20	7.1	6.8	6.9	4	--	--	--	--	7.4	7.1	7.2	4	--	--	--	--	--	--	--	--	7.2	7.0	7.1	2	--	--	--	--	**7.7**	**6.4**	**7.0**	**30**
July	7.7	6.0	6.8	17	6.8	6.8	6.8	2	--	--	--	--	6.9	6.8	6.9	2	--	--	--	--	--	--	--	--	7.1	7.1	7.1	1	--	--	--	--	**7.7**	**6.0**	**6.9**	**22**
August	7.9	6.1	7.0	19	--	--	--	--	7.3	7.3	7.3	1	7.0	6.9	7.0	3	7.0	7.0	7.0	1	6.5	6.5	6.5	1	--	--	--	--	--	--	--	--	**7.9**	**6.1**	**7.0**	**25**
September	8.4	5.9	6.9	23	7.3	6.6	7.0	4	--	--	--	--	7.9	6.9	7.3	3	7.9	7.9	7.9	1	--	--	--	--	6.9	6.7	6.8	2	6.9	6.9	6.9	1	**8.4**	**5.9**	**7.0**	**34**
October	7.6	6.2	6.9	14	--	--	--	--	--	--	--	--	6.8	6.8	6.8	1	6.1	6.1	6.1	1	--	--	--	--	--	--	--	--	6.4	6.4	6.4	1	**7.6**	**6.1**	**6.8**	**17**
November	7.7	6.1	7.0	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**7.7**	**6.1**	**7.0**	**12**
December	7.3	6.1	6.8	17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**7.3**	**6.1**	**6.8**	**17**

[1]Shaded cells do not meet Massachusetts pH standards.

Table 5.3-10 Specific Conductance (µS/cm) Collected from USGS Water Quality Data Locations on the Main Stem of the Merrimack River

Month	Specific Conductance (µS/cm)																																			
	USGS 01100000				USGS 01100220				USGS 01100450				USGS 01100475				USGS 01100500				USGS 01100670				USGS 01100671				USGS 011006712				**TOTAL**			
	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	**Max**	**Min**	**Avg**	**N**
January	399	90	192	21	-	-	-	-	-	-	-	-	-	-	-	-	175	172	174	11	-	-	-	-	-	-	-	-	195	195	195	1	**399**	**90**	**186**	**33**
February	328	80	214	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**328**	**80**	**214**	**18**
March	290	55	154	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**290**	**55**	**154**	**23**
April	218	46	124	26	-	-	-	-	69	69	69	1	-	-	-	-	-	-	-	-	82	82	82	1	-	-	-	-	-	-	-	-	**218**	**46**	**121**	**28**
May	240	56	137	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**240**	**56**	**137**	**25**
June	299	91	169	27	294	188	247	4	-	-	-	-	295	213	255	4	-	-	-	-	-	-	-	-	319	245	282	2	-	-	-	-	**319**	**91**	**193**	**37**
July	336	89	192	25	274	258	266	2	-	-	-	-	230	230	230	2	-	-	-	-	-	-	-	-	250	250	250	1	-	-	-	-	**336**	**89**	**201**	**30**
August	309	86	190	29	-	-	-	-	175	175	175	1	312	311	312	3	286	286	286	1	138	138	138	1	-	-	-	-	-	-	-	-	**312**	**86**	**201**	**35**
September	347	83	180	31	316	305	309	4	-	-	-	-	329	318	325	3	315	315	315	1	-	-	-	-	354	332	343	2	357	357	357	1	**357**	**83**	**218**	**42**
October	275	88	176	22	-	-	-	-	-	-	-	-	172	172	172	1	173	173	173	1	-	-	-	-	-	-	-	-	192	192	192	1	**275**	**88**	**177**	**25**
November	320	102	166	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**320**	**102**	**166**	**24**
December	225	93	147	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**225**	**93**	**147**	**21**

Table 5.3-11 Temperature (°C) Collected from USGS Water Quality Data Locations on the Main Stem of the Merrimack River

Month	Temperature (C)																																			
	USGS 01100000				USGS 01100220				USGS 01100450				USGS 01100475				USGS 01100500				USGS 01100670				USGS 01100671				USGS 011006712				**TOTAL**			
	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	**Max**	**Min**	**Avg**	**N**
January	2.7	-0.1	0.6	24	--	--	--	--	--	--	--	--	--	--	--	--	1.6	1.5	1.5	11	--	--	--	--	--	--	--	--	1.9	1.9	1.9	1	**2.7**	**-0.1**	**0.9**	**36**
February	4.0	-0.1	0.9	17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**4.0**	**-0.1**	**0.9**	**17**
March	10.0	0.0	3.8	19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**10.0**	**0.0**	**3.8**	**19**
April	15.0	2.0	9.2	26	--	--	--	--	15	15	15	1	--	--	--	--	--	--	--	--	14.3	14.3	14.3	1	--	--	--	--	--	--	--	--	**15.0**	**2.0**	**9.6**	**28**
May	21.0	9.0	14.7	23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**21.0**	**9.0**	**14.7**	**23**
June	25.8	10.0	20.7	19	25.0	20.3	22.7	4	--	--	--	--	24.9	20.5	23.1	4	--	--	--	--	--	--	--	--	24.9	22.0	23.5	2	--	--	--	--	**25.8**	**10.0**	**21.5**	**29**
July	29.0	20.0	24.0	23	27.7	27.2	27.5	2	--	--	--	--	27.8	27.0	27.4	2	--	--	--	--	--	--	--	--	28.8	28.8	28.8	1	--	--	--	--	**29.0**	**20.0**	**24.7**	**28**
August	28.6	20.6	24.1	28	--	--	--	--	25	25	25	1	23.8	22.7	23.2	3	24.7	24.7	24.7	1	24.0	24.0	24.0	1	--	--	--	--	--	--	--	--	**28.6**	**20.6**	**24.0**	**34**
September	24.5	14.5	20.0	28	23.2	17.4	21.0	4	--	--	--	--	20.7	18.3	19.4	3	19.6	19.6	19.6	1	--	--	--	--	23.0	21.0	22.0	2	20.0	20.0	20.0	1	**24.5**	**14.5**	**20.1**	**39**
October	17.0	2.5	13.3	19	--	--	--	--	--	--	--	--	12.7	12.7	12.7	1	12.7	12.7	12.7	1	--	--	--	--	--	--	--	--	12.6	12.6	12.6	1	**17.0**	**2.5**	**13.2**	**22**
November	13.5	2.0	7.0	24	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**13.5**	**2.0**	**7.0**	**24**
December	7.0	0.1	2.9	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**7.0**	**0.1**	**2.9**	**18**

[1] Shaded cells do not meet Massachusetts temperature standards.

Table 5.3-12 DO (% Saturation) Collected from USGS Water Quality Data Locations on the Main Stem of the Merrimack River

Month	DO (% Saturation)																							
	USGS 01100000				USGS 01100220				USGS 01100475				USGS 01100500				USGS 011006712				TOTAL			
	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	**Max**	**Min**	**Avg**	**N**
January	105	87	96	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**105**	**87**	**96**	**8**
February	104	92	97	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**104**	**92**	**97**	**7**
March	105	94	101	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**105**	**94**	**101**	**5**
April	114	90	102	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**114**	**90**	**102**	**8**
May	131	93	102	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**131**	**93**	**102**	**8**
June	121	89	102	11	-	-	-	-	86	82	84	2	-	-	-	-	-	-	-	-	**121**	**82**	**99**	**13**
July	98	73	89	8	86	77	82	2	-	-	-	-	-	-	-	-	-	-	-	-	**98**	**73**	**88**	**10**
August	102	26	85	9	-	-	-	-	-	-	-	-	97	97	97	1	-	-	-	-	**102**	**26**	**86**	**10**
September	122	91	100	11	103	47	75	2	99	99	99	1	109	109	109	1	95	95	9	1	**122**	**47**	**97**	**16**
October	102	84	94	6	-	-	-	-	84	84	84	1	91	91	91	1	85	85	8	1	**102**	**84**	**91**	**9**
November	103	89	97	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**103**	**89**	**97**	**8**
December	104	76	94	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**104**	**76**	**94**	**8**

Table 5.3-13 DO (mg/L) Collected from USGS Water Quality Data Locations on the Main Stem of the Merrimack River

Month	DO (mg/L)																																			
	USGS 01100000				USGS 01100220				USGS 01100450				USGS 01100475				USGS 01100500				USGS 01100670				USGS 01100671				USGS 011006712				TOTAL			
	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	Max	Min	Avg	N	**Max**	**Min**	**Avg**	**N**
January	14.5	12.4	13.8	9	-	-	-	-	-	-	-	-	-	-	-	-	15.0	14.2	14.4	11	-	-	-	-	-	-	-	-	14.3	14.3	14.3	1	**15.0**	**12.4**	**14.1**	**21**
February	15.3	12.8	13.9	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**15.3**	**12.8**	**13.9**	**8**
March	14.8	12.6	13.4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**14.8**	**12.6**	**13.4**	**5**
April	13.0	9.5	11.3	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**13.0**	**9.5**	**11.3**	**8**
May	12.9	8.5	10.2	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**12.9**	**8.5**	**10.2**	**9**
June	9.8	7.4	8.6	1	7.7	7.4	7.5	4	-	-	-	-	9.2	6.7	7.8	4	-	-	-	-	-	-	-	-	8.8	7.3	8.1	2	-	-	-	-	**9.8**	**6.7**	**8.2**	**23**
July	8.3	5.8	7.3	9	6.7	6.0	6.4	2	-	-	-	-	7.8	6.8	7.3	2	-	-	-	-	-	-	-	-	8.3	8.3	8.3	1	-	-	-	-	**8.3**	**5.8**	**7.2**	**14**
August	8.8	2.2	7.0	1	-	-	-	-	10.3	10.3	10.3	1	7.4	6.2	6.9	3	8.0	8.0	8.0	1	2.4	2.4	2.4	1	-	-	-	-	-	-	-	-	**10.3**	**2.2**	**7.0**	**18**
September	10.4	6.3	8.5	1	9.1	4.4	6.7	4	-	-	-	-	10.	6.3	8.5	3	10.0	10.0	10.0	1	-	-	-	-	7.0	5.1	6.1	2	8.6	8.6	8.6	1	**10.4**	**4.4**	**8.1**	**24**
October	10.3	5.8	8.9	8	-	-	-	-	-	-	-	-	8.9	8.9	8.9	1	9.7	9.7	9.7	1	-	-	-	-	-	-	-	-	9.1	9.1	9.1	1	**10.3**	**5.8**	**9.0**	**11**
November	12.7	8.7	11.3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**12.7**	**8.7**	**11.3**	**9**
December	13.8	11.1	12.6	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**13.8**	**11.1**	**12.6**	**9**

[1] Shaded cells do not meet Massachusetts DO (mg/L) standards.

5.3.7.3 Merrimack River Watershed Council Data in the Project Vicinity

In 2021, the MRWC's volunteer water quality monitoring program collected water quality data at 13 sites along the Merrimack River from Manchester, NH, to Salisbury, MA, from January to December (MRWC 2022). Data was collected on pH, salinity, total dissolved solids, specific conductivity, and temperature. Monitoring in the greater Lawrence area includes two sites; Lawrence Bashara Boathouse and Methuen Riverview Boulevard (Blvd) (Figure 5.3-1). The Lawrence Bashara Boathouse is located 0.82 mile upstream of the Project and is located upstream of the five GLSD CSO outfalls. The Methuen Riverview Boulevard is located 3.13 miles downstream of the Project and is located downstream of the five GLSD CSO outfalls.

The recorded water temperatures at both monitoring locations were within the state standards (i.e., below 28.3°C) ranging from 2.5°C to 23.9 °C at the Lawrence Bashara Boathouse site and 4.4°C to 25.5°C at the Methuen Riverview Boulevard site (Table 5.3-14). pH values were generally within the state standards (i.e., 6.5 to 8.3 standard units) with a median of 7.2 at the Lawrence Bashara Boathouse site and 7.1 at the Methuen Riverview Boulevard site. However, pH values recorded at the Methuen Riverview Boulevard site show a maximum pH of 8.8, which exceeds the state standards.

Table 5.3-14 2021 MRWC Volunteer Water Quality Monitoring Program Data

Site	River Mile	Temperature (°C)			pH			Specific Conductivity (µS/cm)		
		Min	Max	Median	Min	Max	Median	Min	Max	Median
Lawrence Bashara Boathouse	29.02	2.5	23.9	17.3	6.8	8.0	7.2	141.1	271.3	200.3
Methuen Riverview Blvd	26.20	4.4	25.5	20.7	6.8	8.8	7.1	160.4	922.0	228.2

Source: MRWC 2022.

5.3.8 Impaired Waters

As required by the Federal CWA, every two years, MADEP develops a list of waters that do not meet water quality standards. Waters in the vicinity of the Project were listed on the MADEP Section 303(d) list of waters requiring a total maximum daily load (TMDL) (MADEP 2021). Section 303(d) of the CWA requires states to identify waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule them for the derivation of TMDLs (MADEP 2021). The specific impairments for waters in the Project vicinity are provided in Table 5.3-15.

Table 5.3-15 Impaired Water Segments in the Vicinity of the Lawrence Project

Segment Boundary	Segment ID	Length (miles)	Impairments
Pawtucket Dam, Lowell to Lowell Regional Wastewater Utilities outfall at Duck Island, Lowell.	MA84A-02	3.2	Dewatering[1] Fish Passage Barrier[1] *Escherichia Coli (E. Coli)* Mercury in Fish Tissue Phosphorus, Total
Lowell Regional Wastewater Utilities outfall at Duck Island, Lowell to Essex Dam, Lawrence	MA84A-03	8.8	Fish Passage Barrier[1] *E. Coli* Mercury in Fish Tissue polychlorinated biphenyls (PCBs) in Fish Tissue Phosphorus, Total
Essex Dam, Lawrence to confluence with Little River, Haverhill	MA84A-04	10.0	*E. Coli* PCBs in Fish Tissue Phosphorus, Total

Source: MADEP 2021.
[1] TMDL not required (non-pollutant).

5.3.9 Reservoir Data

The Project's reservoir is 9.8 miles long and has a surface area of 655 acres at the normal impoundment elevation of 44.17 NGVD29 and a gross storage capacity of approximately 19,900 acre-feet. There is no useable storage capacity.

5.3.10 Downstream Reach Gradients

The hydraulic gradient of the Merrimack River immediately downstream of the Essex Dam drops from approximately 15.0 feet NGVD29 at the toe of the dam to approximately 12.0 feet NGVD29 at the Duck Bridge approximately 3,700 feet downstream, resulting in an average river gradient of 0.08% within this reach. The Merrimack River becomes tidally influenced about 6.2 miles downstream of the Essex Dam, in Haverhill, MA.

5.4 Fish and Aquatic Resources

5.4.1 Aquatic Habitat

The Lawrence Project is located at RM 29 of the Merrimack River. The Merrimack River is formed by the confluence of the Pemigewasset and Winnipesaukee rivers in Franklin, New Hampshire, from which it flows 115 miles to the Atlantic Ocean (MEOEEA 2001). The Merrimack River is part of the Merrimack River Watershed, which includes several smaller watersheds (Powwow River, Little River, Spicket River, Beaver Brook, Stony Brook, and Salmon Brook) and has a total drainage area of approximately 5,010 square miles within the states of New Hampshire and Massachusetts.

Historically, the Merrimack River served as a major resource for fisheries; however, an increase in industrial and urban pollution coupled with the construction of numerous dams along its length during the past two hundred years has resulted in decreased value of the Merrimack River as important aquatic habitat. Fish populations most affected by these changes have been sensitive migrating species, such as anadromous fish that live in salt water and spawn in fresh water, and catadromous species that inhabit rivers and spawn in the ocean.

In more recent years, the quality of the Merrimack River has improved, and state and federal fish and wildlife agencies have made a concerted effort to restore diadromous fish populations in the Merrimack River. While present day abundance of migratory species remains relatively low compared to historical levels, restoration efforts over the past 40 years have improved habitat and connectivity conditions, resulting in a modest increase in diadromous fish abundance. Restoration efforts have included stocking the headwaters of the river with adult American shad (*Alosa sapidissima*) and juvenile Atlantic salmon (*Salmo salar*) and building fish ladders at dams to allow fish access to the upper reaches of the Merrimack River. Other anadromous fish that return to the Merrimack River include alewife (*Alosa pseudoharengus*), blueback herring (*A. aestivalis*), and sea lamprey (*Petromyzon marinus*). The only catadromous species reported in the lower portion of the Merrimack River is the American eel (*Anguilla rostrata*) (FHA and Massachusetts Department of Public Works [MDPW] 1985).

Aquatic habitat within the Merrimack River watershed includes quickwaters in the northern portion of the watershed and an estuarine environment in the lower reaches of the Merrimack River, with cold and warm water fisheries found throughout the watershed. The Merrimack River watershed provides critical habitat for anadromous, catadromous, and resident fish species as well as numerous other aquatic species (USACE 2003). Some of these species and their habitat have been impacted by poor water quality, alteration of stream courses, development, and agriculture. The tidally influenced lower 22 miles of the mainstem river also supports a wide range of aquatic species, including extensive shellfish beds, but is considered a vulnerable resource since it is located at the downstream end of the watershed. Impacts to the resources of the estuary are the result of nutrient and bacterial loading, sedimentation, shoreline erosion, and changes in populations of anadromous and catadromous fish species. The Merrimack River in the vicinity of the Lawrence Project is on the 303(d) list of impaired waters for pathogens and nutrients (MEOEEA 2001).

Natural reproduction of anadromous species in the Merrimack River was limited due to several previously impassable barriers blocking access to historic spawning sites, with the first impediment to upstream fish passage being the Essex Dam in Lawrence. Fish passage facilities have been maintained at Essex Dam since 1848 (described in Section 4.3.9), and anadromous fish, specifically Atlantic salmon, American shad, and river herring (alewife and blueback herring) are managed by the MRTC comprised of the Massachusetts Division of Marine Fisheries, MassWildlife, New Hampshire Department of Fish and Game (NHDFG), USFWS, NMFS, and U.S. Department of Agriculture Forest Service (USFS).

The MRTC oversees the management of the Lawrence Project fisheries as directed by the Project's Comprehensive Fish Passage Plan (CFPP) which was filed pursuant to Article 31 of the Project's existing license and approved by FERC in July 2000. The CFPP includes details of operational measures undertaken by Essex to protect upstream and downstream migrating anadromous fish. Upstream and downstream fish passage facilities at the Project include a fish lift, downstream fish bypass, and eel ladder. The fish passage facilities at the Project were designed in consultation with the USFWS and current fish passage operations are supervised by both state and federal fishery agencies per the CFPP. Under the CFPP, Essex is required to provide annual post-season updates to the MRTC.

In accordance with the CFPP, the fish lift is typically operated from late April through mid-July, annually.[9] The final operation schedule is determined in consultation with the MRTC. Upstream fish passage lifts generally occur hourly between 8:00 a.m. to 4:00 p.m. daily during operational periods and maintains operations from river flows of 500 cfs to 25,000 cfs (LHA 1999). The downstream fish bypass facility is a concrete bypass chute that is typically operated from April 1 through July 15 and from September 1 through November 15, annually on a 24-hour basis. The upstream eel passage system is located adjacent to the powerhouse at the toe of Essex Dam. Eel ladder operation occurs annually between May 1 and September 30 (Essex 2014). Additionally, an eel elevator is being installed at the left abutment of Essex Dam, which will supplement the existing eel ladder.

As a component of the CFPP, Essex collects information regarding the abundance of diadromous fishes using the fishways annually. This activity is a joint monitoring effort to inform the Technical Committee that manages these fishery resources. MADFW and Essex staff work cooperatively to record diadromous fish counts at the fish lift throughout the upstream migration season. Essex provides a summary of these counts as part of its annual fishway operations report to the MRTC.

The CFPP is based on several fisheries studies conducted at the Project (see Section 5.4.3) and experience gained at the Project since the installation of the Project's fish lift and fish bypass facilities. The CFPP was developed in consultation with the resource agencies, and many of the agencies' recommendations have been incorporated into the

[9] Note that the CFPP states that upstream passage would also be operated from September through October, for fall-run Atlantic salmon. This fall lifting season was eliminated following the termination of the salmon restoration program in 2013.

CFPP. Currently, Essex is coordinating with the USFWS and University of Massachusetts, Amherst, in upstream and downstream American eel (*Anguilla rostrata*) passage studies at the Project. In 2016, Essex purchased new radio telemetry equipment to assist the USFWS monitoring at three sites to assess the downstream movement of radio tagged adult eels released at the Merrimack River Project upstream (Cleantech 2017). In 2017 Essex deployed telemetry equipment at six locations at the Lowell Project and two locations at the Lawrence Project to again track the movement of radio-tagged eels released at the Merrimack River Project through the Lawrence Project facilities.

5.4.2 Existing Fish and Aquatic Resources

The Merrimack River basin contains 34 native fish species, 9 of which are diadromous, and at least 14 introduced species, the majority of which are game species (Table 5.4-1) (MEOEEA 2001). Common freshwater game species currently found in the Lower Merrimack River include yellow perch (*Perca flavescens*), chain pickerel (*Esox niger*), northern pike (*E. lucius*), brown bullhead (*Ameiurus nebulosus*), smallmouth and largemouth bass (*Micropterus dolomieu* and *M. salmoides,* respectively), walleye (*Sander vitreus*), common carp (*Cyprinus carpio*) and Centrarchid sunfishes (Lower Merrimack River Local Advisory Committee [LMRLAC] 2008). The the fisheries and aquatic resources of the Merrimack River in the vicinity of Lawrence Project are managed jointly by MADFW, NHDFG, and the USFWS. These agencies jointly manage the Merrimack River, including the Lawrence Project, as a warm water recreational fishery, as well as for conservation of diadromous species. Alewife, American eel, American shad, striped bass, and sea lamprey are currently managed diadromous species that are found at the Lawrence Project during certain life stages.

Table 5.4-1 Fish Species of the Merrimack River Watershed

Family	Common Name	Scientific Name
Acipenseridae	Atlantic sturgeon	*Acipenser oxyryhnchus*
	shortnose sturgeon	*Acipenser brevirostrum*
Amiidae	bowfin	*Amia calva*
Ammodytidae	sand lance	*Ammodytes hexapterus*
Anguillidae	American eel	*Anguilla rostrata*
Atherinopsidae	Atlantic silverside	*Menidia menidia*
Catostomidae	white sucker	*Catostomus commersoni*
Centrarchidae	banded sunfish	*Enneacanthus obesus*
	black crappie	*Pomoxis nigromaculatus*
	bluegill	*Lepomis macrochirus*
	largemouth bass	*Micropterus salmoides*
	pumpkinseed	*Lepomis gibbosus*
	redbreast sunfish	*Lepomis macrochirus*
	smallmouth bass	*Micropterus dolomieu*

Family	Common Name	Scientific Name
Cyprinidae	blacknose dace	*Rhinichthys atratulus*
	bridle shiner	*Notropis bifrenatus*
	common carp	*Cyprinus carpio*
	common shiner	*Luxilis cornutus*
	fallfish	*Semotilus corporalis*
	golden shiner	*Notemigonus crysoleucas*
	goldfish	*Carassius auratus*
	longnose dace	*Rhinichthys cataractae*
	spottail shiner	*Notropus hudsonius*
Clupeidae	alewife	*Alosa pseudoharengus*
	American shad	*Alosa sapidissima*
	blueback herring	*Alosa astivalis*
	gizzard shad	*Dorosoma cepedium*
Esocidae	chain pickerel	*Esox niger*
	northern pike	*Esox lucius*
Fundulidae	banded killifish	*Fundulus diaphanus*
	mummichog	*Fundulus heteroclitus*
Gasterosteidae	3-spine stickleback	*Gasterosteus aculeatus*
	4-spine stickleback	*Apeltes quardracus*
	9-spine stickleback	*Pungitius pungitius*
Ictaluridae	brown bullhead	*Ictalurus nebulosus*
	channel catfish	*Ictalurus punctatus*
	margined madtom	*Noturus insignis*
	white catfish	*Ictalurus catus*
	yellow bullhead	*Ictalurus natalis*
Moronidae	striped bass	*Morone saxatilis*
	white perch	*Morone americana*
Osmeridae	Atlantic smelt	*Osmerus mordax*
Percidae	swamp darter	*Etheostoma fusiforme*
	tessellated darter	*Etheostoma olmstedi*
	walleye	*Sander vitreus*
	yellow perch	*Perca flavescens*
Petromyzontidae	sea lamprey	*Petromyzon marinus*

Family	Common Name	Scientific Name
Salmonidae	Atlantic salmon	*Salmo salar*
Syngnathidae	northern pipefish	*Syngnathus fuscus*

Source: MEOEEA 2001.

5.4.3 Fish Passage and Protection Studies

The first obstruction on the Merrimack River, the Essex Dam in Lawrence, has been equipped with fish passage facilities since the mid-19th century. These ladders have been upgraded on several occasions. In the early 1980s the existing fish lift was constructed along with the powerhouse, as a requirement under the current FERC license. The Essex lift was designed to pass 11,000 Atlantic salmon and 840,000 shad annually.

Diadromous upstream fish passing through the Lawrence Project via the fish lift have been counted through the viewing windows since 1983. River herring (alewife and blueback herring) counts have varied, with an annual low of 51 documented fish passing through the Lawrence lift in 1996 and a record high of 417,420 in 2016. American shad counts were relatively more stable throughout the duration of the period of record, peaking at 89,467 in 2015 at Lawrence. Numbers counted at the Pawtucket Dam (Lowell Hydroelectric Project Dam) passage facilities in Lowell dropped off dramatically for those same years. Due to problems with attraction flows at the fish lifts, which are inherent in fish passage facilities on large rivers as well as behavioral differences of the species, the counts may not be an accurate representation of the numbers or relative abundance of anadromous fish utilizing the system. A summary of diadromous fish counts passing through the Lawrence and Lowell Projects is provided in Table 5.4-2.

The USFWS inspected the fish passage facilities at the Lawrence Hydroelectric Project in May 2019. At the time of the inspection, the eel ladder was operational, however, the lower portion of the ladder was damaged (void of any substrate). This condition had been a common occurrence, as documented in the 2017 and 2019 site inspection reports. During the 2019 inspection, fish were not witnessed within the fishway because the run had not started yet, but Project operations staff stated they continually witnessed fish trapped behind the static crowder (a component of the salmon trap) within the exit channel. Divers were employed to investigate the structure due to the de-watering gate being non-functional and did not discover any gaps or holes, yet diver visibility was limited due to turbid conditions.

The USFWS has coordinated with the Licensee and provided technical guidance to improve migratory fish passage at the Lawrence Project, including a more robust design of the eel ladder to protect the lower portion of the ladder and avoid damage during future migratory seasons. USFWS also recommended the Licensee fix the de-watering gate prior to the start of the 2020 migratory season. In early 2022, a crowder system was installed within the fish lift system to facilitate the trapping and trucking of migratory species to upper potions of the Merrimack River watershed by the MRTC.

In accordance with Article 31 of the Project license, multiple studies have been conducted at the Lawrence and Lowell Projects to assess the movement behavior, passage route use, and survival of migratory fish species during the past three decades. Historical studies on migratory fish passage at Lawrence are described in the following sections for each major species, and summarized in Table 5.4-3.

Table 5.4-2 Lawrence and Lowell Hydroelectric Project Diadromous Fish Passage Counts, 1983 - 2022

Year	River Herring		American Shad		American Eel		Atlantic Salmon	Total	
	Lawrence	Lowell	Lawrence	Lowell	Lawrence	Lowell	Lawrence	Lawrence	Lowell
1983	4,794	--	5,629	--	--	--	114	10,537	--
1984	1,769	--	5,497	--	--	--	115	7,381	--
1985	23,112	--	12,793	--	--	--	213	36,118	--
1986	16,265	--	18,173	1,630	--	--	103	34,541	1,630
1987	77,209	--	16,909	3,926	--	--	139	94,257	3,926
1988	361,012	56,739	12,359	1,289	--	--	65	373,436	58,028
1989	387,973	137,296	7,875	940	--	--	84	395,932	138,236
1990	254,242	9,888	6,013	443	--	--	248	260,503	10,331
1991	379,588	6,920	16,098	428	--	--	332	396,018	7,348
1992	102,166	32,501	20,796	6,491	--	--	199	123,161	38,992
1993	14,027	4,315	8,599	1,679	--	--	61	22,687	5,994
1994	88,913	33,735	4,349	383	--	--	21	93,283	34,118
1995	33,425	11,848	13,861	5,255	--	--	34	47,320	17,103
1996	51	51	11,322	400	--	--	76	11,449	451
1997	403	403	22,661	4,446	--	--	71	23,135	4,849
1998	1,362	13	27,891	4,159	--	--	123	29,376	4,172
1999	7,898	2,930	56,461	16,347	--	--	185	64,544	19,277
2000	19,405	673	72,800	12,716	--	--	82	92,287	13,389
2001	1,550	58	76,717	7,740	--	--	83	78,350	7,798
2002	526	--	54,586	5,283	--	--	56	55,168	5,283
2003	10,866	194	55,620	6,580	--	--	147	66,633	6,774
2004	15,051	7,448	36,593	11,028	--	--	129	51,773	18,476
2005	99	201	6,382	716	--	--	34	6,515	917
2006	1,257	27	1,205		--	--	91	2,553	27
2007	1,169	--	15,876	1,653	--	--	74	17,119	1,653
2008	108	--	25,116	4,050	--	--	119	25,343	4,050
2009	1,456	139	23,199	2,267	--	--	81	24,736	2,406
2010	518	43	10,442	490	--	--	85	11,045	533
2011	740	228	13,835	831	--	--	402	14,977	1,059
2012	8,992	1,809	21,396	1,728	6,969	--	137	37,494	3,537
2013	17,359	13,490	37,149	9,756	915	--	22	55,445	23,246

Year	River Herring		American Shad		American Eel		Atlantic Salmon	Total	
	Lawrence	Lowell	Lawrence	Lowell	Lawrence	Lowell	Lawrence	Lawrence	Lowell
2014	57,213	23,610	38,107	3,357	1,788	166	75	97,183	27,133
2015	128,692	31,323	89,467	20,937	8,124	2,647	13	226,296	54,907
2016	417,240	287,343	67,528	11,439	1,981	328	6	486,755	299,110
2017	91,616	5,656	62,846	5,086	17,738	1,981	5	172,205	12,723
2018	449,346	311,867	28,302	14,046	267,353	*	10	745,001	325,913
2019	43,108	43,871	19,450	2,201	81,179	*	15	143,752	46,072
2020	87,150	181,979	52,239	8,449	93,058	974	1	232,448	191,402
2021	96,429	163,266	64,162	21,054	9,296	1,549	0	169,887	185,869
2022	19,319	46,783	36,731	3,919	48,648	552	0	104,698	51,254
Total	**3,223,418**	**1,416,647**	**1,177,034**	**203,142**	**537,049**	**8,197**	**3,850**	**4,941,351**	**1,627,986**

* The fish ladder at Lowell was continuously run in 2018 and 2019 as the primary upstream passage for eels; accurate quantity was unavailable without trapping.
Source: K. Webb, pers comm. 2022.

Table 5.4-3 Major Findings of Historical Fish Passage Studies Performed at and/or in the Vicinity of the Lawrence Project

Year	Study Title	Author	Major Study Objectives and Findings
1993	Lawrence Hydroelectric Project Upstream Fish Passage Efficiency Study 29 May - 16 June 1993	Normandeau Associates, Inc.	<u>Study Findings:</u> • The internal efficiency of the Lawrence fish lift for passing adult American shad was studied using underwater videography. • The system was studied in its original design configuration, i.e., with both entrance weirs operating, 200 cfs attraction flow, and a 12 inch V trap crowder gate configuration. • The internal lift efficiency for shad was 10%. However, because shad would make repeated attempts before being lifted (on average 33 attempts), the overall lift efficiency for shad was 30%. It took an average of 5 days for shad to be lifted upstream. • Internal lift efficiency for adult Atlantic salmon was 5%. • Problem areas identified in the fish lift system which may limit efficiency included the crowder gates, attraction flow entering the fishway downstream of the crowder gates, entrained air in the attraction water, and a low velocity “resting area" downstream of the crowder gates.
1994	Use of the Fish Bypass System at the Lawrence Hydroelectric Project During Spring 1993	Normandeau Associates, Inc.	<u>Major Findings:</u> • The Lawrence bypass was very effective in passing spent adult American shad downstream. Of 8,599 adult shad lifted upstream of the Lawrence Project during 1993, 1,564 (18%) passed downstream through the Lawrence bypass after completing their spawning run. The bypass was sampled only 30% of the time during this period. • Peak passage rates for river herring and salmon smolts were 33 fish/hour and 1.2 fish/hour, respectively. Passage rates for salmon were probably higher due to problems with the bypass net. • The highest passage rates for Atlantic salmon, American shad and river herring occurred when bypass flows were between 40 and 80 cfs. • Passage rates were greatest when the triple leaf gate at the entrance to the downstream bypass was set in a spill mode, which prevented fish from escaping back into the forebay and increased entrance velocities. • The Lawrence fish bypass effectively passes adult American shad and river herring and salmon smolts. • The bypass should be operated with the triple leaf gate at the entrance set in a spill mode.
1994	Use of the Fish Bypass at the Lawrence Hydroelectric Facility During Fall 1993	Normandeau Associates, Inc.	<u>Major Findings:</u> • Percent use of the downstream fish bypass by juvenile clupeids (shad, alewives and blueback herring) was conservatively estimated at 67.4% and 42.5% during two separate tests, respectively. • Juvenile clupeids moved downstream predominantly between dusk and midnight. • Juvenile clupeids began emigrating at water temperatures below 20°C, and peaked at temperatures between 12° and 10°C. Emigration continued into the second week of November. • Increases in river flow were usually followed by an increase in bypass usage. • The Lawrence fish bypass effectively passes juvenile American shad and river herring.

Year	Study Title	Author	Major Study Objectives and Findings
1996	Lawrence Hydroelectric Project Internal Fish Lift Efficiency Monitoring Program Spring 1994 and 1995	Normandeau Associates, Inc.	Major Findings: • The internal efficiency of the Lawrence fish lift for passing adult American shad was studied using underwater videography. • The system was tested using several modifications, including closing off entrance weir 2, attraction flow reduced to 100 cfs, a prototype brail floor was installed downstream of the crowder gate, the main entrance channel was split in half, and the crowder was fished with only one gate open. • Internal efficiency was much higher with the prototype modifications, reaching high as 72%. • Changing crowder gate openings did not significantly affect passage efficiency. Conclusions & Recommendations: • The lift system should be operated using weir 1 only, and weir 2 should be closed off; • The total system flow should be reduced from 200 cfs to 100 cfs, and air entrained In the attraction flow should be eliminated; • The main entrance channel should be split in half to reduce the area that shad can congregate in downstream of the crowder gate; • The crowder should be fished using a single crowder gate, keeping one gate partially open; • A brail floor should be installed between the crowder gate and entrance weir 1, to further restrict congregation of fish in that area; • A constant water flow should be provided to the hopper to prevent mortality due to overcrowding.
1996	Downstream Passage Routes of Radio-Tagged Atlantic Salmon Smolts at the Lowell and Lawrence Hydroelectric Projects on the Merrimack River	Normandeau Associates, Inc.	Study Objective: • Conduct a radio telemetry study to determine the extent to which the Lowell and Lawrence downstream fish bypass systems are used by radio-tagged Atlantic salmon smolts. Study Findings: • The fish bypass systems at both the Lowell and Lawrence Hydroelectric Projects were not very effective at passing radio-tagged Atlantic salmon smolts, and at both sites, most of the downstream passage was through the turbines. • At the Lawrence Project, only 1 (5%) of the radio-tagged salmon smolts that passed the site during this study used the bypass - the remainder went through the turbines. • Of the 22 fish that passed the Lawrence Project, 77% continued downstream movement 2 miles below the project. • Predation appears to have been a factor in the disappearance of some radio-tagged salmon released upstream of both hydroelectric sites.

5.4.3.1 American Eel Passage

The downstream passage for silver-phase American eels was evaluated by Normandeau Associates, Inc. (NAI) in 2017 (NAI 2018). As part of that evaluation, fourteen radio-tagged eels passing downstream of the Amoskeag Project (located approximately 41 miles upstream of Lawrence) were detected at Pawtucket Dam at the Lowell Project, and 13 of the 14 study eels arriving at Lowell were subsequently detected downstream at Lawrence. The transit times between Amoskeag and Pawtucket Dam ranged from 10 – 244 hours. Travel times varied for radio-tagged eels moving through the approximately 11 mile stretch of river from Pawtucket Dam to Essex Dam (range = 3.3 – 130.7 hours). Residence durations were short at both the Lawrence Project, suggesting the majority of tagged eels continued downstream rapidly following passage at Lowell.

More recently, a radio-telemetry assessment of the downstream passage success for adult silver-phase American eels was performed during the fall of 2019, mostly focused on passage at the Lowell Project (NAI 2021a). Following the release of 102 radio-tagged individuals into the Merrimack River 11 miles upstream of the Lowell impoundment, their movements were monitored using a series of stationary radio-telemetry receivers in place along the stretch of the Merrimack River from Amoskeag to downstream of the Lawrence Project. Downstream passage survival was estimated for all radio-tagged eels from the point of initial detection upstream of the Lowell Project Pawtucket Dam downstream to Lawrence. This resulted in an estimated downstream passage survival for silver-phase American eel at Lowell of 75.5%.

5.4.3.2 Alosine Passage

The upstream passage of American Shad was assessed at the Lowell Project in 2011 by Alden Research Laboratory, Inc. Adult shad passage success or impediments and overall fish migration patterns from the Lawrence Hydroelectric Project into the Lowell tailrace and into the Lowell project’s fish lift hopper was evaluated during this study. The acoustic telemetry results indicated that 57% of shad that pass the Lawrence Project reach the Lowell tailrace. Only three individual fish were detected as entering the riverside fish lift entrance. Additional analysis in 2013 by Blue Leaf Environmental concluded that shad did not spend long periods of time holding in a specific position within the tailrace or reside in areas outside of the established pattern of movement. Shad were also determined to move in a clockwise and counter-clockwise direction along both walls in the tailrace, contrary to the 2011 study which suggested shad move in a “U” shaped swimming pattern following the edges of the tailrace and the wall of the powerhouse.

An evaluation of the upstream and downstream passage effectiveness for adult alewives and American shad was conducted during the spring 2020 passage season (May through June) (NAI 2021b). Merrimack River conditions were considered normal or low for the majority of May, and low for most of the month of June. The E.L. Field Powerhouse fish passage facilities at Lowell (i.e., upstream fish lift and downstream fish bypass) were operated throughout the study period and those turbine units were in operation for the duration of the study period. Two major spill events associated with increases in river flows occurred during the early portion of the monitoring period (May 7 and May 18).

Following the release of radio-tagged individuals[10] into the Merrimack River both upstream and downstream of the Lowell facility, their movements were monitored using a series of stationary radio-telemetry receivers in place at Lowell as well as at several additional stationary monitoring receivers installed at bank-side locations upstream and downstream of the Project to inform on general movements, distribution among available passage routes, and passage success.

Of the dual-tagged[11] adult alewives released downstream (150 individuals were dual-tagged and 204 were PIT-tagged), 85% were determined to have approached Lowell and were available to assess passage effectiveness of either the E.L. Field Powerhouse fish lift or the Pawtucket Dam fish ladder. The duration of time for fish to move upstream from the release location at Lawrence to Lowell was around one day for most dual-tagged adult alewives (median = 19.6 hours). Following arrival downstream of the Lowell, 95% of dual-tagged adult alewives made at least one foray upstream towards either the fish lift or ladder. When examined by structure, 64% of dual-tagged alewives made at least one foray in the direction of the fish lift, 67% in the direction of the fish ladder, and 39% in the direction of the fish lift and fish ladder. The overall effectiveness of the E.L. Field Powerhouse fish lift at Lowell for adult alewife passage during 2020 was estimated at 43.9% and the overall effectiveness of the Pawtucket Dam fish ladder for adult alewife passage during 2020 was estimated at 75.6%.

Of the 150 radio-tagged adult alewives released upstream of Lowell, 83% approached the Pawtucket Dam and were available to evaluate downstream passage. The median upstream residence time prior to downstream passage was 2.0 days with 77% of individuals passing downstream in less than 96 hours after their arrival. The majority of individuals passed downstream of Lowell via the E.L. Field turbine units (52% of radio-tagged alewives) or utilized the downstream bypass (45% of radio-tagged alewives). Downstream passage survival was calculated as the joint probability of the three reach-specific survival estimates which encompasses the full section of the Merrimack River from Lowell downstream to Lawrence and resulted in an estimated downstream passage survival for adult alewives at Lowell of 76.5%. This estimate of downstream passage survival for adult alewives at Lowell included background mortality (i.e., natural mortality) for the species in the downstream reach, along with any tagging-related mortalities or tag regurgitations. As a result, this estimate should be viewed as a minimum estimate of total project survival (i.e., due solely to Project effects) for adult alewives at Lowell.

Of the 180 dual-tagged adult American shad released downstream of Lowell, 40% were determined to have approached Lowell and were available to assess passage effectiveness of either E.L. Field Powerhouse fish lift or the Pawtucket Dam fish ladder. An additional 47% of the dual-tagged shad exhibited upstream movement following

[10] A total of 150 adult alewives and 150 adult American shad were radio-tagged and released upstream of the Pawtucket Dam for the purposes of evaluating downstream passage. A total of 354 adult alewives and 384 adult American shad were radio-tagged and released for the purposes of evaluating upstream passage.

[11] Dual- and PIT-tagged individual fish were analyzed separately due to poor conditions at Monitoring Station 20, which precluded effected monitoring of PIT-tagged individuals.

tagging and release at Lawrence but did not move the full length of the Merrimack River reach between the two Projects. The median duration of time for shad to move upstream from the release location at Lawrence to Lowell was 64.5 hours (2.7 days). The majority of those shad made one or more forays in the direction of the fish lift. Only a single dual-tagged shad was determined to have initiated an upstream ascent into the bypassed reach and in the direction of the fish ladder and two additional PIT-tagged shad entered the fish ladder. The overall effectiveness of the E.L. Field Powerhouse fish lift at Lowell for adult American shad passage during 2020 was estimated at 30.4%.

Of the 150 radio-tagged adult shad released upstream of Lowell, 79% approached the Pawtucket Dam and were available to evaluate downstream passage. The median upstream residence time prior to downstream passage was 3.9 days with 51% of individuals passing downstream in less than 96 hours after their arrival. The majority of individuals passed downstream of Lowell via the E.L. Field Powerhouse turbine units (26%), the downstream bypass (28%), or utilized the bypassed reach (38%). Downstream passage survival was calculated as the joint probability of the three reach-specific survival estimates which encompasses the full section of the Merrimack River from Lowell downstream to Lawrence and resulted in an estimated downstream passage survival for adult shad at Lowell of 70.0%. This estimate of downstream passage survival for adult shad at Lowell included background mortality (i.e., natural mortality) for the species in the downstream reach, along with any tagging-related mortalities or tag regurgitations. As a result, this estimate should be viewed as a minimum estimate of total Project survival (i.e., due solely to Project effects) for adult American shad at the Project.

5.4.3.3 Atlantic Salmon Passage

In 1996, a radio telemetry study was performed to determine the extent to which the Lowell and Lawrence downstream fish bypass systems are used by radio-tagged Atlantic salmon smolts. The fish bypass systems at both the Lowell and Lawrence Hydroelectric Projects were not found to be effective at passing radio-tagged Atlantic Salmon smolts, and at both sites, most of the downstream passage was through the turbines. At the Lowell Project, 13% of the radio-tagged salmon used the bypass, a significant increase compared to the 4% bypass usage by radio-tagged salmon in 1990. Only four (15%) of the radio-tagged salmon that passed the Lowell Project made it downstream to the Lawrence Project’s headpond and of these, none were recorded passing the Lawrence site. Predation appears to have been a factor in the disappearance of some radio-tagged salmon released upstream of both hydroelectric sites (NAI 1996).

The effectiveness of the Lowell Project at safely passing downstream migrating Atlantic salmon smolts, as well as passage routing and turbine survival, was evaluated in 2001. Using 20 radio-tagged salmon smolts to test three bypass flows, fish bypass efficiency at the Lowell Project averaged 32% and ranged from 15% passage with a bypass flow of approximately 2% of turbine flow to 42 precent passage with approximately 4% bypass flow. No turbine-passed fish appeared to be injured as a result of turbine passage. Similar to the 1996 study, predation in the tailrace and downstream of the facility seem to have a substantial impact on the survival rates of salmon smolts emigrating past the Lowell Project (Boott Hydropower [Boott] 2001).

Efforts to restore Atlantic salmon to the Merrimack River were abandoned in 2013 after consistently low return numbers were observed, but the species may still occasionally be present in the vicinity of the Project. Since 2013, efforts have shifted towards the restoration of the remaining migratory fish species, notably river herring and shad (Cleantech Analytics 2017). Atlantic salmon counts are available for the Lawrence Project downstream passage (Table 5.4-2).

5.4.3.4 Sturgeon Passage

A biotelemetry study was conducted to track the movement of adult shortnose sturgeon (*Acipenser brevirostrum*) and subadult Atlantic sturgeon through the lower 28.5 miles of the Merrimack River between 1987 and 1990 (Kieffer and Kynard 1993). Historically, the Merrimack River supported an important sturgeon fishery between the 18th and mid-19th centuries; however, only occasional and/or anecdotal sightings were reported in the Merrimack River prior to the start of the study in 1987. Additionally, despite the fish ladder passing anadromous fish upriver of Essex Dam since 1983, no sturgeon have been reported passing through the lift.

Kieffer and Kynard (1993) found that spawning of shortnose sturgeon occurred from April to May at RM 19-22 (Haverhill area) and overwintering at RM 12-16 (the Amesbury area); Essex Dam is at RM 29 and thus movements of shortnose surgeon from their wintering to spawning and postspawning areas do not encompass the Project boundary. Additionally, despite the fish lift passing anadromous fish upriver of Essex Dam since 1983, no sturgeon have been reported passing through the lift.

The biotelemetry study by Kieffer and Kynard (1993) was designed to initially use gill nets to survey for sturgeon and then use telemetry on any found individuals to determine annual movements; identify spawning, summering, and wintering areas; and investigate the spatial distribution of sturgeon relative to salinity. Spawning was verified by sampling for drifting eggs and larvae with plankton nets. Between August 1987 and May 1990, 25 shortnose sturgeon were captured and then recaptured. Two fish were captured 6 times each and 12 fish were only captured once. Between July 1988 and June 1990, 36 Atlantic sturgeon were captured and 9 were recaptured.

The upriver spawning migration pattern of shortnose sturgeon, however, was found to depend on the distance the fish must move from wintering to spawning areas. If the distance was greater than 31 miles, most fish migrated in fall and fewer migrated in spring. If the distance was less than 15.5 miles, all fish migrated to the spawning areas in spring. Unlike shortnose sturgeon documented in other rivers, no prespawning shortnose sturgeon in the Merrimack River migrated upriver in fall and overwintered in the spawning areas, even if water temperatures were similar.

Sexually mature shortnose sturgeon began moving upriver from freshwater wintering areas to a spawning site in April, when increasing water temperatures reached 7 °C and decreasing river discharge reached approximately 570 cubic meters per second (m^3/s). Following spawning in late April or early May, fish moved downriver either to freshwater reach where they remained all year, or farther downriver to a saline reach where they remained for up to 6 weeks. After fish used the saline reach, they returned upriver to freshwater. Shortnose sturgeon were found to use two freshwater reaches and one saline reach annually.

During the three years of tracking, Atlantic sturgeon used the same general area although a different cohort of fish was tracked each year as no tagged Atlantic sturgeon were observed in the Merrimack River in successive years. Atlantic sturgeon entered the Merrimack River from coastal waters by mid-late May when increasing water temperatures reached between 14.8-19.0 °C and decreasing river discharge reached 303-675 m^3/s and occupied a saline reach with 0.0-27.5 parts per thousand (ppt). After using the same saline reach visited briefly by shortnose sturgeon in spring months, Atlantic sturgeon emigrated from the river by October when maximum river temperatures were 12.0-18.4 °C.

The within-river distribution of adult shortnose sturgeon and subadult Atlantic sturgeon in rivers of the Northeast appear to be generally correlated with salinity. Shortnose sturgeon occupy freshwater reaches and subadult Atlantic Sturgeon occupy saline reaches. In the Merrimack River, shortnose sturgeon usually occupied reaches with salinity less than 1.0 ppt and Atlantic sturgeon typically occupied reaches exposed to salinity greater than 10.0 ppt at high tide.

5.4.4 Essential Fish Habitat

In conformance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (as amended 1996) an assessment was conducted to describe Essential Fish Habitat (EFH) within the Project area. EFH is defined as those waters with substrates necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802, 50 CFR § 600.10). The Magnuson-Stevens Act requires the NMFS work with federal and state agencies, regional fishery management councils, and the fishing community to protect, conserve, and enhance EFH.

A desktop review of the NMFS EFH mapper (NOAA 2023a) was used to develop a list of EFH types, habitat areas of particular concern (HAPC), and species of interest based on the New England/North Atlantic Region. The Lawrence Project boundary within the Merrimack River contains EFH Atlantic salmon. No HAPC were identified within the Project boundary.

EFH for the freshwater life history stages of Atlantic salmon includes all rivers, streams, lakes, and ponds in designated drainage systems from Connecticut to Maine, including the Merrimack River watershed (New England Fishery Management Council [NEFMC] 1998). All six life stages of Atlantic salmon (eggs, larvae [alevins], recently-hatched juveniles [fry], older juveniles [parr and smolts], spawning adults, and spent adults [kelts]) utilize freshwater habitats either exclusively or at some point during their life history. Intra-gravel habitat in the stream bed is essential for Atlantic salmon eggs and alevins, whereas EFH for the juveniles and spawning adults is the stream itself. Only parr and smolts utilize non-riffle and run habitats. Freshwater spawning and rearing EFH includes riffle and run habitats in shallow, well-oxygenated, freshwater streams with gravel and/or rocky substrates, as well as pools and vegetated riverine areas of lower velocity. These habitats occur in a range from first order streams (headwaters) to some third or fourth order streams with low temperatures. EFH for migrating smolts and kelts includes streams, rivers, and estuaries from first to fifth order, as well as lakes, ponds, and impoundments.

A variety of riverine, lacustrine, estuarine, and coastal marine habitats are used by older juvenile Atlantic salmon during their downstream migration to the sea, by mature adult salmon during their upstream spawning migration, and by kelts following spawning, before they return to the ocean (NEFMC 1998). EFH for migrating smolts and kelts includes streams, rivers, and estuaries from first to fifth order, as well as lakes, ponds, and impoundments, all are generally characterized by salinities below 25 ppt.

5.4.5 Temporal and Spatial Distribution/Life History Information of Fish Communities

The life history strategies of fish species (such as, but not limited to, the timing and habitat requirements of spawning, hatching, recruitment, dispersal, feeding) determines the behavior and movement over the life of a fish. The Merrimack River is home to a diverse assemblage of fish species, including both cold water and warm water species, and provides a migratory corridor for many diadromous species. The Merrimack River basin is home to approximately 50 species of fish, 9 of which are anadromous (Stolte 1982, Technical Committee 1997). The slower-moving, ponded reaches within the basin contain the majority of the warm water species, while those areas having steeper gradients contain the majority of the cold-water species.

This section details the life history characteristics of several of the most common species or species of interest (such as sportfish) in the Lower Merrimack River in the vicinity of the Lawrence Project.

5.4.5.1 Largemouth Bass

Largemouth bass are native to the eastern United States but have been introduced widely as an important sportfish species (Stuber et al. 1982). The preferred habitat for largemouth bass includes lacustrine environments with an ample littoral zone, but also open water and deeper areas for predation on forage fish and overwintering. They are also found in riverine habitats of slow-moving rivers or in pools of streams with soft bottoms, some aquatic vegetation, and clear water.

Spawning typically begins when water temperature reaches 12-15.5 °C in May and June (Stuber et al. 1982). Gravel substrate is needed for spawning habitat, though other substrates such as vegetation, roots, sand, mud, or cobble may also be used. Males guard the nest and fan the eggs until hatching after approximately 3 to 4 days; larvae are also guarded until they disperse as fry after about a month. Fry feed mainly on microcrustaceans and small aquatic insects before shifting to mostly insects and small fish as juveniles, then primarily fish, crayfish, and other small animals as adults. Largemouth bass mature and spawn as early as one year of age, however, maturity can be delayed in northern populations.

5.4.5.2 Smallmouth Bass

Smallmouth bass are native to freshwaters of eastern-central North America including the Ohio, Tennessee, upper Mississippi basins, Saint-Lawrence River, and Great Lakes, although they been introduced throughout North America (Brown et al. 2009). Smallmouth bass inhabit large lakes (> 100 acres), where they are often associated with littoral drop-offs and substrates comprised of gravel and cobble, and wide rivers or streams (> 10.5 meters wide) with cool and clear water of moderate current. Areas of abundant shade and cover, substrates of gravel and other large materials, and large pools are also utilized by smallmouth bass. In the northern portions of their range, smallmouth bass spawn in June or July. In lake environments, nests are constructed near the shoreline; in rivers and streams, nests are typically constructed downstream of large boulders or other obstructions that offer protection against strong currents. Males begin constructing nests when water temperatures reach 12.5°C and spawning occurs at 16°C. Eggs hatch after 4 to 10 days and larvae remain at the nest for 10 to 12 days until the yolk is absorbed; however, nests may be abandoned if water temperatures drop below 14°C. Juvenile prey primarily on zooplankton until they are large enough to consume crayfish and small fish. Adults consume mostly fish, insects, and crayfish.

5.4.5.3 Northern Pike

Northern pike are widely distributed through New England in lakes, ponds, and rivers, and are typically associated with aquatic vegetation in clear, quiet, slow-moving water between 15-18°C; however, they can tolerate a range of temperatures and some turbidity (USFWS 2023a). The diet of northern pike consists primarily of other fishes, including other pikes, but they may also consume ducks, mice, rats, frogs, snakes, and crayfish.

Spawning migrations occur in later winter or early spring, when adults migrate into shallower tributary streams, flooded grassy lowlands, or lake shallows (USFWS 2023a). Spawning occurs in April and May when water temperatures are around 4-10°C. Northern pike do not construct nests but females do look for vegetation amongst which to spread adhesive eggs. After spawning, adults return to deeper waters. Eggs hatch after approximately 10-14 days and fry remain in the spawning area until they reach 2-3 inches long when they will move to deeper habitats. Fry consume phytoplankton and aquatic insects, but will begin consuming small fishes once they are large enough.

5.4.5.4 Yellow Perch

Yellow perch are a temperate species with a range that extends from west central Canada and the Hudson Bay, east to New Brunswick, down to South Carolina, and west to Kansas (Animal Diversity Web [ADW] 2023). Yellow perch are primarily found in lakes but sometimes occur in impoundments of larger rivers. Yellow perch require clear waters and are intolerant of excessive turbidity; however, they have a high tolerance for low oxygen conditions. They typically inhabit waters with moderate temperatures and avoid both cold deep water and warm surface waters during the summer. Young perch generally inhabit shallower water than adults, but as temperatures increase, they all move to cooler water. Overwintering occurs in deeper waters and spring spawning occurs in shallow water areas.

Reproductive maturity is typically reached between the ages of 2 and 4, with spawning occurring in the spring (April through early May) when water temperatures reach 7.2 – 11.1 °C (ADW 2023). Females release a gelatinous strand of eggs which may be fertilized by several males before settling to the streambed or becoming entangled in vegetation or debris (The Fish Site [TFS] 2007). Fecundity varies with size, age, and nutritional status, but most females lay about 120 to 250 eggs per millimeter of their length. Eggs hatch within 8-10 days, after which larvae first appear nearshore before becoming pelagic (ADW 2023). Young yellow perch feed on zooplankton, then eventually benthic invertebrates, and other fishes as they age.

5.4.5.5 Walleye

Walleye distribution was and is largely influenced by glacial events and stocking, and this species is currently found in freshwater river systems and lakes throughout North America (Bozek et al. 2011). They are found in both rivers and lakes varying in geography, geology, and land use across a wide latitudinal range, which largely affects growing season and life history strategies. Habitat preference is generally given to large (>100-hectare), cool-water bodies with high turbidity, gravel and/or sandy substrate, extensive littoral areas, and ample cover such as boulders, logs, and vegetation (Scott and Crossman 1973; McMahon et al. 1992). In lake environments, Walleye can coexist with other predatory fishes such as northern pike, muskellunge (*Esox masquinongy*), lake trout (*Salvelinus namaycush*), and smallmouth bass; however, in smaller lakes competition may be intense among other predatory species (Bozek et al. 2011).

In northern latitudes, walleye spawn in spring when water temperatures range between 5-7°C and may begin spawning under ice or just following ice-out (Bozek et al. 2011). In lake environments, warm water along the bottom of shallow areas or warmer water from tributary streams mixes with lake water, acting as a stimulus to initiate spawning movements and migration to spawning rivers, although there are also lake-resident and river-resident populations. Spawning typically occurs along shorelines in shallow, mid-lake reefs or in rapids and riffles of rivers where there is adequate flow and oxygen for egg development. Walleye are broadcast spawners and adhesive eggs sink into crevices within the substrate. No parental care is provided, and first-year survival is generally low (< 1%). After hatching, larvae are negatively buoyant and can only withstand minimal water velocities. Feeding on small zooplankton begins before the yolk sac is completely absorbed. Once free-swimming, young walleye move into open water and feed on zooplankton, then eventually benthic invertebrates and other fishes as they grow of size.

5.4.5.6 Atlantic Salmon

Atlantic salmon are an anadromous species native to most coastal rivers northeast of the Hudson in New York; however, overfishing and dams that impede their migratory pathways have greatly reduced populations (NOAA 2023b). The last remaining wild anadromous populations of Atlantic salmon in the U.S. are found in a few rivers in Maine, comprising the Gulf of Maine Distinct Population Segment which is listed as endangered under the Endangered Species Act (ESA). Landlocked populations are typically found in large, glacial lakes with deep, cold water in the summer and tributary rivers or streams with riffle/pool habitat and gravel substrate for spawning.

Anadromous Atlantic salmon have a complex life cycle that begins with spawning and juvenile rearing in freshwater rivers (NOAA 2023b). After one to three years, juveniles outmigrate to the ocean, where adults remain until returning to their natal rivers to spawn. Peak spawning typically occurs in late October and November, with optimal temperatures ranging from 4 to 10°Celsius. Females create depressions in gravel streambeds (redds) downstream of riffles where eggs are deposited. Eggs hatch in late March and April, and hatchlings known as alevins remain in the redd typically until mid-May until they emerge as fry once the yolk-sac has been absorbed. In freshwater, fry feed on plankton but as they grow their diet shifts to aquatic insects and small fish. In the ocean, smolts and adults feed on insects, squid, shrimp, and fishes such as herring, sand lances, and capelin. Habitat for early life stages generally consists of relatively large and cool rivers with extensive gravel substrate.

5.4.5.7 American Eel

American eel (*Anguilla rostrata*) is a catadromous species with a complex life cycle. Adults spend their life in freshwater, migrating to the Sargasso Sea in the western Atlantic Ocean at sexual maturity, which can be between 5 to 20 years old (Lee 1980, Simon 1999, Smith 1997). The American eel is described as being a panmictic species, with all members mating as a collective breeding population. Spawning typically occurs during autumn or winter, after which the adult eels die. Eels hatch from eggs and the larvae are carried to the Atlantic coast after about one year of drifting through currents, during which time they transform into the “glass eel” stage. When the glass eels reach the estuary along the Atlantic coast, they become pigmented “elvers;” many of which remain in the estuary, but others continue upriver to freshwater. The young larvae spend the majority of this life stage in close proximity to shelter such as plant masses, burrows, snags, and tubes (Fahay 1978; Van Den Avyle 1984; COSEWIC 2006). After several months, they enter into the “yellow eel” stage, an adult form that is sexually immature. During this phase they are primarily nocturnal carnivores feeding on insects, fish, fish eggs, crabs, worms, clams, frogs, and dead animal matter (Lookabaugh and Angermeier 1992).

As adults, American eels prefer to live in freshwater streams with continuous flow or in muddy, silt bottom lakes. While small eels are found in faster flowing water, larger eels are associated with slow, deep, and muddy habitats (Fahay 1978; Van Den Avyle 1984; Meffe and Sheldon 1988). The American eel possesses the ability to breathe through its skin, allowing for travel over land and to move around barriers in streams. American eels can tolerate a wide range of temperatures between 4 and 25°C but are sensitive to low dissolved oxygen levels (Baensch and Riehl 1995). American eels reach reproductive maturity based on size, regardless of age. Individuals that live primarily in freshwater will grow slower than those that live in brackish waters, meaning freshwater dwelling individuals will take longer to reach sexual maturity.

5.4.5.8 Atlantic Sturgeon

Atlantic sturgeon are widely distributed along the Atlantic Coast of the United States, occurring in major estuaries and riverine environments within their respective native ranges, or Distinct Population Segments (DPS). The ESA listing status for sturgeon is based on their DPS. Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs are listed as federally endangered; those originating from the Gulf of Maine DPS are listed as federally threatened (NOAA 2023b). Currently, a portion of the Project boundary is listed by NOAA as Critical Habitat for Atlantic sturgeon. The critical habitat for Atlantic sturgeon includes waters “from the Essex Dam (also known as the Lawrence Dam) downstream to where the main stem river discharges at its mouth into the Atlantic Ocean” (NOAA 2016).

Atlantic sturgeon utilizing the Merrimack River as spawning habitat most likely would have originated from the Gulf of Maine DPS, which includes 152 miles of aquatic habitat (NOAA 2023b). The Gulf of Maine DPS incudes all anadromous Atlantic sturgeon spawned in the watersheds from the Maine/Canada border and extending southward to include all associated watersheds draining into the Gulf of Maine as far south as Chatham, MA (NMFS 2017).

The Atlantic sturgeon is a long-lived, late-maturing, estuarine-dependent, anadromous species. Adults spend most of their life in the marine environment but migrate upriver in the spring/early summer (April-May in mid-Atlantic systems) to spawn. Atlantic sturgeon spawning is believed to occur in flowing water between the salt front and fall line of large rivers, where optimal flows are 46–76 centimeters per second with depths of 11–27 meters. Atlantic sturgeon likely do not spawn every year; multiple studies have shown that spawning intervals range from 1–5 years for males and 2–5 for females. Sturgeon eggs are highly adhesive and are deposited on the bottom substrate, usually on hard surfaces (e.g., cobbles).

Eggs typically hatch in 4–7 days depending on temperature (Gilbert 1989; Hildebrand and Schroeder 1928). At hatching, Atlantic sturgeon larvae are large bodied (e.g., 7.8 millimeters [mm] total length) and are assumed to undertake a demersal existence in the same areas where they were spawned (Smith et al. 1980, Bath et al. 1981, Atlantic States Marine Fisheries Commission [ASMFC] 2012). Following yolk-sac absorption, larvae move downstream to rearing grounds. During the day, larvae use benthic structure (e.g., gravel matrix) as refugia. During the latter half of migration when larvae are more fully developed, movement to rearing grounds occurs both day and night. Late-stage larvae transition into the juvenile phase as they move downstream into brackish waters and take up residence in estuarine waters (ASMFC 2012). Snyder (1988) reports that Atlantic sturgeon complete yolk absorption by 13–14 millimeter standard length in 6-7 days.

Subadult Atlantic sturgeon (greater than 50 centimeters but not yet sexually mature) swim among coastal and estuarine habitats, undergoing rapid growth. These migratory subadults, as well as adult sturgeon, are normally captured in shallow (10–50 meters) nearshore areas dominated by gravel and sand substrate. Despite extensive migration in coastal waters, Atlantic sturgeon return to their natal river to spawn as indicated from tagging records and the relatively low rates of gene flow reported in population genetic studies (Atlantic Sturgeon Status Review Team [ASSRT] 2007).

5.4.6 Aquatic Macroinvertebrates

Aquatic benthic macroinvertebrates are small aquatic invertebrate animals and the aquatic larval stages of insects. They include dragonfly and stonefly larvae, snails, worms, and beetles. They lack a backbone, are visible without the aid of a microscope, and are found in and around water bodies during some period of their lives. Benthic macroinvertebrates are often found attached to rocks, vegetation, logs and sticks, or burrowed into the bottom sand and sediments (USEPA 2022c). These organisms provide a link between a system's primary productivity and its aquatic consumers through the conversion of plant biomass to consumable energy.

Freshwater macroinvertebrates serve a number of roles in riverine ecosystems, including acting as a vital food source for other organisms, breaking down and cycling organic matter and nutrients, and serving as bioindicators for ecosystem health (Voshell 2002). Macroinvertebrates exhibit a range of stress tolerance to pollution, habitat modification, or severe natural events, and the presence of certain taxa can serve as an indicator for local water quality condition and stream health. Specifically, the species richness and abundance of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) taxa can indicate the water quality of a stream; the taxa richness of EPT taxa generally decreases with decreasing water quality (USGS 2002). Additionally, EPT species are high-quality forage for a variety of freshwater fish species.

While information on aquatic macroinvertebrates of the Merrimack River in the vicinity of the Lawrence Project is not readily available, biomonitoring of aquatic benthic macroinvertebrate and habitat assessments were conducted as part of the MADEP Division of Watershed Management's 2004 Merrimack River Watershed Assessments. A total of 13 tributary streams were sampled following the USEPA Rapid Bioassessment Protocols for wadeable streams and rivers. Fish Brook and Bartlett Brook are hydrologically connected to the Project impoundment approximately 4.0 and 2.9 river miles upstream of the Essex Dam. Only 4 of the 13 streams were found to be "non-impacted" and support a balanced and diverse benthic aquatic community. The remaining eight streams were considered "slightly" or "moderately impacted" a result of habitat degradation and/or nonpoint source-related water quality impairment. A summary of the benthic taxa collected is described in Table 5.4-4.

Table 5.4-4 Taxa Lista and Counts, Functional Feeding Groups, and Tolerance Values for Macroinvertebrates Collected from Stream Sites During the 2004 Merrimack River Watershed Survey – July and August 2004

Taxon	FFG[1]	TV[2]	South Branch Sougegan River[3]	Richardson Brook	Trull Brook	Martins Pond Brook	Powwow River	Fish Brook	Creek Brook	Bartlett Brook	Peppermint Brook	Black Brook	Bridge Meadow Brook	Tadmuck Brook	Bennets Brook
Laevapex fuscus	SC	7					4								
Pseudosuccinea columella	GC	6												1	
Planorbula armigera	SC	6						1							
Pisidiidae	FC	6			1		2	1				1	1	1	5
Enchytraeidae	GC	10					1								
Nais behningi	GC	6													5
Nais communis	GC	8						11							
Pristinella osborni	GC	10						1							
Limnodrilus hoffmeisteri	GC	10				1									
Tubificidae IWB	GC	10					1				3				
Tubificidae IWH	GC	10				1									
Lumbriculidae	GC	7			2		1	4	2		1				6
Erpobdella sp.	PR	8				1									
Caecidotea sp.	GC	8			4					1					
Caecidotea communis	GC	8				15					2			4	
Caecidotea racovitzai racovitzai	CG	8				30						5			
Crangonyx sp.	GC	6		3	1	3		3		2					
Gammarus sp.	GC	6			7	1	5		2	5	38	56			
Hydrachnidia	PR	6		1										1	
Baetidae	GC	4							3	1					
Baetis (subeq. term.) sp.	GC	6	1				3								
Leptophlebiidae	GC	2													3
Boyeria vinosa	PR	2												1	

Taxon	FFG[1]	TV[2]	South Branch Sougegan River[3]	Richardson Brook	Trull Brook	Martins Pond Brook	Powwow River	Fish Brook	Creek Brook	Bartlett Brook	Peppermint Brook	Black Brook	Bridge Meadow Brook	Tadmuck Brook	Bennets Brook
Plecoptera	GC	3												5	
Acroneuria sp.	PR	0	2					5					1		
Nigronia serricornis	PR	0	2					2		2		1	1		1
Adicrophleps hitchcocki	SH	2												1	
Glossosoma sp.	SC	0			1										
Cheumatopsyche sp.	FC	5	3	9	7	24	5	1	4	6	15	9	8	2	7
Diplectrona sp.	FC	0							3					1	
Hydropsyche sp.	FC	4			47								40		
Hydropsyche betteni	FC	6	16	19		4	37	16	32	17	10	8		17	16
Hydropsyche morosa gr.	FC	6												5	
Ceraclea sp.	GC	3		1											
Oecetis sp.	PR	5		2											
Limnephilidae	SH	4												1	
Pycnopsyche sp.	SH	4								2					
Psilotreta sp.	SC	0				1		2							
Chimarra sp.	FC	4	10	28			10		20	10		2	18		12
Wormaldia sp.	FC	0												1	
Lype diversa	GC	2			1										
Rhyacophila sp.	PR	1												1	
Neophylax sp.	SC	3							1						
Microcylloepus pusillus	GC	3		8			8	1							
Oulimnius latiusculus	SC	4	1	2				1	2						
Promoresia sp.	SC	2		2					1						
Stenelmis sp.	SC	5		4		3	11	10	8	13	4		12	24	7
Stenelmis crenata	SC	5			10							19			

Taxon	FFG[1]	TV[2]	South Branch Sougegan River[3]	Richardson Brook	Trull Brook	Martins Pond Brook	Powwow River	Fish Brook	Creek Brook	Bartlett Brook	Peppermint Brook	Black Brook	Bridge Meadow Brook	Tadmuck Brook	Bennets Brook
Ectopria nervosa	SC	5												1	
Psephenus herricki	SC	4		2				3	5	7					
Bezzia sp.	PR	6													1
Probezzia sp.	PR	6													2
Microtendipes pedellus gr.	FC	6					1								
Microtendipes rydalensis gr.	FC	6		5				1		3					
Paratendipes sp.	GC	6		1											
Polypedilum flavum	SH	6		10	7	16	4	6	4	13	16		18		4
Polypedilum illinoense	SH	6			1										
Polypedilum scalaenum gr.	SH	6												1	
Xenochironomus sp.	PR	0				1									
Micropsectra sp.	GC	7				3									
Micropsectra polita gr.	GC	7						4			4	1			
Paratanytarsus sp.	FC	6													1
Rheotanytarsus exiguus gr.	FC	6	13				11				2		1		
Rheotanytarsus pellucidus	FC	5	5								1			2	1
Tanytarsus sp.	FC	6	12											2	1
Diamesinae	GC	2								1					
Diamesa sp.	GC	5							1						
Orthocladiinae	GC	5											1		
Brillia sp.	SH	5			1										
Cardiocladius sp.	PR	5													1
Eukiefferiella claripennis gr.	GC	8			1										
Orthocladius sp.	GC	6					1								2
Parametriocnemus sp.	GC	5	1	2	1			4			1	1		1	11

Taxon	FFG[1]	TV[2]	South Branch Sougegan River[3]	Richardson Brook	Trull Brook	Martins Pond Brook	Powwow River	Fish Brook	Creek Brook	Bartlett Brook	Peppermint Brook	Black Brook	Bridge Meadow Brook	Tadmuck Brook	Bennets Brook
Rheocricotopus sp.	GC	6		1											
Tvetenia paucunca	GC	5	4		1			8	3	11		1	1	12	1
Tanypodinae	PR	7													1
Conchapelopia sp.	PR	6					1	1		2				1	3
Nilotanypus sp.	PR	6											1		
Thienemannimyia sp.	PR	6	1							1	1			1	2
Clinocera sp.	PR	6													4
Hemerodromia sp.	PR	6	1			1		2					1		
Simulium sp.	FC	5	2	1	3		2	11	4	6				8	12
Antocha sp.	GC	3									2				
Dicranota sp.	PR	3	7											3	
Tipula sp.	SH	6										1			1
Total number of organisms			**97**	**101**	**96**	**105**	**108**	**99**	**95**	**103**	**100**	**105**	**104**	**98**	**110**

[1] Functional Feeding Group (FFG): the feeding habit of each taxon. SH-Shredder; GC-Gathering Collector; FC-Filtering Collector; SC-Scraper; PR-Predator.
[2] Tolerance Value (TV): an assigned value used to calculate the biotic index. Tolerance values range from 0 for organisms very intolerant of organic wastes to 10 for organisms very tolerant.
[3] Reference Station.

5.4.7 Freshwater Mussels

Limited information is available describing the freshwater mussel community of the lower portion of the Merrimack River in the vicinity of Lawrence; however, there are 12 species of freshwater mussels representing 2 families in Massachusetts, of which 6 are protected under the Massachusetts Endangered Species Act (MESA) (Massachusetts Department of Environmental Quality Engineering [MDEQC] 1986). The Margaritiferidae family is represented by a single species, the freshwater pearl mussel (*Margaritifera margaritfera*), which is widespread throughout New England. The other family is Unionidae, of which 11 species live in Massachusetts and comprise a zoogeographical assemblage called the Atlantic Slope fauna. The freshwater mussels of Massachusetts are further described in Table 5.4-5.

Table 5.4-5 Freshwater Mussels of Massachusetts

Common Name	Scientific Name	Habitat Requirements
freshwater pearl mussel	*Margaritifera margaritifear*	Creeks to large rivers with moderate gradient with clean, mixed stable substrate
eastern elliptio	*Elliptio complanta*	Stable shoals of lakes or river-lakes with substrates composed of clay mixed with marl and fine sand
dwarf wedgemussel	*Alasmidonta heterodon*	Waters with slow to moderate currents that have muddy sand to sand/gravel substrate
triangle floater	*Alasmidonta undulata*	Smaller streams to large rivers with low gradients and coarse to fine gravel with sand and mud
brook floater	*Alasmidonta varicosa*	Creeks and small rivers with riffles and moderate rapids with sandy shoals, or riffles with gravel substrates
eastern floater	*Pyganodon cataracta*	Found in variety of habitats including small streams, rivers, ponds, and lakes; usually confined to slow-moving water with sandy or muddy substrates
alewife floater	*Anodonta implicata*	Coastal streams and lakes in sand and gravel substrates with low to moderate gradient
creeper	*Strophitus undulatus*	Found in riffles and pools of streams and rivers of moderate gradient
eastern pondmussel	*Ligumia nasuta*	Protected areas of coastal lakes and ponds, slackwater areas of rivers, slow moving streams, and canals in a wide range of substrates
tidewater mucket	*Leptodea ochracea*	Ponds, canals, and slow-moving sections of rivers, including impoundments, with a variety of substrates such as silt, sand, gravel, cobble, and occasionally clay

Common Name	Scientific Name	Habitat Requirements
yellow lampmussel	*Lampsilis cariosa*	Larger streams and rivers with sand and gravel with moderate current
eastern lampmussel	*Lampsilis radiata radiata*	Smalls streams, large rivers, ponds, and lake with sand or gravel substrate

Many species of freshwater mussels rely on a host species as a part of their life cycle. During the larval phase, mussels are expelled into the water column and must attach to a host (typically a fish) as an external parasite. Some mussel species rely on specific fish species for the parasitic phase, but few mussel-host relationships are currently known.

5.4.8 Aquatic Invasive Species

Aquatic invasive species (AIS) are non-indigenous plants and animals that were introduced to an area outside of their native range and are now causing ecological or economic harm. AIS typically have few or no natural predators in their introduced environments, which results in rapid population growth that quickly outcompetes native species. Invasive species can be introduced intentionally for management objectives (e.g., grass carp [*Ctenopharyngodon idella*] for the control of aquatic invasive weeds), illegally (e.g., angler-introduced sportfish species), or accidentally (e.g., invasive plant parts or mussels on boats and boat trailers).

The Merrimack River supports a relatively large number of invasive species. The Invasive Plant Atlas of New England (IPANE), NHDES, and the MRWC identified the species listed in Table 5.4-6 as potentially occurring in vicinity of the Lowell Hydroelectric Project located approximately 11 miles upstream of the Lawrence Project.

Table 5.4-6 Aquatic Invasive Species Likely to Occur in the Lawrence Project Vicinity

Common Name	Scientific Name
common reed	*Phragmites australis*
curly-leaved pondweed	*Potamogeton crispus*
Eurasian water milfoil	*Myriophyllum spicatum*
Carolina fanwort	*Cabomba caroliniana*
purple loosestrife	*Lythrum salicaria*
twoleaf milfoil	*Myriophyllum heterophyllum*
European water chestnut	*Trapa natans*
yellow iris	*Iris pseudacorus*
European water-clover	*Marsilea quadrifolia*
watercress	*Nasturtium officinale*
reed canarygrass	*Phalaris arundinacea*
yellow iris	*Iris pseudacorus*
flowering rush	*Butomus umbellatus*
yellow floating heart	*Nymphoides peltata*
Asian clam	*Corbicula fluminea*

5.5 Wildlife and Botanical Resources

5.5.1 Common Resource Areas

The Lower Merrimack River corridor, including the Lawrence Project, provides habitats for diverse botanical and wildlife species. Diverse habitats such as wetlands, forests, grasslands, and the river offer essential habitats for a variety of mammals, birds, reptiles, and amphibians in sufficient quantity and quality to ensure sustainable conditions for these species (LMRLAC 2008). The quality and quantity of these habitats have changed over time. Since early European settlement, forests were cleared for agricultural lands and then heavily modified for industrial purposes. Eventually, these agricultural lands were abandoned, and natural forest succession replaced much of them (NHDFG 2015). Current botanical resources that provide wildlife habitat along the Merrimack River are a patchwork of forests comprised of vegetation typical to the Northeast and grasslands that are agricultural remnants or associated with modern development.

The Project is situated in the Northeastern Highlands ecoregion and the Northeastern Coastal Zone. The north and westerly portions of the Merrimack River watershed are in the Northeastern Highlands, characterized by low mountains and ungrazed forests and woodlands. The southern part of the river's watershed is in the Northeastern Coastal Zone, characterized by modified woodlands and forests. Geographically, the Project falls under the New England Physiographic Province umbrella. The Taconic Mountains to the West, the Green Mountains to the Northwest, and the White Mountains to the North-Northeast all factor into water movement within the Merrimack River watershed.

Specifically, the Lawrence Project is in the Seaboard Lowlands section of the New England Physiographic Province. The Seaboard Lowlands Section is generally lower in elevation and less hilly than the adjacent New England Upland Section. In the vicinity of the Project, the Merrimack River flows through a region of rapid population growth and development heavily influenced by the Lawrence metropolitan area. The local relief in the Merrimack River Valley in the Project vicinity is generally characterized as low, open hills.

The Project is in a more urbanized area with medium to high-density development along the shores of the Merrimack River. The City of Lawrence is heavily urbanized, with many businesses capitalizing on the City's recent renewal.

5.5.2 Land Use

There are several land use classifications within the Project boundary, including developed land, woody wetlands, and deciduous forest (see Section 5.1.1). These land use classifications are described in more detail below.

5.5.2.1 Developed

Developed, Open Space areas account for 4.51% of land cover (12.7% of land use) in the Project boundary and are described as a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than

20% of total cover. Generally, these areas most commonly include large-lot, single-family housing units; parks; golf courses; and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes (National Land Cover Database [NLCD] 2019).

Developed, Low Intensity areas account for 6.12% of land cover (17.2% of land use) in the Project boundary and are described as a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49% of total cover. These areas most commonly include single-family housing units (NLCD 2019).

Developed, Medium Intensity areas account for 5.52% of land cover (15.5% land use) in the Project boundary and are described as a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79% of total cover. These areas most commonly include single-family housing units (NLCD 2019).

Developed, High Intensity areas account for 3.58% of land cover (10.1% of land use) in the Project boundary and are described as highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/ industrial. Impervious surfaces account for 80 to 100% of the total cover (NLCD 2019).

5.5.2.2 Wetlands and Forests

Woody Wetlands account for 8.30% of land cover (23.4% land use) within the Project boundary. Woody wetlands are described as areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water (NLCD 2019).

Emergent Herbaceous Wetlands account for 0.49% of land cover (1.4% land use) within the Project boundary. Emergent herbaceous wetlands are described as areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water (NLCD 2019).

Deciduous Forest accounts for 4.82% of land cover (13.6% land use) within the Project boundary. Deciduous forests are described as areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change (NLCD 2019).

Evergreen Forest accounts for 0.73% of land cover (2.1% land use) within the Project boundary. Evergreen forests are described as areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage (NLCD 2019).

Mixed Forest accounts for 0.63% of land cover (1.8% land use) within the Project boundary. Mixed forests are described as areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover (NLCD 2019).

5.5.2.3 Herbaceous

Grassland/Herbaceous vegetation accounts for 0.53% of land cover (1.5% land use) within the Project boundary. Grassland and herbaceous land is described as areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing (NLCD 2019).

5.5.2.4 Barren Land

Barren Land accounts for 0.17% of land cover (0.5% land use) within the Project boundary. Barren land is described as areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover (NLCD 2019).

5.5.2.5 Shrubland

Shrub/Scrub accounts for 0.01% of land cover (0.04% land use) within the Project boundary. Shrub/scrub land is described as areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions (NLCD 2019).

5.5.2.6 Planted/Cultivated

Pasture/Hay accounts for 0.13% of land cover (0.4% land use) within the Project boundary. Pasture and hay land is described as areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation (NLCD 2019).

5.5.3 Natural Communities

Natural communities within the Merrimack River corridor vary between urban and non-urban areas. The vicinity of the Lawrence Project is dominated by hemlock-hardwood-pine, Appalachian oak pine, grasslands, major-river floodplain forest, and ruderal herbaceous/scrub-shrub/forested (NHDFG 2015). These habitat types are discussed below in further detail.

5.5.3.1 Hemlock-Hardwood-Pine Forest

The hemlock-hardwood-pine forest is a widespread habitat in the Lower Merrimack River corridor. It is a transitional forest between Appalachian oak-pine and northern hardwood found at elevations less than 400 feet and more significant than 1,500 feet, respectively. White pine (*Pinus strobus*) and eastern hemlock (*Tsuga canadensis*) are the dominant trees. Still, American beech (*Fagus grandifolia*) and patches of sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), and red oak (*Quercus rubra*) contribute to a variable species mix of this forest type. The understory contains small trees and shrubs such as witch hazel (*Hamamelis virginiana*), maple-leaved viburnum (*Viburnum acerifolium*), black birch (*Betula nigra*), black cherry (*Prunus serotina*), and ironwood (*Ostrya virginiana).* Typical plants found on the forest floor include starflower (*Trientalis borealis*), Canada mayflower (*Maianthemum canadensis*), and wild sarsaparilla (*Aralia nudicaulis*).

Most white pine stands grown from abandoned pastures are examples of this type of hemlock-hardwood pine forest habitat. White pine is replaced by hemlock or hardwoods over time on fertile soils. Older forests that have succeeded to later stages contain patches of larger diameter trees (>18 inches) hemlock or beech in the canopy, layers of young trees and shrubs in the understory, many standing dead trees, and abundant decaying wood on the forest floor. Large-sized cavity trees, pockets of wetlands, patches of acorn-rich oaks, seeps, and tall pine trees make some patches of this forest type especially rich for wildlife (NHDFG 2015; Swain and Kearsley 2001).

5.5.3.2 Appalachian Oak-Pine Forest

Appalachian oak-pine forests, with their abundance of nut-bearing oaks such as red oak, white oak (*Quercus alba*), black oak (*Q. velutina*), and hickories such as shagbark (*Carya ovata*), pignut (*C. glabra*), and sweet pignut (*C. ovalis*), provide a rich food source for wildlife such as ruffed grouse (*Bonasa umbellus*), turkey (*Meleagris gallopavo*), gray squirrels (*Sciurus carolinensis*), and eastern chipmunks (*Tamias striatus*). Common understory shrubs and smaller trees of this forest type include black birch (*Betula lenta*), bigtooth aspen (*Populus grandidentata*), sassafras (*Sassafras albidum*), and yellow birch (*Betula alleghaniensis*). Blueberries (*Vaccinium angustifolium* and *V. pallidum*), black huckleberry (*Gaylussacia baccata*), sheep laurel (*Kalmia angustifolia*), and Pennsylvania sedge (*Carex pennsylvanica*) are typical understory plants. Raptors such as the northern goshawk (*Accipiter gentilis*) feed on small mammals and find nesting and perching sites in white pines in the tree canopy. White pines adjacent to the Merrimack River provide critical nest and perch sites for bald eagles (*Haliaeetus leucocephalus*), great blue herons (*Ardea herodias*), and osprey (*Pandion haliaetus*) (NHDFG 2015).

Many stands of Appalachian oak-pine forest are of the same age, approximately 80-100 years. They grew after farms were abandoned throughout the last century. Many wildlife species in this forest type are attracted to patches of old or young trees within the larger forested landscape. Historically, this region's dry soils and warm temperatures have caused occasional low-intensity fires to burn in these forests. Without fire, these forests have white pine, hemlock, sugar maple, and birch species (*Betula* spp.) rather than nut-bearing trees. Mature Appalachian oak-pine forests may also be denser due to a lack of low-ground fires to maintain an open understory (NHDFG 2015).

5.5.3.3 Grasslands

The most common grassland habitats in the Lower Merrimack River corridor are agricultural fields such as hayfields, pastures, and fallow fields. Grassland vegetation is a mixture of grass species or a combination of grasses, sedges, and wildflowers. Most plants found in grasslands are non-native grasses introduced for agricultural use. These include timothy grass (*Phleum pretense*), Kentucky bluegrass (*Poa pratensis*), orchard grass (*Dactylis glomerata*), and perennial ryegrass (*Lolium perenne*). Common native plants include big bluestem (*Andropogon gerardi*), little bluestem (*Schizachyrium scoparium*), and a variety of species of the wildflower genera, including goldenrod (*Solidago* spp.) and various aster species. Vegetation growing in grassland habitats ranges from less than six inches to over four feet in height. Vegetation height is vital in determining which wildlife species will use it. Few, if any, trees or shrubs are found in grasslands. Unless maintained, most grasslands will return to forest habitat (NHDFG 2015).

5.5.3.4 Major-River Floodplain Forest

The immediate shoreline of the Merrimack River within the Project boundary include areas of floodplain forest. Some of these areas have characteristics of Major-River Floodplain Forest as described by Swain and Kearsley (2001). Major-river floodplain forests are deciduous forested wetland communities that develop after rivers and streams and receive annual (or semi-annual) overbank flooding and alluvial silt deposition. Soils are predominantly sandy loams without soil mottles and a surface organic layer. Flooding at these sites occurs annually and can be severe. An island variant of Major-River Floodplain Forests occurs on elevated sections of riverine islands and riverbanks of significant rivers, with high levels of both natural and human disturbance. All floodplain forest communities in Massachusetts have silver maple (*Acer saccharinum*) as the defining tree, but associated plant species vary depending on the intensity and duration of the flooding and geographic location. Common plant species occurring with silver maple include cottonwood (*Populus deltoides*), American elm (*Ulmus americana*), and/or slippery elm (*U. rubra*) in the subcanopy, and shrubs are generally lacking. A thick shrub to herbaceous layer, generally 3-6 feet tall, dominates the forest floor. A tall (1-2 meters), dense cover of wood nettles (*Laportea canadensis*) and ostrich fern (*Matteuccia struthiopteris*) is sometimes abundant. Other species growing along the upland margins include the tree of heaven (*Ailanthus altissima*), staghorn sumac (*Rhus typhina*), the non-native bittersweet (*Celastrus orbiculatus*), riverbank grape (*Vitis riparia*), Virginia creeper (*Parthenocissus quinquefolia*), Siberian elm (*Ulmus pumila*), purple loosestrife (*Lythrum salicaria*), poison ivy (*Toxicodendron radicans*), Boston ivy (*Parthenocissus tricuspidata*), mullein (*Verbascum thapsus*), and common ragweed (*Ambrosia artemisiifolia*) (HDR 2021).

5.5.3.5 Ruderal Herbaceous/Scrub-Shrub/Forested

Ruderal Herbaceous/Scrub-Shrub/Forested areas in the Project vicinity are largely anthropogenic communities of herbaceous or mixed scrub-shrub and forested vegetation resulting from succession following complete or partial removal of native woody cover. These communities are found in areas where the native forest vegetation has been cleared or partially cleared, in old fields, hedgerows, pedestrian walkways, along Project canals, roadways, etc. Characteristic species can include red maple (*Acer rubrum*), American elm, Siberian elm, bush honeysuckles (*Lonicera* spp.), tree of heaven, Boston ivy, goldenrods (*Solidago* spp.), and various grass species (HDR 2021).

5.5.4 Botanical Resources

The Project vicinity is in a more urbanized area with medium to high-density development along the shores of the Merrimack River. Botanical resources will correlate with current anthropogenic features and historical land uses. Early successional forest and wetland botanical species are more likely to be found in the lower section of the Merrimack River when compared to the Merrimack's headwaters in the White Mountains of New Hampshire. A description of botanical resources within the Project vicinity or localized region is further discussed below.

5.5.4.1 Trees and Herbaceous Plants

Dominant canopy tree species of the region are white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), and red maple (*Acer rubrum*). Predominant understory trees within the region include black cherry (*Prunus serotina*), black birch (*Betula nigra*), yellow birch (*Betula alleghaniensis*), and bigtooth aspen (*Populus grandidentata*). Common understory shrubs and shrub-like trees include sassafras (*Sassafras albidum*), witch hazel (*Hamamelis virginiana*), maple-leaf viburnum (*Viburnum acerfolium*), and sheep laurel (*Kalmia angustifolia*). Common herbaceous plants likely to occur in the Project vicinity include Canada mayflower (*Maianthemum canadense*), eastern skunk cabbage (*Symplocarpus foetidus*), spotted wintergreen (*Chimaphila maculate*), and bunchberry (*Cornus canadensis*). An extended list of potential botanical species that may occur in the Project vicinity is listed in Table 5.5-1 below.

Table 5.5-1 List of Potential Botanical Species in the Project Vicinity (Common Name)

Trees and Shrubs		Herbaceous Plants	
sugar maple	red pine	starflower	common milkweed
silver maple	pitch pine	nodding trillium	pink lady's slipper
scarlet oak	common juniper	common plantain	poison ivy
eastern black oak	American elm	Indian pipe	wild mint
swamp oak	slippery elm	white turtlehead	swamp candles
dwarf chinkapin oak	black tupelo	false Solomon's-seal	wintergreen
American beech	American basswood	moth mullein	wild sarsaparilla
quaking aspen	pignut hickory	common mullein	wild oats
paper birch	sweet birch	common dandelion	Indian cucumber
beaked hazelnut	speckled alder	spotted jewelweed	fringed bindweed
American hazelnut	flowering dogwood	bloodroot	bottlebrush grass
staghorn sumac	gray dogwood	trout-lily	white-wood aster
winged sumac	large pussy-willow	wild geranium	bracken fern
common elderberry	mountain laurel	herb Robert	partridgeberry
boxelder	lowbush blueberry	wild licorice	

Trees and Shrubs		Herbaceous Plants	
black willow	huckleberry	maidenhair fern	

Source: Kaufman and Kaufman 2012; Padgett 2016, Natural Heritage & Endangered Species Program (NHESP) 2016b; NHESP 2016c; NHESP 2016d.

5.5.4.2 Invasive Plant Species

Invasive plant species are generally defined as both non-indigenous and aggressive habitat monopolizers at scales ranging from a small patch to hundreds of continuous acres (Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection [MDCR] 2011). Invasive species often outcompete native species, severely impacting the integrity of the general ecological landscape, reducing recreational opportunities, degrading human health, and straining the economic environment. Invasive species' presence directly correlates with historical land use and environmental disturbance. Depending on the level of aggression, invasive species have evolved to maximize their growth and reproductive production when resources are limited (MDCR 2011). Aggressive, out-competing tendencies enable invasive species to invade existing ecosystems at rates beyond what is capable of other competing and present native plant species.

In 2004, the Massachusetts Invasive Plant Advisory Group (MIPAG), a committee where Massachusetts Natural Heritage and Endangered Species Program (NHESP) and other state agencies are represented, completed a report providing recommendations on invasive plant species management in the Commonwealth. Offered in the report, the committee destined 72 species of the known 2,263 plant species in the Commonwealth as invasive, likely invasive, or potentially invasive (MIPAG 2005a). This "living" list looks to properly manage, identify, control, and eradicate invasive plant species, when possible, with broader hopes of protecting and preserving the Commonwealth's natural environments. Invasive plant species found in the Commonwealth of Massachusetts and have the potential to occur within the Project's vicinity are listed in Table 5.5-2 below.

Table 5.5-2 Invasive Plant Species Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	Habitat
	Terrestrial Plants	
autumn olive	*Elaeagnus umbellata*	Right-of-way (ROWs) and disturbed sites. Can establish along forest edges or in canopy openings in riparian corridors.
bell's honeysuckle	*Lonicera bella*	Shrub occurs in upland, wetland, and coastal habitats. High seed production and longevity.
black locust	*Robinia pseudoacacia*	A tree occurring in upland habitats. Invasive behavior occurs in sandy soils.
black swallow-wort	*Cynanchum louiseae*	Perennial vines occur in upland, wetland, and coastal habitats.

Common Name	Scientific Name	Habitat
burning bush	*Euonymous alatus*	Shrubs occur in many different habitats.
common buckthorn	*Rhamnus cathartica*	Forest edges, right-of-ways, canopy openings, and open forested wetlands. More common in dry sites.
dame's rocket	*Hesperis matronalis*	Biennial and perennial herbs occur in upland and wetland habitats.
fig buttercup	*Ficaria verna*	Perennial herbs occur on stream banks and in lowland and upland woods.
garlic mustard	*Alliaria petiolata*	Grows in upland habitats. Spreads aggressively by seed, especially in wooded areas.
goutweed	*Aegopodium podagraria*	A perennial herb found in upland and wetland habitats. Spreads aggressively by roots; forms dense colonies in flood plains.
Japanese barberry	*Berberis thunbergii*	A shrub found in open and wooded uplands and wetlands.
Japanese honeysuckle	*Lonicera japonica*	A perennial vine in upland, wetland, and coastal habitats. Seeds are spread by bird dispersal.
Japanese knotweed	*Fallopia japonica*	A perennial herbaceous subshrub or shrub in wetland, upland, and coastal habitats. Spreads aggressively and control of knotweed is laborious and expensive.
leafy spurge	*Euphorbia esula*	Perennial herbs occur in all state regions in grassland and coastal habitats. Exceptionally difficult to control or eradicate. Thrives on disturbances, especially on dry, sandy soils.
mile-a-minute vine	*Polygonum perfliatum*	An annual herbaceous vine, highly aggressive; bird and human dispersed.
morrow's honeysuckle	*Lonicera morowii*	A shrub occurring in upland, wetland, and coastal habitats. Escape cultivation through bird dispersal.
multiflora rose	*Rosa multiflora*	In upland, wetland, and coastal habitats, perennial vine/shrub occurs in all state regions.
Norway maple	*Acer platanoides*	Found in upland and wetland habitats and is especially common in woodlands and colluvial soils.
oriental bittersweet	*Celastrus orbiculatus*	A perennial vine occurring in upland habitats Berries spread by birds and humans; overwhelms and kills vegetation.

Common Name	Scientific Name	Habitat
European buckthorn	*Frangula alnus*	A shrub or tree occurring in upland, wetland, and coastal habitats. Seed dispersal over broad areas by birds through quick digestive processes.
sycamore maple	*Acer pseudoplatanus*	Found primarily in woodlands and especially near the coast. Tolerant to a range of soils, and salty and exposed conditions.
tree of heaven	*Ailanthus altissima*	Found in upland, wetland, and coastal habitats. Spreads aggressively from root suckers, especially in disturbed areas.
weeping lovegrass	*Eragrostis curvula*	A perennial warm-season bunchgrass occurs on road edges, agricultural grasslands, sandplain grasslands, and coastal heathland areas, mainly in coastal and island counties.
Wetland Plants		
broad-leaved pepperweed	*Lepidium latifolium*	Perennial herbs along the coastal and upper edge of wetlands. Introduced as a contaminant of sugar beet imported from eastern Europe.
common reed	*Phragmites australis*	A perennial grass grown in predominately wetland habitats but can be found in upland areas. Difficult to eradicate and tends to emerge earlier and be less susceptible to insect herbivory than the native strains.
large gray willow	*Salix atrocinerea*	A large shrub or small tree is mostly found in Massachusetts's eastern and southeastern areas. Found primarily near pond shores but can also be found in other wetland types, rarely in uplands.
reed canary-grass	*Phalais arundinacea*	A perennial grass occurring in wetlands and open uplands. Planted for forage and erosion control. Quickly overtakes environments.
yellow iris	*Iris pseudacorus*	Perennial herbs occurring in wetland habitats. Found mostly in marshes, shores of rivers or lakes, and wetland margins.
creeping jenny	*Lysimachia nummularia*	Perennial herbs occurring in upland and wetland habitats.
purple loosestrife	*Lythrum salicaria*	A perennial herb or subshrub occurring in upland and wetland habitats. Very aggressive invader of sunny wetlands. Displaces native species and reduces plant and animal diversity.
Aquatic Plants		
Carolina fanwort	*Cabomba caroliniana*	A perennial herb occurring in aquatic habitats. Aggressive aquatic weed in New England.

Common Name	Scientific Name	Habitat
curly pondweed	*Potamogeton crispus*	Perennial herbs occurring in aquatic habitats. High tolerance of low light conditions.
Eurasian watermilfoil	*Myriophyllum spicatum*	Open, cool water typically up to 13 feet deep but can be found up to 33 feet deep. Thrives in various conditions and outcompetes native plants and animals.
two-leaved water-milfoil	*Myriophyllum heterophyllum*	Perennial herb found in aquatic habitats. Spreads rapidly by seed and fragmentation.
water-chestnut	*Trapa natans*	Aquatic annual herb found in aquatic habitats. Grows in shallow waters of lakes and rivers. Difficult to control because of seed longevity.

Source: MIPAG 2005b and GoBotany 2023.

5.5.5 Wildlife Resources

The Merrimack River corridor provides extensive habitats for mammals, avian species, reptiles, and amphibians. The three main habitat types that dominate the Project area are hemlock-hardwood-pine, Appalachian oak-pine, and grasslands (Section 5.5.3). Common wildlife species within these habitats are eastern chipmunk (Tamias stratus), gray squirrel (Sciurus carolinensis), Virginia opossum (Didelphis virginiana), white-tailed deer (Odocoileus virginianus), black-capped chickadee (Poecile atricapillus), common raven (Corvus corax), American toad (Anaxyrus americana), spring peeper (Pseudacris crucifer), and painted turtle (Chrysemys picta). A description of wildlife resources within the Project's vicinity or localized region is further discussed below.

5.5.5.1 Mammals

Mammals found in the Project vicinity are those commonly found throughout the region and adapted to living near humans and urban areas. Common small to medium-sized mammals associated with ecological environments in the Lower Merrimack River corridor are raccoon (*Procyon lotor*), gray squirrel, eastern chipmunk, porcupine (*Erethizon dorsatum*), red squirrel (*Tamiasciurus hudsonicus*), striped skunk (*Mephitis mephitis*), river otter (*Lontra canadensisi*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and mink (*Mustela vison*). Medium to large mammals have the potential to occur in the Project vicinity, but occurrence is likely rare. Medium to large mammals that may potentially occur in the Project vicinity include white-tailed deer, eastern coyote (*Canis latrans*), red fox (*Vulpus vulpus*), gray fox (*Urocyon cinereoargenteus*), and black bear (*Ursus americanus*). Large mammals that require extensive habitat areas, or species that require solitude, such as moose (*Alces alces*) and bobcat (*Lynx rufus*), prefer less developed environments that are scarce in the Lower Merrimack River corridor and the Lawrence Project. Table 5.5-3 lists the mammalian species that may potentially occur in the vicinity of the Lawrence Project.

Table 5.5-3 Mammalian Species Potentially Occurring in the Project Vicinity

Common Name	Scientific Name
beaver	*Castor canadensis*
big brown bat	*Eptesicus fuscus*
black bear	*Ursus americanus*
black rat	*Rattus rattus*
bobcat	*Lynx rufus*
coyote	*Canis latrans*
deer mouse	*Peromyscus maniculatus*
eastern chipmunk	*Tamias striatus*
eastern red bat	*Lasiurus borealis*
ermine	*Mustela ermina*
fisher	*Pekania pennanti*
gray fox	*Urcyon cinereoargenteus*
gray squirrel	*Sciurus carolinensis*
hairy-tailed mole	*Parascalops breweri*
hoary bat	*Lasiurus cinereus*
house mouse	*Mus musculus*
little brown bat	*Myotis lucifugus*
long-tail weasel	*Mustela frenata*
long-tailed shrew	*Sorex dispar*
masked shrew	*Sorex cinereus*
meadow jumping mouse	*Zapus hudsonicus*
meadow vole	*Microtus pennsylvanicus*
mink	*Mustela vison*
moose	*Alces alces*
muskrat	*Ondatra zibethicus*
northern flying squirrel	*Glaucomys sabrinus*

Common Name	Scientific Name
northern short-tailed shrew	*Blarina brevicauda*
Norway rat	*Rattus norvegicus*
porcupine	*Erethizon dorsatum*
pygmy shrew	*Sorex hoyi*
raccoon	*Procyon lotor*
red fox	*Vulpes vulpes*
red squirrel	*Tamiasciurus hudsonicus*
river otter	*Lontra canadensis*
silver-haired bat	*Lasionycteris noctivagans*
small-footed bat	*Myotis leibii*
smoky shrew	*Sorex fumeus*
snowshoe hare	*Lepus americanus*
southern bog lemming	*Synaptomys cooperi*
southern flying squirrel	*Glaucamys volans*
southern red-backed vole	*Clethrionomys gapperi*
star-nosed mole	*Condylura cristata*
striped skunk	*Mephitis mephitis*
tricolored bat	*Perimyotis subflavus*
Virginia opossum	*Didelphis virginiana*
water shrew	*Sorex palustris*
white-footed mouse	*Peronyscus leucopus*
white-tailed deer	*Odocoileus virginianus*
woodchuck	*Marmota monax*
woodland jumping mouse	*Napaeozapus insignis*
woodland vole	*Microtus pinetorum*

Source: NHDFG 2015 and MassWildlife 2023a.

5.5.5.2 Birds

The diversity of habitats within the Lawrence Project and Lower Merrimack River corridor provide breeding, migratory stopover, and wintering habitat for a high diversity of avian fauna including neotropical songbirds, resident species, water birds, terrestrial game birds, and waterfowl. Commonly associated avian species to utilize riverine and stream-residing environments within the Lower Merrimack River corridor and have the potential to utilize areas of forested/urban habitats within the Project vicinity include hairy woodpecker (*Leuconotopicus villosus*), downy woodpecker *(Dryobates pubescens*), American kestrel (*Falco sparverius*), bald eagle (*Haliaeetus leucocephalus*), double-crested cormorant (*Nannopterum auritum*), great blue heron (*Ardea Herodias*), fish crow (*Corvus ossifragus*), black-crowned night-heron (*Nycticorax nycticorax*), chimney swift (*Chaetura pelagica*), cooper’s hawk (*Accipiter cooperii*), cedar waxwing (*Bombycilla cedrorum*), and osprey (*Pandion haliaetus*). An extended list of avian species, including those listed above, potentially occurring in the vicinity of the Lawrence Project is included in Table 5.5-4.

Table 5.5-4 Avian Species Potentially Occurring in the Project Vicinity

Common Name	Scientific Name
alder flycatcher	*Empidonax alnorum*
American bittern	*Botaurus lentiginosus*
American black duck	*Anas rubripes*
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*
American redstart	*Setophaga ruticilla*
American robin	*Turdus migratorius*
American woodcock	*Scolopax minor*
bald eagle	*Haliaeetus leucocephalus*
Baltimore oriole	*Icterus galbula*
barn swallow	*Hirundo rustica*
belted kingfisher	*Megaceryle alcyon*
black-billed cuckoo	*Coccyzus erythropthalmus*
blackburnian warbler	*Dendroica fusca*
black-capped chickadee	*Poecile atricapillus*

Common Name	Scientific Name
black-throated blue warbler	*Dendroica caerulescens*
black-crowned night heron	*Nycticorax nycticorax*
black-throated green warbler	*Dendroica virens*
blue jay	*Cyanocitta cristata*
blue-gray gnatcatcher	*Polioptila caerulea*
blue-headed vireo	*Vireo solitarius*
bobolink	*Dolichonyx oryzivorus*
broad-winged hawk	*Buteo platypterus*
brown creeper	*Certhia americana*
brown-headed cowbird	*Molothrus ater*
brown thrasher	*Toxostoma rufum*
bufflehead	*Bucephala albeola*
Canada goose	*Branta canadensis*
canvasback	*Aythya valisineria*
Carolina wren	*Thryothorus ludovicianus*
cedar waxwing	*Bombycilla cedrorum*
chestnut-sided warbler	*Dendroica pensylvanica*
chimney swift	*Chaetura pelagica*
chipping sparrow	*Spizella passerina*
common goldeneye	*Bucephala clangula*
common grackle	*Quiscalus quiscula*
common merganser	*Mergus merganser*
common nighthawk	*Chordeiles minor*
common raven	*Corvus corax*
common redpoll	*Acanthis flammea*
common yellowthroat	*Geothlypis trichas*
cooper’s hawk	*Accipiter cooperii*
dark-eyed junco	*Junco hyemalis*

Common Name	Scientific Name
double-crested cormorant	*Phalacrocorax auritus*
downy woodpecker	*Picoides pubescens*
eastern bluebird	*Sialia sialis*
eastern kingbird	*Tyrannus tyrannus*
eastern phoebe	*Sayornis phoebe*
eastern screech owl	*Megascops asio*
eastern wood-pewee	*Contopus virens*
European starling	*Sturnus vulgaris*
evening grosbeak	*Coccothraustes vespertinus*
gadwall	*Mareca strepera*
golden-crowned kinglet	*Regulus satrapa*
golden eagle	*Aquila chrysaetos*
gray catbird	*Dumetella carolinensis*
great blue heron	*Ardea herodias*
greater scaup	*Aythya marila*
great crested flycatcher	*Myiarchus crinitus*
great horned owl	*Bubo virginianus*
great egret	*Ardea alba*
green heron	*Butorides virescens*
hairy woodpecker	*Picoides villosus*
hermit thrush	*Catharus guttatus*
herring gull	*Larus argentatus*
horned grebe	*Podiceps auritus*
house finch	*Carpodacus mexicanus*
house sparrow	*Passer domesticus*
house wren	*Troglodytes aedon*
indigo bunting	*Passerina cyanea*
killdeer	*Charadrius vociferus*

Common Name	Scientific Name
least bittern	*Ixobrychus exilis*
least flycatcher	*Empidonax minimus*
long-eared owl	*Asio otus*
Louisiana waterthrush	*Seiurus motacilla*
magnolia warbler	*Dendroica magnolia*
mallard	*Anas platyrhynchos*
mourning dove	*Zenaida macroura*
mourning warbler	*Oporornis philadelphia*
northern cardinal	*Cardinalis cardinalis*
northern flicker	*Colaptes auratus*
northern goshawk	*Accipiter gentilis*
northern parula	*Setophaga americana*
northern saw-whet owl	*Aegolius acadicus*
northern shrike	*Lanius borealis*
northern shoveler	*Spatula clypeata*
northern waterthrush	*Seiurus noveboracensis*
olive-sided flycatcher	*Contopus cooperi*
orchard oriole	*Icterus spurius*
osprey	*Pandion haliaetus*
ovenbird	*Seiurus aurocapilla*
pied-billed grebe	*Pied-billed grebe*
pileated woodpecker	*Dryocopus pileatus*
pine siskin	*Spinus pinus*
purple finch	*Carpodacus purpureus*
red-bellied woodpecker	*Melanerpes carolinus*
red-breasted nuthatch	*Sitta canadensis*
red crossbill	*Loxia curvirostra*
red-eyed vireo	*Vireo olivaceus*

Common Name	Scientific Name
redhead	*Aythya americana*
red-shouldered hawk	*Buteo lineatus*
red-tailed hawk	*Buteo jamaicensis*
red-winged blackbird	*Agelaius phoeniceus*
ring-billed gull	*Larus delawarensis*
ring-necked duck	*Aythya collaris*
rock pigeon	*Columba livia*
rose-breasted grosbeak	*Pheucticus ludovicianus*
ruby-crowned kinglet	*Regulus calendula*
ruby-throated hummingbird	*Archilochus colubris*
ruddy duck	*Oxyura jamaicensis*
ruffed grouse	*Bonasa umbellus*
sandhill crane	*Antigone canadensis*
savannah sparrow	*Passerculus sandwichensis*
scarlet tanager	*Piranga olivacea*
sharp-shinned hawk	*Accipiter striatus*
short-eared owl	*Asio flammeus*
snow bunting	*Plectrophenax nivalis*
snow goose	*Anser caerulescens*
snowy owl	*Bubo scandiacus*
song sparrow	*Melospiza melodia*
sora	*Porzana carolina*
spotted sandpiper	*Actitis macularius*
swainson's thrush	*Catharus ustulatus*
swamp sparrow	*Melospiza georgiana*
tree swallow	*Tachycineta bicolor*
tufted titmouse	*Baeolophus bicolor*
turkey vulture	*Cathartes aura*

Common Name	Scientific Name
veery	*Catharus fuscescens*
virginia rail	*Rallus limicola*
warbling vireo	*Vireo gilvus*
white-breasted nuthatch	*Sitta carolinensis*
white-winged crossbill	*Loxia leucoptera*
wild turkey	*Meleagris gallopavo*
wilson's warbler	*Cardellina pusilla*
willow flycatcher	*Empidonax traillii*
wood duck	*Aix sponsa*
wood thrush	*Hylocichla mustelina*
yellow warbler	*Dendroica petechia*
yellow-bellied flycatcher	*Empidonaz flaviventris*
yellow-bellied sapsucker	*Sphyrapicus varius*
yellow-billed cuckoo	*Coccyzus americanus*
yellow-rumped warbler	*Dendroica coronata*
yellow-throated vireo	*Vireo flavifrons*

Source: NHDFG 2015 and eBird 2023.

5.5.5.3 Amphibians and Reptiles

Diverse aquatic, semi-aquatic, and terrestrial habitats that line the Lower Merrimack River corridor have the potential to support reptile and amphibian species. Permanent wetlands and seasonal vernal pools are significant breeding habitats for amphibians. Upland wooded habitats and riparian zones are also important for terrestrial and semi-aquatic reptiles and amphibians during the non-breeding periods of their respective life cycles. Common reptile and amphibian species to use the Lower Merrimack River corridor and have the potential to occur within the Project's vicinity include spotted salamander (*Ambystoma maculatum*), blue-spotted salamander (*Ambystoma laterale*), eastern red-backed salamander (*Plethodon cinereus*), four-toed salamander (*Hemidactylium scutatum*), American toad (*Anaxyrus americanus*), spring peeper (*Pseudacris crucifer*), snapping turtle (*Chelydra serpentina*), wood turtle (*Glyptemys insculpta*), blanding's turtle (*Emydoidea blandingii*), eastern box turtle (*Terrapene Carolina*), eastern ribbon snake (*Thamnophis sauritus*), DeKay's brownsnake (*Storeria dekayi*), and ring-necked snake (*Diadophis punctatus*). An extended list of reptile and amphibian species, including those listed above, with the potential to occur within the Project's vicinity, is in Table 5.5-5.

Table 5.5-5 List of Amphibians and Reptiles Potentially Occurring in the Project Vicinity

Common Name	Scientific Name
Reptiles	
black racer	*Coluber constrictor*
Blanding's turtle	*Emydoidea blandingii*
brown snake	*Storeria dekayi*
common garter snake	*Thamnophis sirtalis*
common musk turtle	*Sternotherus odoratus*
eastern box turtle	*Terrapene carolina*
eastern hognose snake	*Heterodon platirhinos*
milk snake	*Lampropeltis triangulum*
northern water snake	*Nerodia sipedon*
painted turtle	*Chrysemys picta*
red-bellied snake	*Storeria occipitomaculata*
ribbon snake	*Thamnophis sauritus*
ringneck snake	*Diadophis punctatus*
smooth green snake	*Liochlorophis vernalis*
snapping turtle	*Chelydra serpentina*
spotted turtle	*Clemmys guttata*
wood turtle	*Glyptemys insculpta*
Amphibians	
American toad	*Anaxyrus americana*
blue-spotted salamander	*Ambystoma laterale*
bullfrog	*Lithobates catesbeiana*
dusky salamander	*Desmognathus fuscus*
four-toed salamander	*Hemidactylium scutatum*
fowler's toad	*Anaxyrus fowleri*
gray treefrog	*Hyla versicolor*
green frog	*Lithobates clamitans melanota*
marbled salamander	*Ambystoma opacum*
northern leopard frog	*Lithobates pipiens*
pickerel frog	*Lithobates palustris*
redback salamander	*Plethodon cinereus*
red-spotted newt	*Notophthalmus viridescens*
spotted salamander	*Ambystoma maculatum*
spring peeper	*Pseudacris crucifer*
two-lined salamander	*Eurycea bislineata*
wood frog	*Lithobates sylvatica*

Source: NHDFG 2015 and MassWildlife 2023b.

5.5.5.4 Invasive Mammalian Species

Due to the Project's proximity to a major urban metro area, house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*) are two prominent invasive mammalian species likely to occur within the Project's vicinity. Both species are prolific breeders and have evolved through evolutionary processes to rapidly increase and sustain their populations. Most habitat types in the Project's vicinity suit these rodents as they can thrive in urban and rural environments. Both rodent species become a nuisance and often threaten the broader ecological systems. According to the NHDFG (2015), these rodent species could spread and circulate foreign diseases in ecological systems when they infest places where human encounters are present.

5.6 Wetlands, Riparian, and Littoral Habitats

Wetlands are generally defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. Most formal wetland definitions emphasize three primary components that define wetlands: the presence of water, hydric soils, and hydrophytic vegetation. The USFWS (Cowardin et al. 1979) defines wetlands as:

> *…lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have been one or more of the following three attributes: (1) at least periodically, the land supports predominately hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some point during the growing season of the year.*

The USFWS, USACE, and MADEP have jurisdiction over wetlands within Massachusetts. The MADEP's wetland definition is consistent with the USFWS's.

Riparian habitats are lands that support unique vegetation around water bodies such as lakes, impoundments, rivers, and streams. The boundary of the riparian area and the adjoining uplands is gradual and not always well defined. However, riparian areas differ from uplands because of their high levels of soil moisture, frequent flooding, and unique assemblage of plant and animal communities. These habitats support a diversity of unique vegetation communities. Riparian wetlands are valuable to wildlife because they are extremely productive and provide corridors for wildlife migration and dispersal. They also process large fluxes of energy and materials from upstream systems, stabilize streambanks, provide recreation opportunities, and protect against flooding and drought conditions.

Several wetlands are in the Project boundary, the most predominant being freshwater forested/shrub wetland. Potential vernal pools and vernal pools certified by the Massachusetts NHESP are in the Project vicinity, with at least one appearing to be within the Project boundary (MassGIS 2022). Several Riverine Natural Community Systems are within the Project boundary. Riverine Natural Community Systems are one of Massachusetts's Priority Natural Vegetation Communities, which are biodiversity conservation interests in Massachusetts based on the NHESP database (MassGIS 2022). A wetland core is defined as the most intact, least disturbed wetlands within resilient, less-developed landscapes, with fewer stressors such as pollution. Two wetland cores are in the vicinity of the Project, one being a 30.77-acre core along Fish Brook, and another 102.27-acre core north of Dracut (MassWildlife and The Nature Conservancy [TNC] 2022).

5.6.1 Wetlands, Riparian, and Littoral Vegetation

Floodplain forests of the Gulf of Maine Coastal Plain (Level IV) ecoregion are comprised primarily of silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and American elm (*Ulmus americana*) (Griffith et al. 2009). The 1977 license application notes the lower, moister areas of the Project area are dominated by red maple (*Acer rubrum*) (LHA 1977). According to NHESP, alluvial red maple swamps typically occur along main stem sections of low gradient rivers and streams that flood periodically and are the most common deciduous forest type in eastern Massachusetts (NHESP 2016a). Characteristic overstory species include a mixture of red maple and silver maple, with lesser amounts of American elm, sugar maple (*Acer saccharum*), green ash, shagbark hickory (*Carya ovata*), and swamp white oak (*Quercus bicolor*). The subcanopy often includes the canopy dominants, as well as hornbeam (*Carpinus* sp.), northern arrow-wood (*Viburnum dentatum*), American hazelnut (*Corylus americana*), silky dogwood (*Cornus amomum*), buttonbush (*Cephalanthus occidentalis*), meadowsweet (*Spiraea alba*), glossy buckthorn (*Frangula alnus*), and poison ivy (*Toxicodendron radicans*). The herbaceous layer is often dominated by sensitive fern and false nettle (*Boehmeria cylindrica*), with lesser amounts of cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), goldenrods (*Solidago* sp.), jewelweeds (*Impatiens* sp.), beggar-ticks (*Bidens* sp.), bugleweeds (*Ajuga* sp.), awned sedge (*Carex atherodes*), rice cutgrass (*Leersia oryzoides*), bluejoint grass (*Calamagrostis canadensis*), and woodreed (*Cinna arundinacea*). Common wetland vegetation reported to occur in Essex County are listed in Table 5.6-1 below.

Table 5.6-1 Common Wetland Vegetation in Essex County

Common	Scientific	Growth habit	Wetland Status
red maple	*Acer rubrum*	Tree	FAC
silver maple	*Acer saccharinum*	Tree	FACW
American elm	*Ulmus americana*	Tree	FACW
American hornbeam	*Carpinus caroliniana*	Shrub/ Tree	FAC
sweet gale	*Myrica gale*	Shrub	OBL
white meadowsweet	*Spiraea alba*	Shrub	FACW
swamp rose	*Rosa palustris*	Subshrub	OBL

Common	Scientific	Growth habit	Wetland Status
carrion-flower	*Smilax herbacea*	Forb/ Herb/ Vine	FAC
common horsetail	*Equisetum arvense*	Forb/ Herb	FAC
interrupted fern	*Osmunda claytoniana*	Forb/ Herb	FAC
cinnamon fern	*Osmunda cinnamomea*	Forb/ Herb	FACW
grassy arrowhead	*Sagittaria graminea*	Forb/ Herb	OBL
blue-eyed grass	*Sisyrinchium montanum*	Forb/ Herb	FAC
tall meadow-rue	*Thalictrum pubescens*	Forb/ Herb	FACW
garden yellow rocket	*Barbarea vulgaris*	Forb/ Herb	FAC
bog white violet	*Viola lanceolata*	Forb/ Herb	OBL
purple loosestrife	*Lythrum salicaria*	Forb/ Herb	OBL
swamp milkweed	*Asclepias incarnata*	Forb/ Herb	OBL
white vervain	*Verbena urticifolia*	Forb/ Herb	FAC
rattlesnake mana grass	*Glyceria canadensis*	Graminoid	OBL
Virginia wildrye	*Elymus virginicus*	Graminoid	FACW

Source: LHA 1977, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRC) 2023a.

5.6.2 Wetlands, Riparian, and Littoral Wildlife

Although many animal species are wide-ranging generalists and make use of all floodplain habitats including wetlands, others of limited range have distinct habitat preferences. The Merrimack River corridor provides habitat for water-dependent furbearers including beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and mink (*Neovison vison*) (USACE 2003). Muskrat have been reported to use open waters and wetlands near littoral zones of the Project (LHA 1977). The Merrimack River corridor supports over 117 species of birds and waterfowl (USACE 2003). Avian species that are supported by riverine, littoral, and wetland habitats were recorded nearby the Project and may be present within the boundary: species of duck, geese, heron, shore birds, osprey, peregrine falcon, belted kingfisher, yellow warbler, and bald eagle (LHA 1977, City of Lawrence 2017). Vernal pools are within the vicinity of the Project, which provide important breeding habitat for amphibians (NHESP 2016a). In addition, any of the macroinvertebrates, mammals, birds, amphibians, reptiles, or fish discussed in Sections 5.4 or 5.5 are likely to utilize the wetland resources within the Project boundary.

5.6.3 Wetlands, Riparian, and Littoral Mapping

The National Wetlands Inventory (NWI) was the primary source for describing the wetland habitats for the Project. Wetlands currently mapped by the NWI within the boundary of the Project are summarized in Table 5.6-2 and presented in Figure 5.6-1, Figure 5.6-2, Figure 5.6-3, Figure 5.6-4, and Figure 5.6-5. This data includes approximately 824.3 acres of NWI wetlands within the Project boundary.

Table 5.6-2 NWI Wetland Classifications and Acreage Within the Project Boundary

Wetlands Code[1]	System[1]	Subsystem[1]	Class[1]	Subclass[1]	Regime[1]	Special Modifier(s)	NWI Acreage
R2UBH	Riverine	Lower Perennial	Unconsolidated Bottom	-	Permanently Flooded	-	733.28
PFO1A	Palustrine	-	Forested	Broad-Leaved Deciduous	Temporarily Flooded	-	21.30
PFO1E	Palustrine	-	Forested	Broad-Leaved Deciduous	Seasonally Flooded/ Saturated	-	17.28
R2UBHx	Riverine	Lower Perennial	Unconsolidated Bottom	-	Permanently Flooded	Excavated	12.85
PUBHh	Palustrine	-	Unconsolidated Bottom	-	Permanently Flooded	Diked/ Impounded	12.72
PEM1E	Palustrine	-	Emergent	Persistent	Seasonally Flooded/ Saturated	-	12.42
PSS1E	Palustrine	-	Scrub-Shrub	Broad-Leaved Deciduous	Seasonally Flooded/ Saturated	-	3.71
PEM1/UBF	Palustrine	-	Emergent / Unconsolidated Bottom	Persistent	Semi permanently Flooded	-	3.60
R4SBC	Riverine	Intermittent	Streambed	-	Seasonally Flooded	-	2.32
PSS1A	Palustrine	-	Scrub-Shrub	Broad-Leaved Deciduous	Temporarily Flooded	-	1.00
PFO1Eh	Palustrine	-	Forested	Broad-Leaved Deciduous	Seasonally Flooded/ Saturated	Diked/ Impounded	0.80
PEM1C	Palustrine	-	Emergent	Persistent	Seasonally Flooded	-	0.61
R5UBH	Riverine	Unknown Perennial	Unconsolidated Bottom	-	Permanently Flooded	-	0.58
PUBHx	Palustrine	-	Unconsolidated Bottom	-	Permanently Flooded	Excavated	0.49
R4SBCx	Riverine	Intermittent	Streambed	-	Seasonally Flooded	Excavated	0.48

Wetlands Code[1]	System[1]	Subsystem[1]	Class[1]	Subclass[1]	Regime[1]	Special Modifier(s)	NWI Acreage
PEM1A	Palustrine	-	Emergent	Persistent	Temporarily Flooded	-	0.45
PEM1/UBFx	Palustrine	-	Emergent / Unconsolidated Bottom	Persistent	Semi permanently Flooded	Excavated	0.36
R3UBH	Riverine	Upper Perennial	Unconsolidated Bottom	-	Permanently Flooded	-	0.04
						Total	824.3

Source: NWI.
[1.]Wetland codes and classifications as defined by Cowardin et al. (1979).

Figure 5.6-1 Mapped NWI Wetlands in the Lawrence Project Boundary

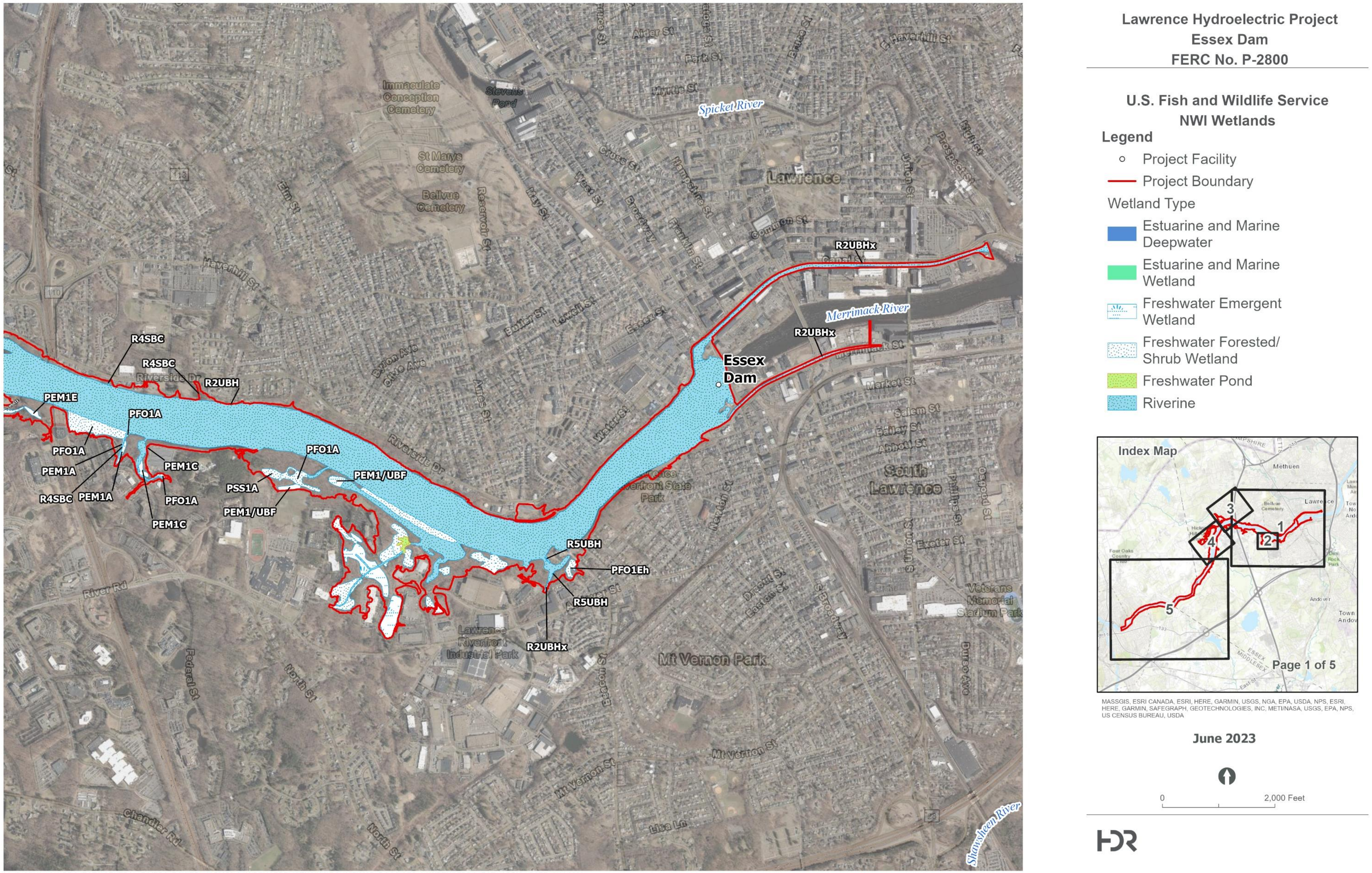


Figure 5.6-2 Mapped NWI Wetlands in the Lawrence Project Boundary

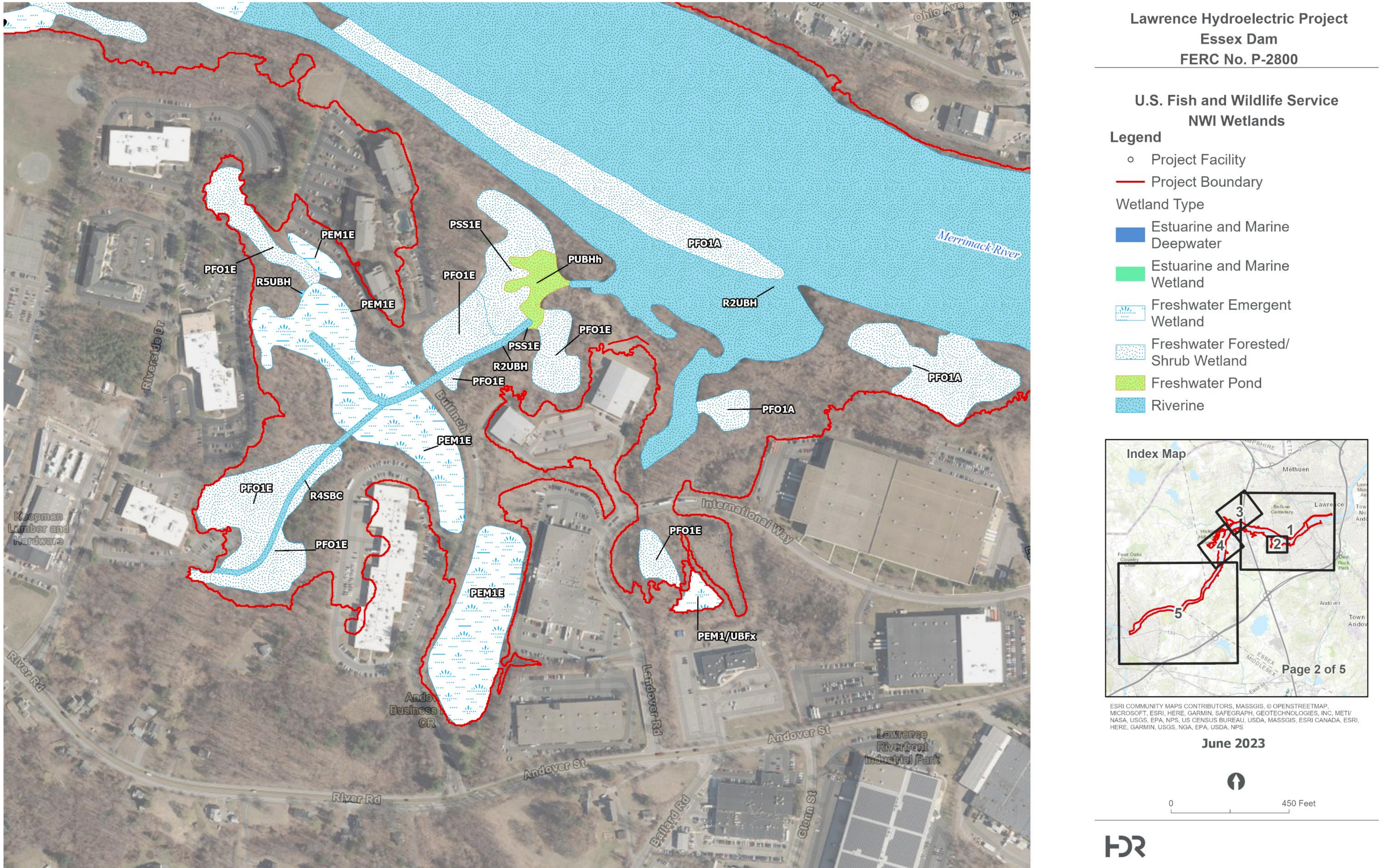


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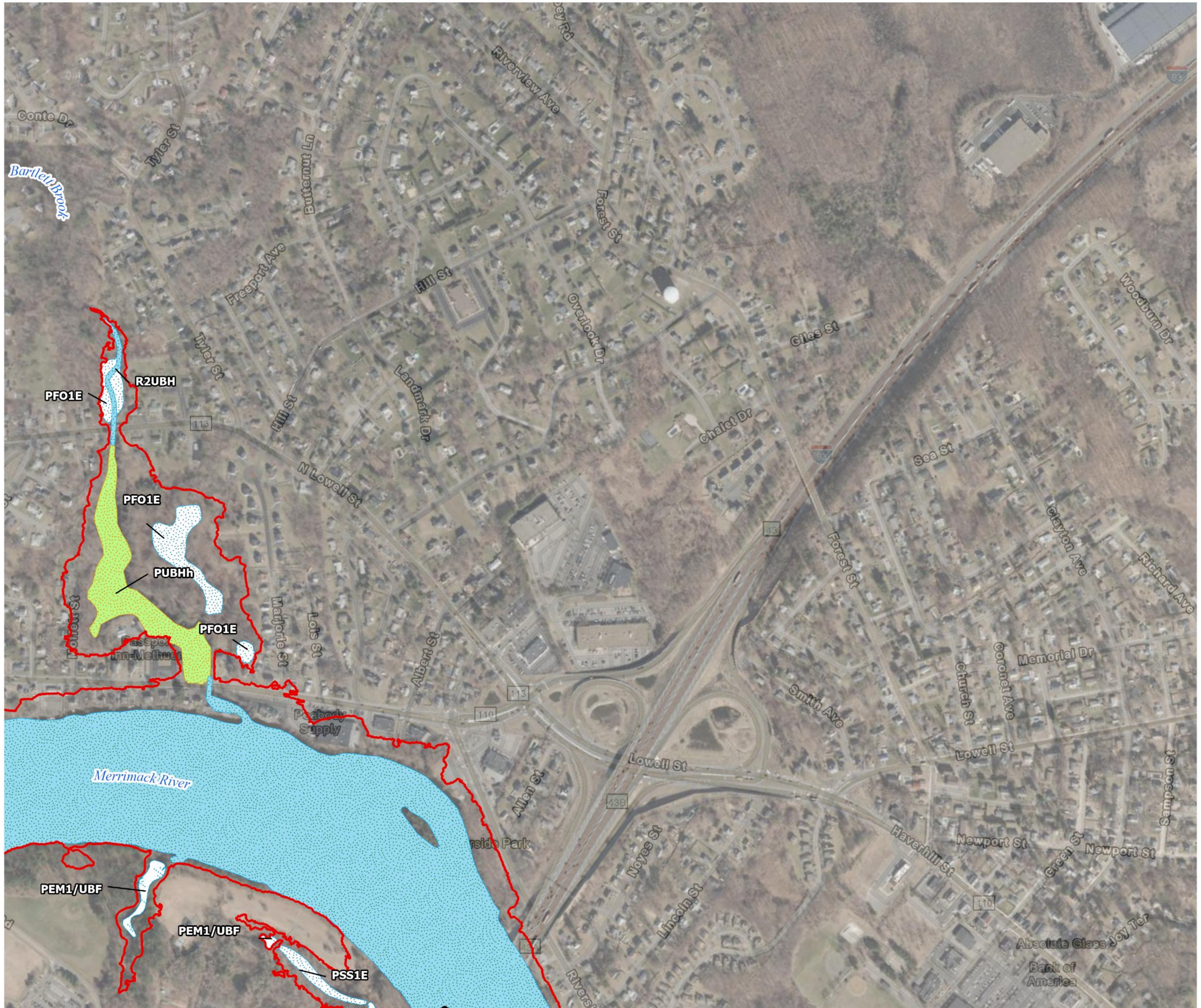
Figure 5.6-3 Mapped NWI Wetlands in the Lawrence Project Boundary



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Lawrence Hydroelectric Project
Essex Dam
FERC No. P-2800

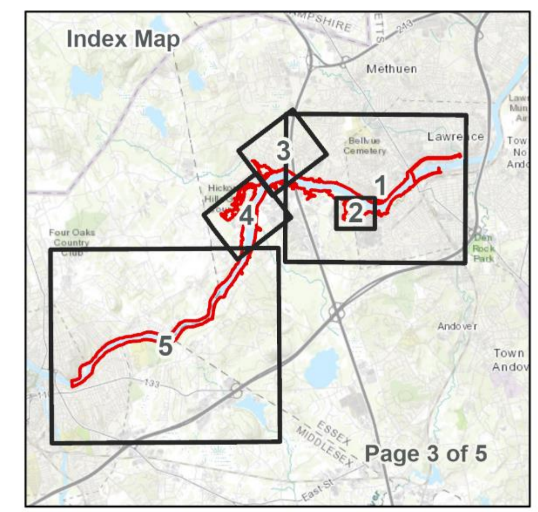
U.S. Fish and Wildlife Service
NWI Wetlands

Legend

- Project Facility
- Project Boundary

Wetland Type

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/ Shrub Wetland
- Freshwater Pond
- Riverine



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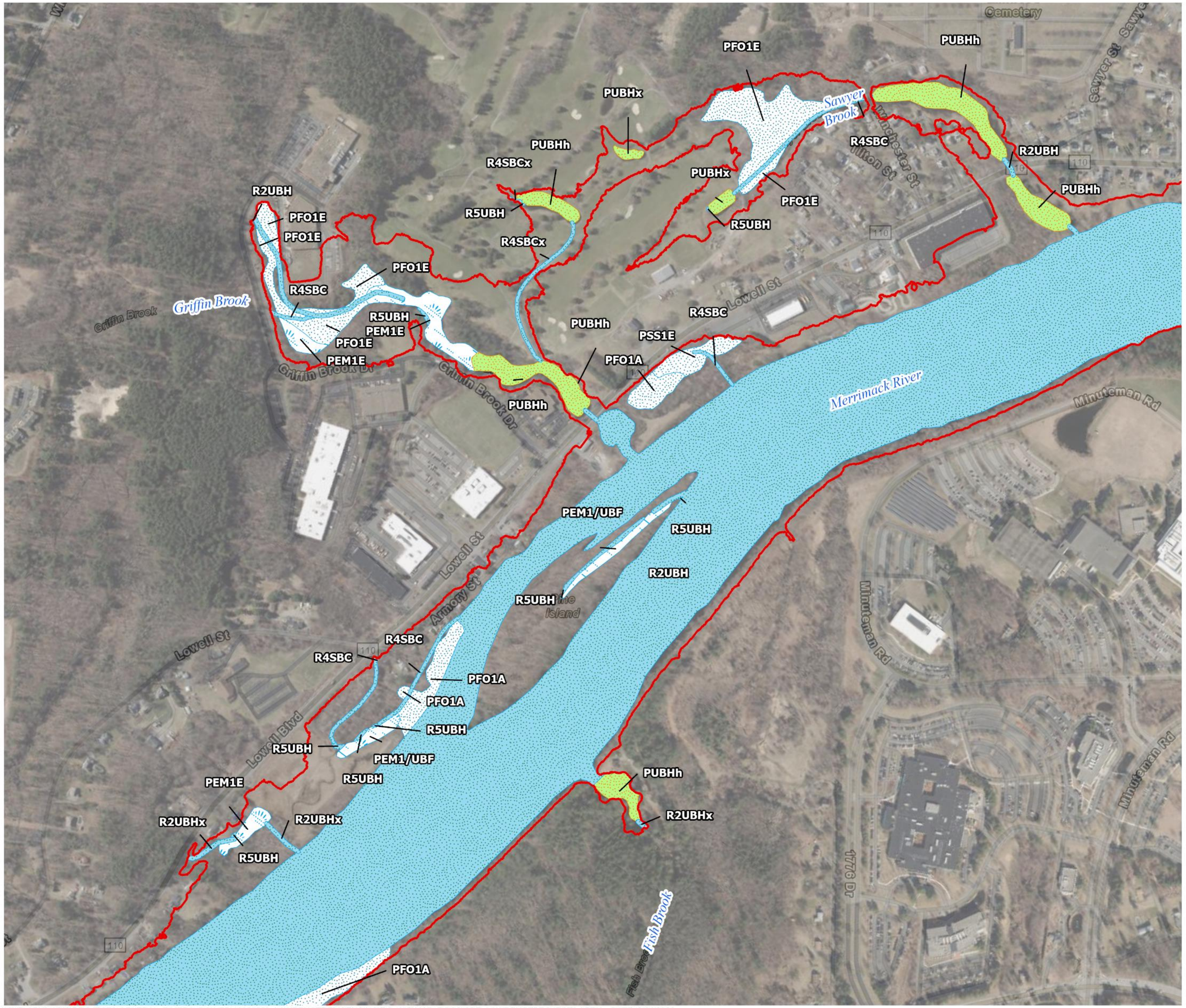
June 2023

0 800 Feet

HDR

Figure 5.6-4 Mapped NWI Wetlands in the Lawrence Project Boundary



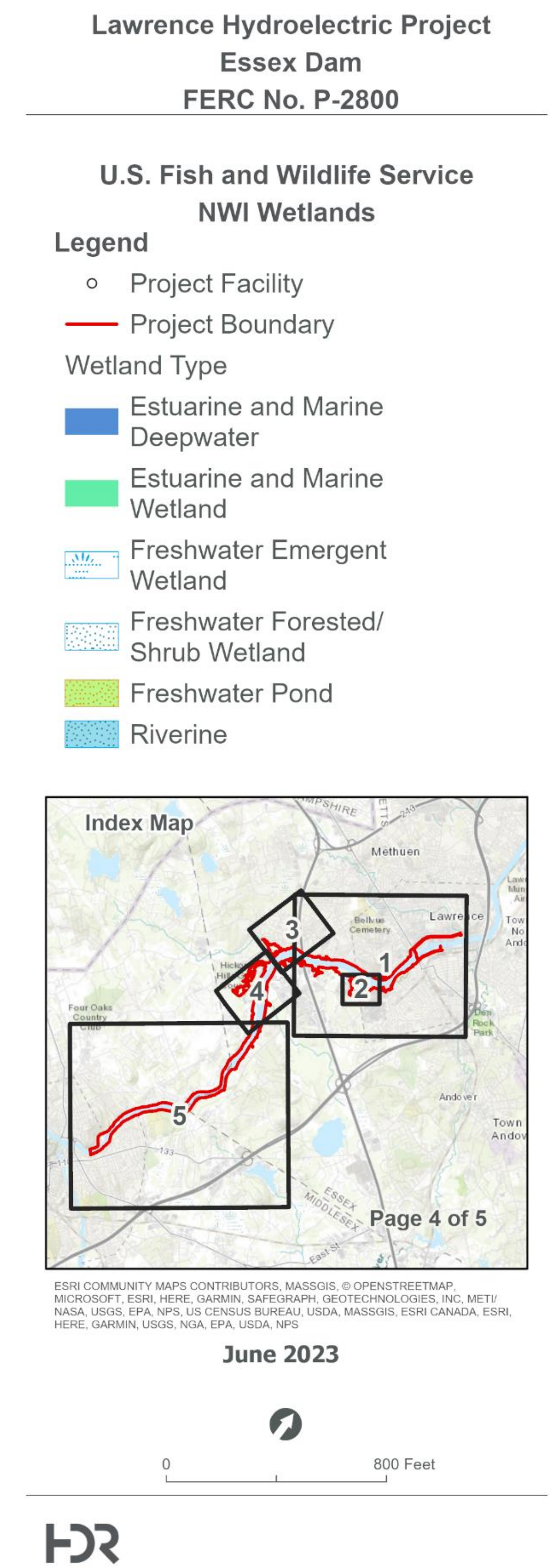


Figure 5.6-5 Mapped NWI Wetlands in the Lawrence Project Boundary

5.7 Rare, Threatened, and Endangered Species

On January 11, 2023, Essex conducted an informal USFWS Information for Planning and Consultation (IPaC) search for the Lawrence Project. The IPaC search generates a report listing species and other resources such as critical habitats under the USFWS's jurisdiction that are known or expected to be on or near the Project boundary. Essex will conduct formal RTE consultation with USFWS during the licensing process.

5.7.1 Federally Listed Threatened, Endangered, and Candidate Species

According to January 11, 2023, informal IPaC search, the federally endangered northern long-eared bat (*Myotis septentrionalis*) and candidate monarch butterfly (*Danaus plexippus*) is listed as potentially affected by activities in the Project area. In addition, NMFS is responsible for the protection of threatened and endangered anadromous and marine fish species. Atlantic sturgeon in the Gulf of Maine DPS is listed as threatened under the ESA, and shortnose sturgeon is listed under the ESA as endangered (NOAA 2023b). No other federally listed species or critical habitats were listed in the informal search. Descriptions of identified species in the Project vicinity are provided below.

Table 5.7-1 ESA-Listed Threatened, Endangered and Candidate Species

Common Name	Scientific Name	Federal Status	State Status
northern long-eared bat	*Myotis septentrionalis*	Endangered	Endangered
monarch butterfly	*Danaus plexippus*	Candidate	-
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Threatened	Endangered
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	Endangered

Source: USFWS 2023b.

5.7.1.1 Northern Long-eared Bat

The northern long-eared bat is found across much of the eastern and north-central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and British Columbia. It is a medium-sized bat, measuring 3 to 3.7 inches, with a wingspan of 9 to 10 inches. Its fur color can be medium to dark brown on the back and tawny to pale brown on the underside. The bat is distinguished by its long ears relative to other bats in the genus Myotis (USFWS 2015).

The northern long-eared bat spends winters hibernating in caves and mines, preferring hibernacula with very high humidity. During the summer, the northern long-eared bat prefers to roost singly or in colonies underneath bark, cavities, or in the crevices of live or dead trees. Breeding begins in late summer or early fall when males swarm near hibernacula. After delayed fertilization, pregnant females migrate to summer colonies where they roost and give birth to a single pup. Young bats begin flying 18 to 21 days after birth, and adult northern long-eared bats can live up to 19 years (USFWS 2015).

Northern long-eared bats emerge at dusk and fly through the understory of forested hillsides feeding on moths, flies, leafhoppers, caddisflies, and beetles. They also feed by gleaning motionless insects from vegetation and water (USFWS 2015).

White-nose syndrome is the most severe and immediate threat to northern long-eared bats. As a result of this disease, based on hibernacula data, northern long-eared bats have declined by 97-100% across the species range (USFWS 2023c). Northern long-eared bats are also susceptible to habitat loss, specifically the loss of wintering and summer roosting hibernacula through anthropogenetic activities. Highway construction, commercial development, surface mining, and wind facility construction permanently remove summer roosting habitat, leading to widespread mortality among individuals and colonies (USFWS 2023c).

5.7.1.2 Monarch Butterfly

A recent review of the USFWS IPaC database indicates that the monarch butterfly, listed as a candidate species in December 2020, can potentially occur in the Project area. In North America, the eastern population of the monarch butterfly migrates north to the United States and Canada in March from the mountains of central Mexico. This species is typically found in open grass areas during the breeding season. Adult monarchs use a wide variety of flowering plants throughout migration and breeding. Important nectar sources during the spring migration typically include tickseeds (*Coreopsis* spp.), *Viburnum* spp., *Phlox* spp., and early blooming milkweeds. Important nectar sources during fall migration include goldenrods (*Solidago* spp.), asters (*Symphyotrichum* spp. and *Eurybia* spp.), gayfeathers (*Liatris* spp.), and coneflowers (*Echinacea* spp.). The optimal survey window for this species is August-December (USFWS 2020).

Within the past decade, monarch butterfly populations have decreased significantly. The decrease in native plants, including milkweed, on which their caterpillars' feed has been and continues to be the greatest threat for the monarch butterfly moving forward (USDA NRCS 2023b). Depletion of native plants and milkweed within the butterflies' native range is partly due to anthropogenic activities, including but not limited to; road construction, herbicide treatment, habitat degradation, grazing and farming pressures, and mowing (USFWS 2020). In general, monarch butterflies are susceptible to insecticide treatment, logging/tree loss, collection/tourism, climate change, disease, and natural predation (USFWS 2020). With the known threats to monarchs, the preservation of current and future population dynamics rests largely on the quality and quantity of milkweed availability.

A candidate species listing indicates that the USFWS has sufficient information on a species' biological status and threats to propose it as endangered or threatened, but for which other higher priority listing activities preclude the development of a proposed listing regulation. Candidate species receive no statutory protection under the ESA.

5.7.1.3 Shortnose sturgeon

Shortnose sturgeon live in rivers and coastal waters from Canada to Florida. They hatch in the freshwater of rivers and spend most of their time in the estuaries, and spawning adults generally migrate upriver from April to May. After spawning, the adults typically move quickly back downstream to the lower river and estuaries. Unlike Atlantic sturgeon, shortnose sturgeon tend to spend relatively little time in the ocean. When they do enter marine waters, they generally stay close to shore. Shortnose sturgeon use their four barbels to search for food in the sandy, muddy bottom of rivers. They use a vacuum-like mouth to suck up a variety of prey from the substrate, typically invertebrates such as insects, crustaceans, worms, and mollusks. (NOAA 2023c)

In general, habitats can be altered, degraded, or destroyed because of various human activities, such as dredging, damming, groundwater pumping. Industrialization and development has also impacted water quality through introduction of nutrients and other contaminants. Fishermen may accidentally capture shortnose sturgeon while trying to catch something else (bycatch). Shortnose sturgeon are primarily bycaught in gillnet fisheries. Shortnose sturgeon have also been captured in pound nets, fyke/hoop nets, catfish pots, shrimp trawls, and even recreational hooks and lines. (NOAA 2023c)

5.7.1.4 Atlantic sturgeon

Atlantic sturgeon are widely distributed along the Atlantic Coast of the United States, occurring in major estuaries and riverine environments within their respective native ranges, or DPS. The ESA listing status for sturgeon is based on their DPS. Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs are listed as federally endangered; those originating from the Gulf of Maine DPS are listed as federally threatened (NOAA 2023b).

Atlantic sturgeon utilizing the Merrimack River as spawning habitat most likely would have originated from the Gulf of Maine DPS, which includes 152 miles of aquatic habitat. The Gulf of Maine DPS incudes all anadromous Atlantic sturgeon spawned in the watersheds from the Maine/Canada border and extending southward to include all associated watersheds draining into the Gulf of Maine as far south as Chatham, MA (NMFS 2017).

The Atlantic sturgeon is a long-lived, late-maturing, estuarine-dependent, anadromous species. Adults spend most of their life in the marine environment but migrate upriver in the spring/early summer (April-May in mid-Atlantic systems) to spawn. Atlantic sturgeon spawning is believed to occur in flowing water between the salt front and fall line of large rivers, where optimal flows are 46–76 centimeters per second (1.5 - 2.5 feet per second) with depths of 11–27 meters (36 – 88 feet).

5.7.2 Critical Habitat

Currently, a portion of the Project boundary is listed by NOAA as Critical Habitat for Atlantic sturgeon. The critical habitat for Atlantic sturgeon includes waters “from the Essex Dam (also known as the Lawrence Dam) downstream to where the main stem river discharges at its mouth into the Atlantic Ocean” (NOAA 2016). Critical habitat for shortnose sturgeon has not been designated.

According to the January 2023 IPaC search, the USFWS has not designated critical habitats in the vicinity of the Lawrence Project.

5.7.3 State-listed, Threatened, Endangered, and Candidate Species

The Massachusetts NHESP provided map and database information based on Essex's request on applicable state-listed threatened, endangered, and candidate species, as well as species of special concern and communities (RTE species). In addition, habitat information was provided by Massachusetts NHESP's fact sheets and flora manuals. Specific to the Project area, the potential presence of RTE species was determined by consulting with Massachusetts NHESP (see Appendix B). Table lists the state-listed species that the Commonwealth of Massachusetts lists as potentially occurring within the Project boundary.

Table 5.7-2 State-Listed Threatened, Endangered and Candidate Species

Common Name	Scientific Name	State Status
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Special Concern
Wood Turtle	*Glyptemys insculpta*	Special Concern

5.7.4 Massachusetts NHESP Priority and Estimated Habitats

The Massachusetts NHESP identifies Priority Habitat based on the known geographical extent of habitat for all state-listed rare species, both plants and animals, and is codified under the MESA. Habitat alteration within Priority Habitat may result in a take of a state-listed species and is subject to regulatory review by the Massachusetts NHESP. Currently, a portion of the Project boundary is listed as Massachusetts NHESP Priority Habitat for sturgeon (PH 2154) (Commonwealth of Massachusetts 2023). This area starts from just upstream of the Essex Dam and extends the length of the Project, and includes the boundaries of the North and South canals. These areas are included as Priority Habitat not because they provide potential sturgeon habitat, but because the operation of the dam and canals could affect downstream sturgeon habitat (Massachusetts NHESP, personal communication). Additionally, the Massachusetts NHESP identified Priority Habitat for bald eagle (PH 1985), which is located adjacent to the Project impoundment approximately 4.5 miles upstream of the Essex Dam. Wood turtle Priority Habitat (PH 2002) is in the vicinity of the Project, located adjacent to the Project impoundment approximately 4 miles upstream of the Essex Dam.

The Massachusetts NHESP also identified Estimated Habitats, which are a subset of the Priority Habitats that are based on the geographical extent of habitat of state-listed rare wetland wildlife and is codified under the Wetlands Protection Act (WPA), which does not protect plants. State-listed wetland wildlife species are protected under the MESA as well as the WPA. Currently, a portion of the Project boundary is listed as Massachusetts NHESP Estimated Habitat (EH 1362). This area starts just upstream of the Essex Dam and extends the length of the Project, and includes the boundaries of the North and South canals. Estimated Habitat is located within the vicinity of the project for bald eagle (EH 1272) and wood turtle (EH 1284). These areas are adjacent to the Project impoundment approximately 4 to 4.5 miles upstream of the Essex Dam.

5.7.5 Biological Opinions, Status Reports, and Recovery Plans

The recovery actions identified in NOAA's Final Recovery Plan for the Shortnose Sturgeon, dated December 1998, has the following components to protect existing populations and rehabilitate habitat:

- Reduce bycatch of shortnose sturgeon;
- Formulate a public education program to increase awareness of shortnose sturgeon and their status;
- Mitigate/eliminate impact of adverse anthropogenic actions on shortnose sturgeon population segments;
- Restore habitats and their functions in the life histories of each population segment;
- Develop a breeding and stocking protocol for shortnose sturgeon;
- Reintroduce shortnose sturgeon into river ecosystems where they have been extirpated.

Using these strategies and following the listed actions, NOAA has a goal to reclassify the species to threatened and eventually delist it from the Federal list of Endangered and Threatened Wildlife (NOAA 1998).

No recovery plans have been developed for the other ESA-listed species potentially occurring in the Project vicinity (Table 5.7-1). Multiple biological opinions have been developed for the Northern long-eared bat, but none are specific to the Project.

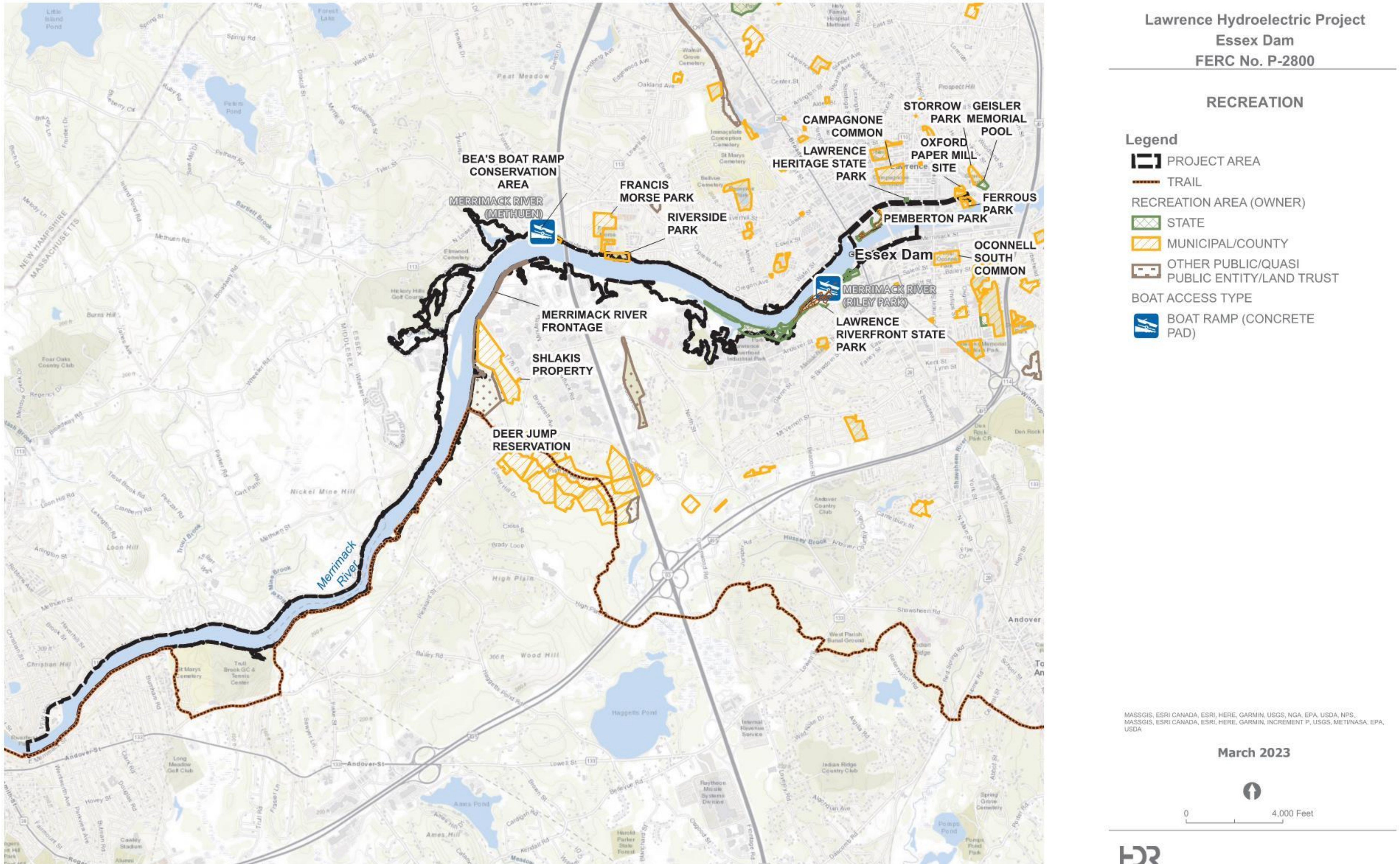
5.8 Recreation and Land Management

The Lawrence Project is founded in a culturally rich region that offers educational opportunities surrounding the American Revolution, the Industrial Revolution, and the American textile industry. The Merrimack River is a focal point across the region, providing drinking water, hydroelectric power, recreation opportunities, food production, and aquatic habitat. Land use within the Project boundary is primarily open water, followed by developed land, woody wetlands, and deciduous forest.

The Project is situated in a distinct ecoregion and environmental setting that directly influences the nature and type of recreational opportunities available. The Lawrence Project is located in the Gulf of Maine Coastal Plain (Level IV) ecoregion as defined by the USEPA. The Gulf of Maine Coastal Plain region is characterized by rolling plains with hills and glacial drumlins. The region contains some ponds, small lakes, wetlands, low and moderate gradient streams, and large rivers with sand, gravel, boulder, and bedrock substrates. The local relief is mostly between 100 and 600 feet (Griffith et al. 2009).

Recreation at the Project has been developed to provide specific opportunities based on the Project location and setting (see Figure 5.8-1). Boating, paddling, and hiking are the primary recreational opportunities that occur in the Project area. The Project has recreational opportunities at the North Canal Carriage House. Various recreational facilities that are not Project related are within the vicinity of the Project. River access is provided both upstream and downstream of the Project.

Figure 5.8-1 Recreational Facilities Associated with the Project



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5.8.1 Existing Recreation Facilities and Opportunities

The Merrimack River provides recreational opportunities to the 200 communities it supports as well as residents of other major cities in the region. The Merrimack River is commonly used for boating, canoeing, kayaking, fishing, rowing, and swimming. The surrounding land is used for walking, biking, hiking, fishing, picnicking, bird watching, photography, skiing, and more.

5.8.2 FERC-Approved Recreational Facilities at the Project

A Recreation Plan was filed June 30, 1977, and supplemented on November 15, 1977, and January 27, 1978, which was subsequently approved in the license order issued December 4, 1978. An amendment to Exhibit R was proposed in a letter dated March 5, 1992, and was supplemented on August 31, 1992. This license amendment requested the picnic area and access to the North Canal Gatehouse be removed from the Recreation Plan, the interpretive programs be revised, and the South Canal Gatehouse to remain in its present location. The revised Exhibit R was approved in an order issued August 1, 1995. On August 10, 1995, a clarification was made to the revised Exhibit R that tours would be provided at the Carriage House, as opposed to the powerhouse and fish lift. This revision was approved in an order dated September 8, 1995.

Under the Recreation Plan, Essex provides a handicap-accessible parking area, tours, and interpretive displays at the North Canal Carriage House. Tours cover the following topics: 1) how electricity is generated from waterpower; 2) the purpose and operation of the fish passage facilities; and 3) the role of The Essex Company, the Great Stone Dam canals and gatehouses (recognized on the National Register of Historic Places) in the development of the City, and early industrialization using hydromechanical power. The interpretive displays explain different aspects of the Project's operation. Figure 5.8-1 above provides a map of recreation facilities associated with the Project. Non-Project recreation facilities and opportunities are discussed in Section 5.8.3 below.

Following a FERC inspection on May 16, 2019, signage was added to better advertise public tours of the North Canal Carriage House. Additionally, flyers advertising the public tours were distributed to the Lawrence History Center, the Massachusetts Department of Conservation & Recreation's Lawrence Heritage State Park, and Lawrence City Hall for posting to public bulletin boards.

5.8.3 Non-Project Recreation Facilities and Opportunities

Numerous non-Project recreation facilities and opportunities exist in the vicinity of the Lawrence Project. The Lawrence Redevelopment Authority, on behalf of the Department of Environmental Management of the Commonwealth of Massachusetts, developed a greenway and pedestrian walkway along the length of the North Canal. On the north side of the North Canal is the Lawrence Heritage State Park, which features a visitors center and Visitor Center Park. Between the North Canal and the Merrimack River exists Pemberton State Park, maintained by the City of Lawrence, which provides a trailer boat ramp, fishing access, a gazebo, park benches, and walking trails. Further downstream of Pemberton State Park is Ferrous Park, which has walking trails, a picnic area, and a gazebo. The Spicket River Greenway is a 3.5-mile-long walking path with connecting parks that extends from Manchester Street Park to Ferrous Park. The Riverwalk Complex has been undergoing redevelopment since 2003 and has included renovation of the mill buildings along Merrimack Street and development of the Riverwalk multi-use recreational trail.

Upstream of the Project is the Lawrence Riverfront State Park, which provides extensive trails, pedestrian bridges, a trailer boat launch, picnic area, playground, gazebo, basketball court, and a street hockey rink. The Abe Bashara Boathouse is located within Lawrence Riverfront State Park and provides sailing lessons, watercraft rentals, and a docking system. The Methuen Riverside Boat Ramp is located approximately 2.7 miles upstream and provides a trailer boat launch and fishing access. The Merrimack River Trail extends on the south shore of the impoundment and includes part of the Bay Circuit Trail, a 230-mile-long trail that traverses the outskirts of Boston. Several municipal parks, conservation lands, boathouses, private boat docks, and athletic facilities are located along the impoundment. A complex of conservation lands is located on river-right approximately 4 miles upstream. Additionally, the Boys and Girls Club of Lawrence, Raymond J. Martin Riverside Park, Phillips Academy Boathouse, Merrimack College Boathouse, Trull Brook Golf Club, and Hickory Hill Golf Course are located along the impoundment. The Clean River Project is located on river-left of the impoundment and offers boat tours of the Merrimack River. The Merrimack Valley Seaplane Base is located west of the Merrimack-Methuen Bridge.

The City of Lawrence contains several recreational opportunities, including parks, athletic facilities, youth facilities, and public pools. There are several plans for redevelopment by various stakeholders in the vicinity of the Project that would provide greater access to the Merrimack River and surrounding area. The Lawrence Rail Trail is proposed as a multi-use recreational path with connecting greenspaces that would cross the Merrimack River, providing pedestrian access to Downtown Lawrence and facilities along the Merrimack River (MassDOT undated). Several other trails are proposed, including a trail along the northern shoreline of the impoundment (City of Lawrence 2017).

The upstream Lowell Hydroelectric Project (FERC No. 2790) and surrounding area offers recreational opportunities covering a wide range of facilities and opportunities including a visitors' center, interpretive displays, boat tours, boating access, conservation areas, state parks, the Lowell National Historical Park, whitewater rapids, a swimming beach, trails, and walking tours.

A list of the recreational facilities in the vicinity of the Project is provided in Table 5.8-1 along with a brief description of each facility.

Table 5.8-1 Recreation Facilities in the Vicinity of the Project

Recreation Area	Description
North Canal Carriage House	Located between the left abutment of Essex Dam and the North Canal entrance. Provides tours and includes a visitor center with a parking area, video displays, lighting, seating, display panels, and other interactive exhibits.

Recreation Area	Description
Lawrence Riverfront State Park	Located immediately adjacent to the Project on the south shoreline of the impoundment. Provides trails, pedestrian bridges, a trailer boat launch, picnic area, playground, gazebo, basketball court, and a street hockey rink.
Pemberton Park	Located between the North Canal and the Merrimack River. Provides trails, picnic tables, and a gazebo.
North Canal pedestrian walkway	Located along the north side of the North Canal. Provides a walkway.
Ferrous Park	Located at the southern terminus of the North Canal. Provides walking trails, a picnic area, and a gazebo.
Spicket River Greenway	Extends from Ferrous Park northwest to Manchester Street Park. Is a 3.5-mile-long walking path with connecting parks.
Oxford Park	Located at the northern terminus of the North Canal. Includes a trail and open greenspace.
Storrow Park	Located east of Ferrous Park and Oxford Park. Provides a playground, basketball court, lawn area, and parking lot.
Geisler Memorial Pool	Located east of Ferrous Park and Oxford Park. Provides a public swimming pool and a parking lot.
Campagnone Common	Located north of the North Canal on Common Street. Provides lawn area, baseball field, playground, walking trails, portable restrooms, fountain, and spectator seating.
O'Connell South Common	Located south of the South Canal on Market Street. Provides a baseball field, walking trails, street hockey rink, basketball court, bandstand, playground, and lawn area.
Lawrence Heritage State Park	Located north of the North Canal. Provides a visitor center and park.
Abe Bashara Boathouse	Located approximately 0.75 mile upstream of Essex Dam. Provides sailing lessons, watercraft rentals, and a docking system.
Clean River Project	Located approximately 2.3 miles upstream of Essex Dam. Provides boat tours of the Merrimack River.
Merrimack Valley Seaplane Base	Located west of the Merrimack- Methuen Bridge on the southern shore of the impoundment. Is a public-use seaplane base.
Boys and Girls Club of Lawrence	Located upstream of Essex Dam. Provides game rooms, gymnasiums, a swimming pool, and a large field.
Raymond J. Martin Riverside Park	Located approximately 2.2 miles upstream of Essex Dam on the northern shoreline of the impoundment. Provides walking trails, playground, and a gazebo.
Francis Morse Park	Located north of the Raymond J. Martin Riverside Park. Provides a baseball field, soccer field, a parking lot, and a walking trail.
Methuen Riverside Boat Ramp	Located approximately 2.7 miles upstream of Essex Dam. Provides a trailer boat launch and fishing access.
Merrimack River Frontage/ Bay Circuit Trail	Located along the southern shoreline of the impoundment from the Lawrence Riverfront State Park to the City of Lowell.

Recreation Area	Description
Strazzula Reservation	Located approximately 1.7 miles upstream of Essex Dam on the southern shoreline of the impoundment, west of the Lawrence Riverfront State Park. Provides trails.
Deer Jump Reservation	Located approximately 3.7 miles upstream of Essex Dam on the southern shoreline of the impoundment. Provides trails, parking areas, provides fishing access, contains the Harold R. Rafton Memorial, and allows hunting.
Albert Retelle Reservation/ Shlakis Property	Located approximately 3.7 miles upstream of Essex Dam on the southern shoreline of the impoundment at the northern section of the Deer Jump Reservation. Provides trails, picnic tables, and a parking area.
Spalding Reservation	Located approximately 6.5 miles upstream of Essex Dam on the southern shoreline of the impoundment. Provides trails and allows hunting.
Behrakis Reservation	Located approximately 6.7 miles upstream of Essex Dam on the southern shoreline of the impoundment. Provides trails.
Rolling Green Reservation	Located approximately 6.3 miles upstream of Essex Dam on the southern shoreline of the impoundment. Provides trails.
Nickel Mine Conservation Land	Located approximately 6.4 miles upstream of Essex Dam north of the impoundment and encompasses Nickel Mine Brook. Provides trails.

5.8.4 Specially Designated Recreation Areas in Close Proximity to the Project

5.8.4.1 Nationwide Rivers Inventory and Wild and Scenic River System

National-level River protection programs include the National Wild and Scenic River System and Nationwide Rivers Inventory (NRI). The National Wild and Scenic River System was created to preserve rivers with outstanding natural, cultural, or recreational values in a free-flowing condition for the enjoyment of present and future generations (NPS 2016). The NRI is a program that lists river segments that are believed to possess one or more “outstandingly remarkable” natural or cultural values; river segments listed on the NRI are eligible for inclusion in the National Wild and Scenic River System (NPS undated-a).

The Merrimack River is not designated as part of, and is not under study for inclusion in, the National Wild and Scenic River System (NPS undated-a). The NPS’s 1999 Upper Merrimack Wild and Scenic River Study found that 26 miles of the river are eligible for inclusion in the National Wild and Scenic River system based on free-flowing character and the presence of outstanding recreation, fish and aquatic, wildlife, cultural, and geological and natural feature values. The study recommended no designation due to lack of support for designation by the affected riverfront communities.

No waters within the Lawrence Project boundary are NRI-listed (NPS 2016). However, portions of the Merrimack River outside of the Project boundary are designated in the NRI. A segment of the Upper Merrimack River is listed based on outstanding resource values in recreation, fish, cultural, and geologic features. The eligible portion comprises the 26-mile section of river between its origin to Concord, NH. Additionally, a 3-mile reach of the Merrimack River downstream of Concord, NH, is listed for outstanding cultural, fish, and recreational values. A 16-mile section of the Merrimack River from Manchester, NH, to Nashua, NH, is listed for outstanding fish, historic, recreational, and wildlife values (NPS 2016).

5.8.4.2 Scenic Byways

There are no national or state scenic byways in the vicinity of the Project.

5.8.4.3 National Trails System and Wilderness Areas

National Trails are established under the authorities of the National Trails System Act (16 USC 1241-51) and consist of three types: National Scenic Trails, National Historic Trails, and National Recreation Trails. There are no national trails in the vicinity of the Lawrence Project (NPS 2020).

The Wilderness Act of 1964 established the National Wilderness Preservation System and instructs federal land management agencies, such as the NPS, Bureau of Land Management, USFWS, and USFS to manage wilderness areas and preserve wilderness character. There are no nationally designated wilderness areas located near the Lawrence Project (Wilderness Connect undated).

5.8.4.4 State Protected River Segments

A 45-mile segment of the Merrimack River in New Hampshire is a designated community river under the New Hampshire Rivers Management and Protection Program (NHDES 2019). Community rivers are defined by the New Hampshire Revised Statutes Title L Section 483:7-a as "those rivers or river segments which flow through populated areas of the state and which possess actual or potential resource values. Such rivers have some residential or other building development near their shorelines, are readily accessible by road or railroad, and may include some impoundments or diversion.” The LMRLAC develops and implements a river management plan and coordinates activities affecting the river on a regional basis.

5.8.5 Current Project Recreation Use Levels

Section 10(a)(1) of the FPA requires the Commission to ensure that any licensed project is best adapted to a comprehensive plan for improving and developing a waterway for a variety of beneficial public uses, including recreational use. FERC Form 80 solicits information on the use and development of recreation facilities at hydropower Projects licensed by the Commission under the FPA. Form 80s have since been eliminated due to the increase in project-specific license conditions for approved recreation plans. However, past Form 80s act as a valuable tool in determining recreation usage for the present. Table 5.8-2 provides FERC Form 80 report data from 2002 through 2014.

Table 5.8-2 Lawrence FERC Form 80 Report Data

Year	Annual Total Recreation Days	Peak Weekend Average Recreation Days	Capacity Utilization
2002	25,610	137	Access Areas: 23% Boat Launch Areas: 27% Boat Launch Lanes: 27% Marinas: 10% Tailwater Fishing Facilities: 30% Parks: 25% Playground Areas: 25% Trails: 5% Wildlife Areas: 40% Visitor Centers: 2% Other (Sailing Club): 60%
2008	14,326	175	Access Areas: 25% Boat Launch Areas: 30% Boat Launch Lanes: 50% Marinas: 25% Tailwater Fishing Facilities: 30% Parks: 50% Playground Areas: 30% Trails: 20% Wildlife Areas: 40% Visitor Centers: 5% Other: 75%
2014	21,355	278	Boat Launch Areas: 30% Marinas: 40% Portages: 15% Tailwater Fishing Facilities: 30% Trails: 20% Active Recreation Areas: 30% Picnic Areas: 40% Visitor Centers: 20% Informal Use Areas: 20%

Source: LHA 2003, LHA 2009, Essex 2015.

5.8.6 Existing Shoreline Buffer Zones

At normal pool elevation of 47.17 feet NGVD29, there are approximately 20 shoreline miles bordering the impoundment impounded by the Essex Dam. In Massachusetts, the Wetlands Protection Act (Massachusetts General Laws Chapter 131, Section 40) protects important wetlands and other resource areas such as land subject to flooding, riverfront area[12], and land under water bodies. MADEP oversees administration of the Wetland Protection Act through its regulations (310 Code of Massachusetts Regulations 10.00). These regulations define the buffer zone as 100 feet around any bank, wetland, beach, dune, or flat bordering the ocean, any estuary, creek, river, stream, pond or lake; land under any waterbody; land subject to tidal action, coastal storm flowage, or flooding; and riverfront area (200 feet from the river or 25 feet in some urban areas). Activities that

[12] Human-made canals, such as the North and South Canals in Lawrence, do not have a riverfront area under Massachusetts' Wetlands Protection regulations. 310 Mass. Reg. 10.58 (2)g.

remove, fill, dredge, or alter an area in the buffer zone must be permitted by the local conservation commission that protects wetland interests.

The General Ordinances for the City of Lawrence include the Wetlands Protection Ordinance, which protects additional resource areas, for additional values, with additional standards, and procedures stricter than those of the Wetland Protection Act. The buffer zone is defined as “the area of land extending one hundred (100) feet horizontally outward from the boundary of the following resource areas: Freshwater Wetlands, Marshes, Wet Meadows, Bogs, Swamps, Lakes, Ponds, Rivers, Streams, Creeks, Banks, Beaches, Vernal Pools, large isolated wetlands, lands under water bodies, lands subject to flooding or inundation by groundwater or surface water as specified in 310 CMR 10.02 (1).”

5.8.7 Shoreline Development Policy

The Licensee does not currently have or anticipate the need for a shoreline management plan.

5.8.8 Recreation Needs Identified in Management Plans

The Massachusetts Statewide Comprehensive Outdoor Recreation Plan (SCORP) was completed in 2017 and covers the period from 2017-2022. The 2017 Massachusetts SCORP guides the distribution of federal money from the Land and Water Conservation Fund to state agencies and municipalities for the acquisition of open space, renovation of parks, development of new parks, and trail construction. The SCORP examined the current supply of outdoor recreation and examined Massachusetts’ residents’ outdoor recreation needs. Outdoor recreation demand was evaluated through three online surveys (one for recreation users, one for municipal recreation providers, and one for land trusts), public meetings throughout the state, and a statistically relevant phone survey. The results of public participation were analyzed and used to formulate the SCORP’s goals and objectives, which are prioritized in the grant rating system.

As described within the SCORP, the direction for recreation in the state is guided by four overarching initiatives with associated goals and recommendations:

1. Access for Underserved Populations;
2. Support the Statewide Trails Initiative;
3. Increase the Availability of Water-based Recreation; and,
4. Support the Creation and Renovation of Neighborhood Parks.

The City of Lawrence Open Space and Recreation Plan (OSRP) was completed in 2017 and covers the period from 2017 to 2024. The OSRP was developed by Groundwork Lawrence to manage the City’s existing park asserts while creating new parks. Through outreach to residents and Geographic Information System analysis, the City of Lawrence developed the following goals and objectives to provide an excellent park system with passive and active recreational opportunities that is equitable for all residents, enhances important natural resources, and values the preservation of the City’s historic resources:

1. Meet the recreational needs of all residents by providing a diverse range of park amenities that appeals to all ages, genders, and abilities.

2. Increase resident awareness about the natural, cultural, recreational, and historic resources provided by Lawrence's park system.

3. Preserving and maintaining Lawrence's historic resources and its rich cultural heritage.

4. Provide residents with alternative transportation options through the establishment of an interconnected system of rail trails, riverwalks, and greenways.

5. Continue to provide opportunities for urban agriculture as a source of local, fresh food for residents.

6. Meet the evolving needs of residents by maintaining and renovating existing parks and open spaces.

5.8.9 Non-Recreational Land Use and Management

Within the Lawrence Project boundary, land cover is a mixture of open water, woody wetlands, urban development, and deciduous forest. There are residential homes and commercial properties along the shoreline of the Project impoundment. Figure 5.1-2 in Section 5.1 provides a map of the land cover types within the Lawrence Project boundary.

Essex manages Project lands to provide for safe and efficient operation of the Project and to provide for the protection of scenic, forestry, and natural resources. As described above in Section 5.8.1, recreation areas are located at the Project that provide river access.

5.9 Aesthetic Resources

The Lawrence Project is located in an urban setting with various commercial and residential properties as well as recreation facilities. The Project operates in a ROR mode which maintains the aesthetic qualities of the bypassed reach Merrimack River. Several residential properties along the impoundment and historic districts of the City of Lawrence are provided scenic views of the river. The Essex Dam is clearly visible from the Broadway Street Bridge. The powerhouse is visible from Broadway Street, however, the powerhouse is largely below ground and the exposed portions of the powerhouse are screened by a berm (LHA 1977). Appropriate trees and shrubs were planted to soften the Project structures (LHA 1977). The exposed walls of the Project were constructed of materials designed to be compatible with the adjacent rough-cut granite blocks of the dam and canal embankments (LHA 1977). The utility connector is located in a corridor already containing overhead utility lines. The North and South Canals and associated structures contribute to the aesthetic qualities of the area and are visible from the adjacent roadways, pedestrian walkways, and recreation areas.

Several observation/picnic areas and trails in the Project area provide views of the Merrimack River and historical structures including multiple textile mills, gatehouses, and canals. Of note, the North Canal Carriage House is a recreation area provided by Essex that provides an opportunity for viewing the Carriage House and Essex Dam. Downstream of Essex Dam, Pemberton Park and the Riverwalk are popular access areas for viewing the Merrimack River. Ferrous Park and Oxford Park provide access for viewing the North Canal spillway, Spicket River, and Merrimack River. The Merrimack River upstream of the Essex Dam is enjoyed by recreationists at the Riverfront State Park and various conservation areas that border the Project impoundment.

An allegation of non-compliance was filed by Complainants in 2017 regarding the visual quality of the North and South Canals (see Section 4.7.2 for more details). Complainants were concerned about the vegetation growing from the Canal walls, the water levels within the Canals, and trash accumulation in the Canals. Essex was not found to be in violation of its license (FERC 2019). As a follow-up item to the inspection performed by FERC staff in response to the complaint, Essex maintains a Trash Removal Plan, in which debris is removed at each canal gatehouse twice a year (Essex 2019b). Additionally, weekly inspections of debris accumulation are performed at each canal gatehouse. When necessary, additional removal efforts are arranged. Vegetation maintenance is an ongoing task and Essex has contracted with a third party to provide regular vegetation management work.

5.10 Cultural Resources

In considering a new license for the Project, FERC has the lead responsibility for compliance with applicable federal laws, regulations, and policies pertaining to historic properties, including the National Historic Preservation Act of 1966 (NHPA), as amended. Section 106 of the NHPA (Section 106) requires federal agencies to consider the effects of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment.

The regulations implementing Section 106 (36 CFR Part 800 – The Protection of Historic Properties) define a “historic property” as any precontact or historic period district, site, building, structure, or individual object listed in or eligible for inclusion in the National Register of Historic Places (NRHP). This term includes artifacts, records, and remains that are related to and located within historic properties, as well as properties of traditional religious and cultural significance (often referred to as “traditional cultural properties” or “TCPs”) that meet the NRHP criteria. The Section 106 process is intended to accommodate historic preservation concerns with the needs of federal undertakings through a process of consultation with agency officials, the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officers, federally recognized Indian tribes, and other parties with a potential interest in an undertaking’s effects on historic properties. Concurrent with the filing of this PAD and the NOI, Essex is requesting designation as the Commission’s non-federal representative for purposes of conducting informal consultation pursuant to Section 106.

The Secretary of the Interior has established the National Register Criteria for evaluating properties for inclusion in the NRHP (36 CFR Part 60). In accordance with the criteria, properties are eligible if they are significant in American history, architecture, archaeology, engineering, or culture. The quality of significance is present in historic properties that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- Criterion A: Are associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B: Are associated with the lives of persons significant in our history; or
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant or distinguishable entity whose components may lack individual distinction; or
- Criterion D: Have yielded or may be likely to yield information important in prehistory or history.

5.10.1 Cultural Context - Cultural Sequence of the Project Area

The archaeological record of Precontact and Historic period populations in Massachusetts begins 13,000 years ago before present (B.P.) at the end of the last Ice Age. This section provides a brief overview of the cultural context of the region.

5.10.1.1 Precontact Period

The Precontact Period is divided into three major cultural stages or periods that define Precontact cultural behaviors and developments in northeastern Massachusetts. The cultural stages or periods are defined as Paleoindian (13,000 to 10,000 B.P.), Archaic (10,000 to 3,000 B.P.), and Woodland (3,000 to 500 B.P.). The Archaic and Woodland periods are each comprised of three subperiods designated as Early, Middle, and Late based on defined cultural and technological traits. The cultural stages or periods of the Precontact Period are as follows:

Paleoindian Period (13,000 to 10,000 B.P.)

Archaic Period (10,000 to 3,000 B.P.)

Early Archaic Period (10,000 to 8,000 B.P.)
Middle Archaic Period (8,000 to 6,000 B.P.)
Late Archaic Period (6,000 to 3,000 B.P.)

Woodland Period (3,000 to 500 B.P.)

Early Woodland Period (3,000 to 2,000 B.P.)
Middle Woodland Period (2,000 to 1,000 B.P.)
Late Woodland Period (1,000 to 500 B.P.)

The Paleoindian Period (13,000 to 10,000 B.P.) is defined as the earliest evidence of peopling and human occupation in present-day Massachusetts to occur during the Late

Glacial Interstadial warming period after the Last Glacial Maximum, which is temporally defined as the Late Pleistocene and Early Holocene epochs. The Younger Dryas (12,900 to 11,600 B.P.) reversed gradual climatic warming during the Late Glacial Interstadial, creating a tundra environment with spruce parkland flora and an ideal environment for a variety of Pleistocene megafauna (e.g., Mammutidae, or Castorides) (Newby et al. 2005, Lothrop et al. 2011, Ridge 2003). Paleoindian subsistence practices relied heavily on a hunter-gather strategy with an emphasis on large migratory animals and migrating caribou populations (Ritchie and Funk 1973, Lothrop et al. 2016). Movement, mobility, and settlement patterns of Paleoindian peoples have been associated with seasonal fauna migratory routes, select topographic features, and procurement of high-quality lithic materials from select sources (Lothrop et al. 2011, 2018). Paleoindian Period archaeological sites in New England and the Canadian Maritime Provinces typically consist of a sparse lithic tool assemblage that includes fluted projectile points, endscapers, gravers, and blade technology (Robinson 2011, Robinson and Ort 2013, Singer 2017). Previous archaeological investigations of Paleoindian archaeological sites in Essex County includes the Bull Brook and Bull Brook II sites in Ipswich, Massachusetts (Grimes et al. 1984, Robinson et al. 2009). The Memorial Park 2 Locus Site (19-ES-758) located to the southeast of the Project site along the Shawsheen River in Lawrence, Massachusetts, yielded an untyped projectile point and chert graver associated with Paleoindian occupation (Waller and Ritchie 2003, Bell 2012). No Paleoindian Period sites have been identified within the Project boundary.

The Archaic Period (10,000 to 3,000 B.P.) is a cultural stage or period that seriates from the preceding Paleoindian Period (13,000 to 10,000 B.P.) based on a variety of differing cultural material assemblages and settlement and subsistence patterns concurrent with the temporal shift from Pleistocene to Holocene geological epochs (e.g., Ellis et al. 1998; Spiess 1992). Archaeologists have temporally subdivided the Archaic Period into Early Archaic (10,000 to 8,000 B.P.), Middle Archaic (8,000 to 6,000 B.P.), and Late Archaic (6,000 to 3,000) subperiods. Each subperiod is discussed separately below.

Archaeological sites and materials relating to the Early Archaic Period (10,000 to 8,000 B.P.) are comparatively rare to the other periods of the cultural chronology and characterized as small social groups occupying riverine and lacustrine settings with an inclination to inhabit mosaic landscapes within former glacial lake basins that influenced increased generalized subsistence strategies (Nicholas 1987, 1988). Three cultural and lithic traditions are diagnostically assigned to the Early Archaic Period and include the Late-Paleoindian, the Piedmont (bifurcated base lithic technology), and the Gulf of Maine Archaic Tradition (Jones 1999; Funk 1997; Robinson and Petersen 1993). The Morrill Mound Site (19-ES-281) located at the mouth of the Merrimac River in Salisbury, Massachusetts, contained red ochre cremation burials associated with full-channel gouges, stone rods, celts, and atypical serrated and notched projectile points with the oldest ^{14}C radiocarbon date at 8,500 ± 80 B.P. (AA 21974) (Robinson 1992, 2006). No Early Archaic Period sites have been identified within the Project boundary.

The Middle Archaic Period (8,000 to 6,000 B.P.) is ecologically defined as a dry and warm climate containing a diversity of flora and fauna that influenced increased foraging behaviors compared to preceding cultural periods (Dincauze and Mulholland 1977). Archaeological sites of this period are represented by permanent or semi-permanent riverine-located settlement strategies where social groups would seasonally convene to exploit anadromous and catadromous fishes (Dincauze 1974,1976; Nassaney 1999). Dincauze (1976) proposes an “Atlantic Slope Macrotradition” ranging from North Carolina to New Hampshire that establish an early broadpoint stylization beginning during the Early Archaic Period and regionally manifesting into Neville and Neville-variant projectile points. Other diagnostic technologies of the Middle Archaic Period include Stark projectile points, atlatls, knives, ulu (semi-lunar knives), perforators, axes, adzes, celts, scrapers, abraders, gouges, and harpoons. The Lawrence Stadium Site (19-ES-200) to the southeast of the Project site, along the Shawsheen River in Lawrence, Massachusetts, identified a Middle Archaic component while no Middle Archaic Period sites have been identified within the Project boundary.

The latter portion and terminus of the Archaic Period is defined as the Late Archaic Period (6,000 to 3,000 B.P.) and represents an incline of flora and fauna diversity, comparable to present-day populations; increased population densities and settlement strategies via a higher density of archaeological sites in close proximity to riverine, lacustrine, and coastal locales (e.g., coastal shell middens); in addition to evidence of arboriculture and sylviculture in mast forest settings (e.g., Hart and Asch-Sidell 1997, Snow 1980: 187-259). Archaeologists have identified three separate cultural and technological traditions during the Late Archaic Period and includes the Laurentian (6,000 to 4,500 B.P.), the Susquehanna (4,100 to 2,700 B.P.), and the Small Stemmed/Mast Forest Archaic (6,000 to 1,000 B.P.) (Deal et al. 2022, Dincauze 1975, Ritchie 1969:79-83, Snow 1980: 223-233). Archaeologists do not fully comprehend the complexity of the relationships between the three identified cultural traditions yet are distinguished via projectile point stylizations and lithic toolkits, expressing differing subsistence adaptations, while the Susquehanna tradition is distinct by the development of steatite vessel technology, broadpoint technology, a ceremonial cremation burial tradition, and regional incorporation of copper usage (e.g., Dincauze 1968, Campbell 2016, Leveillee 1999). Late Archaic components have been identified at the Lawrence Stadium Site (19-ES-200), the Den Rock Site (19-ES-203), and the Shawsheen River 2 Site (19-ES-204) along the Shawsheen River in southeastern Lawrence, Massachusetts. No Late Archaic Period sites have been identified within the Project boundary.

The Woodland Period (3,000 to 500 B.P.) represents a cultural stage or period that differs from the preceding Archaic Period (10,000 to 3,000 B.P.) based on the development of ceramic and bow-and-arrow technologies, the introduction of horticultural practices creating semi-permanent settlements, vast trade networks (e.g., Hopewell Interaction Sphere), complex mortuary ceremonialism (e.g., Orient, Meadowood, Middlesex, and Adena), and defined political systems (e.g., Hasenstab 1999, Mulholland 1988, Snow 1980: 261-344). Archaeologists have temporally subdivided the Woodland Period into the Early Woodland (3,000 to 2,000 B.P.), the Middle Woodland (2,000 to 1,000 B.P.), and the Late Woodland (1,000 to 500 B.P.) subperiods. Each subperiod is discussed briefly below.

The Early Woodland Period (2,000 to 1,000 B.P.) has been defined as a declined population in the wake of the Late Archaic Period (6,000 to 3,000 B.P.) cultural florescence, the introduction of ceramic vessel technology (Vinette I), bow-and-arrow technology, the development of vast trade networks, and increased complex mortuary ceremonialism (Snow 1980). Some archaeologists have argued that cultural ethnicity and the Algonquian language were established as early as this subperiod (Fiedel 1987, 2013). The Den Rock Site (19-ES-203) has been identified as having a Woodland Period component that may date to Early Woodland occupation, but no definitive Early Woodland sites have been identified in the City of Lawrence.

Cultural trends stemming from the Early Woodland Period continue into the Middle Woodland Period (2,000 to 1,000 B.P.) with cultural and technological differences in ceramic decoration and stylization, diagnostic projectile point typologies (e.g., Jack's Reef Horizon [1,500 to 1,100 B.P.] and Fox Creek Phase [1,600 to 1,250 B.P.]), increased presence of exotic lithic materials, and an emphasis on coastal riverine and coastal settings (e.g., Boudreau 2016, Luedtke 1987, Strauss 1993, Snow 1980). The Shattuck Farm site (19-ES-196) in neighboring Salisbury, Massachusetts, contained Fox Creek and Jack's Reef Middle Woodland Period diagnostic projectile points (Luedtke 1985). In comparison, the Late Woodland Period (1,000 to 500 B.P.) is defined by spatially expanding horticultural practices centered on maize, beans, and squash (Three Sisters), increased permanent village settlements along positioned landforms in major riverine and coastal settings, intricate ceramic vessel design, vast trade networks, and the presence of European exploration and initial settlement beginning by the late 15th century (e.g., Bragdon 1996; Lavin 1987, 2002; Leveillee 2006).

Two archeological sites: the Village Site 1 (19-ES-182) and Village Site 2 (19-ES-191) do not have a temporal affiliation as referenced on the Massachusetts Cultural Resources Information System (MACRIS), yet both archaeological sites are referenced during the Merrimac River Archaeological Survey conducted in 1930 by Warren K. Moorehead for the Peabody Museum (now the Peabody Essex Museum) in Salem, Massachusetts (Moorehead 1931). Moorehead mentions that "below the dam at Lawrence are extensive sand flats, particularly on the south side of the river. During the construction of the American Woolen Company mills many Indian objects were found [Village Site 2]," additionally noting that "before the textile companies of Lawrence erected the present thirty-foot dam, there were falls opposite the Shattuck site, and great quantities of shad and salmon were taken each spring" (Moorehead 1931:13,23). Village Site 1 (19-ES-182) and Village Site 2 (19-ES-191) are located along the northern and southern banks of the Merrimac River, in proximity to the Great Stone Dam (LAW. 907), with Village Site 1 located within the northwestern edge of the Project site, and Village Site 2 abutting the southwestern Project boundary.

5.10.1.2 Historic Period

Ephemeral contact between Native Americans and Europeans along the Gulf of Maine and locally at the mouth of the Merrimack River at modern-day Salisbury and Newburyport, Massachusetts, may have begun as early as the 16th century (e.g., Faulkner 1985, Fisher 2008). Historically, the Pawtucket or Naumkeag Tribe, an Algonquian-speaking population consisting of a loose confederation of villages, lived along the southern extents of the Merrimack River and were allied with the Pennacook Tribe, another Algonquian-speaking population residing along the northern extents of the Merrimac River with extended relations with the northern Wabanaki Confederacy. Due to poor European documentation of Indigenous populations of northeastern Massachusetts in the 17th century, a variety of endonyms have been assigned to potentially the same or differing Indigenous cultural groups. European incursion along the eastern seaboard had direct and indirect ramifications for Native American populations across northeastern North America. Disease and illness, intra and inter-competition for resources, and Atlantic World trade systems altered the Indigenous landscape by the mid-17th century. The earliest settlement of the general area was in 1640 when a group of men from Newbury and Ipswich, Massachusetts, created a settlement in modern-day Haverhill, Massachusetts, and created meadow lots along the western edge of the Spicket River, but no records can be found of who the first settlers were and when they settled in Lawrence, Massachusetts (Wadsworth 1880).

Although there is lacking evidence of historic settlement and development of Lawrence, Massachusetts, the city was originally part of the 1640 Haverhill settlement and the 1642 Andover settlement; and over two centuries later, Lawrence was founded in 1845 and incorporated in 1847 as a "planned mill town based on the textile industry" (Massachusetts Historical Commission [MHC] 1986). The city began with the incorporation of the Essex Company in 1845, which was headed by the company's President and Chief Stockholder Abbot Lawrence, the city's namesake, who wanted to harness the power of Bodwell Falls on the Merrimack River (MHC 1986). The Essex Company acquired 4,313 acres, helping the company to secure rights and leases to waterpower, creating a boom in the construction of mills and mill worker housing and associated infrastructural developments within the following decades (MHC 1986). The development of textile and paper mills, with the heavy influx of immigration during the mid-19th to 20th centuries created the expanse and identity of Lawrence, Massachusetts.

The MHC, through the use of MACRIS, has identified one 19th to 20th century historic period archaeological site, known as the Shattuck Street Dump (LAW.HA.1) along the southwestern edge of the Project boundary, while 180 historic architectural resources, mainly 19th to 20th century mill complexes, mill worker housing, and religious institutions have been located within and outside of the Project site (MACRIS 2023). All historic architectural resources located within the Project site are associated with the North Canal Historic District (LAW.A/W), where all contributing elements are also listed in the NRPH.

5.10.1.3 Lawrence Hydroelectric Project

The Lawrence Hydroelectric Project is located along the Merrimac River in Lawrence, Massachusetts, and the Project consists of 11 facilities including the Essex Dam, or the Great Stone Dam (LAW.907), the Project impoundment, intake canal, powerhouse, turbines and generators, the North Canal (LAW.906), the South Canal (LAW.908), tailrace, fish passage structures, transmission line, and recreational facilities (see Section 4.3). The City of Lawrence was founded in 1845 and later incorporated in 1847 with the incorporation of the Essex Company as a planned mill town. Between 1845 and 1896 the construction of the Great Stone Dam (1848), the North Canal (1848), the Locks and Wasteway (LAW.931) (1845), and the South Canal (1866/1896) was conducted to secure rights and leases to waterpower. All of the initial construction by the Essex Company was designed by Charles Storrow, Chief Engineer and Treasurer of the Essex Company, and was constructed by Storrow's successor, Charles Bigelow. The hydroelectric plant, including the Project impoundment, intake canal, powerhouse, turbines and generators, tailrace, fish passage structures, transmission line, and recreational facilities were commissioned in 1981.

The City of Lawrence is named after Abbott Lawrence, the Essex Company's President and Chief Stockholder, who oversaw the design and development of Lawrence into a mill city. Abbott Lawrence later served as United States Minister to the United Kingdom from 1849 to 1852 and provided $50,000 to establish the Lawrence Scientific School at Harvard College (now the Harvard John A. Paulson School of Engineering and Applied Sciences). Certain facilities such as, the Great Stone Dam, the North Canal, and the Locks and Wasteway are listed in the NRHP and are contributing elements to the North Canal Historic District (LAW.A/W) listed in the NRHP on November 13, 1984, and later amended to include the Morehouse Bakery (LAW.789) on May 8, 2009. The South Canal (LAW.908) may be potentially eligible for listing in the NRHP according to Criterion C, given the canal's distinctive type, period, and method of construction. The remaining facilities do not meet the criteria for listing in the State Register of Historic Places (SRHP) or for the NRHP.

5.10.2 Area of Potential Effects

An area of potential effects (APE) is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking. Although the nature of the Project's potential effects is limited by the nature of this undertaking (the relicensing and continued operation of an existing hydroelectric Project), the Project has the potential to affect historic properties directly or indirectly.

The Commission has not yet defined an APE for the relicensing of the Project. In the context of the FERC relicensing process, the Commission typically defines the APE to include all lands within a project's boundary (as defined in Exhibit K) and any lands outside a project's boundary where cultural resources may be affected by project-related activities that are conducted in accordance with a FERC license.

An APE as typically defined by the Commission for relicensing, is consistent with the potential scope of the Project effects. Accordingly, Essex proposes to adopt this definition of the APE for this undertaking. Essex will consult with the MHC, ACHP, and federally recognized Indian tribes (collectively, the "Consulting Parties") regarding the proposed definition of the APE.

5.10.3 Existing Discovery Measures

Article 29 of the Lawrence Hydroelectric Project license requires the Licensee to consult with the MHC prior to any future construction to assess the need for a cultural resource survey and salvage work.

5.10.4 Cultural Resources Studies and Consultation

Based on a review of the MHC's MACRIS database, a portion of the Lawrence Hydroelectric Project is within a National Registered Historic District (North Canal National Register Historic District). A total of six (6) archaeological surveys were identified via MHC's MACRIS database occurring within and in vicinity of the Project boundaries:

- The Phase II Archaeology Survey, Methuen Wastewater Project, Town of Methuen, Essex County, Massachusetts.
- The Phase I Intensive (Locational) Survey, Spicket River Facilities Plan, City of Lawrence, Essex County, Massachusetts.
- The Phase I Archaeological Reconnaissance and Intensive (Locational) Survey, Urban State Heritage Park, City of Lawrence, Essex County, Massachusetts.
- The Phase I Archaeological Reconnaissance and Intensive (Locational) Survey, Lawrence Hydroelectrical Project, City of Lawrence, Essex County, Massachusetts.
- The Phase I Intensive (Locational) Survey, Phase II Archaeological Survey, and Phase III Data Recovery, The Shattuck Street Dump Site, City of Lawrence, Essex County, Massachusetts.
- The Phase I Intensive (Locational) Survey, Merrimack Congregation Plant, City of Lawrence, Essex County, Massachusetts.

5.10.5 Reported Archaeological and Historic Resources

Essex reviewed publicly available information regarding previously reported historic and archaeological resources within or adjacent to the proposed APE. This review provides information to better characterize the nature and types of known resources located within the vicinity of the proposed APE.

5.10.5.1 Archaeological Resources

Essex conducted a review of the MHC's MACRIS database to identify previously reported archaeological resources within the Project's vicinity. Table 5.10-1 summarizes the reported archaeological resources within approximately 1,000 feet of the Project boundary.

Table 5.10-1 Archaeological Sites within Approximately 1,000 Feet of the Project

Site Name/Identifier	Period	NRHP Status	Relationship to Project Boundary
Village Site I (19-ES-182)	Prehistoric	Undetermined	Within Project Boundary
Village Site II (19-ES-191)	Prehistoric	Undetermined	Outside of Project Boundary
Shattuck Street Dump Site (LAW.HA.1)	Historic	Undetermined	Outside of Project Boundary

5.10.5.2 Historic Architectural Resources

Based on a review of MACRIS, 180 total historic architectural resources comprised of 141 NRHP and 39 State Inventoried Properties were identified within approximately 1,000 feet of the Project boundary. 140 of the identified NRHP are contributing elements to four National Historic Districts (North Canal Historic District [LAW.A/W], Downtown Lawrence Historic District [LAW.B], American Woolen Mill Housing District [LAW.E], and American Woolen Company Townhouses [LAW.Z]), one Historic Commercial District (Blakeley and Bicknell Buildings Commercial District [LAW.P]) and one Local Historic District (North Common Local Historic District [LAW.M]). Eight of the identified State Inventoried Properties are contributing elements to three Local Historic districts (North Common Local Historic District [LAW.M], Mechanics Block Local Historic District [LAW.N], and Blakeley and Bicknell Buildings Commercial District [LAW.P]). Table 5.10-2 summarizes the reported historic architectural resources within approximately 1,000 feet of the Project boundary.

Table 5.10-2 Historic Architectural Resources within Approximately 1,000 Feet of the Project

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
North Canal Historic District (LAW.A/W)	Essex Company Machine Shop (LAW.4)	1846	Yes	Yes	Outside of Project Boundary
	Pemberton Manufacturing Company Main Mill (LAW.4)	1861	Yes	Yes	Outside of Project Boundary
	Essex Company Offices and Yard (LAW.10)*	1883	Yes	Yes	Outside of Project Boundary
	Atlantic Cotton Mills Boarding House (LAW.61)	1847	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
North Canal Historic District (LAW.A/W)	Washington Mills – Building #1 (LAW.217)	1868	Yes	Yes	Outside of Project Boundary
	Bay State Woolen Mills Boarding House (LAW.219)	1847	Yes	Yes	Outside of Project Boundary
	Everett Mills Company Weaving and Spinning Mill #5 (LAW.255)	1909	Yes	Yes	Outside of Project Boundary
	North Canal Gatekeeper's House (LAW.263)	1845	Yes	Yes	Within Project Boundary
	Upper Pacific Cotton Mill Weave Shed and Office (LAW.264)	1887	Yes	Yes	Outside of Project Boundary
	Upper Pacific Cotton Mill Turbine House Fragments (LAW.265)	1852	Yes	Yes	Outside of Project Boundary
	Upper Pacific Storehouse #5 (LAW.266)	1860	Yes	Yes	Outside of Project Boundary
	Merrimack Valley United Fund (LAW.267)	1960	Yes	Yes	Outside of Project Boundary
	Merrimac Valley United Fund (LAW.268)	1959	Yes	Yes	Outside of Project Boundary
	Kid Start (LAW.269)	1955	Yes	Yes	Outside of Project Boundary
	Atlantic Mill Company Spinning Mill #5 (LAW. 270)	1906	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
North Canal Historic District (LAW.A/W)	Upper Pacific Cotton Yarn Mill # 5 (LAW.272)	1902	Yes	Yes	Outside of Project Boundary
	Goodyear Store (LAW.273)	1895	Yes	Yes	Outside of Project Boundary
	Upper Pacific Cotton Yarn Mill (LAW.274)	1896	Yes	Yes	Outside of Project Boundary
	Upper Pacific Worsted Mill #10 (LAW.275)	1889	Yes	Yes	Outside of Project Boundary
	Upper Pacific Storehouse #7 (LAW.276)	1896	Yes	Yes	Outside of Project Boundary
	New England Telephone Building (LAW.277)	1950	Yes	Yes	Outside of Project Boundary
	Lower Pacific Cotton Mill (LAW.278)	1883	Yes	Yes	Outside of Project Boundary
	Lower Pacific Worsted Mill (LAW.279)	1864	Yes	Yes	Outside of Project Boundary
	Lower Pacific Cotton Mill Power House (LAW.280)	1885	Yes	Yes	Outside of Project Boundary
	Lower Pacific Finishing Mill (LAW. 281)	1911	Yes	Yes	Outside of Project Boundary
	Lower Pacific Finishing and Packing Mill (LAW.282)	1882	Yes	Yes	Outside of Project Boundary
	Lower Pacific Worsted Weaving Mill (LAW.283)	1895	Yes	Yes	Outside of Project Boundary
	American Woolen Company Dye House (LAW.285)	1887	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
North Canal Historic District (LAW.A/W)	American Woolen Company- Mill #7 (LAW. 286)	1887	Yes	Yes	Outside of Project Boundary
	American Woolen Company Storehouse (LAW.287)	1919	Yes	Yes	Outside of Project Boundary
	American Woolen Company Office (LAW.288)	1900	Yes	Yes	Outside of Project Boundary
	Washington Mills Company – Building #6 (LAW.289)	1887	Yes	Yes	Outside of Project Boundary
	Pemberton Powerhouse (LAW.290)	-	Yes	Yes	Outside of Project Boundary
	American Woolen Company Storehouse (LAW.291)	1890	Yes	Yes	Outside of Project Boundary
	Pemberton Company Offices and Warehouse #3 (LAW.292)	1890	Yes	Yes	Outside of Project Boundary
	Walton School (LAW.293)	1860	Yes	Yes	Outside of Project Boundary
	Pemberton Company Stable (LAW.294)	1880	Yes	Yes	Outside of Project Boundary
	American Woolen Company Power Plant (LAW.295)	1923	Yes	Yes	Outside of Project Boundary
	Bay State Mills Railroad Shed (LAW.296)	1848	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Pemberton Mill Picker House (LAW.297)	1850	Yes	Yes	Outside of Project Boundary
	Lawrence Duck Company Mill #3 (LAW.298)	1853	Yes	Yes	Outside of Project Boundary
	Everett Mills Company Storehouse #8 (LAW. 300)	1900	Yes	Yes	Outside of Project Boundary
	Everett Mill Company Waving Mill #4 (LAW.302)	1892	Yes	Yes	Outside of Project Boundary
	Everett Mill Company Picker (LAW.303)	1892	Yes	Yes	Outside of Project Boundary
	Everett Mill Company Cloth Room (LAW.304)	1892	Yes	Yes	Outside of Project Boundary
	Everett Mill Storehouse #6 (LAW.305)	1863	Yes	Yes	Outside of Project Boundary
	Everett Mills Storehouse (LAW.306)	1905	Yes	Yes	Outside of Project Boundary
	Kunhardt, George E. Woolen Mill #1 and Office (LAW.307)	1890	Yes	Yes	Outside of Project Boundary
	Kunhardt, George E. Woolen Shop and Boiler House (LAW.308)	1896	Yes	Yes	Outside of Project Boundary
	Kunhardt, George E. Woolen Mill #4 (LAW.309)	1896	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Kunhardt, George E. Warehouse (LAW.310)	1896	Yes	Yes	Outside of Project Boundary
	Hamblet Machine Company (LAW.311)	1859	Yes	Yes	Outside of Project Boundary
	Ferrous Technology (LAW.312)	1960	Yes	Yes	Outside of Project Boundary
	Ferrous Technology (LAW.313)	1978	Yes	Yes	Outside of Project Boundary
	Ferrous Technology (LAW.314)	1940	Yes	Yes	Outside of Project Boundary
	Lawrence Experimental Sanitation Station (LAW.315)	1886	Yes	Yes	Outside of Project Boundary
	North Canal Lockkeeper's House (LAW.316)	1848	Yes	Yes	Outside of Project Boundary
	Kunhardt, George E. Corporation (LAW.581)	1890	Yes	Yes	Outside of Project Boundary
	Morehouse Bakery Company (LAW.789)	1907	Yes	Yes	Outside of Project Boundary
	Museum Square Garage (LAW.792)	1995	Yes	Yes	Outside of Project Boundary
	Kunhardt, George E. Woolen Mill #9 (LAW.795)	1896	Yes	Yes	Outside of Project Boundary
	U.S. Citizenship Center (LAW.796)	2008	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Fenton Judicial Center (LAW.797)	1995	Yes	Yes	Outside of Project Boundary
	Central Bridge (LAW.901)	1918	Yes	Yes	Within Project Boundary
	Prospect Street Bridge (LAW.904)	1855	Yes	Yes	Outside of Project Boundary
	North Canal Bridge-Central Bridge (LAW.905)	1918	Yes	Yes	Within Project Boundary
North Canal Historic District (LAW.A/W)	North Canal (LAW.906)	1848	Yes	Yes	Within Project Boundary
	Great Stone Dam (LAW.907)	1848	Yes	Yes	Within Project Boundary
	Upper Pacific Bridge (LAW.909)	1864	Yes	Yes	Within Project Boundary
	Lower Pacific Bridge (LAW.910)	1870	Yes	Yes	Within Project Boundary
	Washington Mills Canal Bridge (LAW.911)	1923	Yes	Yes	Within Project Boundary
	Spicket Penstock (LAW.912)	1855	Yes	Yes	Outside of Project Boundary
	Union Street Bridge over North Canal (LAW.915)	1938	Yes	Yes	Within Project Boundary
	Washington Mills Gate House (LAW.924)	1886	Yes	Yes	Outside of Project Boundary
	Boston and Maine North Canal Railroad Bridge (LAW.928)	1888	Yes	Yes	Within Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Locks and Wasteway (LAW.931)	1845	Yes	Yes	Within Project Boundary
	Broadway Bridge (LAW.998)	1854	Yes	Yes	Within Project Boundary
	Upper Pacific Cotton Mill Pedestrian Bridge (LAW.999)	1849	Yes	Yes	Within Project Boundary
	Amesbury Street Pedestrian Bridge (LAW.9000)	1880	Yes	Yes	Within Project Boundary
	Washington Mills Building #1 Bridge (LAW. 9001)	2007	Yes	Yes	Within Project Boundary
	Pemberton Mill Bridge (LAW.9002)	1902	Yes	Yes	Within Project Boundary
	Pemberton Mill Bridge II (LAW.9003)	1920	Yes	Yes	Within Project Boundary
	Lawrence Heritage State Park (LAW.9005)	1985	Yes	Yes	Outside of Project Boundary
Downtown Lawrence Historic District (LAW.B)	Currier, Ebenezer – Hosmer, Abner Building (LAW.220)	1850	Yes	Yes	Outside of Project Boundary
	Bachelder, Otis – John Building (LAW.221)	1854	Yes	Yes	Outside of Project Boundary
	Smith Charles – Perkins, Andrew Building (LAW.222)	1856	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Currier, James Building (LAW.223)	1857	Yes	Yes	Outside of Project Boundary
	Sharpe, Andrew Building (LAW.224)	1866	Yes	Yes	Outside of Project Boundary
	(LAW.225)	1863	Yes	Yes	Outside of Project Boundary
	(LAW.226)	1863	Yes	Yes	Outside of Project Boundary
	Boardman, William H. Block (LAW.227)	1854	Yes	Yes	Outside of Project Boundary
	Boardman, William H. Building (LAW.228)	1854	Yes	Yes	Outside of Project Boundary
	Lawrence Savings Bank (LAW.229)	1911	Yes	Yes	Outside of Project Boundary
	Saunders, Daniel Building (LAW.230)	1856	Yes	Yes	Outside of Project Boundary
	Morse, Julius Building (LAW.231)	1855	Yes	Yes	Outside of Project Boundary
	Morse, Julius Block (LAW.232)	1853	Yes	Yes	Outside of Project Boundary
	Smith, Charles Building (LAW.233)	1852	Yes	Yes	Outside of Project Boundary
	Eagle Tribune Building (LAW.234)	1929	Yes	Yes	Outside of Project Boundary
	(LAW.235)	1913	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Appleton, Nathanial Block (LAW.237)	1854	Yes	Yes	Outside of Project Boundary
	Stearns Building (LAW.238)	1854	Yes	Yes	Outside of Project Boundary
	(LAW.239)	1906	Yes	Yes	Outside of Project Boundary
	Adams Block (LAW.240)	1890	Yes	Yes	Outside of Project Boundary
	Godfrey Building (LAW.241)	1891	Yes	Yes	Outside of Project Boundary
	Oswald, William Building (LAW.242)	1912	Yes	Yes	Outside of Project Boundary
	Merchants National Bank (LAW.243)	1889	Yes	Yes	Outside of Project Boundary
	(LAW.244)	1869	Yes	Yes	Outside of Project Boundary
	Bay State Merchant National Bank (LAW.245)	1926	Yes	Yes	Outside of Project Boundary
	(LAW.246)	1868	Yes	Yes	Outside of Project Boundary
	Sweeny, Patrick Building (LAW.247)	1874	Yes	Yes	Outside of Project Boundary
	(LAW.248)	1872	Yes	Yes	Outside of Project Boundary
	Sullivan Building (LAW.249)	1923	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
Downtown Lawrence Historic District (LAW.B) and North Common Local Historic District (LAW.M)	Calvary Baptist Church (LAW.202)	1923	Yes	Yes	Outside of Project Boundary
	Lawrence City Hall (LAW.211)	1849	Yes	Yes	Outside of Project Boundary
	Essex County Superior Courthouse (LAW.212)	1903	Yes	Yes	Outside of Project Boundary
	Bay State Building (LAW.236)	1904	Yes	Yes	Outside of Project Boundary
	Goldberg, Benjamin Building (LAW.250)	1895	Yes	Yes	Outside of Project Boundary
	Pride Upholstering Company (LAW.251)	1898	Yes	Yes	Outside of Project Boundary
	(LAW.252)	1885	Yes	Yes	Outside of Project Boundary
	(LAW.253)	1865	Yes	Yes	Outside of Project Boundary
	New England Telephone Building (LAW.322)	1924	Yes	Yes	Outside of Project Boundary
	Bay State Building (LAW.694)	1904	Yes	Yes	Outside of Project Boundary
	Lawrence World War II Monument (LAW.987)	1948	Yes	Yes	Outside of Project Boundary
	Lawrence Civil War Monument (LAW.988)	1881	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Lawrence Spanish Wars Veteran Statue (LAW.989)	1913	Yes	Yes	Outside of Project Boundary
American Woolen Mill Housing District (LAW.E)	American Woolen Mills Worker Housing #1 (LAW.435)	1909	Yes	Yes	Outside of Project Boundary
	American Woolen Mills Worker Housing #2 (LAW.436)	1909	Yes	Yes	Outside of Project Boundary
	American Woolen Mills Worker Housing #3 (LAW.437)	1909	Yes	Yes	Outside of Project Boundary
	American Woolen Mills Worker Housing #4 (LAW.438)	1909	Yes	Yes	Outside of Project Boundary
	American Woolen Mills Worker Housing #5 (LAW.439)	1909	Yes	Yes	Outside of Project Boundary
	American Woolen Mills Worker Housing #6 (LAW.440)	1909	Yes	Yes	Outside of Project Boundary
	American Woolen Mills Worker Housing #7 (LAW.441)	1909	Yes	Yes	Outside of Project Boundary
	American Woolen Mills Worker Housing #8 (LAW.442)	1909	Yes	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	American Woolen Mills Worker Housing #9 (LAW.443)	1909	Yes	Yes	Outside of Project Boundary
American Woolen Company Townhouses (LAW.Z)	American Woolen Company Townhouse (LAW.799)	1907	Yes	Yes	Outside of Project Boundary
	American Woolen Company Townhouse (LAW.1000)	1907	Yes	Yes	Outside of Project Boundary
	American Woolen Company Townhouse (LAW.1001)	1907	Yes	Yes	Outside of Project Boundary
	American Woolen Company Townhouse (LAW.1002)	1907	Yes	Yes	Outside of Project Boundary
	American Woolen Company Townhouse (LAW.1003)	1907	Yes	Yes	Outside of Project Boundary
	American Woolen Company Townhouse (LAW.1004)	1907	Yes	Yes	Outside of Project Boundary
North Common Local Historic District (LAW.M)	(LAW.18)	1855	Undetermined	Yes	Outside of Project Boundary
	Grace Episcopal Church (LAW.204)	1852	Yes	Yes	Outside of Project Boundary
	Bongi's Market (LAW.682)	1875	Undetermined	Yes	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Daysi's Restaurant (LAW.683)	1960	Undetermined	Yes	Outside of Project Boundary
	Stella, Michael T. Lawyer Office (LAW.684)	1970	Undetermined	Yes	Outside of Project Boundary
	(LAW.695)	1940	Undetermined	Yes	Outside of Project Boundary
Mechanics Block Local Historic District (LAW.N)	Garden Street Methodist Episcopal Church (LAW.203)	1855	Undetermined	Yes	Outside of Project Boundary
Blakeley and Bicknell Buildings Commercial District (LAW.P)	Blakeley Building (LAW.764)	1898	Yes	Yes	Outside of Project Boundary
	Bicknell Brothers Clothing Store (LAW.765)	1880	Undetermined	Yes	Outside of Project Boundary
None	Gleason Building (LAW.254)	1891	Yes	No	Outside of Project Boundary
	Ayers Mills (LAW.2)	1909	Undetermined	No	Outside of Project Boundary
	Plymouth Mills (LAW.257)	1913	Undetermined	No	Outside of Project Boundary
	Plymouth Mills (LAW.2580)	1920	Undetermined	No	Outside of Project Boundary
	Merrimac Paper Company (LAW.564)	1872	Undetermined	No	Outside of Project Boundary
	McCabe Boiler Company (LAW.567)	1865	Undetermined	No	Outside of Project Boundary
	Prospect Mile (LAW.568)	1872	Undetermined	No	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	United States Worsted Company Dyeing Plant (LAW.572)	1915	Undetermined	No	Outside of Project Boundary
	Lewis, E. Frank Company (LAW.576)	1895	Undetermined	No	Outside of Project Boundary
	Truell Building (LAW.766)	1909	Undetermined	No	Outside of Project Boundary
	Broadway Savings Bank Building (LAW.791)	1927	Undetermined	No	Outside of Project Boundary
	South Canal (LAW.908)	1866	Eligible	No	Within Project Boundary
	Car Hill Bridge-Old Colony Railroad (LAW.920)	1945	No	No	Outside of Project Boundary
	Munroe Paper Company Bridge (LAW.921)	1867	Undetermined	No	Outside of Project Boundary
	Manchester and Lawrence Railroad Bridge (LAW.923)	1871	Undetermined	No	Outside of Project Boundary
	Salem Street Bridge (LAW.926)	1928	Undetermined	No	Outside of Project Boundary
	Boston and Maine South Canal Railroad Bridge (LAW.927)	1907	No	No	Outside of Project Boundary
	Boston and Maine Parker Street Railroad Bridge (LAW.930)	1930	No	No	Outside of Project Boundary

Historic District	Site Name/Identifier	Construction	NRHP Status	Contributing Element	Relationship to Project Boundary
	Ayer Mill Clock Tower (LAW.9006)*	1909	Undetermined	No	Outside of Project Boundary

*= Preservation Restrictions

5.10.6 Traditional Cultural Properties

At this time, Essex is not aware of any information regarding TCPs within the Project boundaries or in the vicinity of the Project.

5.10.7 Identification of Indian Tribes

By letter dated December 1, 2022, the Commission invited the Mashpee Wampanoag Tribe, the Wampanoag of Gay Head (Aquinnah) Tribe, and the Stockbridge-Munsee Tribe to participate in the relicensing process for the Project. Essex is not aware of any other Native American Tribes with a potential interest in Project relicensing.

5.11 Socioeconomic Resources

5.11.1 Existing Socioeconomic Conditions

Economic development in Essex County historically was centered around the growing manufacturing economy of the Industrial Revolution. The City of Lawrence was at the forefront of the Industrial Revolution, being one of the first planned industrial cities. Beginning in 1845, the Essex Dam transformed the landscape into a prominent industrial center, harnessing the water of the Merrimack River for energy production and textile manufacturing. The economic opportunity arising from the mills of the City of Lawrence attracted successive waves of immigrants. Known as the “Immigrant City,” Lawrence has remained a multi-ethnic and multicultural gateway city. The City of Lawrence is now a diversified industrial city, supporting a population that is largely Hispanic or Latino (U.S. Census Bureau 2021a).

5.11.1.1 Population

The Project is located in the City of Lawrence within Essex County, Massachusetts. The 2020 census reported that 809,829 people reside in Essex County, which encompasses approximately 492.52 square miles (U.S. Census Bureau 2020). Compared to the 2010 census population of 743,159 people, the current population has increased 1.09% (U.S. Census Bureau 2010). There was an estimate of 307,959 households in 2021 (U.S. Census Bureau 2021b). The population density is 1,644.3 people per square mile (U.S. Census 2020). The City of Lawrence, an area of 6.93 square miles, supported a population of 89,143 people in 2020, a 1.17% increase since 2010 (U.S. Census Bureau 2020). The number of estimated households in 2021 was 30,291 (U.S. Census Bureau 2021b). The population density is 12,861.5 people per square mile (U.S. Census Bureau 2020).

5.11.1.2 Employment and Income

The Essex Dam and associated textile mills transformed the City of Lawrence into a major industrial center. The City of Lawrence is currently supported by a mix of industries including: educational services, health care, and social assistance (21%), manufacturing (18%), professional, scientific, management, administrative, and waste management services (14%), and retail trade (12%) (U.S. Census Bureau 2021c). The majority of civilians have occupations in production, transportation, and material moving (30%), followed by service (26%), management, business, science, and arts (19%), sales and office (18%), and natural resources, construction, and maintenance (7%) (U.S. Census Bureau 2021c). The median household income for the City of Lawrence, estimated in 2021, is $47,542, with approximately 19.2% of the population being in poverty (U.S. Census Bureau 2021d, 2021e).

The area surrounding the City of Lawrence is currently populated with other large urban centers and small communities. Essex County is supported by a mix of industries including: educational services, health care, and social assistance (25%), professional, scientific, management, administrative, and waste management services (15%), manufacturing (10%), and retail trade (10%) (U.S. Census Bureau 2021c). The majority of civilians have occupations in management, business, science, and arts (46%), followed by sales and office (20%), service (17%), production, transportation, and material moving (11%), and natural resources, construction, and maintenance (7%) (U.S. Census Bureau 2021c). The median household income for Essex County is $86,684, with approximately 9.9% of the population being in poverty (U.S. Census Bureau 2021d, 2021e).

5.11.1.3 Environmental Justice Communities

Pursuant to Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad,* and Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended, FERC is required to complete an analysis of potential impacts from Project operations on the local community in the vicinity of the Project. The goal of this analysis is to understand the impacts to human health and the environment as they relate to environmental justice communities, or communities that stand to be disproportionately impacted by construction of a new facility or the continued operation of an existing facility, including socioeconomic and/or sociocultural impacts.

Although FERC is not required to comply with Executive Order 13985, *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, FERC has voluntarily elected to participate in the process. In response to Executive Order 13985, FERC has developed an Equity Action Plan to promote equity and remove barriers that underserved communities face in the context of hydropower project licensing processes (FERC 2022). The information compiled in this section is intended to support FERC's consideration of environmental justice communities as they relate to the relicensing process.

The Massachusetts Executive Office of Energy & Environmental Affairs provides an environmental justice map with the latest U.S. Census data (MEOEEA 2022). Environmental justice communities are identified based on criteria set forth in Chapter 8 Section 56 of the Acts of 2021: *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy* (Commonwealth of Massachusetts 2021). This act defines an environmental justice population as a census block group that meets one or more of the following criteria: (i) the annual median household income is not more than 65% of the statewide annual median household income; (ii) minorities comprise 40% or more of the population; (iii) 25% or more of households lack English language proficiency; or (iv) minorities comprise 25% or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150% of the statewide annual median household income. Within the Project boundary, thirteen block groups were identified as environmental justice communities by a minority population, and of those, six were also identified by income and language isolation, and two by income (Table 5.11-1).

Table 5.11-1 Environmental Justice Communities Within the Project Boundary

Census Tract	Block Group	Minority Population (%)	Medium Household Income (% of statewide annual median household income)	Households with Language Isolation (%)
2501	1	88.7*	14.4*	40.1*
2501	2	82.2*	41.9*	40.5*
2508	3	78.5*	52.5*	13.8
2513	3	91.3*	63*	23.6
2514	3	92.6*	59.8*	30.7*
2515	1	89.5*	83.6*	34.5*
2515	4	84.5*	85.4	0
2515	5	91.3*	55.8*	34.5*
2516	4	93.1*	49.0*	43.1*
2521.01	3	34.6*	69.4	3.1
2521.02	3	24.9*	107.6	0.9
2544.02	4	49.3*	215	20.9
3102	3	70.6*	90.9	15

* denotes an environmental justice community as defined by MEOEEA.
Source: MEOEEA 2022.

6 Preliminary Issues, Project Effects, and Potential Studies List

6.1 Consultation to Date and Summary of Relevant Issues for the Lawrence Project Relicensing

The primary purpose of the PAD is to identify environmental resources that may be affected by the Project and to inform the development of proposed studies to assess the scope of potential Project impacts. The information developed as part of the study process will inform the development of the Project's license application, including mitigation measures. As stated previously, Essex distributed the PAD questionnaire to approximately 170 parties to:

- Notify interested governmental agencies, municipalities, non-governmental organizations, Indian tribes, and individuals of the upcoming relicensing proceeding;
- Identify existing, relevant, and reasonably available information that describes the existing Lawrence Project's existing or historical environment; and
- Help identify resource interests for consideration during the relicensing process.

The Licensee received responses from the following thirteen stakeholders: USFWS, U.S. Environmental Protection Agency, Town of Andover, Town of Georgetown, NMFS, Berkeley Investments, MRWC, MassWildlife, Upper Merrimack River Local Advisory Committee (UMRLAC), Town of Tewksbury, Town of Rowley, Lawrence Redevelopment Authority, and Groundwork Lawrence. Responses received from the questionnaire are provided in Appendix B.

To date, Essex has performed the following initial consultation activities:

- PAD questionnaires were distributed to 170 parties.
- The Massachusetts Office of Coastal Zone Management was consulted regarding the location of the Project relative to the State's coastal zone.
- The Massachusetts Division of Fisheries & Wildlife and USFWS were contacted regarding federal or state-listed, threatened, or endangered species, critical habitat, sensitive natural communities, and species of special concern within the Project's vicinity.

Based on information gathered in support of the PAD, Essex presents potential resource effects and studies by resource area in Table 6.1-1. Essex notes that this list of resource issues is preliminary and Essex anticipates consulting with the resource agencies, stakeholders, and other interested parties regarding these resources areas as well as other potential resources areas of interest to the parties.

Table 6.1-1 Resource Areas, Potential Resource Effects, and Potential Studies

Resource Area	Issues Pertaining to Specific Resource Areas
Geology and Soils	Groundwork Lawrence noted potential bank erosion at the Riverfront State Park and the south bank of the Merrimack River below the dam. A majority of the Project impoundment shoreline is natural and vegetated and Essex's proposed continued ROR operations are not expected to negatively affect geology and soils. Geology and soils are not believed to be a resource area requiring further evaluation.
Water Resources	There are no known issues regarding water quality or quantity at the Project. The Project's ROR operations allow for continuous water flow. MRWC noted that the North Canal and water levels are an area of concern. MRWC also noted that pollution and emerging contaminants are areas of concerns. Essex notes that pollution in the Merrimack River is not associated with Project operations and is outside of the scope of this relicensing. Whereas Essex does not believe that water quality and quantity is a resource area requiring a substantial level of further evaluation, Essex anticipates performing consultation with the MADEP regarding the information needed by MADEP in support of issuing the Project's Section 401 WQC.
Fish and Aquatic Resources	Fish passage was noted by NMFS, MRWC, MassWildlife, and UMRLAC as aa potential resource issue. Essex anticipates further consultation with stakeholders regarding fish passage associated with the Project.
North Canal	MRWC and Groundwork Lawrence noted concern with the condition of the North Canal.
Wildlife and Botanical Resources	MassWildlife identified a potential resource concern with invasive species.
Threatened and Endangered Species	UMRLAC and MassWildlife noted concern with threatened and endangered species. Essex anticipates consultation with the USFWS and NMFS regarding federally listed species and MassWildlife regarding state listed species.
Recreation and Land Management	Groundwork Lawrence noted in their PAD Questionnaire response that Essex has critical right-of-way for the implementation of the Lawrence Greenway Framework.
Cultural Resources	Essex anticipates further consultation with the Massachusetts SHPO and other participants regarding cultural resources associated with the Project.

6.2 Potential Studies of Information Needs List

At this time, Essex is not proposing specific studies to analyze the preliminary resource issues identified in Section 6.1. Essex has had informal discussions with the members of the MRTC regarding fisheries studies anticipated to be conducted during the course of this relicensing effort. Essex will continue to consult with the appropriate resource agencies, Native American tribes, members of the public, and other stakeholders pursuant to the process defined in the ILP to determine which studies are necessary and applicable to collect information regarding the identified resource issues.

Within 60 days of the PAD/NOI notice and issuance of SD1, pursuant to 18 CFR § 5.9(a), each interested resource agency, Native American tribe, and stakeholder may provide study requests and written comments on the PAD and SD1. The Licensee respectfully requests that resource agencies and stakeholders utilize the ILP study request guidelines as set forth by the Commission at 18 CFR § 5.9(b) and outlined below. Addressing the criteria outlined below is required under the ILP and will better define the resource issues and provide for more effective studies that will better serve all parties throughout the relicensing process:

- Describe the goals and objectives of each study proposal and the information to be obtained;
- If applicable, explain the relevant resource management goals of the agencies or Native American tribes with jurisdiction over the resource to be studied;
- If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- Describe existing information concerning the subject of the study proposal, and the need for additional information;
- Explain any nexus between Project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge; and
- Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

7 Qualifying Comprehensive Plans Deemed Applicable

Section 10(a)(2)(A) of the FPA, 16 USC section 803(a)(2)(A), requires FERC to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the Project.

On April 27, 1988, the Commission issued Order No. 481-A, revising Order No. 481, issued October 26, 1987, establishing that FERC will accord FPA section 10(a)(2)(A) comprehensive plan status to any federal or state plan that:

1. Is a comprehensive study of one of more of the beneficial uses of a waterway or waterways;
2. Specifies the standards, the data, and the methodology used; and,
3. Is filed with the Secretary of the Commission.

The Licensee reviewed FERC's August 2022 revised list of comprehensive plans for Massachusetts and has identified that the twenty following comprehensive waterway and resource management plans do, or have the potential to, relate to the Project area:

- Atlantic States Marine Fisheries Commission. 1995. Interstate fishery management plan for Atlantic striped bass. (Report No. 24). March 1995.
- Atlantic States Marine Fisheries Commission. 1998. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*). (Report No. 31). July 1998.
- Atlantic States Marine Fisheries Commission. 1998. Interstate fishery management plan for Atlantic striped bass. (Report No. 34). January 1998.
- Atlantic States Marine Fisheries Commission. 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). April 1999.
- Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (*Anguilla rostrata*). (Report No. 36). April 2000.
- Atlantic States Marine Fisheries Commission. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000.
- Atlantic States Marine Fisheries Commission. 2008. Amendment 2 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2008.

- Atlantic States Marine Fisheries Commission. 2009. Amendment 2 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. May 2009.
- Atlantic States Marine Fisheries Commission. 2010. Amendment 3 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. February 2010.
- Atlantic States Marine Fisheries Commission. 2013. Amendment 3 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. August 2013.
- Atlantic States Marine Fisheries Commission. 2014. Amendment 4 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2014.
- Massachusetts Department of Environmental Management. n.d. Commonwealth connections: A greenway vision for Massachusetts. Boston, Massachusetts.
- Massachusetts Division of Fisheries and Wildlife. 2015. Massachusetts State Wildlife Action Plan 2015. Westborough, Massachusetts. October 2015.
- Massachusetts Executive Office of Energy and Environmental Affairs. Statewide Comprehensive Outdoor Recreation Plan (SCORP): Massachusetts Outdoor 2006. Boston, Massachusetts.
- National Marine Fisheries Service. 1998. Final Amendment #11 to the Northeast Multi-species Fishery Management Plan; Amendment #9 to the Atlantic sea scallop Fishery Management Plan; Amendment #1 to the monkfish Fishery Management Plan; Amendment #1 to the Atlantic salmon Fishery Management Plan; and Components of the proposed Atlantic herring Fishery Management Plan for Essential Fish Habitat. Volume 1. October 7, 1998.
- National Marine Fisheries Service. 1998. Final Recovery Plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. December 1998.
- National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.
- Technical Committee for Fishery Management of the Merrimack River Basin. 2021. Merrimack River Watershed Comprehensive Plan for Diadromous Fishes.
- U.S. Fish and Wildlife Service. 1989. Atlantic salmon restoration in New England: Final environmental impact statement 1989-2021. Department of the Interior, Newton Corner, Massachusetts. May 1989.

- U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.

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Appendix A – PAD Information Questionnaire and Distribution List

April 20, 2023

Subject: Lawrence Hydroelectric Project (FERC No. 2800)
Pre-Application Document Information Questionnaire

To Whom it May Concern:

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project is licensed by the Federal Energy Regulatory Commission (FERC or Commission).

The license for the 16.8-megawatt Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate a formal relicensing process with the filing of a Notice of Intent (NOI) and Pre-Application Document (PAD) on or after June 1, 2023, and before November 30, 2023.

The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project, which will help identify potential data collection needs or resource issues early in the relicensing process.

The attached PAD Questionnaire is one tool that will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. Essex's intent is to include relevant information received in response to the questionnaire within the PAD. Accordingly, Essex respectfully requests that you complete the attached PAD Questionnaire and provide any relevant information your organization may have regarding the Project, or the resource areas listed below.

- Geology and soils
- Water resources
- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

A majority of parties on the distribution list are receiving the PAD Questionnaire by email. We respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com within 30 days of your receipt of this letter.

If you received a hardcopy of the PAD Questionnaire by regular mail, it is preferred that the completed questionnaire is emailed to Kelsey Iffert. Completed questionnaires also may be delivered via the self-addressed, stamped envelope provided.

Please note that if you no longer wish to receive correspondence regarding the Project, simply email “unsubscribe” to Kelsey Iffert at the email address above.

If you have questions regarding this request or would like additional information, please contact Mr. Kevin Webb at kwebb@patriothydro.com or at (978) 935-6039, or the undersigned at Kelsey.Iffert@hdrinc.com or (315) 706-5176.

We appreciate your response and your assistance in this effort to identify information and parties interested in this proceeding.

Sincerely,

HDR Engineering, Inc.

Kelsey Iffert

Kelsey Iffert
Project Manager

Attachments

1. Distribution List
2. PAD Information Questionnaire (with Project Location Map)

cc: Kevin Webb, Essex
Richard Malloy, Essex
Jim Gibson, HDR
Sarah Humiston, HDR

Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Brona Simon
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Bjorn Lake
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Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Bettina Washington
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Brian De Pena
City of Lawrence, MA
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Ana Levy
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Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Thomas Lannan
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Scott Galvin
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Christopher Cronin
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Director of Public Works
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Andover, MA 01810

Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Andover, MA 01810

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Michael Lindstrom
Town of Andover, MA
Deputy Town Manager
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Brian Pena
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Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Lawrence Hydroelectric Project (FERC No. 2800)
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Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Lawrence Hydroelectric Project (FERC No. 2800)
Distribution List

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Jacob Kaminsky
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Christina Minicucci
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Lawrence Hydroelectric Project (FERC No. 2800)
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Lawrence Hydroelectric Project (FERC No. 2800)
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Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	
Organization	
Address	
Phone	
Email Address	

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☐ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	
Organization	
Address	
Phone	
Email Address	

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

   ☐ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

   a. If yes, please circle the specific resource area(s) that the information relates to:

      - Geology and soils
      - Water resources
      - Fish and aquatic resources
      - Wildlife and botanical resources
      - Wetlands, riparian, and littoral habitat
      - Rare, threatened, and endangered species
      - Recreation and land use
      - Aesthetic resources
      - Cultural resources
      - Socioeconomic resources
      - Tribal resources
      - Other resource information

   b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

   c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☐ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

Appendix B – PAD Information Questionnaire Responses and PAD Consultation Correspondence

Lawrence Hydroelectric Project (FERC No. 2800)
Correspondence Log

Date	Type	From	To	Subject
April 20, 2023	Email, Letter	HDR/ Essex	Stakeholders[1]	PAD Questionnaire
April 20, 2023	Email	FWS (K. Hogan)	HDR/ Essex	PAD Questionnaire
April 20, 2023	Email	HDR/ Essex	FWS (D. Smithwood)	RTE Species Information Request
April 20, 2023	Email	HDR/Essex	Massachusetts Office of Coastal Zone Management (R. Boeri)	CZM Coastal Zone Determination
April 20, 2023	Email	HDR/Essex	Massachusetts Office of Coastal Zone Management (P. Bordonaro)	CZM Coastal Zone Determination
April 20, 2023	Email	USEPA (E. Reiner)	HDR/ Essex	PAD Questionnaire
April 24, 2023	Email	Town of Andover (B. Pena)	HDR/ Essex	Inquiry into PAD Questionnaire

[1] The stakeholder list includes over 170 parties including federal and state agencies, municipalities, Indian tribes, and other interested parties.

Date	Type	From	To	Subject
May 1, 2023	Email	Berkeley Investments (K. Longo)	HDR/ Essex	PAD Questionnaire
May 4, 2023	Email	NMFS (B. German)	HDR/ Essex	PAD Questionnaire
May 5, 2023	Email	MRWC (John Macone)	HDR/ Essex	PAD Questionnaire
May 8, 2023	Email	Mass Wildlife Natural Heritage & Endangered Species Program (NHESP) (Misty-Anne Marold)	HDR/ Essex	PAD Questionnaire
May 16, 2023	Email	Michele L. Tremblay, Chair (Upper Merrimack River Local Advisory Committee)	HDR/ Essex	PAD Questionnaire
April 27, 2023	Email	Town of Rowley (A. Lydon)	HDR/ Essex	Inquiry into PAD Questionnaire
May 22, 2023	Email	Lawrence Redevelopment Authority (B. Corrigan)	HDR/ Essex	PAD Questionnaire

Date	Type	From	To	Subject
May 22, 2023	Email	Groundwork Lawrence (B. Buschur)	HDR/ Essex	PAD Questionnaire
May 22, 2023	Letter	Town of Georgetown	HDR/ Essex	PAD Questionnaire
June 1, 2023	Email	Natural Heritage & Endangered Species Program	HDR/ Essex	Massachusetts Endangered Species Act Information Request
June 1, 2023	Email	Tewksbury Department of Public Works Water Treatment Division	HDR/ Essex	PAD Questionnaire

From: Hogan, Kenneth J <kenneth_hogan@fws.gov>
Sent: Thursday, April 20, 2023 11:20 AM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Cc: Sojkowski, Bryan <Bryan_Sojkowski@fws.gov>
Subject: Lawrence PAD Questionnaire USFWS Response.pdf

Thank you Kelsey.

Ken

Kenneth Hogan || Hydropower Program
U.S. Fish & Wildlife Service || New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301
(603) 227-6426
Kenneth_Hogan@fws.gov | fws.gov/newengland/FERC/

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

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Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Kenneth Hogan, Hydropower Program Coordinator
Organization	U.S. Fish and Wildlife Service
Address	70 Commercial Street, Suite 300, Concord, NH 03301
Phone	6032276426
Email Address	Kenneth_Hogan@fws.gov

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	Bryan Sojkowski, Fish Passage Engineer
Organization	USFWS
Address	
Phone	
Email Address	

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☑ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
- Water resources
- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

Inspection of the Service's hard copy documents will be made available upon request and by appointment.

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

Documents will be made available at 70 Commercial Street, Suite 300, Concord, NH by appointment only.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☐ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

From: Reiner, Edward <reiner.ed@epa.gov>
Sent: Thursday, April 20, 2023 11:53 AM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Subject: RE: Lawrence Hydroelectric Project PAD Questionnaire Package

As requested. Thank you. Sorry I do not have specific information to offer at this time.

Edward Reiner
Senior Wetland Scientist
USEPA
5 Post Office Square.
Suite 100 (06-2)
Boston, MA 02109-3912

Phone: 617-918-1692
Email: Reiner.ed@epa.gov

From: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Sent: Thursday, April 20, 2023 10:51 AM
To: Alexandra Freeman (alex@manzofreeman.com) <alex@manzofreeman.com>; Ana Levy (alevy@cityoflawrence.com) <alevy@cityoflawrence.com>; Andrew Flanagan (andrew.flanagan@andoverma.us) <andrew.flanagan@andoverma.us>; Andrew Sheehan (Andrew.Sheehan@middletonma.gov) <Andrew.Sheehan@middletonma.gov>; Angela Gile (agile@winnco.com) <agile@winnco.com>; Anthony Curtis (anthonycurtis256@gmail.com)

<anthonycurtis256@gmail.com>; Armand Hyatt (ahyatt@lawrencecommunityworks.org) <ahyatt@lawrencecommunityworks.org>; Barry Finegold (Barry.Finegold@masenate.gov) <Barry.Finegold@masenate.gov>; Gahagan, Ben (FWE) <ben.gahagan@state.ma.us>; Ben Martello (ben@northsideventures.com) <ben@northsideventures.com>; Ben Meade (contact@tunoreast.org) <contact@tunoreast.org>; Benjamin Beaulieu (selectman3@townofmerrimac.com) <selectman3@townofmerrimac.com>; benjamin.german <benjamin.german@noaa.gov>; Bettina Washington (thpo@wampanoagtribe-nsn.gov) <thpo@wampanoagtribe-nsn.gov>; Bjorn Lake <bjorn.lake@noaa.gov>; bbuschur@groundworklawrence.org; Brett Leavitt (bleavitt@glsd.org) <bleavitt@glsd.org>; Brian Corrigan (corriganlaw@gmail.com) <corriganlaw@gmail.com>; Brian De Pena (mayordepena@cityoflawrence.com) <mayordepena@cityoflawrence.com>; Brian Gilbert (bgilbert@tewksbury-ma.gov) <bgilbert@tewksbury-ma.gov>; Brian McCarthy (TownAdmin@WindhamNH.gov) <TownAdmin@WindhamNH.gov>; brian.pena@andoverma.us; Sojkowski, Bryan <bryan_sojkowski@fws.gov>; Carlos Jaquez (carlos.jaquez@andoverma.us) <carlos.jaquez@andoverma.us>; Celina Reyes (CREYES@CITYOFLAWRENCE.COM) <CREYES@CITYOFLAWRENCE.COM>; Cheri Cousens (Ccousens@GLSD.org) <Ccousens@GLSD.org>; Cheryl Andrew-Maltais (chariwoman@wampanoagtribe-nsn.gov) <chariwoman@wampanoagtribe-nsn.gov>; christopher.Boelke@Noaa.gov; Chris Grobicki (chris@grobicki.com) <chris@grobicki.com>; Christina Minicucci (christina.minicucci@mahouse.gov) <christina.minicucci@mahouse.gov>; Christopher Cronin (christopher.cronin@andoverma.us) <christopher.cronin@andoverma.us>; cspero@glsd.org; crogers <crogers@merrimack.org>; dlahiff@cityoflawrence.com; Daniel McCarthy (DMcCarthy@cityoflawrence.com) <DMcCarthy@cityoflawrence.com>; David Deas (daviddeas@mass.gov) <daviddeas@mass.gov>; David Hilgeman (David.Hilgeman@mass.gov) <David.Hilgeman@mass.gov>; David Meehan (dmeehan@cityoflawrence.com) <dmeehan@cityoflawrence.com>; David Weeden (David.Weeden@mwtribe-NSN.gov) <David.Weeden@mwtribe-NSN.gov>; Deirdre Desmond Esq (deirdre.desmond@state.ma.us) <deirdre.desmond@state.ma.us>; Destiny Gonzalez (gonzaabh@bc.edu) <gonzaabh@bc.edu>; Douglas Smithwood (doug_smithwood@fws.gov) <doug_smithwood@fws.gov>; Hay, Duncan E <duncan_hay@nps.gov>; Reiner, Edward <reiner.ed@epa.gov>; Eddie Rosa <erosa@groundworklawrence.org>; Eric Lundquist <elundquist@groundworklawrence.org>; Erika Castillo (atty@erikacastillo.com) <atty@erikacastillo.com>; Evelyn Rodriguez (erodriguez@mylmcc.org) <erodriguez@mylmcc.org>; Francis Murphy (fmurphy@shaheengordon.com) <fmurphy@shaheengordon.com>; Frank Moran (Frank.Moran@mahouse.gov) <Frank.Moran@mahouse.gov>; Frank Surillo (frank.surillo@cityoflawrence.com) <frank.surillo@cityoflawrence.com>; Gerry Darcy (gdarcy@lupolico.com) <gdarcy@lupolico.com>; Gregory Del Rosario (gregory.delrosario@cityoflawrence.com) <gregory.delrosario@cityoflawrence.com>; harold.peterson@bia.gov; Jacob Kaminsky (jacob.kaminsky@mahouse.gov) <jacob.kaminsky@mahouse.gov>; Jeannie O'Rand (jorand@cityoflawrence.com) <jorand@cityoflawrence.com>; Jed Koehler (jkoehler@boatingprogram.com) <jkoehler@boatingprogram.com>; Jeffery C. Bendremer (preservation@mohican-nsn.gov) <preservation@mohican-nsn.gov>; Jeovanny Rodriguez (JRODRIGUEZ@CITYOFLAWRENCE.COM) <JRODRIGUEZ@CITYOFLAWRENCE.COM>; Jessica Andors (jandors@lawrencecommunityworks.org) <jandors@lawrencecommunityworks.org>; Jim Donchess (NashuaMayor@NashuaNH.gov) <NashuaMayor@NashuaNH.gov>; Joe Geary (jgeary@woodardcurran.com) <jgeary@woodardcurran.com>; John Curran (jcurran@town.billerica.ma.us) <jcurran@town.billerica.ma.us>; John Eddins <jeddins@achp.gov>; John Harden (jharden@lawrencecommunityworks.org) <jharden@lawrencecommunityworks.org>; John Hess (hess.john@att.net) <hess.john@att.net>; John Spain <john.spain@ferc.gov>; Jonas Stundza (jstundza@cityoflawrence.com) <jstundza@cityoflawrence.com>; jguzman@groundworklawrence.org;

Jorge Hernandez (jorgeahernandez1843@gmail.com) <jorgeahernandez1843@gmail.com>; Joseph Giarrusso (jgiarrusso@ci.methuen.ma.us) <jgiarrusso@ci.methuen.ma.us>; Joseph Larson (Mass.Wildlife@state.ma.us) <Mass.Wildlife@state.ma.us>; Kassandra Gove (govek@amesburyma.gov) <govek@amesburyma.gov>; Kate Hernandez (khernandez@neiwpcc.org) <khernandez@neiwpcc.org>; Hogan, Kenneth J <kenneth_hogan@fws.gov>; Kevin Harutunian (Kharutunian@topsfield-ma.gov) <Kharutunian@topsfield-ma.gov>; Kevin Longo (klongo@berkinv.com) <klongo@berkinv.com>; Mendik, Kevin R <kevin_mendik@nps.gov>; lmelendez@groundworklawrence.org; Lisa Hultgren (lisahultgren@derrynh.org) <lisahultgren@derrynh.org>; Marc Laplante (MLaplante@cityoflawrence.com) <MLaplante@cityoflawrence.com>; Marianne Paley Nadel (info@everettmills.com) <info@everettmills.com>; Marisa Browning-Kamins (marisa.browningkamin@andoverma.us) <marisa.browningkamin@andoverma.us>; Mark Dockser (selectboard@ci.reading.ma.us) <selectboard@ci.reading.ma.us>; Mark Prout (mprout@fs.fed.us) <mprout@fs.fed.us>; Massachusetts Department of Conservation and Recreation (dam.safety@state.ma.us) <dam.safety@state.ma.us>; Matt Carpenter (matthew.carpenter@wildlife.nh.gov) <matthew.carpenter@wildlife.nh.gov>; Matt Hanson (mhanson@tyngsboroughma.gov) <mhanson@tyngsboroughma.gov>; Matthew Ayer (matt.ayer@mass.gov) <matt.ayer@mass.gov>; Melissa Rodrigues (mrodrigues@northandoverma.gov) <mrodrigues@northandoverma.gov>; Michael Judge (michael.judge@state.ma.us) <michael.judge@state.ma.us>; Michael Lindstrom (michael.lindstrom@andoverma.us) <michael.lindstrom@andoverma.us>; Michael O'Brien (mobrien@WINNCO.com) <mobrien@WINNCO.com>; Misty Anne Marold (misty-anne.marold@state.ma.us) <misty-anne.marold@state.ma.us>; Pam Harvey (pamela.harvey@state.ma.us) <pamela.harvey@state.ma.us>; Paul Cohen (pcohen@ChelmsfordMA.Gov) <pcohen@ChelmsfordMA.Gov>; Paul Sagarino Jr. (psagarino@burlington.org) <psagarino@burlington.org>; Phelps Turner (joneill@clf.org) <joneill@clf.org>; Rebecca Oldham (ROldham@grovelandma.com) <ROldham@grovelandma.com>; Quinones, Rebecca (FWE) <Rebecca.Quinones@mass.gov>; Rebecca Tepper (env.internet@mass.gov) <env.internet@mass.gov>; richard.f.chase@state.ma.us; Richard Montuori (rmontuori@tewksbury-ma.gov) <rmontuori@tewksbury-ma.gov>; Robert Nasdor (bob@americanwhitewater.org) <bob@americanwhitewater.org>; rocky@cleanriverproject.org; Rodney Elliott (Rodney.Elliott@mahouse.gov) <Rodney.Elliott@mahouse.gov>; Ronald Keohane (rkeohane@tyngsboroughma.gov) <rkeohane@tyngsboroughma.gov>; sbrinch@tewksbury-ma.gov; Scott Galvin (sgalvin@cityofwoburn.com) <sgalvin@cityofwoburn.com>; shannon.holsey@mohican-nsn.gov; Stephanie Moura (stephanie.moura@state.ma.us) <stephanie.moura@state.ma.us>; Steve Bartha (sbartha@danversma.gov) <sbartha@danversma.gov>; Steve Malizia (smalizia@hudsonnh.gov) <smalizia@hudsonnh.gov>; Steve Mattocks (steven.mattocks@mass.gov) <steven.mattocks@mass.gov>; Steve Olausen (solausen@palinc.com) <solausen@palinc.com>; Steve Poulos (spoulos@wenhamma.gov) <spoulos@wenhamma.gov>; Susan Grabski (director@lawrencehistory.org) <director@lawrencehistory.org>; Thomas Baranowski (thomas.baranowski@mahouse.gov) <thomas.baranowski@mahouse.gov>; Thomas Lannan (tjlannan@cityofmethuen.net) <tjlannan@cityofmethuen.net>; Tom Golden (tomgolden@lowellma.gov) <tomgolden@lowellma.gov>; US Department of the Interior (DOISOLNE-FERC@sol.doi.gov) <DOISOLNE-FERC@sol.doi.gov>; Vanna Howard (Vanna.Howard@mahouse.gov) <Vanna.Howard@mahouse.gov>; William Hale (whale@cityoflawrence.com) <whale@cityoflawrence.com>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Skip Medford <smedford@patriothydro.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Humiston, Sarah <Sarah.Humiston@hdrinc.com>; Kathy French <KFrench@lspower.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: Lawrence Hydroelectric Project PAD Questionnaire Package

Hello –

Essex Company, LLC (Essex) is the Licensee, owner, and operator of the Lawrence Hydroelectric Project, located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project is licensed by the Federal Energy Regulatory Commission (FERC or Commission). The license for the Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate a formal relicensing process with the filing of a Pre-Application Document (PAD) on or after June 1, 2023, and before November 30, 2023.

The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project, which will help identify potential data collection needs or resource issues early in the relicensing process. The attached PAD Questionnaire is one tool that will help identify available information pertinent to the Project. Essex's intent is to include relevant information received in response to the questionnaire within the PAD.

Accordingly, Essex respectfully requests that you complete the attached PAD Questionnaire and provide any relevant information your organization may have regarding the Project within 30 days of your receipt of this email. As detailed in the attached letter, you can complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

We appreciate your response and your assistance in this effort to identify information resources and parties interested in this proceeding. Thank you,

Kelsey Iffert, MS
Environmental/Regulatory Section Lead

HDR
1304 Buckley Road, Suite 202
Syracuse, NY 13212
D 315.414.2206 **M** 315.706.5176
kelsey.iffert@hdrinc.com
hdrinc.com/follow-us

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Ed Reiner, Senior Wetland Scientist
Organization	USEPA
Address	5 Post Office Square Suite 100 (06-2) Boston, MA 02109
Phone	617-918-1692
Email Address	Reiner.ed@epa.gov

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

   ☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

   Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	Ed Reiner
Organization	USEPA
Address	5 Post Office Square Suite 100 (06-2) Boston, MA 02109
Phone	617-918-1692
Email Address	Reiner.Ed@epa.gov

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

   ☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☐ Yes *(If yes, please complete Nos. 4a through 4d)* ☑ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
- Water resources
- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☐ Yes *(please list specific issues below)* ☑ No (if no, please go to No. 5)

Resource Area	Description of Issue

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

From: Brian Pena <brian.pena@andoverma.us>
Sent: Monday, April 24, 2023 9:46 AM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Cc: Christopher Cronin <christopher.cronin@andoverma.us>
Subject: RE: Lawrence Hydroelectric Project PAD Questionnaire Package

Good morning Kelsey – at this time, the Andover Dept. of Public Works does not intend to share any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment.

Please note that the Town of Andover operates a drinking water intake along the Merrimack River, located within the project area, which is duly registered and permitted with the Massachusetts Department of Environmental Protection.

Please also note that our failure to submit any information or documentation does not indicate any waiver of our rights within the project area.

Thank you,
Brian

Brian A. Peña, P.E. | Water Treatment Superintendent
Town of Andover | Department of Public Works
397 Lowell Street, Andover, MA 01810
P. 978.623.8871 | E. brian.pena@andoverma.us

From: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Sent: Thursday, April 20, 2023 10:51 AM
To: Alexandra Freeman (alex@manzofreeman.com) <alex@manzofreeman.com>; Ana Levy (alevy@cityoflawrence.com) <alevy@cityoflawrence.com>; Andrew Flanagan <andrew.flanagan@andoverma.us>; Andrew Sheehan (Andrew.Sheehan@middletonma.gov) <Andrew.Sheehan@middletonma.gov>; Angela Gile (agile@winnco.com) <agile@winnco.com>; Anthony Curtis (anthonycurtis256@gmail.com) <anthonycurtis256@gmail.com>; Armand Hyatt (ahyatt@lawrencecommunityworks.org) <ahyatt@lawrencecommunityworks.org>; Barry Finegold (Barry.Finegold@masenate.gov) <Barry.Finegold@masenate.gov>; Gahagan, Ben (FWE) <ben.gahagan@state.ma.us>; Ben Martello (ben@northsideventures.com) <ben@northsideventures.com>; Ben Meade (contact@tunoreast.org) <contact@tunoreast.org>; Benjamin Beaulieu (selectman3@townofmerrimac.com) <selectman3@townofmerrimac.com>; benjamin.german <benjamin.german@noaa.gov>; Bettina Washington (thpo@wampanoagtribe-nsn.gov) <thpo@wampanoagtribe-nsn.gov>; Bjorn Lake <bjorn.lake@noaa.gov>; Brad Buschur <bbuschur@groundworklawrence.org>; Brett Leavitt (bleavitt@glsd.org) <bleavitt@glsd.org>; Brian Corrigan (corriganlaw@gmail.com) <corriganlaw@gmail.com>; Brian De Pena (mayordepena@cityoflawrence.com) <mayordepena@cityoflawrence.com>; Brian Gilbert (bgilbert@tewksbury-ma.gov) <bgilbert@tewksbury-ma.gov>; Brian McCarthy (TownAdmin@WindhamNH.gov) <TownAdmin@WindhamNH.gov>; Brian Pena <brian.pena@andoverma.us>; Sojkowski, Bryan <bryan_sojkowski@fws.gov>; Carlos Jaquez <carlos.jaquez@andoverma.us>; Celina Reyes (CREYES@CITYOFLAWRENCE.COM) <CREYES@CITYOFLAWRENCE.COM>; Cheri Cousens (Ccousens@GLSD.org) <Ccousens@GLSD.org>; Cheryl Andrew-Maltais (chariwoman@wampanoagtribe-nsn.gov) <chariwoman@wampanoagtribe-nsn.gov>; christopher.boelke <christopher.boelke@noaa.gov>; Chris Grobicki (chris@grobicki.com) <chris@grobicki.com>; Christina Minicucci (christina.minicucci@mahouse.gov) <christina.minicucci@mahouse.gov>; Christopher Cronin <christopher.cronin@andoverma.us>; Colleen Spero (cspero@glsd.org) <cspero@glsd.org>; Curt Rogers (crogers@merrimack.org) <crogers@merrimack.org>; Daniel Lahiff (dlahiff@cityoflawrence.com) <dlahiff@cityoflawrence.com>; Daniel McCarthy (DMcCarthy@cityoflawrence.com) <DMcCarthy@cityoflawrence.com>; David Deas (daviddeas@mass.gov) <daviddeas@mass.gov>; David Hilgeman (David.Hilgeman@mass.gov) <David.Hilgeman@mass.gov>; David Meehan (dmeehan@cityoflawrence.com) <dmeehan@cityoflawrence.com>; David Weeden (David.Weeden@mwtribe-NSN.gov) <David.Weeden@mwtribe-NSN.gov>; Deirdre Desmond Esq (deirdre.desmond@state.ma.us) <deirdre.desmond@state.ma.us>; Destiny Gonzalez (gonzaabh@bc.edu) <gonzaabh@bc.edu>; Douglas Smithwood (doug_smithwood@fws.gov) <doug_smithwood@fws.gov>; Hay, Duncan E <duncan_hay@nps.gov>; Ed Reiner (Reiner.ed@Epa.gov) <Reiner.ed@Epa.gov>; Eddie Rosa

<erosa@groundworklawrence.org>; Eric Lundquist <elundquist@groundworklawrence.org>; Erika Castillo (atty@erikacastillo.com) <atty@erikacastillo.com>; Evelyn Rodriguez (erodriguez@mylmcc.org) <erodriguez@mylmcc.org>; Francis Murphy (fmurphy@shaheengordon.com) <fmurphy@shaheengordon.com>; Frank Moran (Frank.Moran@mahouse.gov) <Frank.Moran@mahouse.gov>; Frank Surillo (frank.surillo@cityoflawrence.com) <frank.surillo@cityoflawrence.com>; Gerry Darcy (gdarcy@lupolico.com) <gdarcy@lupolico.com>; Gregory Del Rosario (gregory.delrosario@cityoflawrence.com) <gregory.delrosario@cityoflawrence.com>; Harold Peterson (harold.peterson@bia.gov) <harold.peterson@bia.gov>; Jacob Kaminsky (jacob.kaminsky@mahouse.gov) <jacob.kaminsky@mahouse.gov>; Jeannie O'Rand (jorand@cityoflawrence.com) <jorand@cityoflawrence.com>; Jed Koehler (jkoehler@boatingprogram.com) <jkoehler@boatingprogram.com>; Jeffery C. Bendremer (preservation@mohican-nsn.gov) <preservation@mohican-nsn.gov>; Jeovanny Rodriguez (JRODRIGUEZ@CITYOFLAWRENCE.COM) <JRODRIGUEZ@CITYOFLAWRENCE.COM>; Jessica Andors (jandors@lawrencecommunityworks.org) <jandors@lawrencecommunityworks.org>; Jim Donchess (NashuaMayor@NashuaNH.gov) <NashuaMayor@NashuaNH.gov>; Joe Geary (jgeary@woodardcurran.com) <jgeary@woodardcurran.com>; John Curran (jcurran@town.billerica.ma.us) <jcurran@town.billerica.ma.us>; John Eddins PhD (jeddins@achp.gov) <jeddins@achp.gov>; John Harden (jharden@lawrencecommunityworks.org) <jharden@lawrencecommunityworks.org>; John Hess (hess.john@att.net) <hess.john@att.net>; John Spain <john.spain@ferc.gov>; Jonas Stundza (jstundza@cityoflawrence.com) <jstundza@cityoflawrence.com>; Jonathan Guzman <jguzman@groundworklawrence.org>; Jorge Hernandez (jorgeahernandez1843@gmail.com) <jorgeahernandez1843@gmail.com>; Joseph Giarrusso (jgiarrusso@ci.methuen.ma.us) <jgiarrusso@ci.methuen.ma.us>; Joseph Larson (Mass.Wildlife@state.ma.us) <Mass.Wildlife@state.ma.us>; Kassandra Gove (govek@amesburyma.gov) <govek@amesburyma.gov>; Kate Hernandez (khernandez@neiwpcc.org) <khernandez@neiwpcc.org>; Hogan, Kenneth J <kenneth_hogan@fws.gov>; Kevin Harutunian (Kharutunian@topsfield-ma.gov) <Kharutunian@topsfield-ma.gov>; Kevin Longo (klongo@berkinv.com) <klongo@berkinv.com>; Mendik, Kevin R <kevin_mendik@nps.gov>; Lesly Melendez <lmelendez@groundworklawrence.org>; Lisa Hultgren (lisahultgren@derrynh.org) <lisahultgren@derrynh.org>; Marc Laplante (MLaplante@cityoflawrence.com) <MLaplante@cityoflawrence.com>; Marianne Paley Nadel (info@everettmills.com) <info@everettmills.com>; Marisa MacDonald <marisa.macdonald@andoverma.us>; Mark Dockser (selectboard@ci.reading.ma.us) <selectboard@ci.reading.ma.us>; Mark Prout (mprout@fs.fed.us) <mprout@fs.fed.us>; Massachusetts Department of Conservation and Recreation (dam.safety@state.ma.us) <dam.safety@state.ma.us>; Matt Carpenter (matthew.carpenter@wildlife.nh.gov) <matthew.carpenter@wildlife.nh.gov>; Matt Hanson (mhanson@tyngsboroughma.gov) <mhanson@tyngsboroughma.gov>; Matthew Ayer (matt.ayer@mass.gov) <matt.ayer@mass.gov>; Melissa Rodrigues (mrodrigues@northandoverma.gov) <mrodrigues@northandoverma.gov>; Michael Judge (michael.judge@state.ma.us) <michael.judge@state.ma.us>; Michael Lindstrom <michael.lindstrom@andoverma.us>; Michael O'Brien (mobrien@WINNCO.com) <mobrien@WINNCO.com>; Misty Anne Marold (misty-anne.marold@state.ma.us) <misty-anne.marold@state.ma.us>; Pam Harvey (pamela.harvey@state.ma.us) <pamela.harvey@state.ma.us>; Paul Cohen (pcohen@ChelmsfordMA.Gov) <pcohen@ChelmsfordMA.Gov>; Paul Sagarino Jr. (psagarino@burlington.org) <psagarino@burlington.org>; Phelps Turner (joneill@clf.org) <joneill@clf.org>; Rebecca Oldham (ROldham@grovelandma.com) <ROldham@grovelandma.com>; Rebecca Quinones <rebecca.quinones@mass.gov>; Rebecca Tepper (env.internet@mass.gov) <env.internet@mass.gov>; Richard Chase (richard.f.chase@mass.gov) <richard.f.chase@mass.gov>;

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Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Skip Medford <smedford@patriothydro.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Humiston, Sarah <Sarah.Humiston@hdrinc.com>; Kathy French <KFrench@lspower.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: Lawrence Hydroelectric Project PAD Questionnaire Package

Hello –

Essex Company, LLC (Essex) is the Licensee, owner, and operator of the Lawrence Hydroelectric Project, located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project is licensed by the Federal Energy Regulatory Commission (FERC or Commission). The license for the Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate a formal relicensing process with the filing of a Pre-Application Document (PAD) on or after June 1, 2023, and before November 30, 2023.

The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project, which will help identify potential data collection needs or resource issues early in the relicensing process. The attached PAD Questionnaire is one tool that will help identify available information pertinent to the Project. Essex's intent is to include relevant information received in response to the questionnaire within the PAD.

Accordingly, Essex respectfully requests that you complete the attached PAD Questionnaire and provide any relevant information your organization may have regarding the Project within 30 days of your receipt of this email. As detailed in the attached letter, you can complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

We appreciate your response and your assistance in this effort to identify information resources and parties interested in this proceeding. Thank you,

Kelsey Iffert, MS

Environmental/Regulatory Section Lead

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From: Kevin Longo <klongo@berkinv.com>
Sent: Monday, May 1, 2023 2:01 PM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Cc: John Karoff <jkaroff@berkinv.com>
Subject: RE: Lawrence Hydroelectric Project PAD Questionnaire Package

Hi Kelsey,
Please see attached from Berkeley Investments with our contacts for this process.
Thanks
Kevin

From: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Sent: Thursday, April 20, 2023 10:51 AM
To: Alexandra Freeman (alex@manzofreeman.com) <alex@manzofreeman.com>; Ana Levy (alevy@cityoflawrence.com) <alevy@cityoflawrence.com>; Andrew Flanagan (andrew.flanagan@andoverma.us) <andrew.flanagan@andoverma.us>; Andrew Sheehan (Andrew.Sheehan@middletonma.gov) <Andrew.Sheehan@middletonma.gov>; Angela Gile (agile@winnco.com) <agile@winnco.com>; Anthony Curtis (anthonycurtis256@gmail.com) <anthonycurtis256@gmail.com>; Armand Hyatt (ahyatt@lawrencecommunityworks.org) <ahyatt@lawrencecommunityworks.org>; Barry Finegold (Barry.Finegold@masenate.gov) <Barry.Finegold@masenate.gov>; Gahagan, Ben (FWE) <ben.gahagan@state.ma.us>; Ben Martello (ben@northsideventures.com) <ben@northsideventures.com>; Ben Meade (contact@tunoreast.org) <contact@tunoreast.org>; Benjamin Beaulieu (selectman3@townofmerrimac.com) <selectman3@townofmerrimac.com>; benjamin.german <benjamin.german@noaa.gov>; Bettina Washington (thpo@wampanoagtribe-nsn.gov) <thpo@wampanoagtribe-nsn.gov>; Bjorn Lake

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Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Skip Medford <smedford@patriothydro.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Humiston, Sarah <Sarah.Humiston@hdrinc.com>; Kathy French <KFrench@lspower.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: Lawrence Hydroelectric Project PAD Questionnaire Package

Hello –

Essex Company, LLC (Essex) is the Licensee, owner, and operator of the Lawrence Hydroelectric Project, located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project is licensed by the Federal Energy Regulatory Commission (FERC or Commission). The license for the Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate a formal relicensing process with the filing of a Pre-Application Document (PAD) on or after June 1, 2023, and before November 30, 2023.

The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project, which will help identify potential data collection needs or resource issues early in the relicensing process. The attached PAD Questionnaire is one tool that will help identify available information pertinent to the Project. Essex's intent is to include relevant information received in response to the questionnaire within the PAD.

Accordingly, Essex respectfully requests that you complete the attached PAD Questionnaire and provide any relevant information your organization may have regarding the Project within 30 days of your receipt of this email. As detailed in the attached letter, you can complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

We appreciate your response and your assistance in this effort to identify information resources and parties interested in this proceeding. Thank you,

Kelsey Iffert, MS
Environmental/Regulatory Section Lead

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Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Kevin Longo & John Karoff
Organization	Berkeley GGC Canal St., LLC & Berkeley GGC Canal St. II, LLC
Address	c/o Berkeley Investments 125 High St, STE 531 Boston, MA 02110
Phone	617 456 3313
Email Address	klongo@berkinv.com, jkaroff@berkinv.com

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	Kevin Longo & John Karoff
Organization	Berkeley GGC Canal St., LLC & Berkeley GGC Canal St. II, LLC
Address	c/o Berkeley Investments 125 High St, STE 531 Boston, MA 02110
Phone	617 456 3313
Email Address	klongo@berkinv.com, jkaroff@berkinv.com

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☐ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
- Water resources
- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☐ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

From: Benjamin German - NOAA Federal <benjamin.german@noaa.gov>
Sent: Thursday, May 4, 2023 3:06 PM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Cc: Bjorn Lake <bjorn.lake@noaa.gov>; Nick Anderson - NOAA Federal <nick.anderson@noaa.gov>; Christopher Boelke - NOAA Federal <christopher.boelke@noaa.gov>
Subject: Re: Lawrence Hydroelectric Project PAD Questionnaire Package

Hi Kelsey,

Please find the completed questionnaire for NMFS attached.

Thank you,

Benjamin German (he/him)
Marine Habitat Resource Specialist
NOAA | National Marine Fisheries Service
Habitat and Ecosystem Services Division
Greater Atlantic Regional Fisheries Office (GARFO)
55 Great Republic Drive
Gloucester, MA 01930
(978) 281-9353 (office)
www.fisheries.noaa.gov
NOAA FISHERIES

"I have made this letter longer than usual, only because I have not had the time to make it shorter." – Blaise Pascal

On Thu, Apr 20, 2023 at 10:51 AM Iffert, Kelsey <Kelsey.Iffert@hdrinc.com> wrote:

Hello –

Essex Company, LLC (Essex) is the Licensee, owner, and operator of the Lawrence Hydroelectric Project, located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project is licensed by the Federal Energy Regulatory Commission (FERC or Commission). The license for the Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate a formal relicensing process with the filing of a Pre-Application Document (PAD) on or after June 1, 2023, and before November 30, 2023.

The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project, which will help identify potential data collection needs or resource issues early in the relicensing process. The attached PAD Questionnaire is one tool that will help identify available information pertinent to the Project. Essex's intent is to include relevant information received in response to the questionnaire within the PAD.

Accordingly, Essex respectfully requests that you complete the attached PAD Questionnaire and provide any relevant information your organization may have regarding the Project within 30 days of your receipt of this email. As detailed in the attached letter, you can complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

We appreciate your response and your assistance in this effort to identify information resources and parties interested in this proceeding. Thank you,

Kelsey Iffert, MS

Environmental/Regulatory Section Lead

HDR

1304 Buckley Road, Suite 202
Syracuse, NY 13212

D 315.414.2206 **M** 315.706.5176
kelsey.iffert@hdrinc.com

> hdrinc.com/follow-us

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

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If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Benjamin German
Organization	NOAA/NMFS
Address	55 Great Republic Drive Gloucester MA, 01930
Phone	978-281-9353
Email Address	benjamin.german@noaa.gov

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	Benjamin German
Organization	NOAA/NMFS
Address	55 Great Republic Drive Gloucester MA, 01930
Phone	978-281-9353
Email Address	benjamin.german@noaa.gov

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Benjamin German
Organization	
Address	
Phone	
Email Address	

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	Bjorn Lake, Fish Passage Engineer
Organization	NOAA/NMFS
Address	1315 East-West Highway 14th Floor Silver Spring, MD 20910
Phone	
Email Address	bjorn.lake@noaa.gov

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

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4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☑ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
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- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

Merrimack River Watershed Comprehensive Plan for Diadromous Fishes (MRTC, 2021)

Review of other available materials can be arranged upon request and appointment.

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20210617-5016&optimized=false

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☑ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue
Fish and Aquatic Resources	Fish Passage Improvements

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

From: Marold, Misty-Anne (FWE) <misty-anne.marold@state.ma.us>
Sent: Monday, May 8, 2023 2:20 PM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Cc: Quinones, Rebecca (FWE) <rebecca.quinones@state.ma.us>; Cheeseman, Melany (FWE) <melany.cheeseman@state.ma.us>
Subject: RE: Lawrence Hydroelectric Project PAD Questionnaire Package

Hi Kelsey,

Please find attached responses from the MA Division of Fisheries and Wildlife. I was having trouble saving the .pdf format, so this is converted to MSWord. But, it should contain all the same questions. The MA Division of Marine Fisheries will also have a role in the fisheries for this relicensing due to a shared fisheries responsibilities.

Misty-Anne

Misty-Anne R. Marold (*she/her/hers*)
Senior Endangered Species Review Biologist
Massachusetts Division of Fisheries & Wildlife
Natural Heritage & Endangered Species Program
1 North Drive, Rabbit Hill Road
Westborough, MA 01581
508-389-6356
misty-anne.marold@mass.gov

From: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Sent: Thursday, April 20, 2023 10:51 AM
To: Alexandra Freeman (alex@manzofreeman.com) <alex@manzofreeman.com>; Ana Levy (alevy@cityoflawrence.com) <alevy@cityoflawrence.com>; Andrew Flanagan (andrew.flanagan@andoverma.us) <andrew.flanagan@andoverma.us>; Andrew.Sheehan@middletonma.gov; Angela Gile (agile@winnco.com) <agile@winnco.com>; Anthony Curtis (anthonycurtis256@gmail.com) <anthonycurtis256@gmail.com>; Armand Hyatt (ahyatt@lawrencecommunityworks.org) <ahyatt@lawrencecommunityworks.org>; Barry Finegold (Barry.Finegold@masenate.gov) <barry.finegold@masenate.gov>; Gahagan, Ben (FWE) <ben.gahagan@mass.gov>; Ben Martello (ben@northsideventures.com) <ben@northsideventures.com>; Ben Meade (contact@tunoreast.org) <contact@tunoreast.org>; Benjamin Beaulieu (selectman3@townofmerrimac.com) <selectman3@townofmerrimac.com>; benjamin.german <benjamin.german@noaa.gov>; Bettina Washington (thpo@wampanoagtribe-nsn.gov) <thpo@wampanoagtribe-nsn.gov>; Bjorn Lake <bjorn.lake@noaa.gov>; Brad Buschur <bbuschur@groundworklawrence.org>; Brett Leavitt (bleavitt@glsd.org) <bleavitt@glsd.org>; Brian Corrigan (corriganlaw@gmail.com) <corriganlaw@gmail.com>; Brian De Pena (mayordepena@cityoflawrence.com) <mayordepena@cityoflawrence.com>; Brian Gilbert (bgilbert@tewksbury-ma.gov) <bgilbert@tewksbury-ma.gov>; Brian McCarthy (TownAdmin@WindhamNH.gov) <TownAdmin@WindhamNH.gov>; Brian Pena (brian.pena@andoverma.us) <brian.pena@andoverma.us>; Sojkowski, Bryan <bryan_sojkowski@fws.gov>; Carlos Jaquez (carlos.jaquez@andoverma.us) <carlos.jaquez@andoverma.us>; Celina Reyes (CREYES@CITYOFLAWRENCE.COM) <CREYES@CITYOFLAWRENCE.COM>; Cheri Cousens (Ccousens@GLSD.org) <Ccousens@GLSD.org>; Cheryl Andrew-Maltais (chariwoman@wampanoagtribe-nsn.gov) <chariwoman@wampanoagtribe-nsn.gov>; christopher.boelke <christopher.boelke@noaa.gov>; Chris Grobicki (chris@grobicki.com) <chris@grobicki.com>; Christina Minicucci (christina.minicucci@mahouse.gov) <christina.minicucci@mahouse.gov>; Christopher Cronin (christopher.cronin@andoverma.us) <christopher.cronin@andoverma.us>; Colleen Spero (cspero@glsd.org) <cspero@glsd.org>; Curt Rogers (crogers@merrimack.org) <crogers@merrimack.org>; Daniel Lahiff (dlahiff@cityoflawrence.com) <dlahiff@cityoflawrence.com>; Daniel McCarthy (DMcCarthy@cityoflawrence.com) <DMcCarthy@cityoflawrence.com>; David Deas (daviddeas@mass.gov) <daviddeas@mass.gov>; Hilgeman, David (DEP) <David.Hilgeman@mass.gov>; David Meehan (dmeehan@cityoflawrence.com) <dmeehan@cityoflawrence.com>; David Weeden (David.Weeden@mwtribe-NSN.gov) <David.Weeden@mwtribe-NSN.gov>; Desmond, Deirdre (DEP) <deirdre.desmond@mass.gov>; Destiny Gonzalez (gonzaabh@bc.edu) <gonzaabh@bc.edu>; Douglas Smithwood (doug_smithwood@fws.gov) <doug_smithwood@fws.gov>; Hay, Duncan E <duncan_hay@nps.gov>; Reiner, Edward <reiner.ed@epa.gov>; Eddie Rosa <erosa@groundworklawrence.org>; Eric Lundquist <elundquist@groundworklawrence.org>; Erika Castillo (atty@erikacastillo.com) <atty@erikacastillo.com>; Evelyn Rodriguez (erodriguez@mylmcc.org) <erodriguez@mylmcc.org>; Francis Murphy (fmurphy@shaheengordon.com) <fmurphy@shaheengordon.com>; Frank Moran (Frank.Moran@mahouse.gov) <frank.moran@mahouse.gov>; Frank Surillo (frank.surillo@cityoflawrence.com) <frank.surillo@cityoflawrence.com>; Gerry Darcy (gdarcy@lupolico.com) <gdarcy@lupolico.com>; Gregory Del Rosario (gregory.delrosario@cityoflawrence.com) <gregory.delrosario@cityoflawrence.com>; Harold Peterson

(harold.peterson@bia.gov) <harold.peterson@bia.gov>; Jacob Kaminsky (jacob.kaminsky@mahouse.gov) <jacob.kaminsky@mahouse.gov>; Jeannie O'Rand (jorand@cityoflawrence.com) <jorand@cityoflawrence.com>; Jed Koehler (jkoehler@boatingprogram.com) <jkoehler@boatingprogram.com>; Jeffery C. Bendremer (preservation@mohican-nsn.gov) <preservation@mohican-nsn.gov>; Jeovanny Rodriguez (JRODRIGUEZ@CITYOFLAWRENCE.COM) <JRODRIGUEZ@CITYOFLAWRENCE.COM>; Jessica Andors (jandors@lawrencecommunityworks.org) <jandors@lawrencecommunityworks.org>; Jim Donchess (NashuaMayor@NashuaNH.gov) <NashuaMayor@NashuaNH.gov>; Joe Geary (jgeary@woodardcurran.com) <jgeary@woodardcurran.com>; John Curran (jcurran@town.billerica.ma.us) <jcurran@town.billerica.ma.us>; John Eddins PhD (jeddins@achp.gov) <jeddins@achp.gov>; John Harden (jharden@lawrencecommunityworks.org) <jharden@lawrencecommunityworks.org>; John Hess (hess.john@att.net) <hess.john@att.net>; John Spain <john.spain@ferc.gov>; Jonas Stundza (jstundza@cityoflawrence.com) <jstundza@cityoflawrence.com>; Jonathan Guzman <jguzman@groundworklawrence.org>; Jorge Hernandez (jorgeahernandez1843@gmail.com) <jorgeahernandez1843@gmail.com>; Joseph Giarrusso (jgiarrusso@ci.methuen.ma.us) <jgiarrusso@ci.methuen.ma.us>; Mass Wildlife (FWE) <mass.wildlife@mass.gov>; mayor-govek <govek@amesburyma.gov>; Kate Hernandez (khernandez@neiwpcc.org) <khernandez@neiwpcc.org>; Hogan, Kenneth J <kenneth_hogan@fws.gov>; kharutunian@topsfield-ma.gov; Kevin Longo (klongo@berkinv.com) <klongo@berkinv.com>; Mendik, Kevin R <kevin_mendik@nps.gov>; Lesly Melendez <lmelendez@groundworklawrence.org>; Lisa Hultgren (lisahultgren@derrynh.org) <lisahultgren@derrynh.org>; Marc L. Laplante <mlaplante@cityoflawrence.com>; Marianne Paley Nadel (info@everettmills.com) <info@everettmills.com>; Marisa Browning-Kamins (marisa.browningkamin@andoverma.us) <marisa.browningkamin@andoverma.us>; Mark Dockser (selectboard@ci.reading.ma.us) <selectboard@ci.reading.ma.us>; Mark Prout (mprout@fs.fed.us) <mprout@fs.fed.us>; Dam Safety (DCR) <dam.safety@mass.gov>; Matt Carpenter (matthew.carpenter@wildlife.nh.gov) <matthew.carpenter@wildlife.nh.gov>; Matt Hanson (mhanson@tyngsboroughma.gov) <mhanson@tyngsboroughma.gov>; Ayer, Matt (FWE) <matt.ayer@mass.gov>; Rodrigues, Melissa (EXT) <mrodrigues@northandoverma.gov>; zzzJudge, Michael (ENE) <michael.judge@mass.gov>; Michael Lindstrom (michael.lindstrom@andoverma.us) <michael.lindstrom@andoverma.us>; O'Brien, Michael - ext1 <mobrien@winnco.com>; Marold, Misty-Anne (FWE) <misty-anne.marold@mass.gov>; Harvey, Pamela (DEP) <Pamela.Harvey@mass.gov>; Paul Cohen (pcohen@ChelmsfordMA.Gov) <pcohen@ChelmsfordMA.Gov>; Sagarino, Paul (EXT) <PSagarino@burlington.org>; Phelps Turner (joneill@clf.org) <joneill@clf.org>; Rebecca Oldham (ROldham@grovelandma.com) <ROldham@grovelandma.com>; Quinones, Rebecca (FWE) <rebecca.quinones@mass.gov>; internet, env (EEA) <env.internet@mass.gov>; Chase, Richard F. (DEP) <richard.f.chase@mass.gov>; Montuori, Richard (EXT) <rmontuori@tewksbury-ma.gov>; Robert Nasdor (bob@americanwhitewater.org) <bob@americanwhitewater.org>; Rocky Morrison (Rocky@cleanriverproject.org) <Rocky@cleanriverproject.org>; Rodney Elliott (Rodney.Elliott@mahouse.gov) <rodney.elliott@mahouse.gov>; Ronald Keohane (rkeohane@tyngsboroughma.gov) <rkeohane@tyngsboroughma.gov>; Scott Brinch (sbrinch@tewksbury-ma.gov) <sbrinch@tewksbury-ma.gov>; Scott Galvin (sgalvin@cityofwoburn.com) <sgalvin@cityofwoburn.com>; Shannon Holsey (shannon.holsey@mohican-nsn.gov) <shannon.holsey@mohican-nsn.gov>; Moura, Stephanie (DEP) <Stephanie.Moura@mass.gov>; Bartha, Steve (EXT) <sbartha@danversma.gov>; Steve Malizia (smalizia@hudsonnh.gov) <smalizia@hudsonnh.gov>; Mattocks, Steven (FWE) <steven.mattocks@mass.gov>; Steve Olausen (solausen@palinc.com) <solausen@palinc.com>; Poulos, Steve <spoulos@wenhamma.gov>; Susan Grabski (director@lawrencehistory.org) <director@lawrencehistory.org>; Thomas Baranowski (thomas.baranowski@mahouse.gov)

<thomas.baranowski@mahouse.gov>; Thomas Lannan (tjlannan@cityofmethuen.net) <tjlannan@cityofmethuen.net>; Golden, Thomas (EXT) <tomgolden@lowellma.gov>; US Department of the Interior (DOISOLNE-FERC@sol.doi.gov) <DOISOLNE-FERC@sol.doi.gov>; Vanna Howard (Vanna.Howard@mahouse.gov) <vanna.howard@mahouse.gov>; William Hale (whale@cityoflawrence.com) <whale@cityoflawrence.com>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Skip Medford <smedford@patriothydro.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Humiston, Sarah <Sarah.Humiston@hdrinc.com>; Kathy French <KFrench@lspower.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: Lawrence Hydroelectric Project PAD Questionnaire Package

Hello –

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We appreciate your response and your assistance in this effort to identify information resources and parties interested in this proceeding. Thank you,

Kelsey Iffert, MS
Environmental/Regulatory Section Lead

HDR
1304 Buckley Road, Suite 202
Syracuse, NY 13212
D 315.414.2206 **M** 315.706.5176
kelsey.iffert@hdrinc.com
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Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Rebecca Quinones, Climate Change & Large River Ecologist Misty-Anne Marold, Senior Endangered Species Biologist
Organization	MA Division of Fisheries & Wildlife
Address	1 North Drive, Rabbit Hill RoadWestborough, MA 01581
Phone	RQ 508-389-6333; MAM 508-389-6356
Email Address	RQ rebecca.quinones@mass.gov; MAM misty-anne.marold@mass.gov

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	*Same as above*
Organization	
Address	
Phone	
Email Address	

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☑ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
- **Water resources**
- **Fish and aquatic resources**
- **Wildlife and botanicalresources**
- **Wetlands, riparian, andlittoral habitat**
- **Rare, threatened, and endangered species**
- **Recreation and land use**
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

Fisheries
Survey data available upon request

State-Listed Species
Request through an Information Request
BioMAP

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

- **Fisheries** - Email to Rebecca.Quinones@mass.gov, MRTC Comprehensive Plan for restoration of diadromous species; https://www.mass.gov/doc/merrimack-river-watershed-comprehensive-plan/download
- **Water Resources** – DEP Permits
- **BioMap**. The BioMap web portal delivers the latest scientific data and resources to help state and local governments, land trusts, non-government organizations, and other conservation partners strategically plan projects to conserve wildlife and their habitats. The latest version of BioMap combines more than 40 years of rigorously documented rare species and natural community records from MassWildlife with cutting-edge climate resilience data from The Nature Conservancy and spatial data identifying intact fish and wildlife communities, habitats, and ecosystems that are the focus of the Massachusetts State Wildlife Action Plan.

  https://biomap-mass-eoeea.hub.arcgis.com/
- **State-Listed Species** - https://www.mass.gov/how-to/request-rare-species-information. We recommend that you request the information in sections relevant to the project. So, species for the upper impoundment, lower impoundment, immediately below the dam, downstream to the limit of project effect, canals, etc.
- **Federally-Listed Species** - https://ipac.ecosphere.fws.gov/

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☒ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue
Fish and fisheries	Fish passage, eel passage, natural hydrologic regime, habitat restoration; timing and amount of flow for spawning habitat
Invasive species (plants and animals)	Monitoring and reporting

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

From: John Macone <jmacone@merrimack.org>
Sent: Tuesday, May 9, 2023 1:10 PM
To: Iffert, Kelsey <kelsey.iffert@hdrinc.com>
Subject: Response to Essex Company questionnaire

Attached please find my response to the questionnaire.

Thank you
--
John Macone
Policy and Education Specialist
Phone -- 978-376-1475
Sign up for our newsletter!
merrimack.org

MRWC
MERRIMACK RIVER WATERSHED COUNCIL

Facebook:
Instagram:
Twitter:

1. Please provide the following information about the person completing this questionnaire.

Name & Title	John Macone, Policy Specialist
Organization	Merrimack River Watershed Council
Address	60 Island Street, Suite 246 Lawrence, Mass., 01840
Phone	978-376-1475
Email Address	jmacone@merrimack.org

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page.*)

Name & Title	As above
Organization	
Address	
Phone	
Email Address	

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☑ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
- Water resources
- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

We have multiple documents and reports, extending back about 50 years, on the general condition of the Merrimack River, as well as specifc goals and projects. These cover a wide range of subjects.

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

These reports are in our office, they are the only copies that we have and are not publicly accessible. Most likely there are other sources for these reports -- state and federal agencies for example.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☑ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue
Merrimack River	Fish passage
North Canal	Condition of structure, water level
Merrimack River	Non-point pollution
Merrimack River	Single point pollution, such as CSOs
Merrimack River	Emerging contaminants

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

From: Kevin Webb <kwebb@patriothydro.com>
Sent: Thursday, April 27, 2023 12:25 PM
To: Amy Lydon <amy.lydon@townofrowley.org>; Iffert, Kelsey <kelsey.iffert@hdrinc.com>
Cc: Debbie Eagan <debbie@townofrowley.org>
Subject: RE: Lawrence Hydroelectric Project Questionnaire

Amy:

Federal regulations require that we contact all municipalities within 15 miles of the dam having a population greater than 5,000. A 15 mile radius around Lawrence covers most of Essex County and a good piece of Middlesex County, so I'm sure you're not the only town administrator with the same question. The original licensing of the dam happened back in the 1970's. I am not sure whether the Town of Rowley participated in that licensing, but I think that it's doubtful since Rowley does not border the Merrimack River.

Let me know if you have any further questions.

Kevin

Kevin Webb
Hydro Licensing Manager

Patriot Hydro, LLC
670 N Commercial Street, Suite 204| Manchester, NH 03101
C: (978) 935-6039
kwebb@patriothydro.com

From: Amy Lydon <amy.lydon@townofrowley.org>
Sent: Thursday, April 27, 2023 11:29 AM
To: Kevin Webb <kwebb@patriothydro.com>; kelsey.iffert@hdrinc.com
Cc: Debbie Eagan <debbie@townofrowley.org>
Subject: Lawrence Hydroelectric Project Questionnaire

Hi Kevin and Kelsey,

The Town of Rowley has received the attached letter. We are confused about why we received this letter. Did Rowley participate in the original licensing process? If so, could you send us the original license?

Thank-you,
Amy

Amy Lydon
Assistant Town Administrator

Town of Rowley
PO Box 275
Rowley, MA 01969
978-948-2372 (p)
978-948-8202 (f)

From: Brian Corrigan <corriganlaw@gmail.com>
Sent: Monday, May 22, 2023 4:22 PM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Subject: Re: Lawrence Hydroelectric Project PAD Questionnaire Package

Good afternoon, Ms. Iffert:

Attached, please find a completed PAD Questionnaire for Lawrence Redevelopment Authority. Kindly update my contact information on the distribution list. I noticed that I am on the list but combined with another entity. Thank you.

Brian

Brian T. Corrigan, Esq.
122 Chestnut Street
Andover, MA 01810
Tel: (978) 988-1544

On Thu, Apr 20, 2023 at 10:50 AM Iffert, Kelsey <Kelsey.Iffert@hdrinc.com> wrote:

> Hello –

Essex Company, LLC (Essex) is the Licensee, owner, and operator of the Lawrence Hydroelectric Project, located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project is licensed by the Federal Energy Regulatory Commission (FERC or Commission). The license for the Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate a formal relicensing process with the filing of a Pre-Application Document (PAD) on or after June 1, 2023, and before November 30, 2023.

The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project, which will help identify potential data collection needs or resource issues early in the relicensing process. The attached PAD Questionnaire is one tool that will help identify available information pertinent to the Project. Essex's intent is to include relevant information received in response to the questionnaire within the PAD.

Accordingly, Essex respectfully requests that you complete the attached PAD Questionnaire and provide any relevant information your organization may have regarding the Project within 30 days of your receipt of this email. As detailed in the attached letter, you can complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

We appreciate your response and your assistance in this effort to identify information resources and parties interested in this proceeding. Thank you,

Kelsey Iffert, MS

Environmental/Regulatory Section Lead

HDR

1304 Buckley Road, Suite 202
Syracuse, NY 13212

D 315.414.2206 **M** 315.706.5176
kelsey.iffert@hdrinc.com

hdrinc.com/follow-us

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Brian T. Corrigan, Esq., General Counsel
Organization	Lawrence Redevelopment Authority
Address	12 Methuen Street Lawrence, MA 01840
Phone	(978) 988-1544
Email Address	corriganlaw@gmail.com

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

   ☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

   Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	Brian T. Corrigan, Esq., General Counsel
Organization	Lawrence Redevelopment Authority
Address	12 Methuen Street Lawrence, MA 01840
Phone	(978) 988-1544
Email Address	corriganlaw@gmail.com

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

   ☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☐ Yes *(If yes, please complete Nos. 4a through 4d)*　　☑ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
- Water resources
- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☐ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

From: Brad Buschur <bbuschur@groundworklawrence.org>
Sent: Monday, May 22, 2023 4:52:14 PM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Subject: Lawrence PAD Questionnaire.pdf

CAUTION: [EXTERNAL] This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Kelsey,

Please see attached.

Thanks, Brad

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Brad Buschur, Project Director
Organization	Groundwork Lawrence
Address	50 Island Street, Suite 101 Lawrence MA 01840
Phone	617 874 6498
Email Address	bbuschur@groundworklawrence.org

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	
Organization	
Address	
Phone	
Email Address	

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☑ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
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- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

City of Lawrence Open Space & Recreation Plan; Condition Assessment of Canal Walls Report, North Canal; Lawrence TBD, Lawrence Urban Renewal Plan; Climate Risk Assessment - Lawrence Massachusetts August 2022.

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

https://drive.google.com/drive/folders/1xkiYAoTb3qVDAAP6oD-K3kvGBAJg1rQx?usp=share_link

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☑ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue
Head Pond - Merrimack River	Bank erosion at Riverfront State Park
North Canal	See Canal Condition Report
South Bank of Merrimack Below the dam	Water discharge from unused wasteway, large volume of trash on Essex property
Riverfront Recreation	Essex Company has critical right of way for the implementation of the Lawrence Greenway Framework

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

From: Upper Merrimack River LAC <umrlac@MerrimackRiver.org>
Sent: Tuesday, May 16, 2023 3:39 PM
To: Kevin Webb <kwebb@patriothydro.com>
Cc: umrlac listserve <umrlacers@merrimackriver.org>; Tracie Sales <tracie.j.sales@des.nh.gov>
Subject: Re: FW: Lawrence Hydroelectric Project PAD Questionnaire Package

Dear Kevin,

The Upper Merrimack River Local Advisory Committee's response to your PAD questionnaire is attached in the PDF you provided.

Thank you for adding UMRLAC@MerrimackRiver.org to your future lists. We did not see our email (or mine) in your 4.20.23 announcement.

Thank you.

Sincerely,

Michele L. Tremblay, Chair
Upper Merrimack River Local Advisory Committee

```
--
Michele L. Tremblay
naturesource communications
PO Box 3019 | Penacook NH  03303
603.796.2615 office landline | 902.218.2291 Canada
naturesource.net | linkedin.com/pub/Michele-L-Tremblay/22/869/523
Follow us on Facebook and Twitter
my pronouns are she, her, hers
```

Kevin Webb wrote:

From: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Sent: Thursday, April 20, 2023 10:51 AM
To: Alexandra Freeman (alex@manzofreeman.com) <alex@manzofreeman.com>; Ana Levy (alevy@cityoflawrence.com) <alevy@cityoflawrence.com>; Andrew Flanagan (andrew.flanagan@andoverma.us) <andrew.flanagan@andoverma.us>; Andrew Sheehan (Andrew.Sheehan@middletonma.gov) <Andrew.Sheehan@middletonma.gov>; Angela Gile (agile@winnco.com) <agile@winnco.com>; Anthony Curtis (anthonycurtis256@gmail.com) <anthonycurtis256@gmail.com>; Armand Hyatt (ahyatt@lawrencecommunityworks.org) <ahyatt@lawrencecommunityworks.org>; Barry Finegold (Barry.Finegold@masenate.gov) <Barry.Finegold@masenate.gov>; Gahagan, Ben (FWE) <ben.gahagan@state.ma.us>; Ben Martello (ben@northsideventures.com) <ben@northsideventures.com>; Ben Meade (contact@tunoreast.org) <contact@tunoreast.org>; Benjamin Beaulieu (selectman3@townofmerrimac.com) <selectman3@townofmerrimac.com>; benjamin.german <benjamin.german@noaa.gov>; Bettina Washington (thpo@wampanoagtribe-nsn.gov) <thpo@wampanoagtribe-nsn.gov>; Bjorn Lake <bjorn.lake@noaa.gov>; Brad Buschur <bbuschur@groundworklawrence.org>; Brett Leavitt (bleavitt@glsd.org) <bleavitt@glsd.org>; Brian Corrigan (corriganlaw@gmail.com) <corriganlaw@gmail.com>; Brian De Pena (mayordepena@cityoflawrence.com) <mayordepena@cityoflawrence.com>; Brian Gilbert (bgilbert@tewksbury-ma.gov) <bgilbert@tewksbury-ma.gov>; Brian McCarthy (TownAdmin@WindhamNH.gov) <TownAdmin@WindhamNH.gov>; Brian Pena (brian.pena@andoverma.us) <brian.pena@andoverma.us>; Sojkowski, Bryan <bryan_sojkowski@fws.gov>; Carlos Jaquez (carlos.jaquez@andoverma.us) <carlos.jaquez@andoverma.us>; Celina Reyes (CREYES@CITYOFLAWRENCE.COM) <CREYES@CITYOFLAWRENCE.COM>; Cheri Cousens (Ccousens@GLSD.org) <Ccousens@GLSD.org>; Cheryl Andrew-Maltais (chariwoman@wampanoagtribe-nsn.gov) <chariwoman@wampanoagtribe-nsn.gov>; christopher.boelke <christopher.boelke@noaa.gov>; Chris Grobicki (chris@grobicki.com) <chris@grobicki.com>; Christina Minicucci (christina.minicucci@mahouse.gov) <christina.minicucci@mahouse.gov>; Christopher Cronin

(christopher.cronin@andoverma.us) <christopher.cronin@andoverma.us>; Colleen Spero (cspero@glsd.org) <cspero@glsd.org>; Curt Rogers (crogers@merrimack.org) <crogers@merrimack.org>; Daniel Lahiff (dlahiff@cityoflawrence.com) <dlahiff@cityoflawrence.com>; Daniel McCarthy (DMcCarthy@cityoflawrence.com) <DMcCarthy@cityoflawrence.com>; David Deas (daviddeas@mass.gov) <daviddeas@mass.gov>; David Hilgeman (David.Hilgeman@mass.gov) <David.Hilgeman@mass.gov>; David Meehan (dmeehan@cityoflawrence.com) <dmeehan@cityoflawrence.com>; David Weeden (David.Weeden@mwtribe-NSN.gov) <David.Weeden@mwtribe-NSN.gov>; Deirdre Desmond Esq (deirdre.desmond@state.ma.us) <deirdre.desmond@state.ma.us>; Destiny Gonzalez (gonzaabh@bc.edu) <gonzaabh@bc.edu>; Douglas Smithwood (doug_smithwood@fws.gov) <doug_smithwood@fws.gov>; Hay, Duncan E <duncan_hay@nps.gov>; Ed Reiner (Reiner.ed@Epa.gov) <Reiner.ed@Epa.gov>; Eddie Rosa <erosa@groundworklawrence.org>; Eric Lundquist <elundquist@groundworklawrence.org>; Erika Castillo (atty@erikacastillo.com) <atty@erikacastillo.com>; Evelyn Rodriguez (erodriguez@mylmcc.org) <erodriguez@mylmcc.org>; Francis Murphy (fmurphy@shaheengordon.com) <fmurphy@shaheengordon.com>; Frank Moran (Frank.Moran@mahouse.gov) <Frank.Moran@mahouse.gov>; Frank Surillo (frank.surillo@cityoflawrence.com) <frank.surillo@cityoflawrence.com>; Gerry Darcy (gdarcy@lupolico.com) <gdarcy@lupolico.com>; Gregory Del Rosario (gregory.delrosario@cityoflawrence.com) <gregory.delrosario@cityoflawrence.com>; Harold Peterson (harold.peterson@bia.gov) <harold.peterson@bia.gov>; Jacob Kaminsky (jacob.kaminsky@mahouse.gov) <jacob.kaminsky@mahouse.gov>; Jeannie O'Rand (jorand@cityoflawrence.com) <jorand@cityoflawrence.com>; Jed Koehler (jkoehler@boatingprogram.com) <jkoehler@boatingprogram.com>; Jeffery C. Bendremer (preservation@mohican-nsn.gov) <preservation@mohican-nsn.gov>; Jeovanny Rodriguez (JRODRIGUEZ@CITYOFLAWRENCE.COM) <JRODRIGUEZ@CITYOFLAWRENCE.COM>; Jessica Andors (jandors@lawrencecommunityworks.org) <jandors@lawrencecommunityworks.org>; Jim Donchess (NashuaMayor@NashuaNH.gov) <NashuaMayor@NashuaNH.gov>; Joe Geary (jgeary@woodardcurran.com) <jgeary@woodardcurran.com>; John Curran (jcurran@town.billerica.ma.us) <jcurran@town.billerica.ma.us>; John Eddins PhD (jeddins@achp.gov) <jeddins@achp.gov>; John Harden (jharden@lawrencecommunityworks.org) <jharden@lawrencecommunityworks.org>; John Hess (hess.john@att.net) <hess.john@att.net>; John Spain <john.spain@ferc.gov>; Jonas Stundza (jstundza@cityoflawrence.com) <jstundza@cityoflawrence.com>; Jonathan Guzman <jguzman@groundworklawrence.org>; Jorge Hernandez (jorgeahernandez1843@gmail.com) <jorgeahernandez1843@gmail.com>; Joseph Giarrusso (jgiarrusso@ci.methuen.ma.us) <jgiarrusso@ci.methuen.ma.us>; Joseph Larson (Mass.Wildlife@state.ma.us) <Mass.Wildlife@state.ma.us>; Kassandra Gove (govek@amesburyma.gov) <govek@amesburyma.gov>; Kate Hernandez (khernandez@neiwpcc.org) <khernandez@neiwpcc.org>; Hogan, Kenneth J <kenneth_hogan@fws.gov>; Kevin Harutunian (Kharutunian@topsfield-ma.gov) <Kharutunian@topsfield-ma.gov>; Kevin Longo (klongo@berkinv.com) <klongo@berkinv.com>; Mendik, Kevin R <kevin_mendik@nps.gov>; Lesly Melendez <lmelendez@groundworklawrence.org>; Lisa Hultgren (lisahultgren@derrynh.org) <lisahultgren@derrynh.org>; Marc Laplante (MLaplante@cityoflawrence.com)

<MLaplante@cityoflawrence.com>; Marianne Paley Nadel (info@everettmills.com) <info@everettmills.com>; Marisa Browning-Kamins (marisa.browningkamin@andoverma.us) <marisa.browningkamin@andoverma.us>; Mark Dockser (selectboard@ci.reading.ma.us) <selectboard@ci.reading.ma.us>; Mark Prout (mprout@fs.fed.us) <mprout@fs.fed.us>; Massachusetts Department of Conservation and Recreation (dam.safety@state.ma.us) <dam.safety@state.ma.us>; Matt Carpenter (matthew.carpenter@wildlife.nh.gov) <matthew.carpenter@wildlife.nh.gov>; Matt Hanson (mhanson@tyngsboroughma.gov) <mhanson@tyngsboroughma.gov>; Matthew Ayer (matt.ayer@mass.gov) <matt.ayer@mass.gov>; Melissa Rodrigues (mrodrigues@northandoverma.gov) <mrodrigues@northandoverma.gov>; Michael Judge (michael.judge@state.ma.us) <michael.judge@state.ma.us>; Michael Lindstrom (michael.lindstrom@andoverma.us) <michael.lindstrom@andoverma.us>; Michael O'Brien (mobrien@WINNCO.com) <mobrien@WINNCO.com>; Misty Anne Marold (misty-anne.marold@state.ma.us) <misty-anne.marold@state.ma.us>; Pam Harvey (pamela.harvey@state.ma.us) <pamela.harvey@state.ma.us>; Paul Cohen (pcohen@ChelmsfordMA.Gov) <pcohen@ChelmsfordMA.Gov>; Paul Sagarino Jr. (psagarino@burlington.org) <psagarino@burlington.org>; Phelps Turner (joneill@clf.org) <joneill@clf.org>; Rebecca Oldham (ROldham@grovelandma.com) <ROldham@grovelandma.com>; Rebecca Quinones <rebecca.quinones@mass.gov>; Rebecca Tepper (env.internet@mass.gov) <env.internet@mass.gov>; Richard Chase (richard.f.chase@mass.gov) <richard.f.chase@mass.gov>; Richard Montuori (rmontuori@tewksbury-ma.gov) <rmontuori@tewksbury-ma.gov>; Robert Nasdor (bob@americanwhitewater.org) <bob@americanwhitewater.org>; Rocky Morrison (Rocky@cleanriverproject.org) <Rocky@cleanriverproject.org>; Rodney Elliott (Rodney.Elliott@mahouse.gov) <Rodney.Elliott@mahouse.gov>; Ronald Keohane (rkeohane@tyngsboroughma.gov) <rkeohane@tyngsboroughma.gov>; Scott Brinch (sbrinch@tewksbury-ma.gov) <sbrinch@tewksbury-ma.gov>; Scott Galvin (sgalvin@cityofwoburn.com) <sgalvin@cityofwoburn.com>; Shannon Holsey (shannon.holsey@mohican-nsn.gov) <shannon.holsey@mohican-nsn.gov>; Stephanie Moura (stephanie.moura@state.ma.us) <stephanie.moura@state.ma.us>; Steve Bartha (sbartha@danversma.gov) <sbartha@danversma.gov>; Steve Malizia (smalizia@hudsonnh.gov) <smalizia@hudsonnh.gov>; Steve Mattocks (steven.mattocks@mass.gov) <steven.mattocks@mass.gov>; Steve Olausen (solausen@palinc.com) <solausen@palinc.com>; Steve Poulos (spoulos@wenhamma.gov) <spoulos@wenhamma.gov>; Susan Grabski (director@lawrencehistory.org) <director@lawrencehistory.org>; Thomas Baranowski (thomas.baranowski@mahouse.gov) <thomas.baranowski@mahouse.gov>; Thomas Lannan (tjlannan@cityofmethuen.net) <tjlannan@cityofmethuen.net>; Tom Golden (tomgolden@lowellma.gov) <tomgolden@lowellma.gov>; US Department of the Interior (DOISOLNE-FERC@sol.doi.gov) <DOISOLNE-FERC@sol.doi.gov>; Vanna Howard (Vanna.Howard@mahouse.gov) <Vanna.Howard@mahouse.gov>; William Hale (whale@cityoflawrence.com) <whale@cityoflawrence.com>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Skip Medford <smedford@patriothydro.com>; Jim Gibson <jim.gibson@hdrinc.com>; Humiston, Sarah <Sarah.Humiston@hdrinc.com>; Kathy French <KFrench@lspower.com>; Curt Mooney <cmooney@patriothydro.com>
Subject: Lawrence Hydroelectric Project PAD Questionnaire Package

Hello –

Essex Company, LLC (Essex) is the Licensee, owner, and operator of the Lawrence Hydroelectric Project, located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project is licensed by the Federal Energy Regulatory Commission (FERC or Commission). The license for the Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate a formal relicensing process with the filing of a Pre-Application Document (PAD) on or after June 1, 2023, and before November 30, 2023.

The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project, which will help identify potential data collection needs or resource issues early in the relicensing process. The attached PAD Questionnaire is one tool that will help identify available information pertinent to the Project. Essex's intent is to include relevant information received in response to the questionnaire within the PAD.

Accordingly, Essex respectfully requests that you complete the attached PAD Questionnaire and provide any relevant information your organization may have regarding the Project within 30 days of your receipt of this email. As detailed in the attached letter, you can complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

We appreciate your response and your assistance in this effort to identify information resources and parties interested in this proceeding. Thank you,

Kelsey Iffert, MS
Environmental/Regulatory Section Lead

HDR
1304 Buckley Road, Suite 202
Syracuse, NY 13212
D 315.414.2206 **M** 315.706.5176
kelsey.iffert@hdrinc.com
hdrinc.com/follow-us

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Michele L Tremblay, Chair
Organization	Upper Merrimack River Local Advisory Committee
Address	PO Box 3019 Penacook NH 03303
Phone	6037962615
Email Address	UMRLAC@MerrimackRiver.org

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

☑ Yes *(If yes, please complete information below)* ☐ No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	Michele L Tremblay, Chair
Organization	Upper Merrimack River Local Advisory Committee
Address	PO Box 3019 Penacook NH 03303
Phone	6037962615
Email Address	UMRLAC@MerrimackRiver.org

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

☐ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☑ Yes *(If yes, please complete Nos. 4a through 4d)* ☐ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

- Geology and soils
- Water resources
- Fish and aquatic resources
- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
- Recreation and land use
- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

Lower Merrimack River Corridor Management Plan
(https://www4.des.state.nh.us/blogs/rivers/wp-content/uploads/mer-low-plan.pdf)
Upper Merrimack River Corridor Management Plan
(https://www.merrimackriver.org/upper-merrimack-river-local-advisory-committee/management-plan/)
New Hampshire Wildlife Action Plan (https://www.wildlife.state.nh.us/wildlife/wap.html)
#Turkey River Watershed Restoration and Management Plan
(https://www.merrimackriver.org/upper-merrimack-river-local-advisory-committee/management-plan/)

above listed resources are to support geology and soils; water resources; fish and aquatic resources; wildlife and botanical resources; rare, threatened, and endangered species; recreation and land use

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

CHAPTER 1 (revize.com) Lower Merrimack River Corridor Management Plan
Management Plan - The Upper Merrimack Watershed Association (merrimackriver.org) Upper Merrimack River Corridor Management Plan
Wildlife Action Plan | Wildlife | New Hampshire Fish and Game Department (state.nh.us) New Hampshire Wildlife Action Plan

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☑ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

Resource Area	Description of Issue
Fish and aquatic resources	Description of Issue = inadequate passage for migratory fish species and
Rare, threatened, and	rare, threatened, and endangered species not sufficiently accommodated

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

1. Does Essex Co. or Patriot Hydro work with any LAC's (or similar) to make imp

Figure 1. Lawrence Project Area of Interest

Project Area

AREA OF INTEREST
ESSEX DAM AND FACILITIES

\\SYR-SRV01\GIS\PROJECTS\CENTRAL_RIVERS_POWER\10358652_LAWRENCERELICENSING\7.2_WIP\MAP_DOCS\CRP_LAWRENCEPROJECT1.APRX DATE: 3/7/2023

LAWRENCE HYDROELECTRIC PROJECT

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Lawrence Project or Project), located along the Merrimack River in the City of Lawrence in Essex County, Massachusetts (see Figure 1).

Under the Federal Power Act, the Federal Energy Regulatory Commission (FERC) administers the relicensing of the Project. The license for the 16.8-megawatt (MW) Lawrence Project was issued on December 4, 1978, and expires on November 30, 2028. Essex intends to initiate FERC relicensing process for the Project on or after June 1, 2023 (but before November 30, 2023).

Responses to this Pre-Application Document (PAD) Questionnaire will help identify sources of existing, relevant, and reasonably available information pertinent to the Project. The PAD will provide FERC and other entities with existing, relevant, and reasonably available information pertaining to the Project as well as resources within the vicinity of the Project.

Essex's intent is to include relevant information received in response to this questionnaire in the PAD in support of identifying potential data collection needs or resource issues early in the relicensing process. Accordingly, we respectfully request that you complete and return this PAD Questionnaire by email to Kelsey Iffert with HDR at Kelsey.Iffert@hdrinc.com.

If you received a hardcopy of the PAD Questionnaire by regular mail, please email the completed questionnaire to Kelsey Iffert (preferred) or return the completed questionnaire in the self-addressed, stamped envelope provided. If you no longer wish to receive correspondence regarding the Project, simply email "unsubscribe" to Kelsey Iffert at the email address above.

Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Orlando Pacheco
Organization	Town of Georgetown MA
Address	1 Library Street Georgetown MA 01833
Phone	(978) 352-5755
Email Address	opacheco@georgetownma.gov

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

__ Yes *(If yes, please complete information below)* X No *(If no, please go to No. 3)*

Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page.*)

Name & Title	
Organization	
Address	
Phone	
Email Address	

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

__ Please remove me and the entity I represent from the mailing list.

4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

   __ Yes *(If yes, please complete Nos. 4a through 4d)*   X No *(If no, please go to No. 5)*

   a. If yes, please circle the specific resource area(s) that the information relates to:

      - Geology and soils
      - Water resources
      - Fish and aquatic resources
      - Wildlife and botanical resources
      - Wetlands, riparian, and littoral habitat
      - Rare, threatened, and endangered species
      - Recreation and land use
      - Aesthetic resources
      - Cultural resources
      - Socioeconomic resources
      - Tribal resources
      - Other resource information

   b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

   c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

__ Yes *(please list specific issues below)* __ No (if no, please go to No. 5)

Resource Area	Description of Issue

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Iffert, Kelsey

Subject: FW: MESA Info Request, Lawrence Hydroelectric, IR-55114
Attachments: IR-55114.pdf

Kelsey Scott Iffert, MS
Environmental/Regulatory Section Lead

HDR
231 Salina Meadows Parkway, Suite 210
Syracuse, NY 13212
D 315.414.2206 **M** 315.706.5176
kelsey.iffert@hdrinc.com
hdrinc.com/follow-us

From: Cheeseman, Melany (FWE) <melany.cheeseman@state.ma.us>
Sent: Thursday, June 1, 2023 9:49 AM
To: Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>
Subject: MESA Info Request, Lawrence Hydroelectric, IR-55114

Good morning,

Please see the attached MESA Information Request letter. In addition to the species listed in the response letter there is new Regulatory Habitat for Riverine Clubtail (*Stylurus amnicola;* Endangered) along the Merrimack River from the Lawrence/Methuen town line to the confluence with Fish Brook. This area will be mapped as Priority Habitat in the next issuance of the Natural Heritage Atlas. Let me know if you have any questions. Thank you,

Melany Cheeseman
Endangered Species Review Assistant
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
melany.cheeseman@mass.gov | www.mass.gov/nhesp

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

June 01, 2023

Kelsey Iffert
231 Salina Meadows Parkway, Suite 210
Syracuse, New York 13212

RE: Project Location: 9 South Broadway
Town: Lawrence
Heritage Hub Form ID: IR-55114
NHESP Tracking No.: 23-0072

To Whom It May Concern:

Thank you for contacting the Natural Heritage and Endangered Species Program (NHESP) of the MA Division of Fisheries & Wildlife (the "Division") for information regarding state-listed species in the vicinity of the above referenced site. Based on the information provided, this project site or a portion thereof is located **within** the current *Massachusetts Natural Heritage Atlas*. The following state-listed species are mapped for either *Priority Habitat (PH)* alone, or for both *Priority Habitat (PH)* and *Estimated Habitat (EH)*, as indicated in the following table:

Scientific Name	Common Name	Taxonomic Group	State Status	EH	PH
Acipenser brevirostrum	Shortnose Sturgeon	Fish	Endangered	1362	2154
Acipenser oxyrinchus	Atlantic Sturgeon	Fish	Endangered	1362	2154
Haliaeetus leucocephalus	Bald Eagle	Bird	Special Concern	1272	1985
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern	1284	2002

The species listed above are protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife are also protected under the Massachusetts Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for most state-listed species can be found on our website (www.mass.gov/nhesp).

Projects and activities located within Priority and/or Estimated Habitat **must** be reviewed by the Division for compliance with the state-listed species protection provisions of MESA (321 CMR 10.00) and/or the WPA (310 CMR 10.00). Please note, Atlantic Sturgeon Critical Habitat is mapped from the mouth of the Merrimack to the face of the Lawrence Dam pursuant to the federal Endangered Species Act. See https://www.fisheries.noaa.gov/resource/map/atlantic-sturgeon-critical-habitat-map-and-gis-data"

Wetlands Protection Act (WPA)

If the project site is within Estimated Habitat and a Notice of Intent (NOI) is required, then a copy of the NOI must be submitted to the Division so that it is received at the same time as the local conservation commission. If the Division determines that the proposed project will adversely affect the actual Resource Area habitat of state-protected wildlife, then the proposed project may not be permitted (310 CMR 10.37, 10.58(4)(b) & 10.59). In such a case, the project proponent may request a consultation with the Division to discuss potential project design modifications that would avoid adverse effects to state-listed wildlife habitat.

A streamlined joint MESA/WPA review process is available. When filing an NOI, the applicant may file concurrently under the MESA and qualify for a 30-day streamlined joint review. Please visit our website for filing instructions: www.mass.gov/regulatory-review.

MA Endangered Species Act (MESA)

If the proposed project is located within Priority Habitat and is not exempt from review (see 321 CMR 10.14), then project plans, a fee, and other required materials must be submitted to the Division to determine whether a Take under the MA Endangered Species Act would occur (321 CMR 10.18). Please note that all proposed and anticipated development must be disclosed, as MESA does not allow project segmentation (321 CMR 10.16). Please visit our website for filing instructions: www.mass.gov/regulatory-review.

We recommend that state-listed species habitat concerns be addressed during the project design phase prior to submission of a formal MESA filing, as avoidance and minimization of impacts to state-listed species and their habitats is likely to expedite regulatory review. Please visit our website for more information on how to request a pre-filing consultation with the Division: www.mass.gov/how-to/request-a-pre-filing-consultation

This evaluation is based on the most recent information available in the NHESP database, which is constantly being expanded and updated through ongoing research and inventory. If the purpose of your inquiry is to generate a species list to fulfill the federal Endangered Species Act (16 U.S.C. 1531 et seq.) information requirements for a permit, proposal, or authorization of any kind from a federal agency, we recommend that you use the NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper (https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=1bc332edc5204e03b250ac11f9914a27) and the U.S. Fish and Wildlife Service's Information for Planning and Conservation website (https://ecos.fws.gov/ipac). If you have any questions regarding this letter please contact Melany Cheeseman, Endangered Species Review Assistant, at Melany.Cheeseman@mass.gov.

Sincerely,

Everose Schlüter, Ph.D.
Assistant Director

Iffert, Kelsey

From:	Scott Brinch <sbrinch@tewksbury-ma.gov>
Sent:	Thursday, June 1, 2023 2:37 PM
To:	Iffert, Kelsey
Subject:	Lawrence Hydroelectric Project PAD Questionnaire
Attachments:	Lawrence PAD Questionnaire - Tewksbury DPW.pdf
Follow Up Flag:	Follow up
Flag Status:	Flagged

Attached for Tewksbury Department of Public Works Water Treatment Division.

Thank you.

Scott Brinch
Assistant Director – Utilities

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Please provide your response within 30 days of your receipt of this letter. We appreciate your response and your assistance in this effort to identify information resources and interested parties in this proceeding.

1. Please provide the following information about the person completing this questionnaire.

Name & Title	Scott Brinch Assistant Director - Utilities of Public Works
Organization	Tewksbury, MA Department of Public Works
Address	999 Whipple Rd, Tewksbury, MA 01880
Phone	978-640-4440
Email Address	sbrinch@tewksbury-ma.gov

2. Do you or your organization plan to participate in the relicensing proceeding for the Lawrence Project?

   ☐ Yes *(If yes, please complete information below)* ☑ No *(If no, please go to No. 3)*

   Please provide the contact information for the representative(s) of your organization that will be participating in the relicensing process for the Project. (*Additional contacts may be provided on a separate page*.)

Name & Title	
Organization	
Address	
Phone	
Email Address	

3. If you and the entity you represent do not want to receive any further correspondence associated with this proceeding, please indicate so here:

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4. Do you or your organization know of any existing, relevant, and reasonably available information that describes the Project's existing environment or historical environment (i.e., Lawrence Project areas, adjacent vicinities, or areas upstream or downstream of the Project)?

☐ Yes *(If yes, please complete Nos. 4a through 4d)* ☑ No *(If no, please go to No. 5)*

a. If yes, please circle the specific resource area(s) that the information relates to:

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- Wildlife and botanical resources
- Wetlands, riparian, and littoral habitat
- Rare, threatened, and endangered species
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- Aesthetic resources
- Cultural resources
- Socioeconomic resources
- Tribal resources
- Other resource information

b. Please briefly describe the information referenced above or list available documents *(additional information may be provided at the end of this questionnaire.)*

c. Please provide referenced documents, source website link, or description of where Essex can obtain this information, if available.

d. Based on the specific resources listed in 4a, are you aware of any specific issues or improvements pertaining to the identified resource area(s)? *(Additional information may be provided at the end of this questionnaire.)*

☐ Yes *(please list specific issues below)* ☐ No (if no, please go to No. 5)

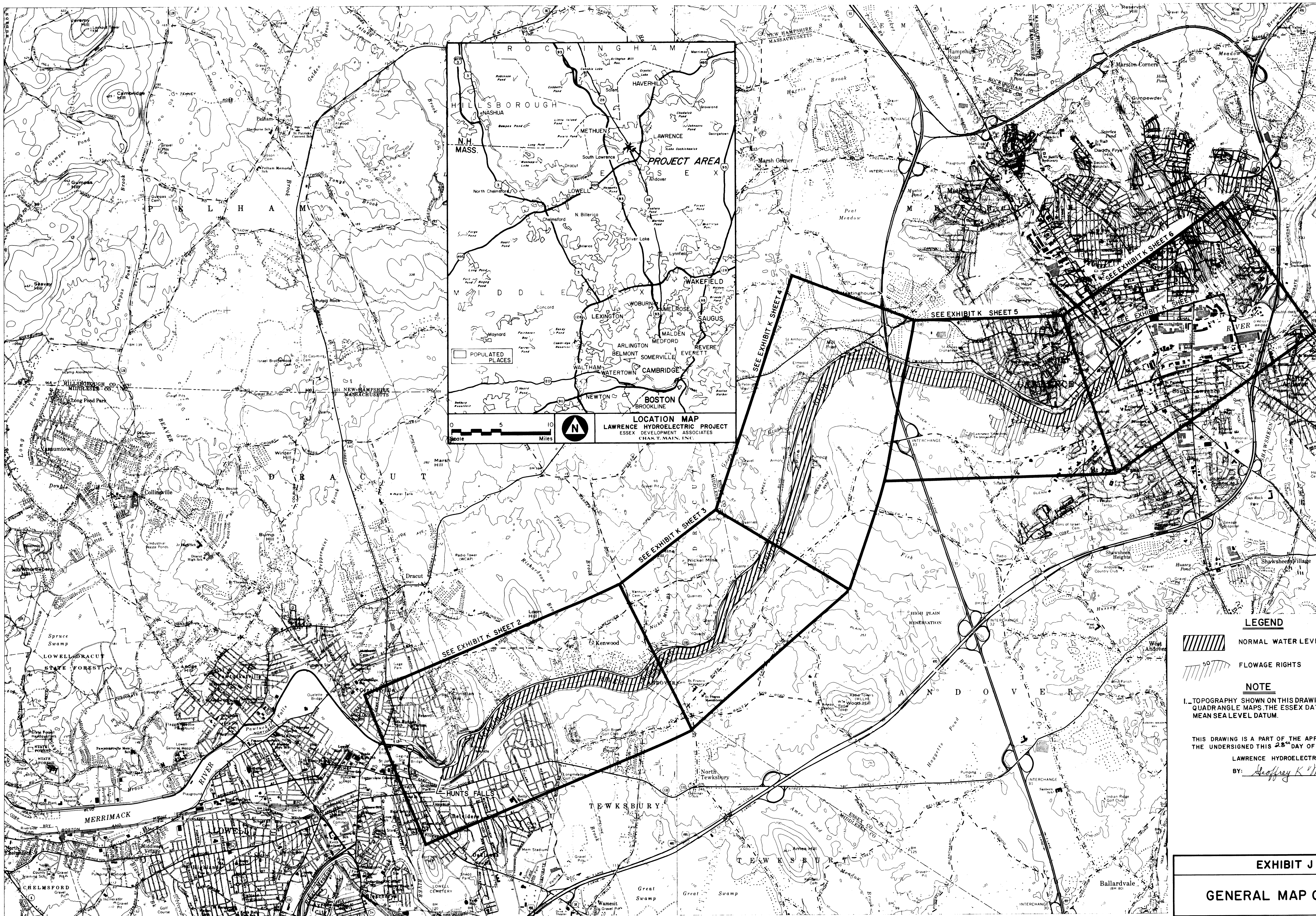
Resource Area	Description of Issue

5. If you have additional comments and/or questions regarding the Lawrence Project or the relicensing process, please provide them below.

Figure 1. Lawrence Project Area of Interest

Appendix C – Project Exhibit K Drawings

EXHIBIT J SHEET I



LEGEND

NORMAL WATER LEVEL

FLOWAGE RIGHTS

NOTE

1. TOPOGRAPHY SHOWN ON THIS DRAWING WAS REPRODUCED FROM U.S.G.S. QUADRANGLE MAPS. THE ESSEX DATUM IS 5.07 FEET ABOVE THE U.S.G.S. MEAN SEA LEVEL DATUM.

THIS DRAWING IS A PART OF THE APPLICATION FOR A LICENSE MADE BY THE UNDERSIGNED THIS 28th DAY OF JUNE, 1977

LAWRENCE HYDROELECTRIC ASSOCIATES

BY: Geoffrey K. Mitchell

15° TRUE NORTH MAGNETIC NORTH (1966)

2000 0 2000 4000 6000 8000

1" = 2000'

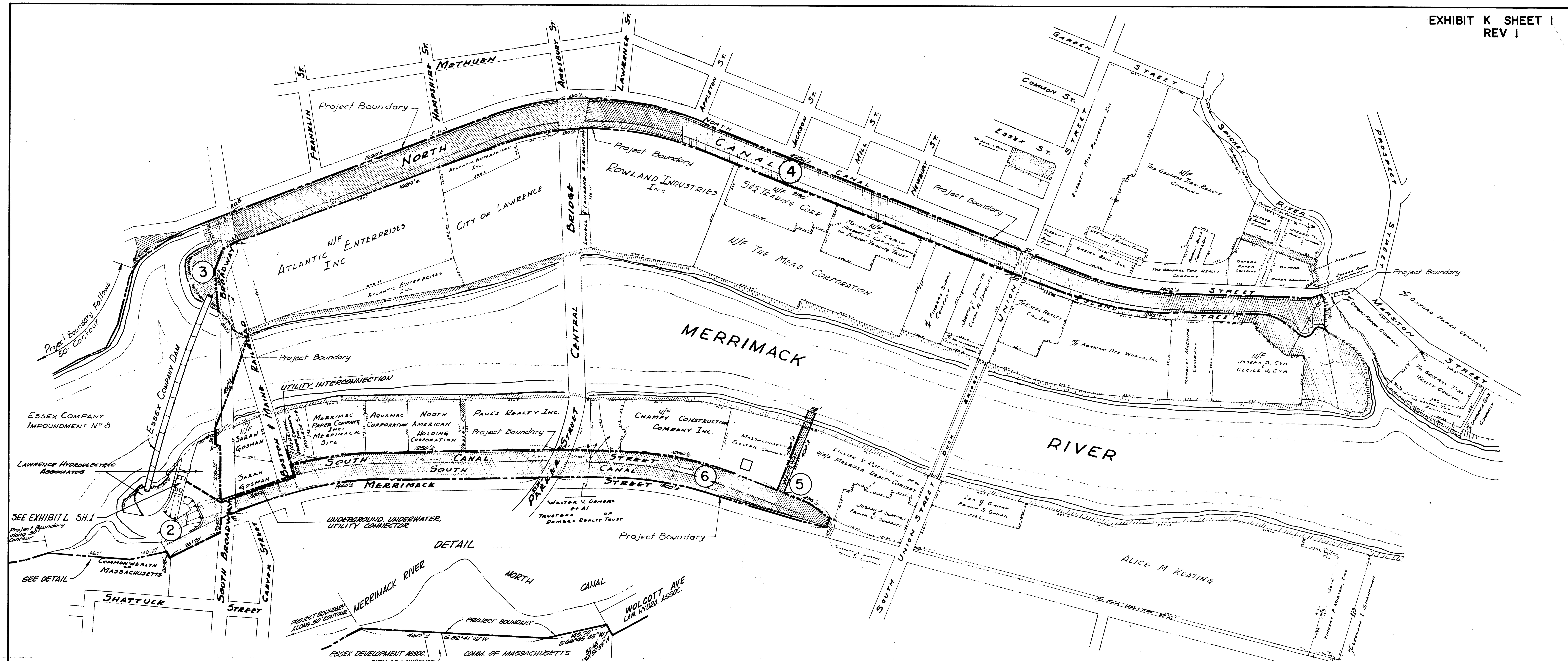
EXHIBIT J SHEET I

GENERAL MAP OF PROJECT AREA

LAWRENCE HYDROELECTRIC PROJECT
LAWRENCE HYDROELECTRIC ASSOCIATES
CHAS. T. MAIN, INC.

FERC NO. 2800-1

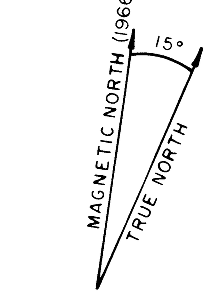
EXHIBIT K SHEET I
REV I

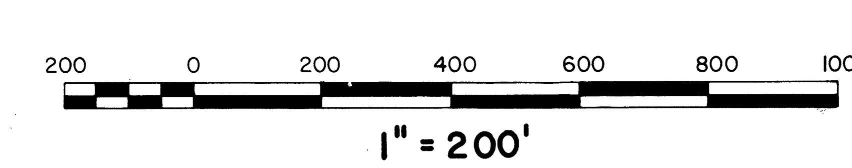


PROJECT BOUNDARY
DESCRIPTION

LAWRENCE HYDROELECTRIC ASSOCIATES, INC.

Beginning at the southeast corner of the intersection of Broadway with Canal Street; Thence Easterly 1620 feet, more or less, by the southerly sideline of Canal Street to the southwest corner of the intersection of the Central Bridge, so called, with said Canal Street; Thence continuing Easterly across said Central Bridge to the southeast corner of said intersection; Thence continuing Easterly along the said southerly sideline of Canal Street 2256 feet, more or less, to Union Street; Thence continuing Easterly across said Union Street 50 feet; Thence continuing Easterly along said southerly sideline 1402 feet, more or less, to the westerly edge of the Spicket River, the last 5 courses being 10 feet, more or less, Northerly of the North Wall of the North Canal; Thence turning and running Southerly along said westerly edge 140 feet, more or less, to other land of Essex Company; Thence turning and running Westerly, Southerly, Northerly and again Westerly by the North Canal to the easterly line of Island Street; Thence Southerly by said line 25 feet to the centerline of said Island Street; Thence Westerly along said centerline 1242 feet, more or less, to the easterly line of Union Street; Thence continuing Westerly along the extension of said centerline across Union Street 50 feet; Thence continuing Westerly and Southwesterly on a line parallel and 25 feet, more or less, Southerly of the South Wall of the North Canal, by various abbutters, 2190 feet, more or less, to the easterly line of the Central Bridge; Thence continuing Southwesterly along the aforementioned parallel line across the Central Bridge 80 feet; Thence continuing Southwesterly along said parallel line 1689 feet, more or less, to the easterly sideline of Broadway; Thence Southwesterly across Broadway, 70 feet, more or less; Thence Southerly by the westerly line of Broadway 300 feet, more or less, to the face of the Falls Bridge abbuttment at the northerly edge of the Merrimack River; Thence Southeasterly by said river 200 feet; Thence Southerly across said river 450 feet, more or less, to the northeast corner of property owned by Lawrence Hydroelectric Associates, Inc. being the site of the Lawrence Hydroelectric Power Plant; Thence Southerly by land of the Commonwealth of Massachusetts 35 feet; Thence turning and running Easterly by said land 14 feet to the westerly line of South Broadway; Thence Southerly by said South Broadway 276.35 feet to the northerly wall of the South Canal; Thence Northeasterly across said South Broadway by the said northerly wall 350 feet, more or less, to the easterly line of the Boston and Maine Railroad right of way; Thence turning and running Northwesterly by said right of way 50 feet to the northerly sideline of South Canal Street; Thence Easterly by said northerly sideline 1250 feet, more or less, to the westerly sideline of Parker Street; Thence continuing Easterly by said northerly sideline across Parker Street 80 feet, more or less; Thence continuing Easterly along said sideline 1000 feet, more or less, to the southeasterly corner of land of Massachusetts Electric Company and a wasteway owned by the Essex Company; Thence Northerly by said wasteway 400 feet, more or less, to the Merrimack River; Thence Easterly 30 feet; Thence Southerly by the easterly line of said wasteway 400 feet, more or less, to the aforesaid northerly sideline of South Canal Street; Thence Easterly along said sideline 235 feet, more or less; Thence Southerly across said South Canal Street 37.11 feet, more or less, to the north sideline of Merrimack Street; Thence Westerly along said northerly sideline 1300 feet, more or less, to the aforesaid Parker Street; Thence continuing Westerly across said Parker Street 83.34 feet; Thence continuing Westerly along said northerly sideline 1440 feet, more or less, to the easterly sideline of South Broadway; Thence Westerly across South Broadway to the intersection of the westerly sideline of South Broadway and the northerly line of Wolcott Avenue 66 feet, more or less; Thence Southerly by the westerly sideline of South Broadway to the southerly sideline of Wolcott Avenue 70.42 feet; Thence Southwesterly by said southerly sideline of Wolcott Avenue 251.70 feet to land of Commonwealth of Massachusetts; Thence Northwesterly by said land 30.45 feet; Thence Southwesterly by said land 145.70 feet to a point; Thence Westerly by said land and land of the City of Lawrence and Essex Development Associates, Inc. 460 feet more or less, to the southerly line of the Merrimack River; Thence generally Westerly by said River and the 50 foot contour line, U.S.C. and G.S. Datum to a point where the 50 foot control line crosses said Merrimack River, said point being near the Hunts Falls Bridge in Lowell, Massachusetts; Thence Northerly across said River; Thence Easterly continuing by said 50 foot contour line to the entrance to the North Canal Street in Lawrence, Massachusetts; Thence Northerly and Northeasterly by said 50 foot contour line near the north bank of the North Canal to the entrance gate of said North Canal; Thence continuing Northeasterly across Broadway to the Point of Beginning.





NOTES

1. [hatched symbol] - DESIGNATES LAND OWNED BY THE ESSEX COMPANY.
2. PROPERTY INFORMATION FROM PLAN OF LAND ESSEX COMPANY LAND SUBJECT TO MILL POWERS DATED DEC. 26, 1963 BY CHARLES E. CYR LAWRENCE, MASS.
3. ——·—— DESIGNATES PROJECT BOUNDARIES.

THIS DRAWING IS A PART OF THE APPLICATION FOR A LICENSE MADE BY THE UNDERSIGNED THIS 28th DAY OF JUNE, 1977

LAWRENCE HYDROELECTRIC ASSOCIATES

BY: Geoffrey K. Mitchell

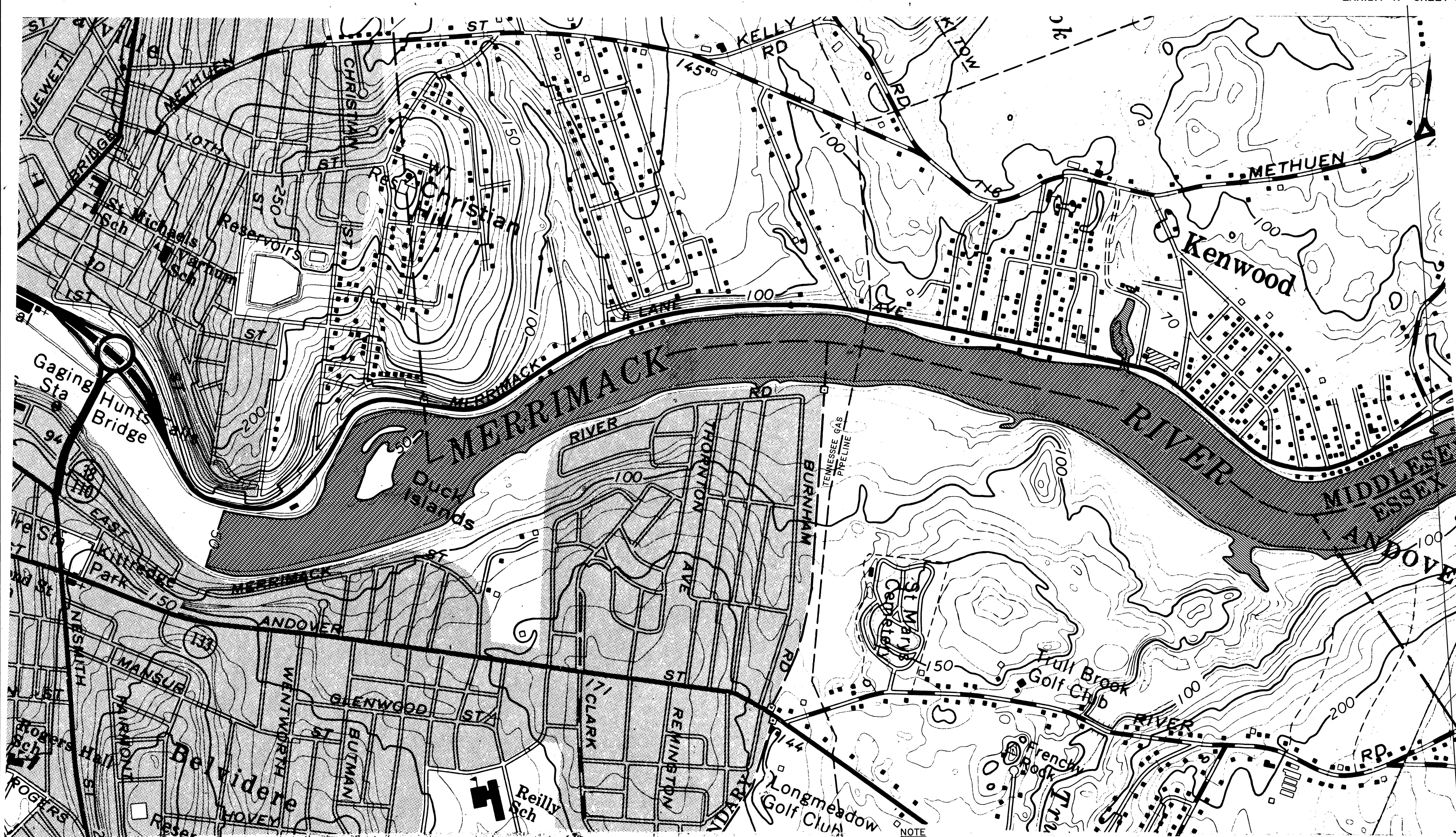
REVISED: NOV. 22, 1983
REVISED: MAR. 3, 1982
REVISED: DEC. 9, 1981

EXHIBIT K SHEET I REV. I

DETAIL MAP OF PROJECT AREA

LAWRENCE HYDROELECTRIC PROJECT
LAWRENCE HYDROELECTRIC ASSOCIATES
CHAS. T. MAIN, INC.

FERC NO. 2800 – 22



NOTE
TOPOGRAPHY SHOWN ON THIS DRAWING WAS REPRODUCED FROM U.S.G.S. QUADRANGLE MAPS. THE ESSEX DATUM IS 5.07 FEET ABOVE THE U.S.G.S. MEAN SEA LEVEL DATUM.

MATCH LINE
SEE EXHIBIT K SHEET 3

ISSUED

THIS DRAWING IS A PART OF THE APPLICATION FOR A LICENSE MADE BY THE UNDERSIGNED THIS 28th DAY OF June, 1977

LAWRENCE HYDROELECTRIC ASSOCIATES

BY: Geoffrey K. Mitchell

MAGNETIC NORTH (1966)
TRUE NORTH
15°

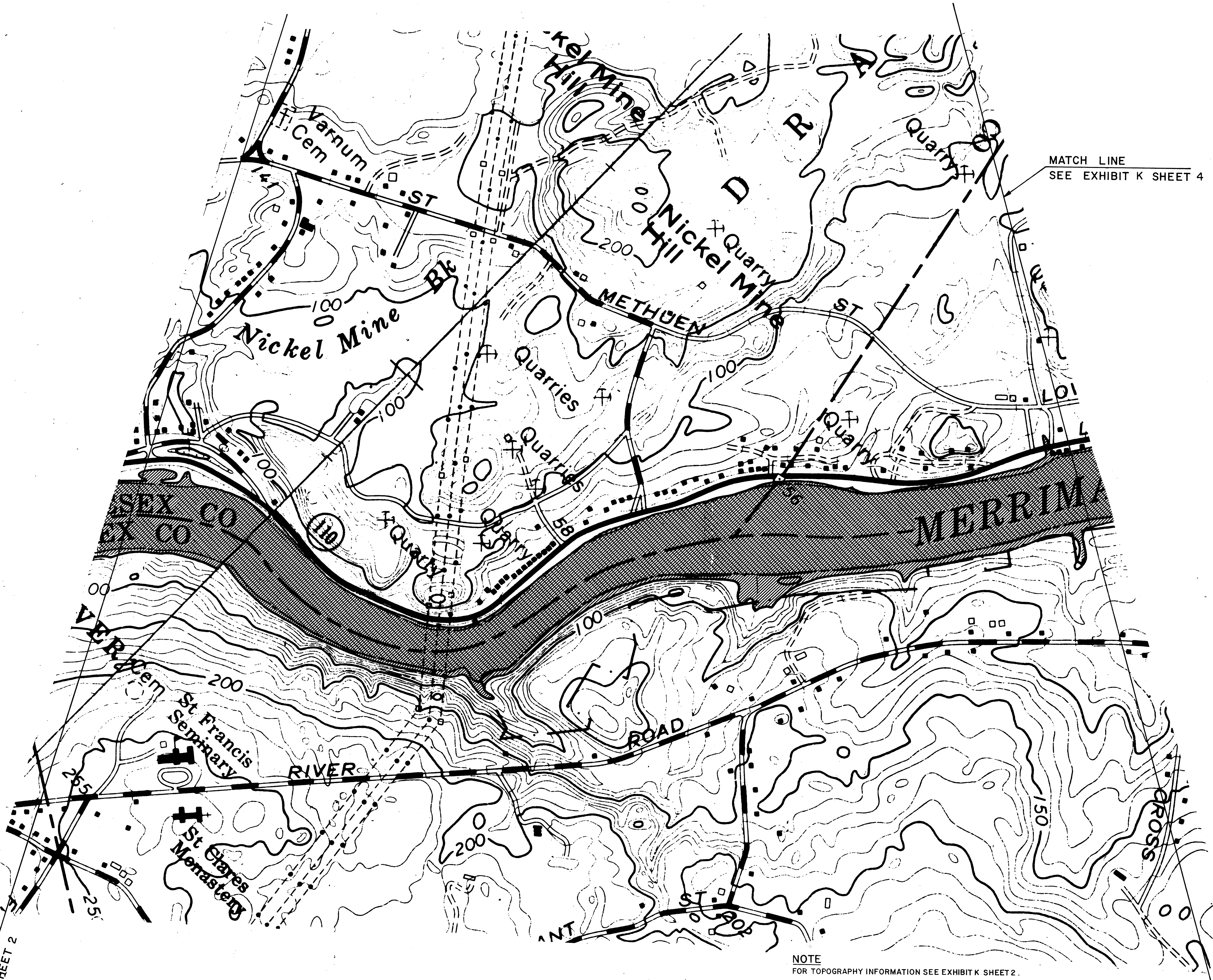
400 0 400 800 1200 1800 2000
1" = 400'

EXHIBIT K SHEET 2

DETAIL MAP OF PROJECT AREA

LAWRENCE HYDROELECTRIC PROJECT
LAWRENCE HYDROELECTRIC ASSOCIATES
CHAS. T. MAIN, INC.

EXHIBIT K SHEET 3



ISSUED
DEC 5 1977

NOTE
FOR TOPOGRAPHY INFORMATION SEE EXHIBIT K SHEET 2.

THIS DRAWING IS A PART OF THE APPLICATION FOR A LICENSE MADE BY THE UNDERSIGNED THIS 28th DAY OF June, 1977

LAWRENCE HYDROELECTRIC ASSOCIATES

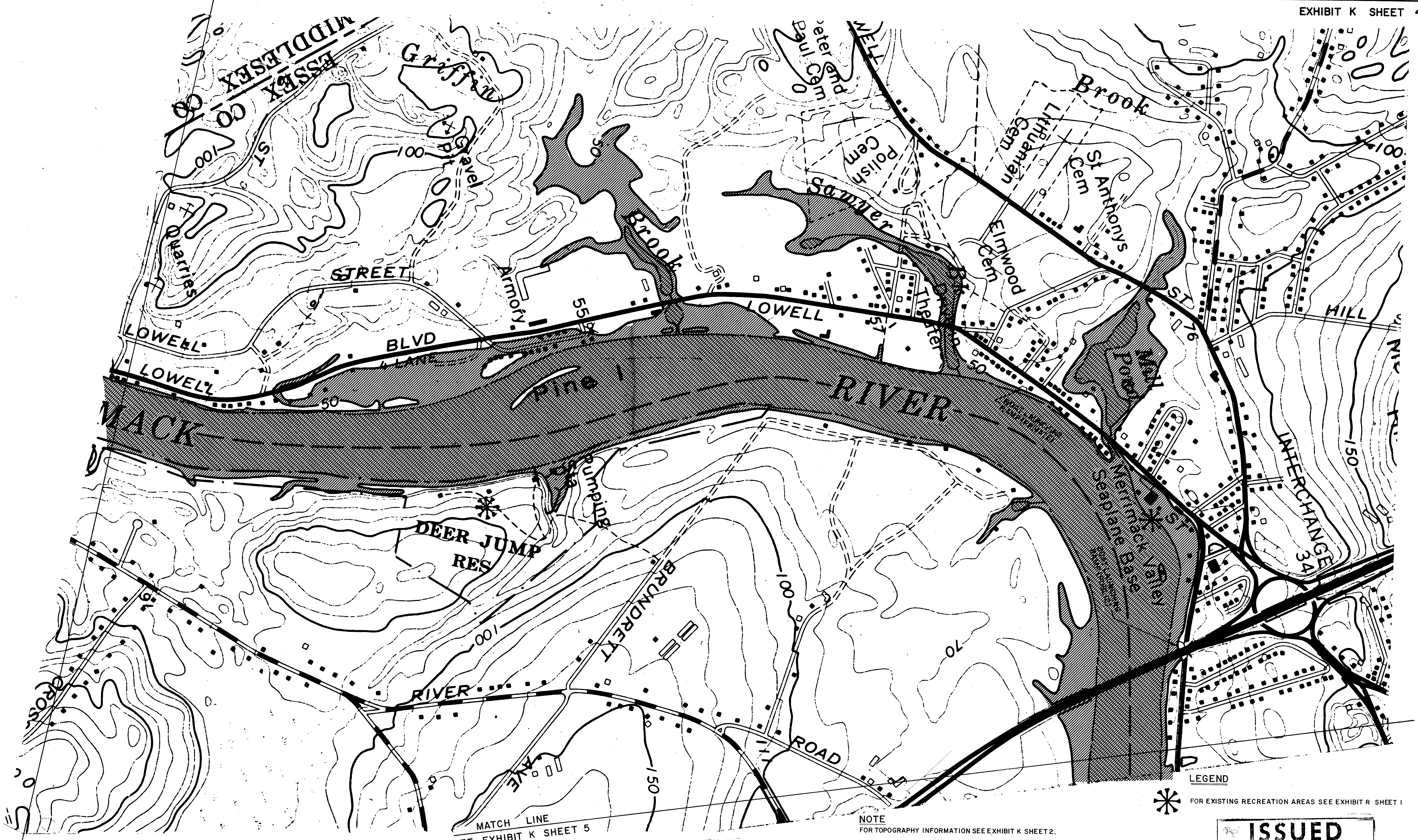
BY: Geoffrey K Mitchell

MAGNETIC NORTH (1968)
TRUE NORTH
15°

400 0 400 800 1200 1600 2000
1" = 400'

EXHIBIT K SHEET 3
DETAIL MAP OF PROJECT AREA
LAWRENCE HYDROELECTRIC PROJECT LAWRENCE HYDROELECTRIC ASSOCIATES CHAS. T. MAIN, INC.

EXHIBIT K SHEET 4



LEGEND

FOR EXISTING RECREATION AREAS SEE EXHIBIT R SHEET I

NOTE
FOR TOPOGRAPHY INFORMATION SEE EXHIBIT K SHEET 2.

ISSUED
DEC 5 1977

THIS DRAWING IS A PART OF THE APPLICATION FOR A LICENSE MADE BY THE UNDERSIGNED THIS 28th DAY OF June, 1977

LAWRENCE HYDROELECTRIC ASSOCIATES

BY: Geoffrey K. Mitchell

MAGNETIC NORTH (1966) 15°
TRUE NORTH

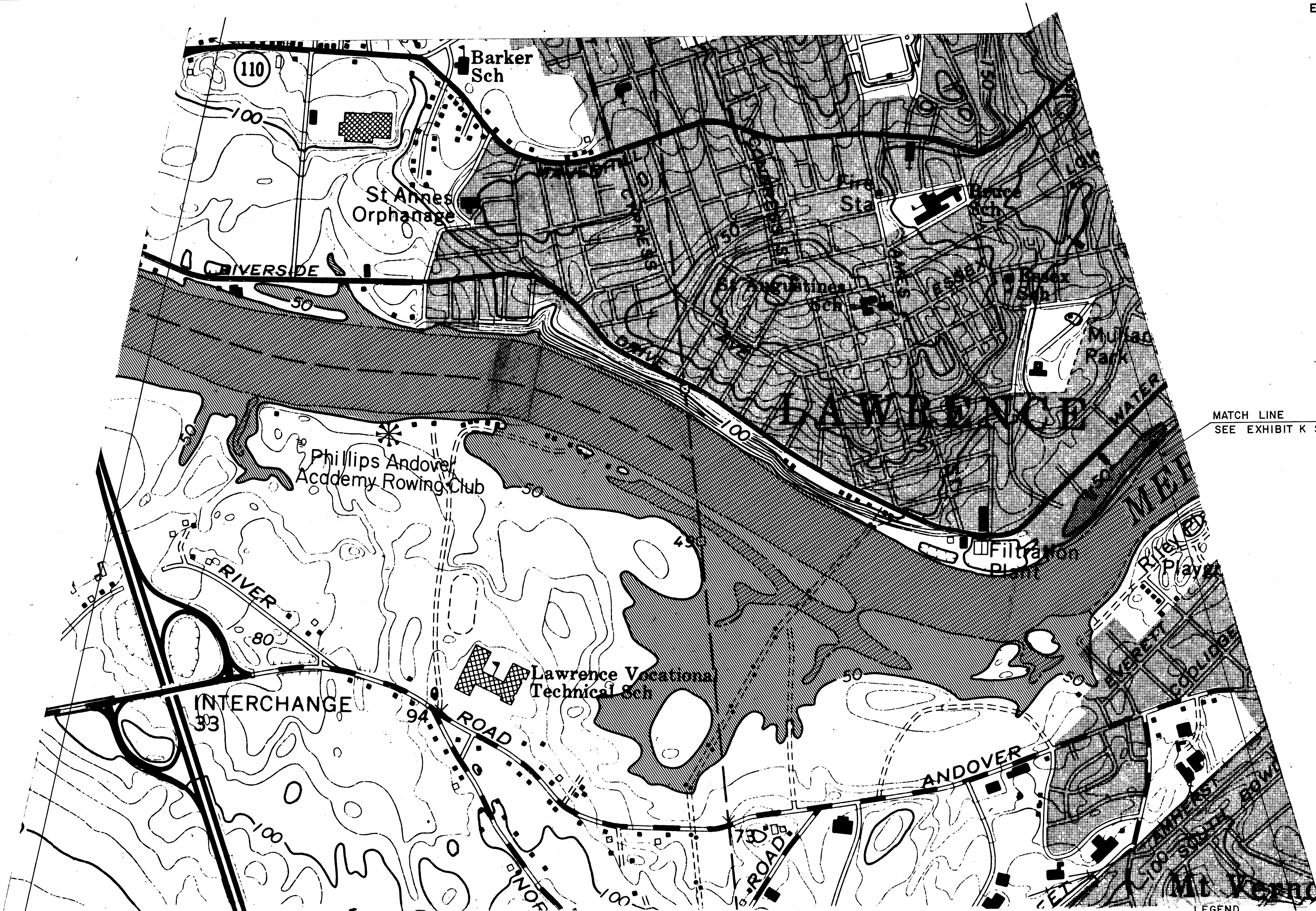
400 0 400 800 1200 1600 2000
1" = 400'

EXHIBIT K SHEET 4

DETAIL MAP OF PROJECT AREA

LAWRENCE HYDROELECTRIC PROJECT
LAWRENCE HYDROELECTRIC ASSOCIATES
CHAS. T. MAIN, INC.

EXHIBIT K SHEET 5



MATCH LINE
SEE EXHIBIT K SHEET 6

MATCH LINE
SEE EXHIBIT K SHEET 4

NOTE
FOR TOPOGRAPHY INFORMATION SEE EXHIBIT K SHEET 2

LEGEND
* FOR EXISTING RECREATION AREAS SEE EXHIBIT R SHEET 1

ISSUED
DEC 5 1977

THIS DRAWING IS A PART OF THE APPLICATION FOR A LICENCE MADE BY THE UNDERSIGNED THIS 28th DAY OF June, 1977

LAWRENCE HYDROELECTRIC ASSOCIATES
BY: Geoffrey K Mitchell

MAGNETIC NORTH (1966) 15° TRUE NORTH

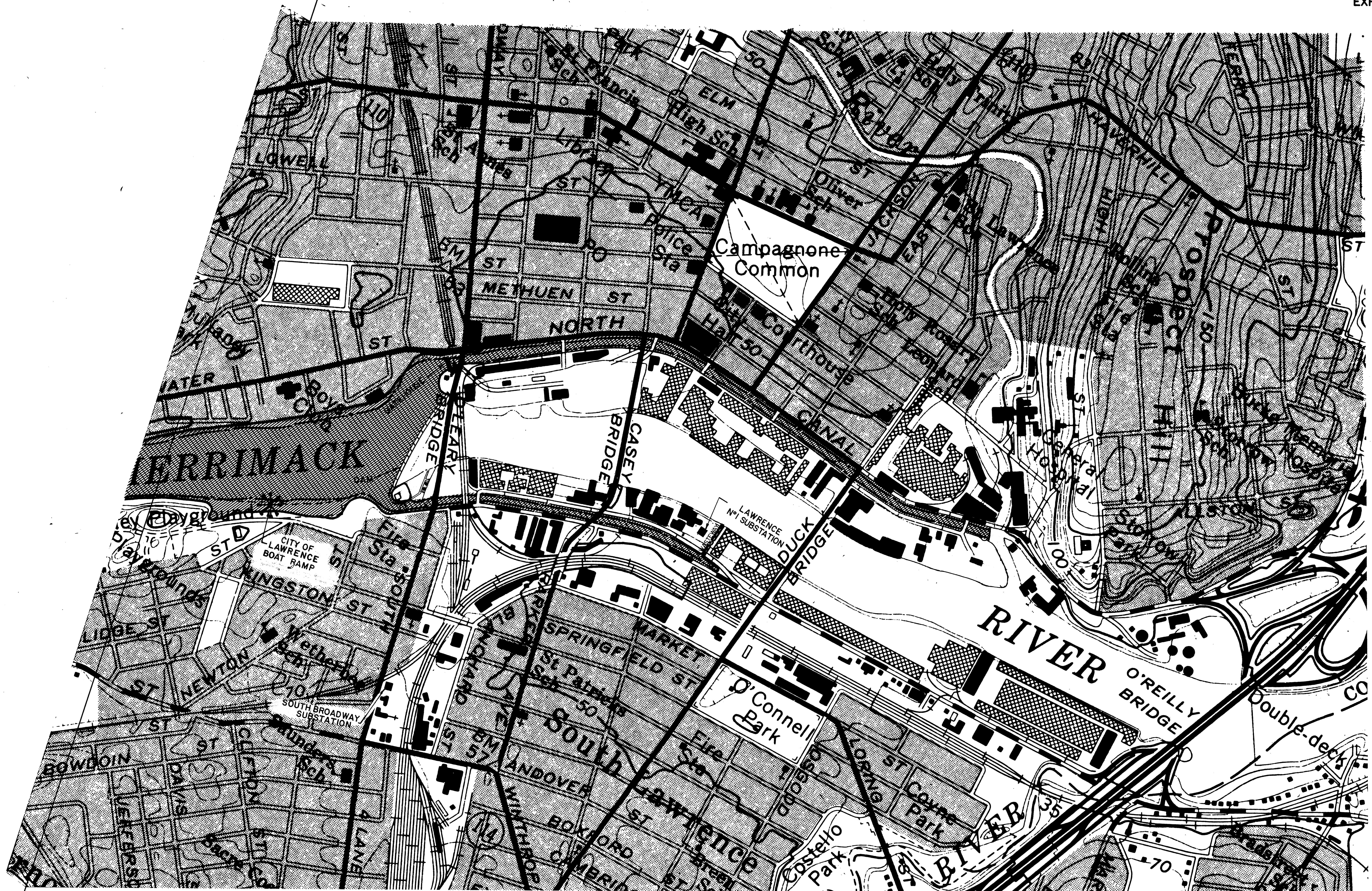
400 0 400 800 1200 1600 2000
1" = 400'

EXHIBIT K SHEET 5

DETAIL MAP OF PROJECT AREA

LAWRENCE HYDROELECTRIC PROJECT
LAWRENCE HYDROELECTRIC ASSOCIATES
CHAS. T. MAIN, INC.

EXHIBIT K SHEET 6



MATCH LINE
SEE EXHIBIT K SHEET 5

NOTES

1. FOR TOPOGRAPHY INFORMATION SEE EXHIBIT K SHEET 2.
2. FOR PROJECT BOUNDARIES SEE EXHIBIT K SHEET I.

LEGEND

FOR EXISTING RECREATION AREAS SEE EXHIBIT R SHEET I

ISSUED

THIS DRAWING IS A PART OF THE APPLICATION FOR A LICENSE MADE BY THE UNDERSIGNED THIS 28th DAY OF June 1977

LAWRENCE HYDROELECTRIC ASSOCIATES

BY: Geoffrey K. Mitchell

MAGNETIC NORTH (1966)
TRUE NORTH

400 0 400 800 1200 1600 2000

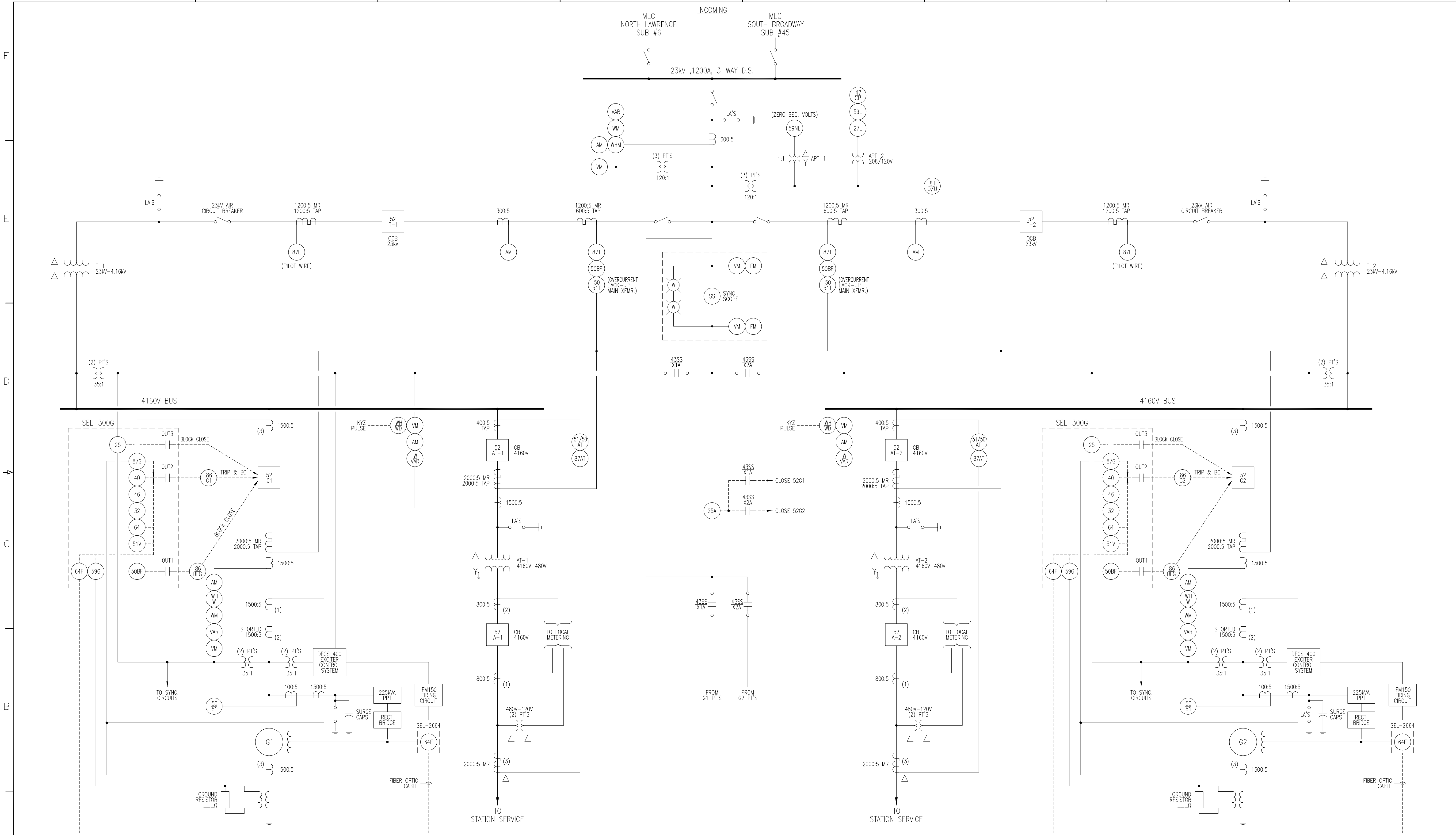
1" = 400'

EXHIBIT K SHEET 6

DETAIL MAP OF PROJECT AREA

LAWRENCE HYDROELECTRIC PROJECT
LAWRENCE HYDROELECTRIC ASSOCIATES
CHAS. T. MAIN, INC.

Appendix D – Single-Line Diagram



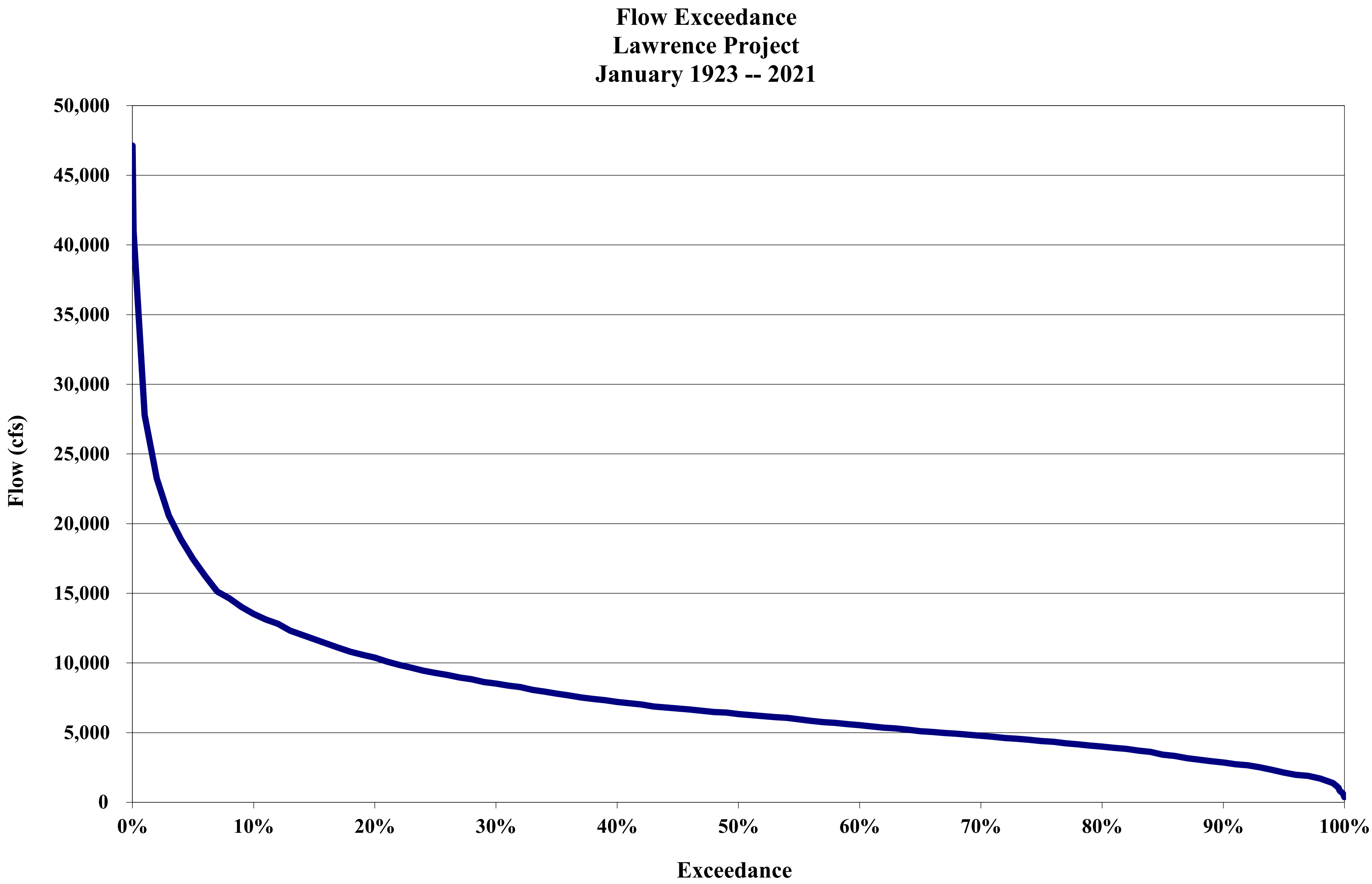
REVISION		
1	1/22/10	AS RECORDED

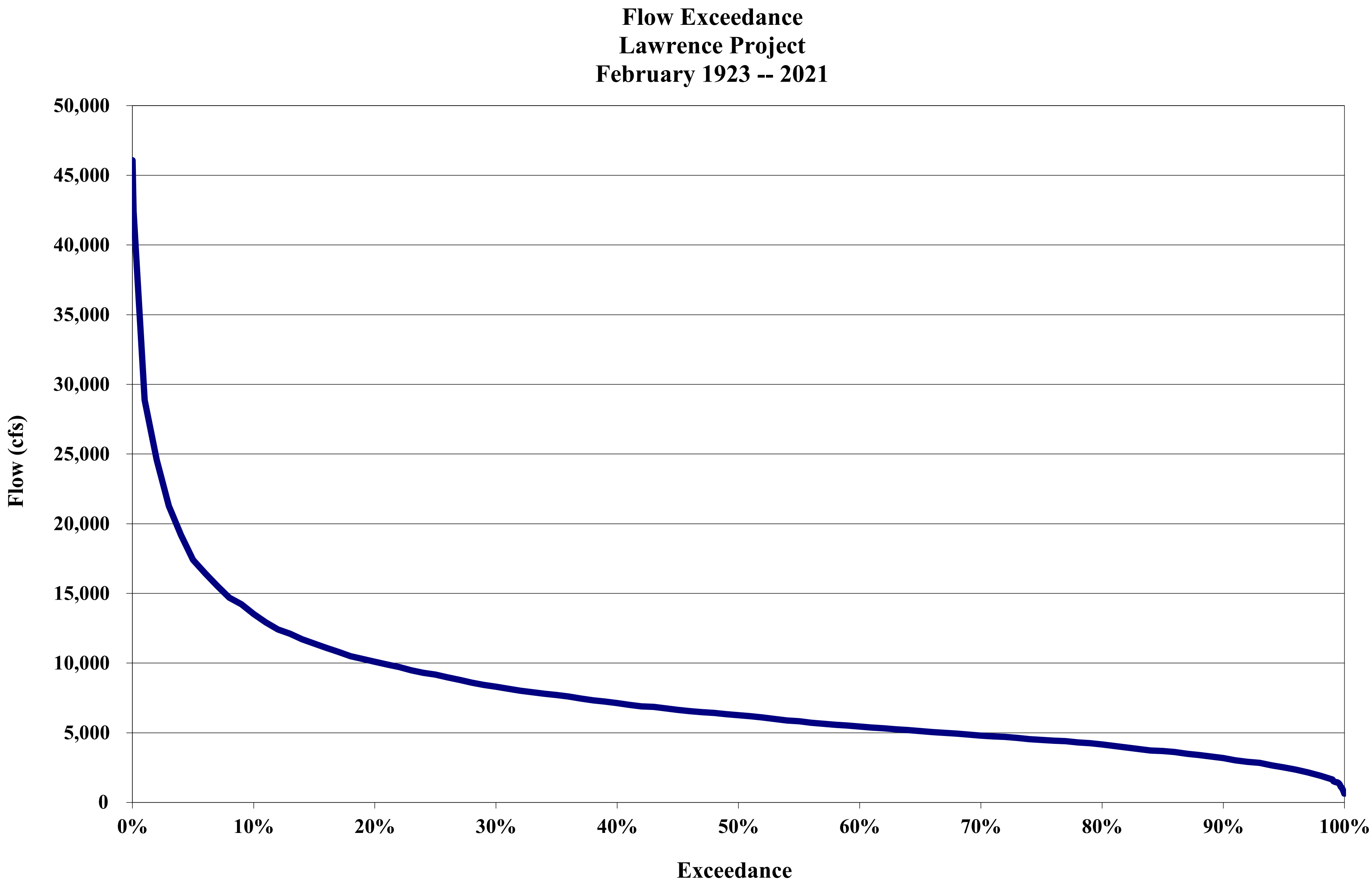
THE INFORMATION ON THIS DOCUMENT WAS CREATED BY EATON ELECTRICAL. IT WAS DISCLOSED IN CONFIDENCE AND IS ONLY TO BE USED FOR THE PURPOSE IN WHICH IT WAS SUPPLIED.

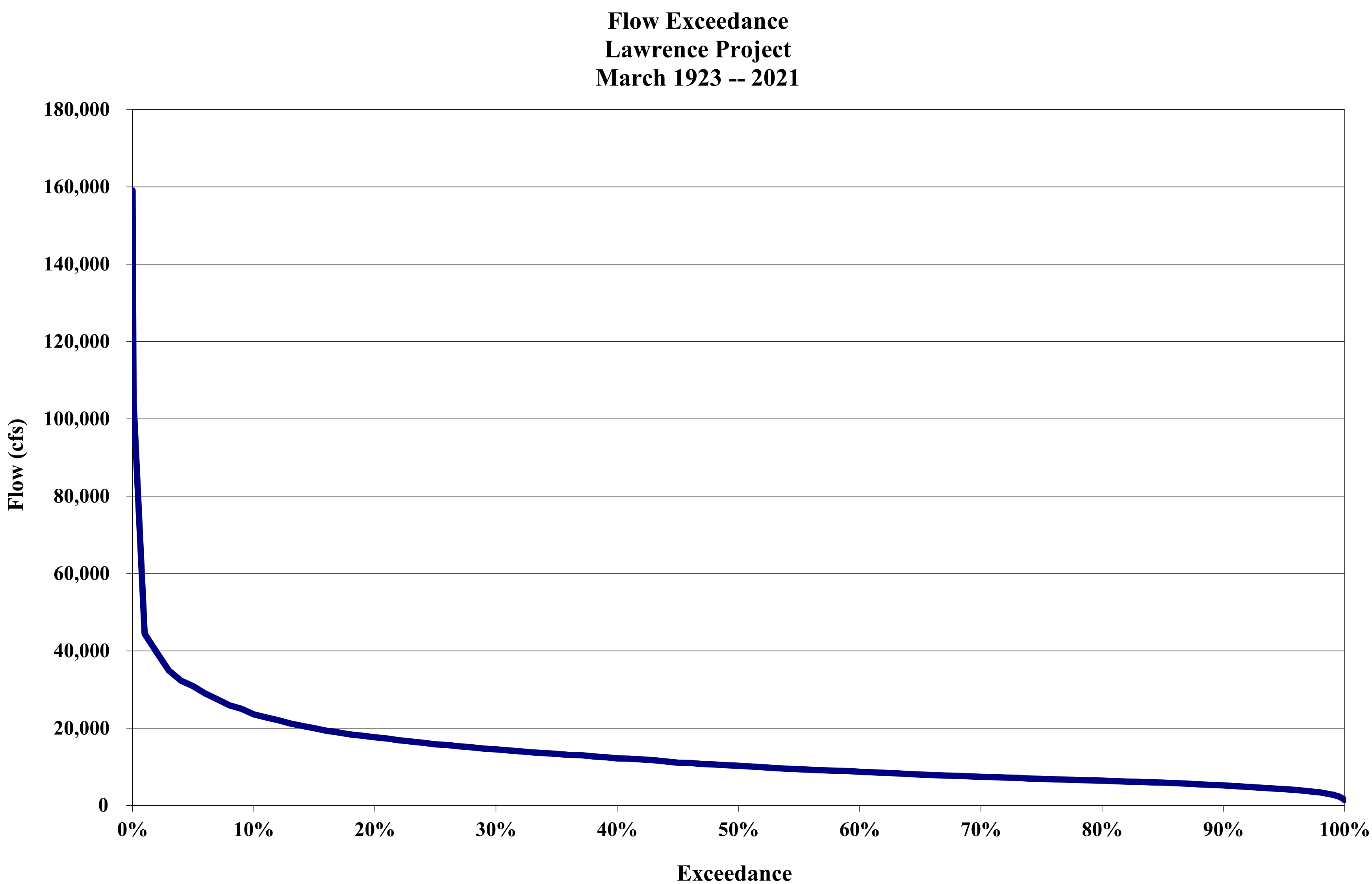
EATON | Electrical Services & Systems

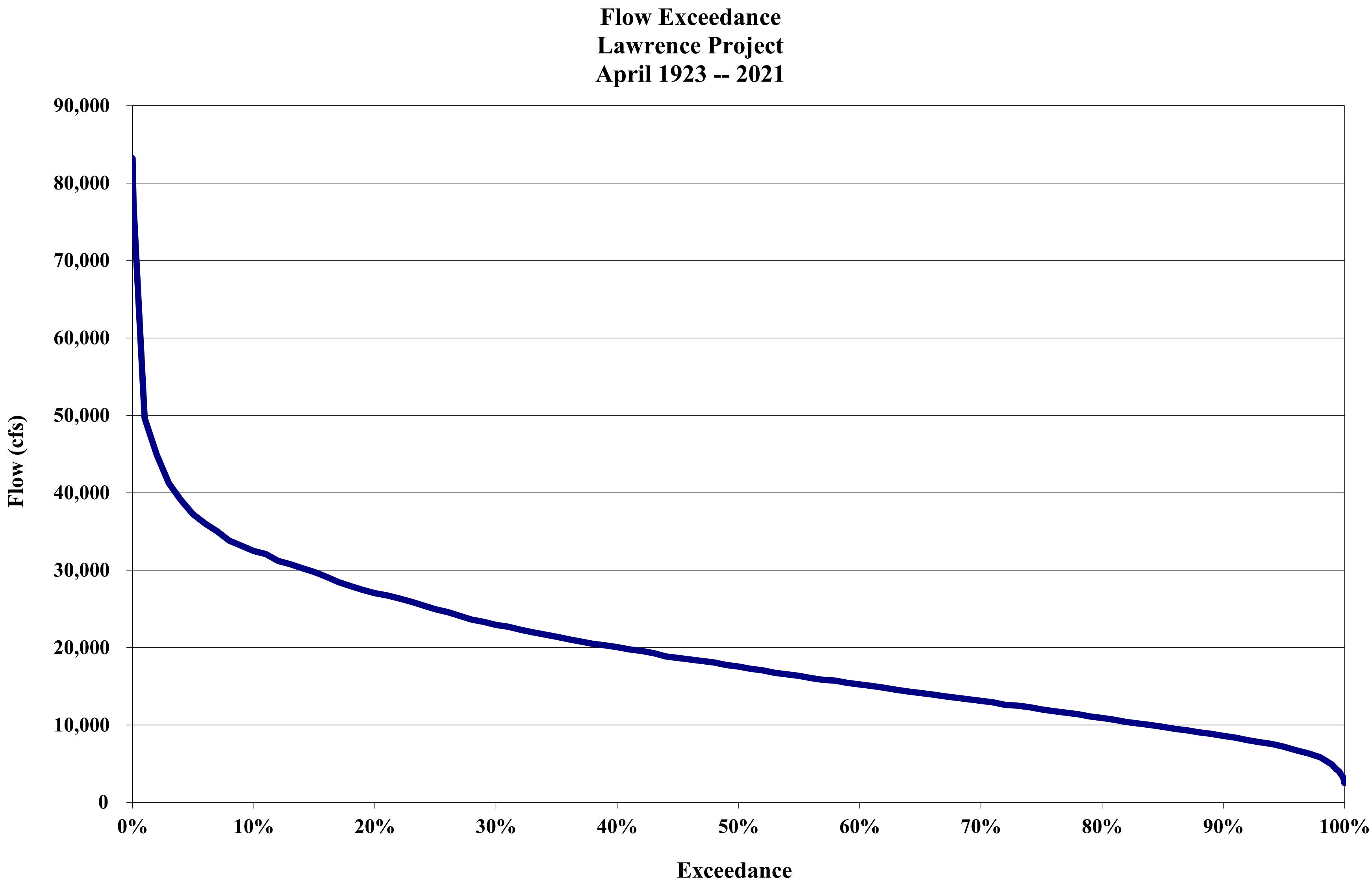
DFTR SXL	DATE 08/27/09	TITLE ENEL – LAWRENCE HYDRO STATION ONE-LINE DIAGRAM
ENGR IP	DATE 08/27/09	
SCALE NONE		TYPE X — ONE-LINE
CAD FILENAME EMP00130-3-01	PRODUCT CODE X	REVISION 1
G.O. EMP00130	DWG EMP00130-3-01	SHEET 1 OF 1

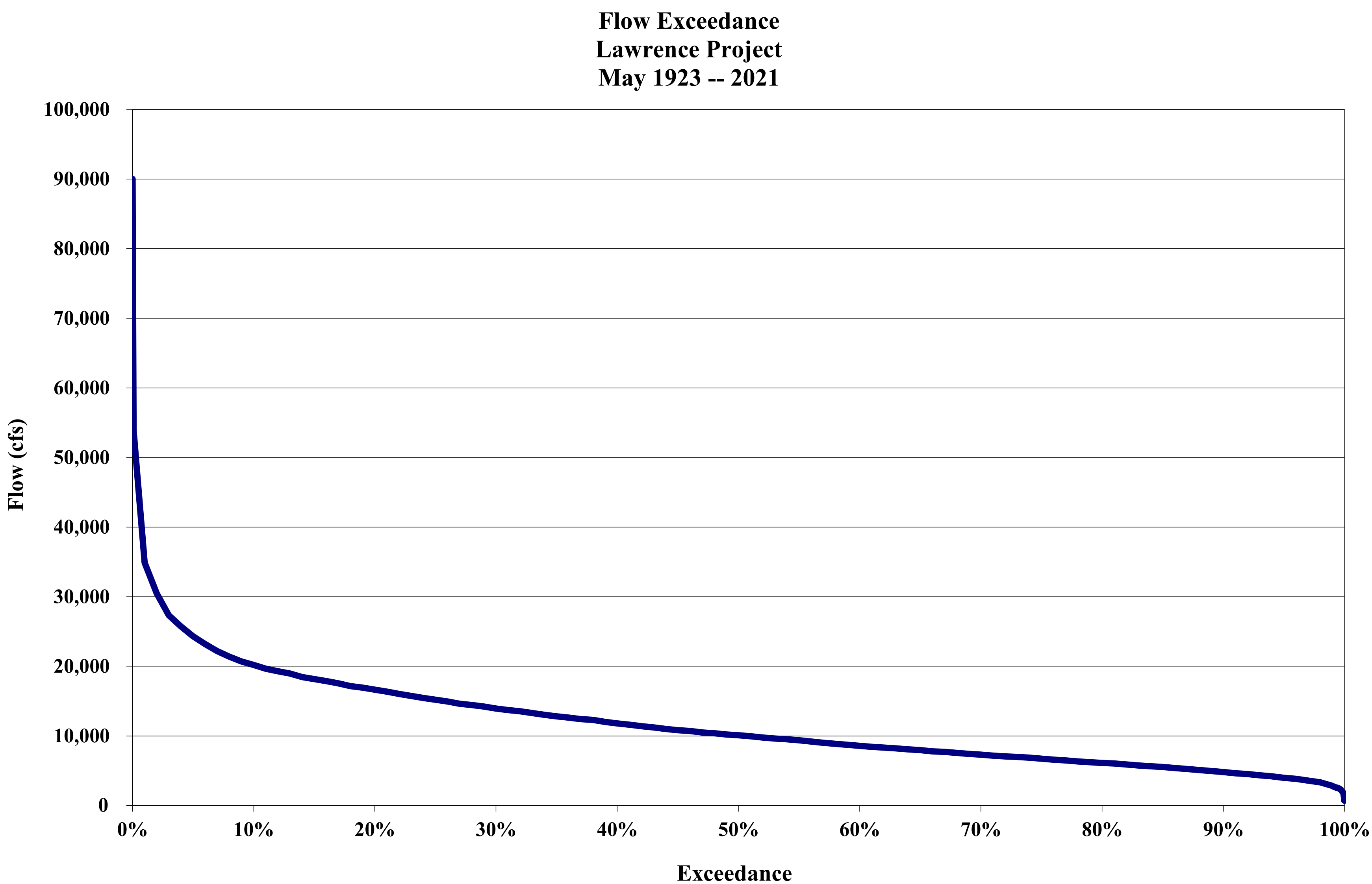
Appendix E – Flow Duration Curves


Flow Exceedance
Lawrence Project
January 1923 -- 2021
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

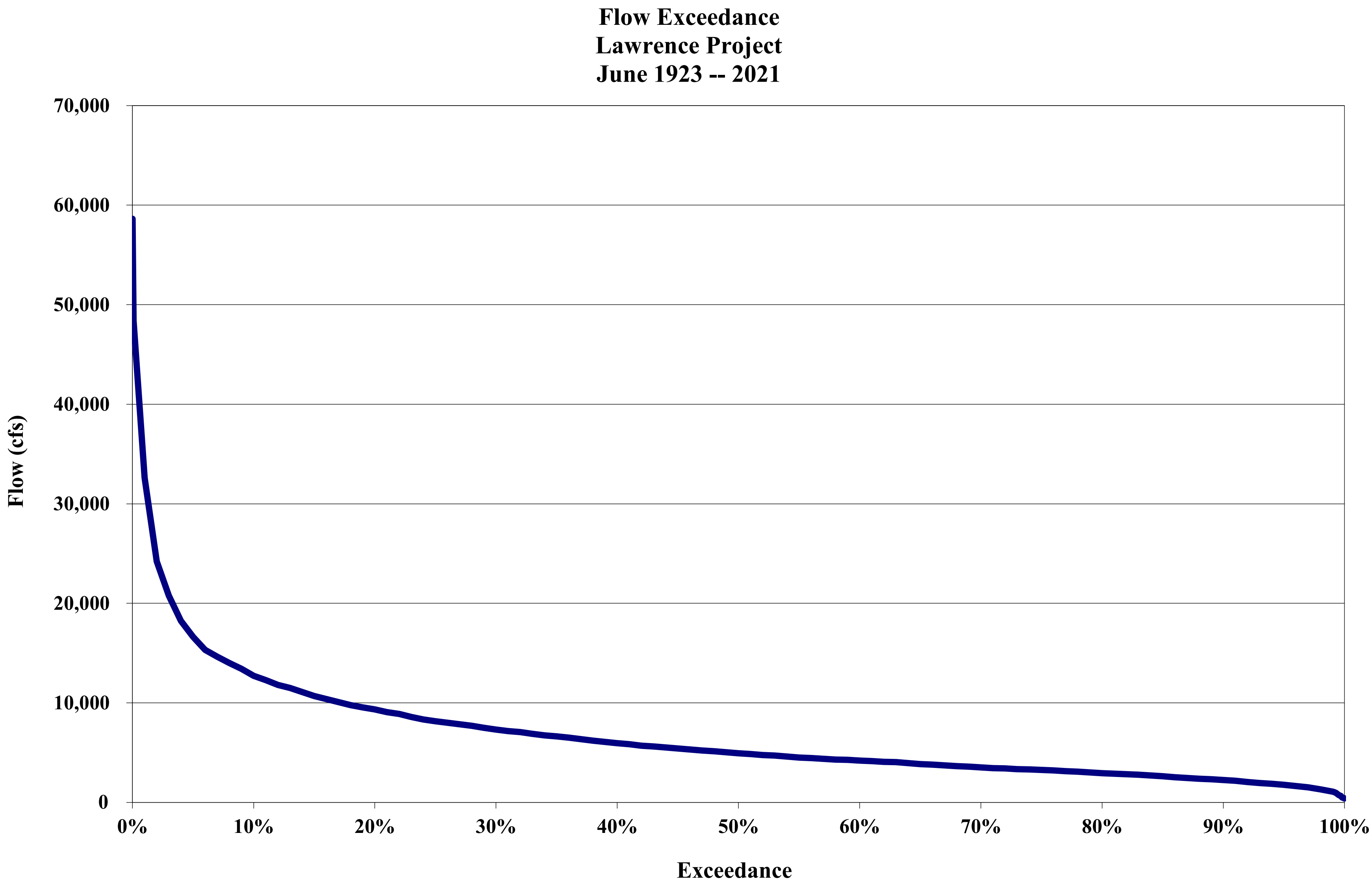

Flow Exceedance
Lawrence Project
February 1923 -- 2021
Flow (cfs)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

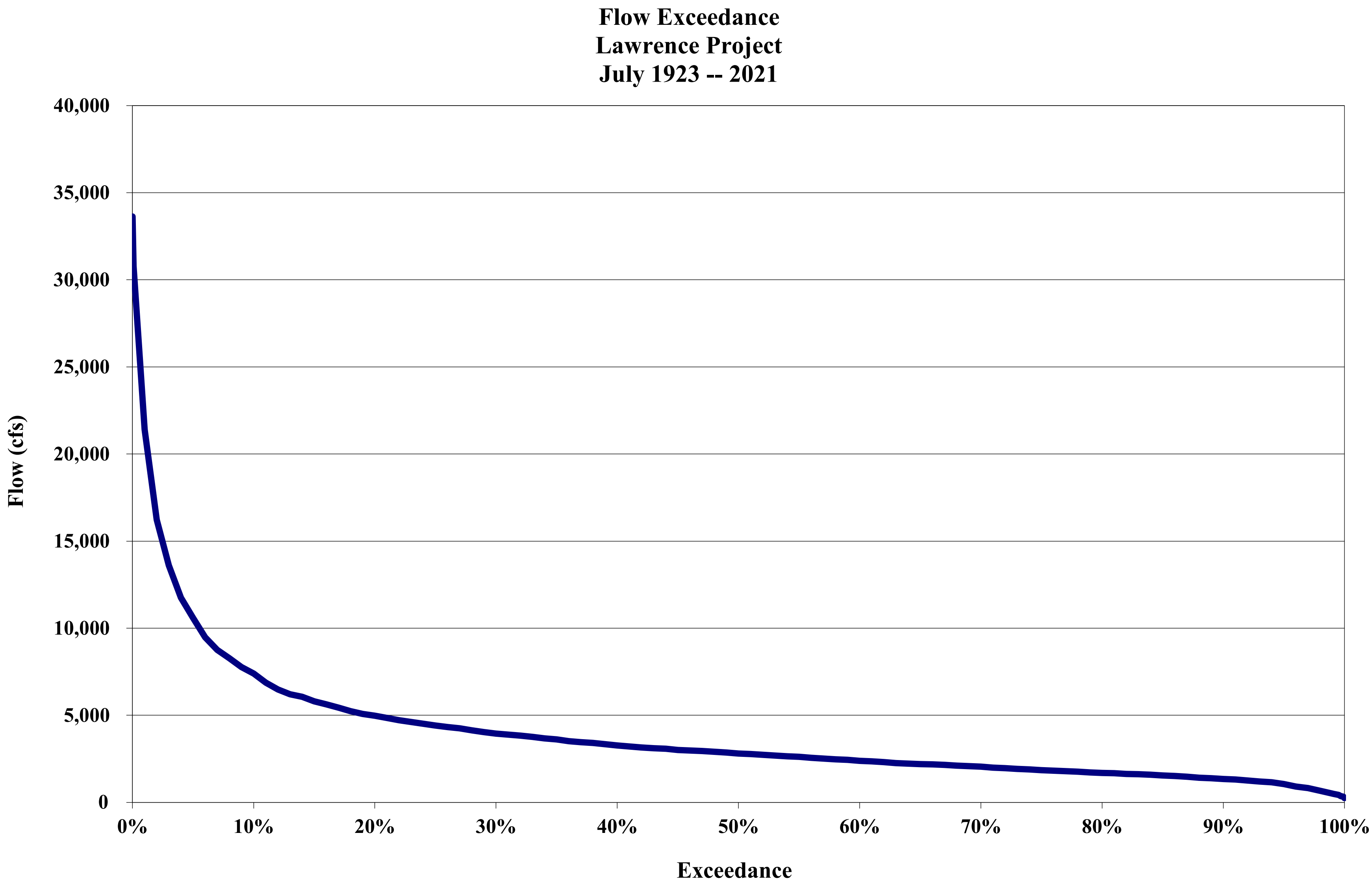

Flow Exceedance
Lawrence Project
March 1923 -- 2021
Flow (cfs)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

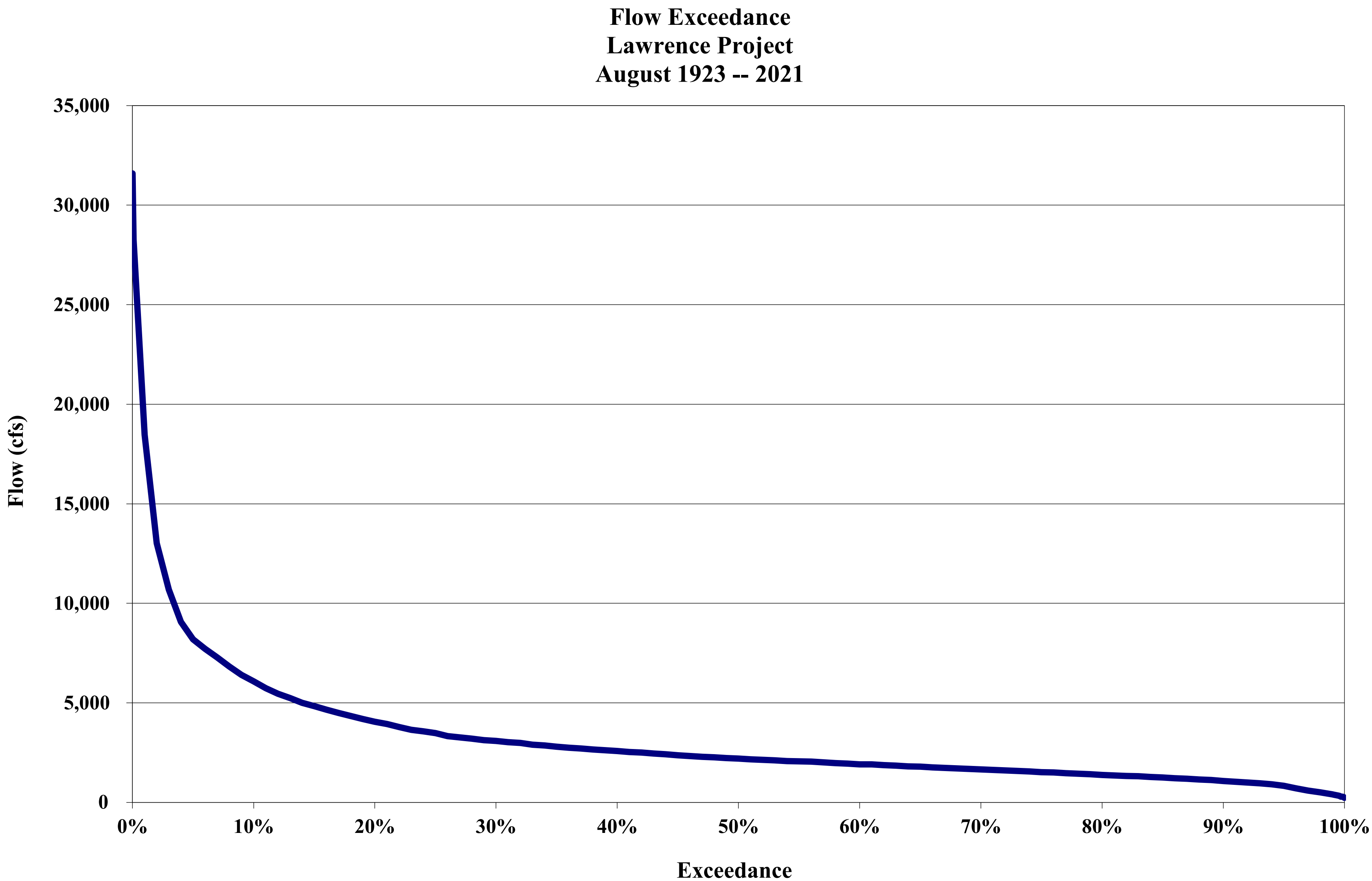

Flow Exceedance
Lawrence Project
April 1923 -- 2021
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

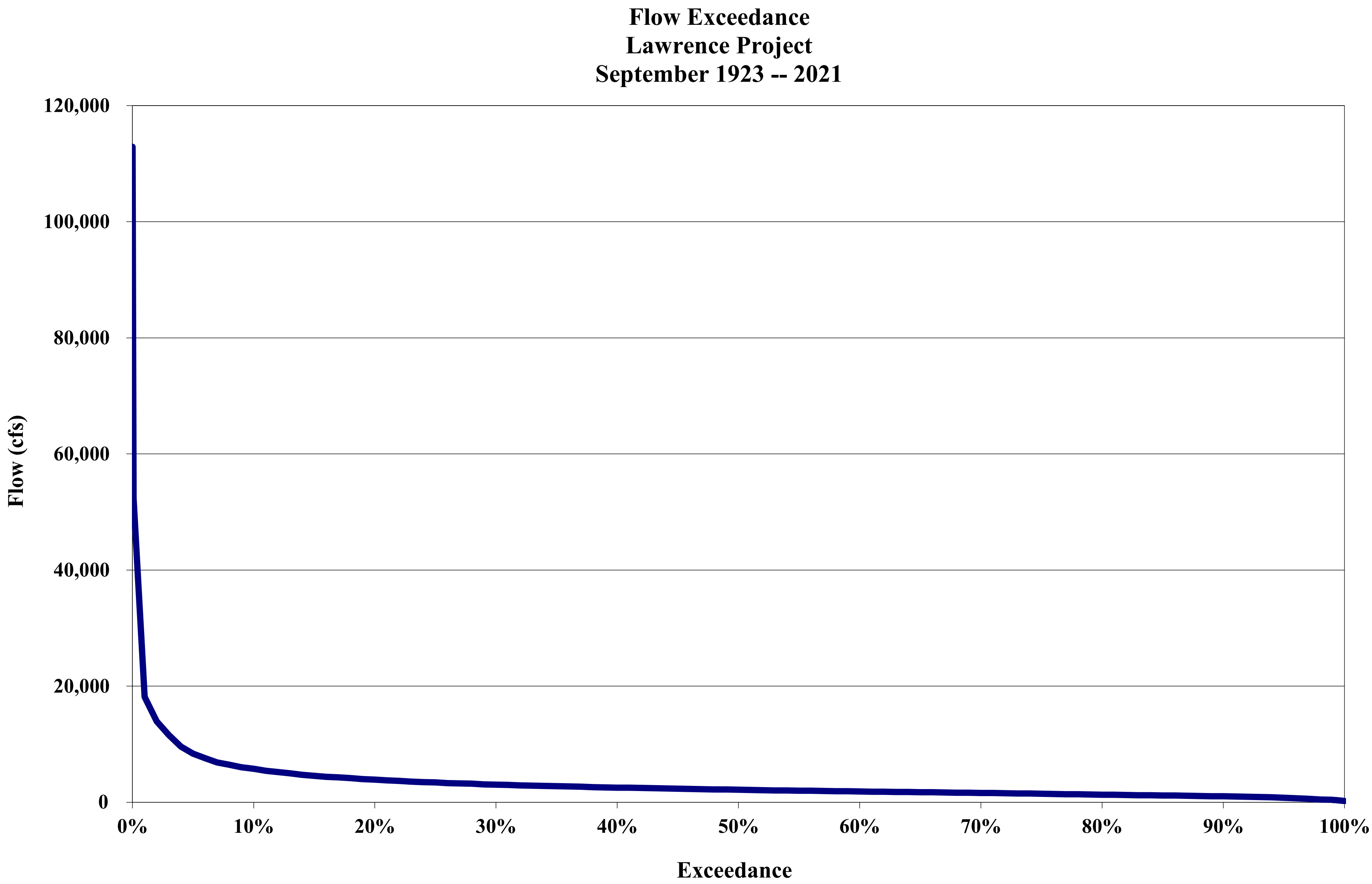


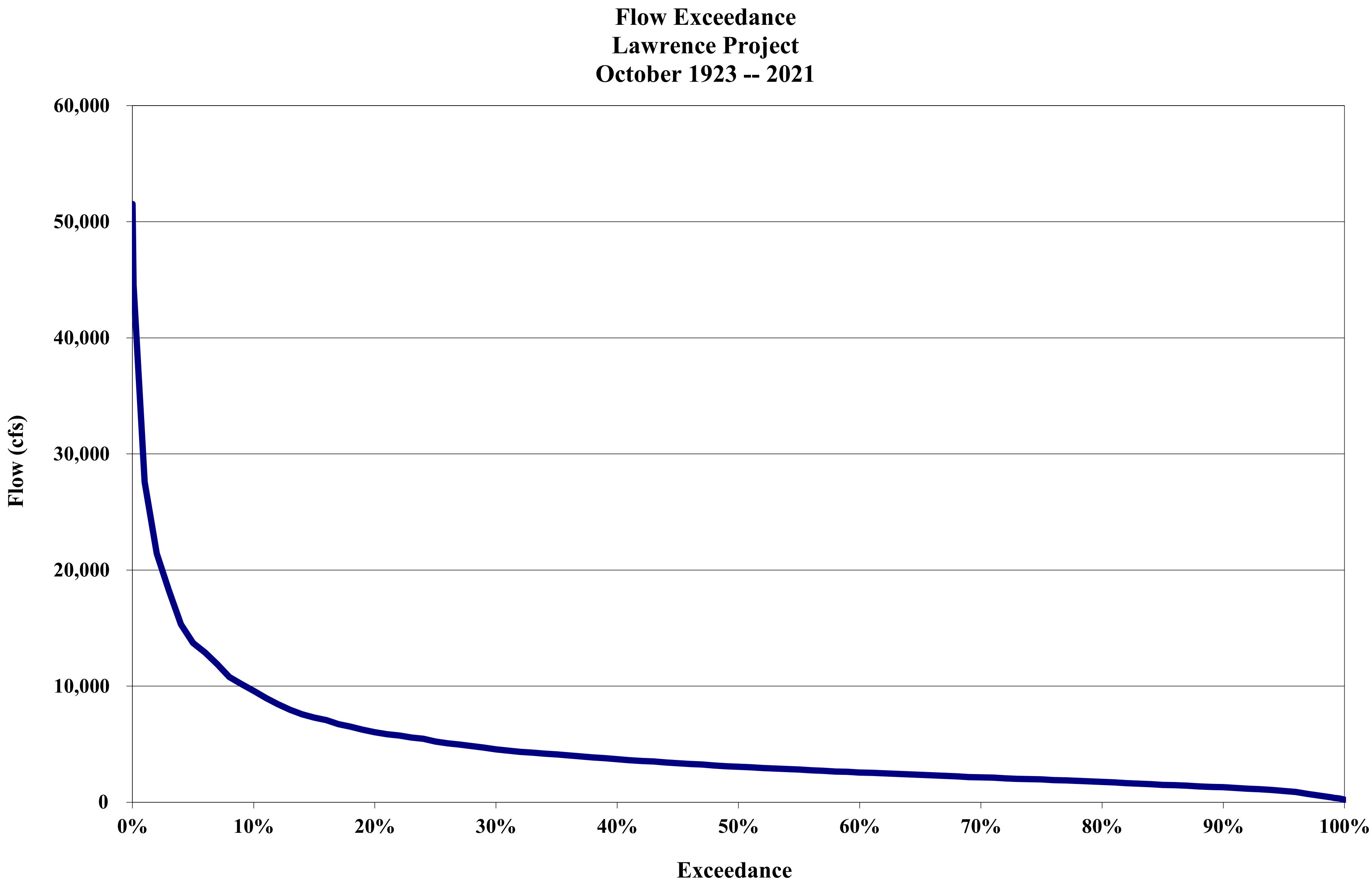
Flow Exceedance
Lawrence Project
May 1923 -- 2021
Flow (cfs)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

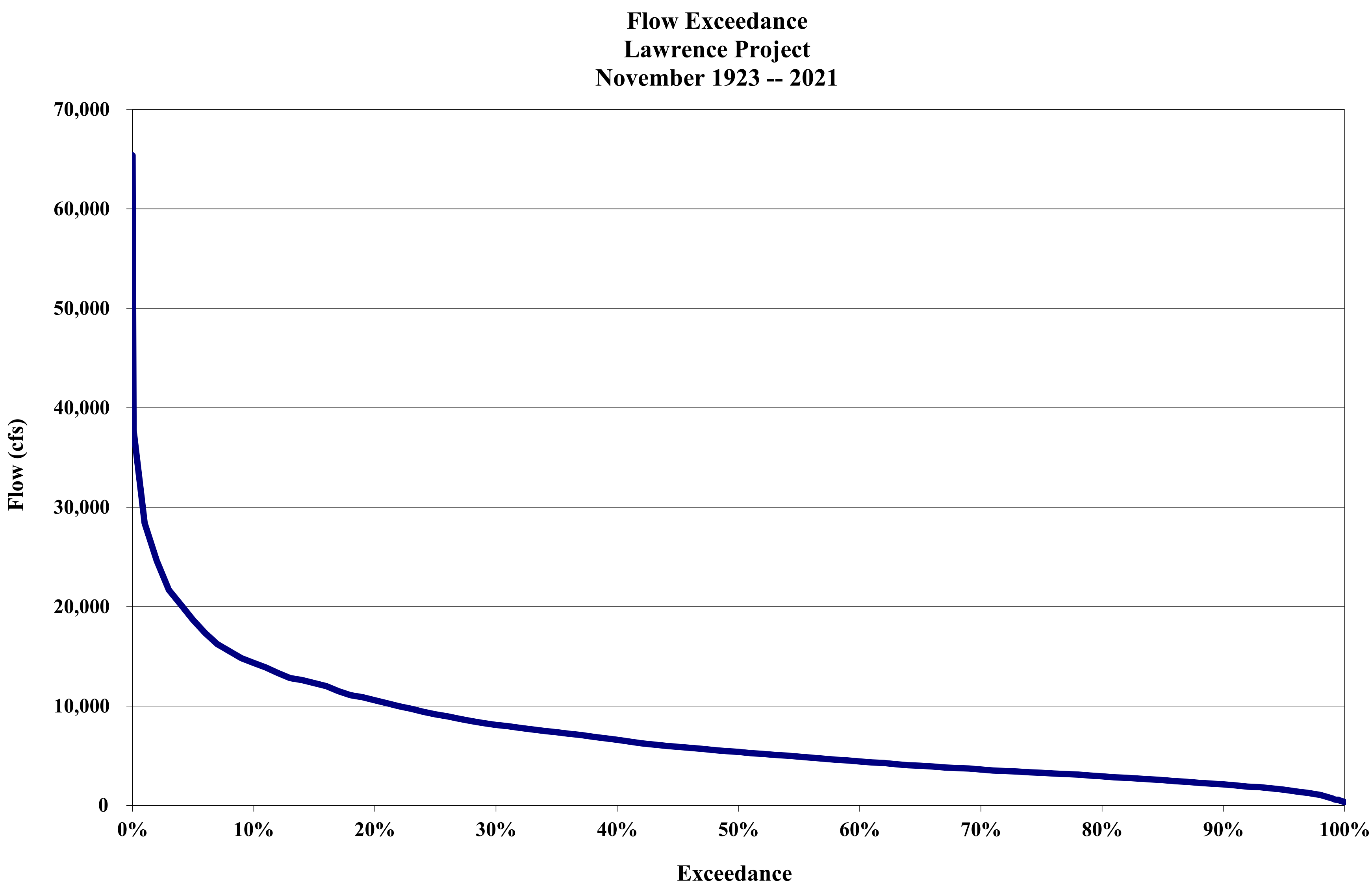

Flow Exceedance
Lawrence Project
June 1923 -- 2021
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

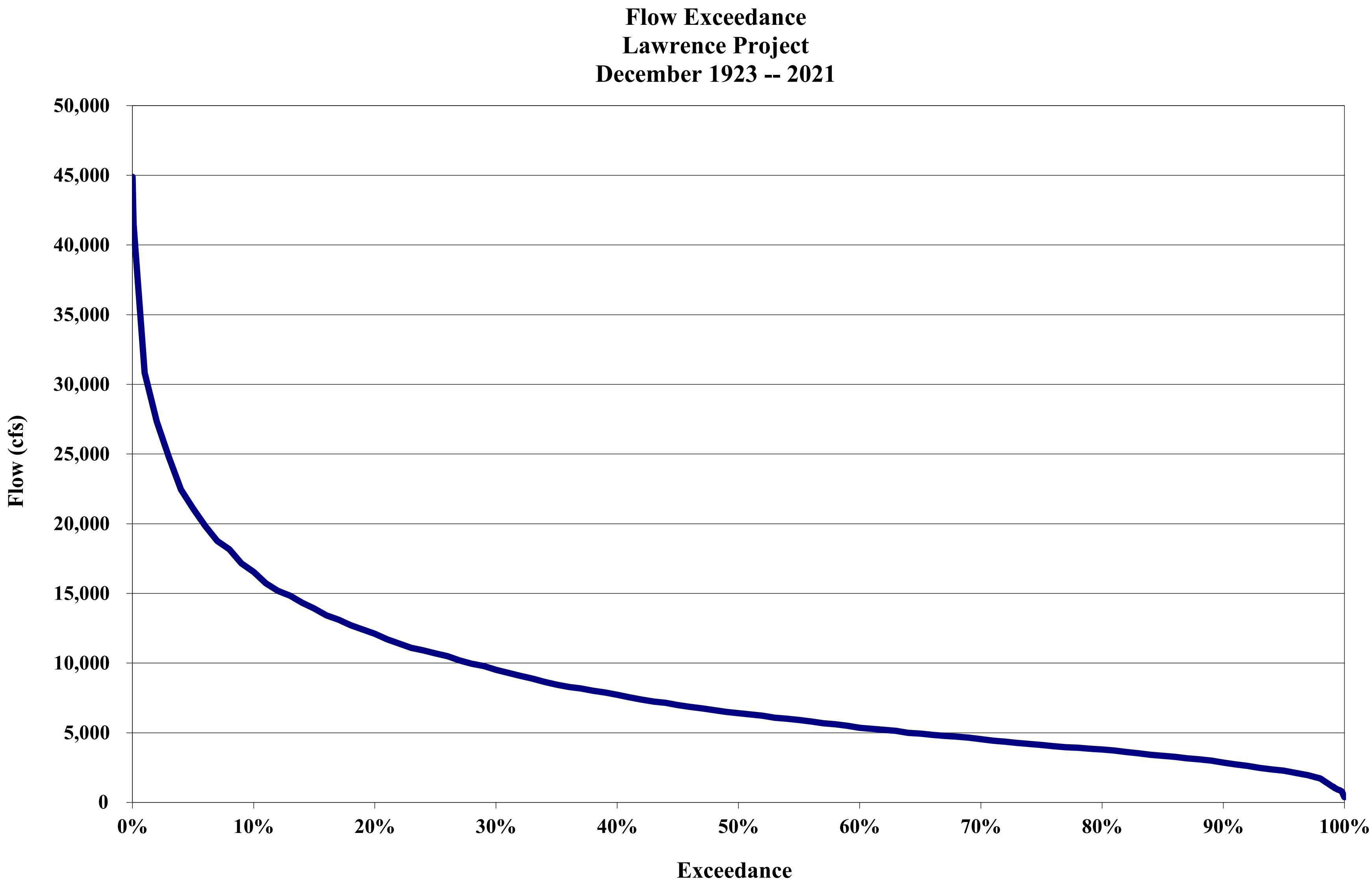

Flow Exceedance
Lawrence Project
July 1923 -- 2021
Flow (cfs)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

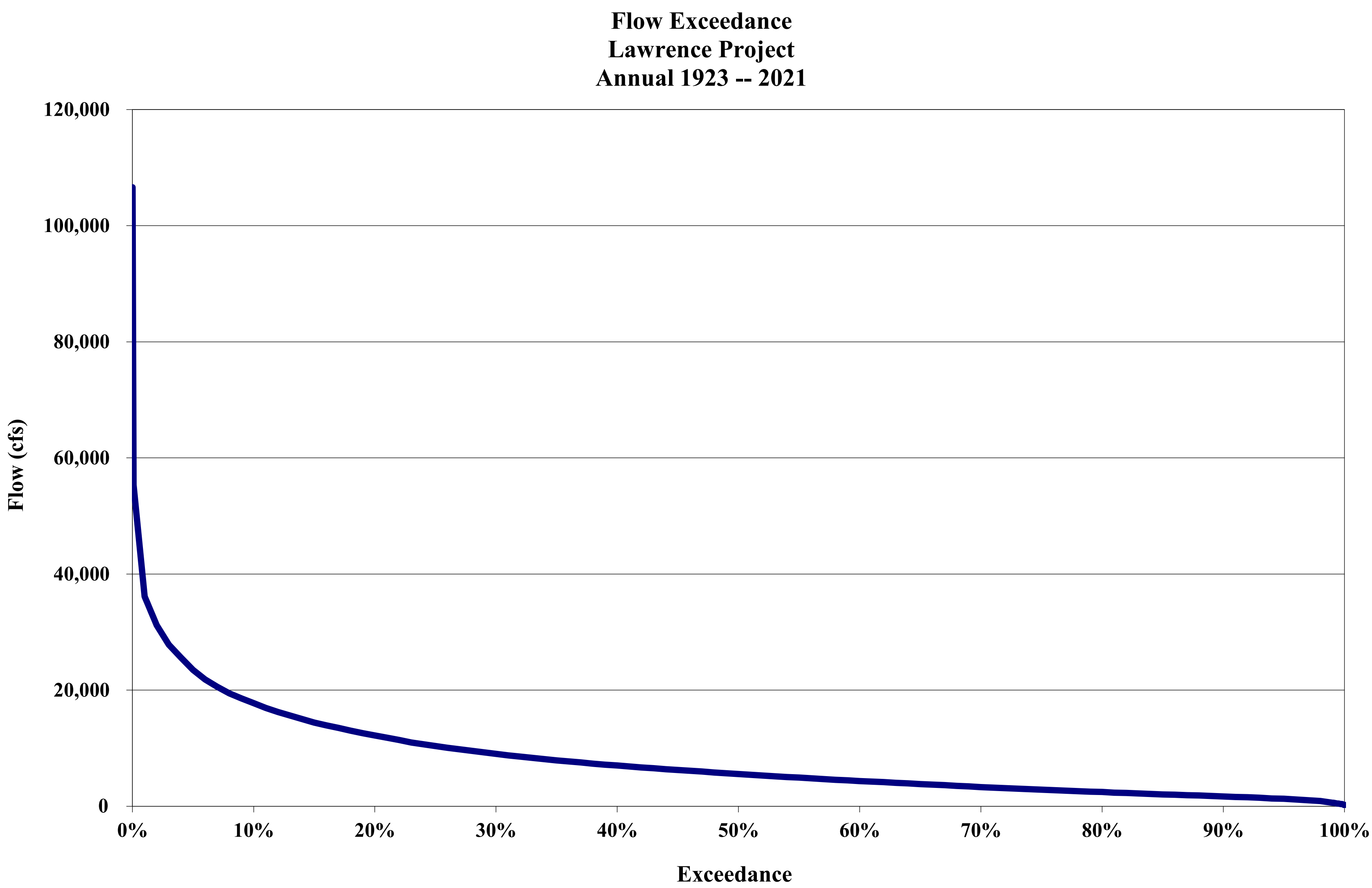

Flow Exceedance
Lawrence Project
August 1923 -- 2021
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance


Flow Exceedance
Lawrence Project
September 1923 -- 2021
Flow (cfs)
120,000
100,000
80,000
60,000
40,000
20,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance


Flow Exceedance
Lawrence Project
October 1923 -- 2021
Flow (cfs)
60,000
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance


Flow Exceedance
Lawrence Project
November 1923 -- 2021
Flow (cfs)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance


Flow Exceedance
Lawrence Project
December 1923 -- 2021
Flow (cfs)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance



Flow Exceedance
Lawrence Project
Annual 1923 -- 2021
120,000
100,000
80,000
60,000
40,000
20,000
0
Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance

Appendix F – Copies of Project FERC License, Amendments, and 401 WQC

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Charles B. Curtis, Chairman;
Georgiana Sheldon, and George

Lawrence Hydroelectric Associates) Project No. 2800
and Essex Company) Docket No. ES78-44

ORDER ISSUING MAJOR LICENSE
AND AUTHORIZING NEGOTIATIONS FOR SALE OF SECURITIES

(Issued December 4, 1978)

On June 30, 1977, Lawrence Hydroelectric Associates ("Applicant" or "LHA") filed an application 1/ for a major license for the proposed Lawrence Hydroelectric Project, FERC No. 2800. The project would be located in Lawrence, Massachusetts, on the Merrimack River, a navigable waterway of the United States. 2/

Public Notice

Public notice of the application for Project No. 2800 was given. Eight organizations and governmental bodies filed petitions to intervene. Seven were granted intervention and the eighth petitioner was granted permission to withdraw its request for intervention. The issues and concerns raised by the various intervenors are addressed below.

The Secretary of the Commission requested comments on the application from appropriate federal and state agencies pursuant to Section 4(e) of the Federal Power Act. 3/ Applicant responded to these comments by letters dated June 21 and July 11, 1978. The significant issues raised in the various agency letters and Applicant's responses are also presented below.

1/ This proceeding was commenced before the Federal Power Commission (FPC). By regulation of October 1, 1977 (10 CFR 1000.0), it was transferred to the Federal Energy Regulatory Commission (FERC). In this order, the term "Commission" refers to the FPC for actions or statements that occured before October 1, 1977; otherwise it refers to the FERC.

2/ Order Issuing License for Project No. 1893 (issued May 5, 1949) found the Merrimack River to be navigable.

3/ 16 U.S.C. 797(e).

Status of Applicant

Applicant, Lawrence Hydroelectric Associates, is a limited partnership organized pursuant to the laws of Massachusetts. LHA consists of a number of individual partners with limited liability and a general partner, the Essex Development Associates (EDA), also a Massachusetts partnership. As proposed in its application, Lawrence Hydroelectric Associates will be responsible for the construction of the project as well as the subsequent generation and sale of electric power.

The Essex Company (Essex), a Massachusetts' corporation, owns the water rights, flowage rights, and easements which are integral to the proposed project. Under the terms of an existing stock option agreement, EDA will acquire control of the Essex Company and make available to LHA all necessary properties and rights.

Given the relationships which exist among LHA, EDA, and Essex, any license for Project No. 2800 should be issued jointly to Lawrence Hydroelectric Associates and the Essex Company. LHA has indicated that it would take the steps necessary to make the Essex Company accept a joint license, if the Commission desires. Accordingly, we issue a joint license to LHA and Essex, effective for a period of 50 years, beginning December 1, 1978, and terminating November 30, 2028.

Project Description

The Lawrence Hydroelectric Project will provide 14.8 megawatts of capacity and an average annual generation of 91,100 megawatt hours. 4/ The project will consist of an existing dam, reservoir, and canal works plus a new powerhouse. The existing dam (known as the Great Stone Dam), the North Canal, and gatehouse were built between 1845 and 1848. In 1866 the South Canal and its gates were constructed and in 1896 the South Canal was expanded.

Safety

The Great Stone Dam has been analyzed for stability and found to be safe for loading conditions under maximum

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4/ This hydroelectric energy production will be based primarily on a run-of-the-river operation and will save the equivalent of approximately 149,600 barrels of oil or 42,000 tons of coal per year.

flood flows, normal reservoir elevation with ice, and normal reservoir elevation with earthquake. Our staff has also inspected the existing portions of the project and found them to be in satisfactory condition. Applicant filed on March 2, 1978, an engineering consultant's field inspection and office report which found the dam to be sound and capable of continued use. The consultant suggested that additional subsurface explorations be made during excavation for the new powerhouse to ensure that the dam is founded on competent rock and to verify that there has been no undercutting at the contact of the dam with the foundation bedrock. Special Article 37 has been inserted in the license to require Licensees to make additional investigations by subsurface explorations during excavations for the powerhouse. If there is a need for remedial work, Article 37 also requires Licensees to submit a plan and schedule for such work to the Director of the Office of Electric Power Regulation.

Transmission Facilities

The electrical equipment associated with the turbine-generator units will be located in the powerhouse structure. No substations or switchyards will be constructed. Energy produced by the Lawrence Hydroelectric Project will travel approximately 2,500 feet via a 13.8 kV overhead power line to the existing Lawrence substation No. 1 of the Massachusetts Electric Company. The energy will then flow into the interconnected system of the New England Power Company. Thus, the transmission facilities to be included as part of Project No. 2800 consist of one 13.8 kV line approximately 2,500 feet long and appurtenant facilities to connect to the existing substation.

Fish and Wildlife

The National Marine Fisheries Service (NMFS) of the Department of Commerce, the Fish and Wildlife Service (FWS) of the Department of the Interior, the Office of the Secretary of the Department of the Interior (Interior), and the Division of Fisheries and Game of the Commonwealth of Massachusetts commented on the possible effects of the proposed project on fish and wildlife resources.

Interior noted that "[t]errestrial wildlife resources will not be affected by project construction or operation due to the fact that the project is located in an urban industrial area."

With regard to fisheries, Interior noted that Applicant had consulted with the Policy and Technical Committees for Anadromous Fishery Management of the Merrimack River. As a result, Applicant's proposal for fish passage and related facilities incorporated the comments and plans of the Massachusetts Division of Marine Fisheries, Massachusetts Division of Fisheries and Game, the New Hampshire Fish and Game Department, NMFS, and FWS.

NMFS expressed concern with respect to the protection and safety of adult shortnose sturgeon during downstream migration. Applicant met with officials from NMFS and provided that agency with sufficient information to demonstrate that adequate safeguards are incorporated in the project design. NMFS subsequently reported that, based on the additional information, it now concludes that the project will not have an adverse effect on any population of shortnosed sturgeon in the Merrimack River.

The FWS and the Massachusetts Division of Fisheries and Game both stated that no significant adverse impacts on fish species are expected from the construction or operation of Project No. 2800.

On January 27, 1978, Applicant filed an Exhibit S which incorporated the comments of the aforementioned agencies and which generally conforms to this Commission's Rules and Regulations. The Exhibit S, however, contains conceptual plans, and not functional design drawings for fish passage facilities. Therefore, the Exhibit S is approved only to the extent that it proposes measures to conserve and enhance fishery resources affected by the project and conceptual plans for fishways. Special Article 30 has been included in the license to require Licensees to file functional design drawings for fish passage facilities to be constructed at the project and to file "as-built" drawings following construction of the facilities.

Articles 15 and 16, 31 and 33 of the license for the Lawrence Hydroelectric Project also relate to fish and fish passage facilities. Articles 15 and 16 provide for the installation of additional fish passage facilities should they become necessary. Special Article 31 requires Licensees to conduct operational studies and to file a final report to the Commission on the effectiveness of the proposed fish ladder. Special Article 33 provides for monitoring of the fish passage facilities for determining the presence of threatened or endangered species, and implementing any measures necessary to protect and conserve such species.

Navigation

The U.S. Army Corps of Engineers (Corps) reported that the proposed Lawrence Hydroelectric Project will not be in conflict with any existing or anticipated Corps projects; that it will have no effect on the navigability of the Merrimack River; and that the plans of the structures for Project No. 2800 are approved in accordance with the provisions of Section 4(e) of the Federal Power Act. 5/

Water Quality and Minimum Flow

Interior reported that "[t]here is a need for determining instantaneous minimum flow requirements at this and other upstream dams." Interior added that until the upstream minimum flows are determined, a minimum release of 400 cfs should be required from the Lawrence Project. Once minimum releases are set for upstream dams, Interior recommended increasing Project No. 2800's minimum flow from 400 cfs to 890 cfs.

The Massachusetts Division of Water Pollution Control (MDWPC) commented on the effect of the proposed project on the water quality of the Merrimack River. MDWPC stated in its letter of July 5, 1978, that "the Division was concerned lest the regimen of the river would be so changed through the operation of the proposed facility that the Class B standard would be violated." MDWPC determined that a minimum of 951 cfs should be released from the Great Stone Dam to maintain the "B" classification for the Merrimack River. MDWPC then issued, in accordance with the Federal Water Pollution Control Act, 6/ a Water Quality Certificate. The certificate subjects the project to a minimum release of 951 cfs unless and until the reservoir water surface elevation is drawn below the crest of the dam; thereupon the required minimum release would be equal to inflow.

5/ We are not including a special article requiring the licensee to comply with the Federal Water Pollution Control Act Amendments of 1972, §404, because it would be superfluous.

6/ See Section 401 of the Federal Water Pollution Control Act Amendments of 1972.

Applicant noted in response that the ability to maintain minimum releases from the Great Stone Dam in excess of those recommended by Interior had been demonstrated to FWS and the Policy Committee for Anadromous Fishery Management of the Merrimack River. In reference to the minimum releases required by the Water Quality Certificate, Applicant stated that the project will be operated in a manner that will not cause a violation of applicable water quality standards.

Article 32 of the license requires Licensees to maintain a continuous minimum flow of 951 cfs, unless and until the reservoir water surface elevation is drawn below the crest of the dam; thereupon the minimum release must equal inflow.

Recreation

Project No. 2800 will be located in a highly industrial area bounded by numerous light industries such as shoe and electronics manufacturers. 7/ The industrial nature of the area limits recreational development at the Lawrence Project. Notwithstanding this limitation, Applicant submitted an Exhibit R recreation plan which will allow public access and enjoyment of the historical aspects of the project area as well as the new power generating facility. In its Exhibit R, Applicant proposes to provide a parking area, sanitary facilities, access walkways to fish viewing facilities, picnic tables, and trash receptacles. Applicant also proposes to provide a multi-media slide/tape presentation on hydroelectric generation, the functioning of the fish passage facilities, and the history of the Great Stone Dam.

In these circumstances we conclude that the Exhibit R is adequate and should be approved.

Cultural Resources

The Great Stone Dam and the North Canal, two structures listed in the National Register of Historic Places, are part of the Lawrence Hydroelectric Project. The South Canal and its associated gatehouse structure are eligible, as determined by the Secretary of the Interior, for inclusion in the National Register. These cultural resources will not be adversely affected by the redevelopment and operation of hydroelectric facilities for Project No. 2800.

7/ These light industries occupy buildings that once housed the textile mills for which the Great Stone Dam and canal system was constructed. At the turn of the century, the Lawrence textile center was the largest in the world.

Pursuant to the National Historic Preservation Act of 1966, 8/ the Commission's Staff, in conjunction with the Massachusetts Historical Commission, determined that Project No. 2800 would not adversely affect the historical structures. The Massachusetts State Historical Preservation Officer concurred in the "no adverse determination" report and suggested that the Advisory Council on Historic Preservation (Advisory Council) be notified. By letter dated August 21, 1978, the Advisory Council reported that it does not object to the no adverse determination report and that the project may proceed.

Environmental Impacts

Redevelopment and operation of the Lawrence Hydroelectric Project will not significantly affect the human environment. The major project works - the dam, reservoir, and canal system - have been in existence for more than a century. Construction of the new powerhouse could cause some temporary turbidity of the river near the work site; this impact, however, will be short term and minor in nature. The project will be operated in a manner that duplicates the historical operation of the dam and canals. The operating procedures will permit the continuation of traditional uses of the river and adjacent lands. For the above reasons, approval of the application for major license for the Lawrence Hydroelectric Project does not constitute a major Federal action significantly affecting the quality of the human environment.

Exhibits

As part of its application for major license, Applicant filed exhibits F, J, K, L, M, R, and S. As previously discussed, the Exhibit R is approved and the Exhibit S is approved only to the extent that it proposes measures to conserve and enhance fishery resources affected by the project and shows conceptual fishway plans. The Exhibit J, which is a general map of the entire project area, complies with the Commission's regulations and is also approved.

Exhibits F, K, L, and M are incomplete. The Exhibit K does not define the project boundary line by a contour or a survey as required by our regulations. In addition, the Exhibit K does not indicate the owners of land adjacent to the project boundary. The Exhibit F does not fully

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8/ 16 U.S.C. 470f, as amended, 90 Stat. 1320.

describe lands owned by Applicant or to be used as part of the project. Article 36 requires Licensees to file revised Exhibits L and M showing final designs and locations of project works prior to construction. Article 41 requires Licensees to file revised Exhibits F and K within three years from the date of issuance of this order.

Intervenors Comments

The Andover Village Improvement Society (AVIS), Massachusetts Municipal Wholesale Electric Company (MMWEC), Merrimack Valley Building Trades Council, New England Power Company (NEPCO), the Town of Andover, Massachusetts, the Town of Metheun, Massachusetts, and Mayor L. P. LeFebre on behalf of the City of Lawrence, Massachusetts have been permitted to intervene in this proceeding. 9/ AVIS, the Town of Metheun, the Town of Andover, and the City of Lawrence all own or lease lands adjacent to the project. These intervenors are concerned with the possible impacts the hydroelectric facility may have upon the public's use and enjoyment of those lands. The municipalities also draw water for public consumption from the Merrimack River and they are concerned with potential impacts on the public water supplies. According to the petitions, AVIS and the municipalities have intervened in order to ensure that the Lawrence Hydroelectric Project will be operated in a manner which duplicates the historical operation of the dam and canals of the Essex Company. AVIS and the municipalities have each requested that a special article be included in the license to restrict Licensees' ability to alter the project's mode of operation. Except for emergencies, the operation of the Lawrence Hydroelectric Project would be carried out pursuant to Article 32 of this license. We would approve a change only after public notice and an opportunity for hearing. We believe that these procedures are adequate to protect the concerns of AVIS and the municipalities and, therefore, the suggested articles have not been inserted in the license. We further note that Article 13 of this license provides for the joint use of the project reservoir or other facilities by municipalities, industrial concerns, and others.

9/ Merrimac Paper Company and Aquamac Corporation filed a joint petition to intervene, but were permitted to withdraw that petition.

Intervenor New England Power Company had been in negotiations with Applicant concerning the purchase of electricity from Project No. 2800. In its petition, NEPCO alleged that the terms and conditions of any license obtained by Applicant may have an effect on the availability, reliability, and cost of power from the Lawrence Hydroelectric Project. Intervenor Massachusetts Municipal Wholesale Electric Company stated in its petition that it, too, had been negotiating the acquisition and use of the output of Project No. 2800. On October 27, 1978, Applicant filed with the Commission copies of a power contract dated October 25, 1978, between Lawrence Hydroelectric Associates and New England Power Company. That filing eliminates the issues and interests asserted in the petitions filed by NEPCO and MMWEC.

The final intervenor in the proceedings concerning the application for the Lawrence Hydroelectric Project is the Merrimack Valley Building Trades Council (Council). The Council intervened to show its support for the project and to request that a license be promptly issued to Applicant.

Economic Feasibility

The Commission's staff has estimated the annual cost of hydroelectric energy to be produced at Project No. 2800. Based on estimated costs in 1981, the year the project becomes operational, the total project cost would be $23,413,000. Using a 50 year amortization period, the total estimated annual cost of energy produced at the Lawrence Hydroelectric Project would be $4,274,000 which is equivalent to 46.9 mills per kWh. This estimated annual cost figure assumes that assets and mill powers owned by the Essex Company are not capitalized but carried as part of the annual variable charges.

On October 27, 1978, Applicant filed copies of a power contract between LHA and New England Power Company. Under the terms of the contract, NEPCO will make monthly payments sufficient to cover LHA's debt service obligations and to pay the cost of operating and maintaining the project during the term of the license. Accordingly, we find the proposed project economically and financially feasible. 10/

10/ This finding should not be construed as prejudging any Commission rate review that may be required in the future under Parts I or II of the Federal Power Act.

Issuance of Securities

On June 1, 1978, LHA, Applicant in Docket No. ES78-44, filed a petition with the Federal Energy Regulatory Commission seeking a declaratory order disclaiming jurisdiction pursuant to Section 204 (16 USC 824c(a) and 20 (16 USC 813) of the Federal Power Act and Part 34 of the Commission's Regulations under the Federal Power Act (18 CFR Part 34), requiring prior Commission authorization for the issuance of securities to finance the project. Alternatively, the Applicant requested Commission authorization to engage in negotiations for the sale or underwriting of securities pursuant to Section 34.2(f)(2) of the Commission's Regulations (18 CFR 34.2(f)(2)).

On November 20, 1978, LHA renewed its petition for a declaratory order disclaiming Commission jurisdiction over the issuance of securities to finance the project.

Sections 34.1a(a)(4) and 34.2(f)(2) of the Commission's Regulations under the Federal Power Act (18 CFR 34.1a(a)(4) and 34.2(f)(2)) require Commission authorization for the negotiation for the sale or underwriting of securities. Section 34.1 of the Commission's Regulations (18 CFR 34.1) applies the requirement of prior Commission authorization for the sale or underwriting of securities to "...licensees and others seeking authority under Section 19 and 20 of the Federal Power Act...in accordance with Part 20 11/ of the subchapter..." and to "... public utilities seeking under Section 204 of the Federal Power Act."

Applicant, becoming a licensee by issuance of this order, is required to file an application for the issuance of securities pursuant to Section 204 of the Federal Power Act.

11/ Section 20.2 of the Commission's Regulations (18 CFR 20.2) states that licensee or other person issuing or proposing to issue securities shall comply with the same requirements as the Commission would administer to it as if it were a public utility issuing securities pursuant to Section 204 of the Federal Power Act.

LHA's alternative request for Commission authorization to engage in negotiation for the issuance of securities states that the proposed financing would require complex arrangements with the equipment supplier, the general contractor and the sources of debt and equity funds. Applicant further states that this project is its first venture and believes that financing could not be arranged other than on a negotiated basis and therefore requests that the Commission exempt it from the competitive bidding requirements of Part 34 of the Commission's Regulations.

Upon good cause shown the Commission has determined that the LHA should not be precluded by the second clause of Seciton 34.2(f)(2) or the next to the last sentence of Section 34.1(a)(4) of the Commission's Regulations under the Federal Power Act from applying for and obtaining an order of the Commission exempting the proposed underwriting and sale of securities from the competitive bidding requirements of Part 34 of the Commission's Regulations. Therefore, LHA is hereby authorized, pursuant to its request, to engage in negotiations for the sale of securities subject to the following:

(1) Licensees will be required to file a separate application requesting Commission approval for the issuance of securities pursuant to final negotiated terms;

(2) The authorization granted by this order is solely for the purpose of engaging in negotiations and shall have no other or further effect, and shall be without prejudice to the consideration on the merits of any application which may be filed; and

(3) The provisions hereof shall not be construed as dispensing with the necessity for full compliance with any of the applicable requirements of the Securities Act of 1933, the Securities Exchange Act of 1934, or any order, rule or regulation thereunder.

Comprehensive Development

The Great Stone Dam is situated within the Merrimack River Basin which has a drainage area of 5,015 square miles of which 4,460 lie above the dam. The average flow of the river in the vicinity of the Great Stone Dam is 7,430 cfs varying from an approximate average of 2,300 cfs in September to about 17,200 cfs in April. Applicant proposes to install two, high efficiency, bulb type turbine generator units each rated at 7,400 kw.

The Lawrence Hydroelectric Project would reasonably develop the usuable head at the project site. Located about 11 miles upstream of the Great Stone Dam is the Pawtuckett Dam, FERC No. 2790. Between the two dams the land on both sides of the Merrimack River is heavily developed by commercial and industrial concerns. In this stretch of the river there is approximately 10 feet of undeveloped head. Increasing the height of the Great Stone Dam, and thereby flooding additional land in order to develop that 10 feet of head would not be economically feasible. Accordingly, we conclude that the project as conditioned in this order is best adapted to a comprehensive plan of development of the waterway.

The Commission orders:

(A) This license is issued under Section 4(e) of the Federal Power Act to Lawrence Hydroelectric Associates and the Essex Company of Lawrence, Massachusetts, effective December 1, 1978, and terminating November 30, 2028, for the construction, operation, and maintenance of the Lawrence Hydroelectric Project No. 2800, located on the Merrimack River, a navigable waterway of the United States, subject to the terms and conditions of the Act, which is incorporated by reference as part of this license, and subject to such rules and regulations as the Commission issues or prescribes under the provisions of the Act.

(B) Project No. 2800 consists of: (i) all lands, to the extent of the Licensees' interest in those lands, constituting the project area and enclosed by the project boundary, the project area and boundary being shown and described by certain exhibits which form part of the application for license and are designated and described as:

Exhibit	FERC Drawing No. 2800	Titled
J-1	1	General Map of the Project Project Area
K-1	2	Detail Map of the Project Area
K-2	3	"
K-3	4	"
K-4	5	"
K-5	6	"
K-6	7	"

(ii) Project works consisting of: (1) the existing 33-foot high and 900-foot-long dam of rubble masonry construction; (2) an existing 9.8-mile-long reservoir having a surface area of 655 acres at normal high water elevation 44.17 msl and a maximum storage capacity of approximately 19,900 acre-feet; (3) the existing South Canal approximately 35 feet wide and 10 feet deep, originating at the south abutment of the Essex Dam and generally paralleling the Merrimack River bed, below the Essex Dam, for a distance of approximately 2,750 feet; (4) the existing North Canal, approximately 95 feet wide and 15 feet deep, originating at the north abutment of the dam and paralleling the Merrimack River below the dam for a distance of approximately 5,300 feet; (5) a fish elevator installed at the dam and a fish ladder; (6) a powerhouse containing two 7.4 MW hydroelectric generating units and a tailrace channel extending into the Merrimack River Channel; (7) a single-circuit overhead 13.8-kV powerline to the Massachusetts Electric Company's Lawrence No. 1 substation; and (8) appurtenant facilities which are generally shown and described by the previously mentioned exhibits and specifically described by the following exhibits:

Exhibit	FERC Drawing No. 2800	Titled
L-1	8	Powerhouse Plan
L-2	9	Powerhouse and Section Details
L-3	10	Existing Essex Dam Plan-Profile Section
L-4	11	Existing Canals-North
L-5	12	Canal, Wasteway Plans and Sections

Exhibit M

Entitled, "Description of Major Equipment", consisting of 12 typewritten pages filed January 27, 1978.

Exhibit R

Filed June 30, 1977, and as supplemented on November 15, 1977, and January 27, 1978, consisting of: (1) 7 pages of text; (2) 5 pages of photographs; (3) Plate 1; (4) Exhibit R Map, Sheet 1, entitled "Recreation Plan Extended Project Area", (FERC No. 2800-13), and Exhibit R Drawing, Sheet 2, entitled "Recreation Plan Immediate Project Area", (FERC No. 2800-14); and (5) Appendix 1.

Exhibit S

Filed June 30, 1977, consisting of: (1) 5 pages of text; (2) 1 page of photographs; (3) 2 tables; and (4) 2 drawings, entitled "Conceptual Plan of Proposed Fish Elevator System at Lawrence Hydro Plant", (Plate 1) and "Schematic Elevation Fish Elevator or Fish Lift System", (Plate 2).

(iii) All of the structures, fixtures, equipment, facilities or property which may be employed in connection with the project, located on or off the project area, as approved by the Commission, and all riparian or other rights, which are necessary or appropriate for the maintenance or operation of the project.

(C) Exhibits K, L, and M, designated and described in Paragraph (B) above, are hereby approved and made a part of the license only to the extent that they show the general location and layout of the project. Exhibit S, also designated and described in Paragraph (A), is also approved and made a part of the license only to the extent that it proposes measures to conserve and enhance fishery resources affected by the project and conceptual plans for fishways.

(D) Exhibits J and R designated and described in Paragraph (B) above, are hereby approved and made a part ot the license.

(E) This license is also subject to the terms and conditions set forth in FERC Form L-4 (revised October 1975) entitled "Terms and Conditions of License for Unconstructed Major Projects Affecting Navigable Waters of the United

States." These terms, designated as Articles 1 through 28, are made a part of the license. This license is also subject to the following special conditions set forth as additional articles:

ARTICLE 29: Licensees shall continue to cooperate with the Massachusetts Historical Commission in order to avoid any adverse impact on identified historic structures at the project. In addition, if any previously unrecorded archeological resources are discovered during the course of construction, construction activity shall be halted, a qualified archeologist shall be consulted to determine the significance of the resources, and the Licensees shall consult with the Massachusetts Historical Commission and the State Archeologist to develop a mitigation plan for the protection of significant archeological resources. Licensees shall provide funds in a reasonable amount for any salvage activities which may be necessary. If at any point the Licensee and the Executive Director of the Massachusetts Historical Commission (State Historic Preservation Officer) cannot agree on the amount of money to be expended on archeological work at the project, the Commission reserves the right, after notice and opportunity for hearing, to require the Licensees to conduct at their own expense such archeological work as may be found necessary.

ARTICLE 30: Licensees shall, within two years after the date of issuance of this license, file, for Commission approval, a revised Exhibit S developed in cooperation with the U. S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Massachusetts Division of Fisheries and Game. The revised Exhibit S shall include, but not be limited to, functional design drawings of the fish lift and passage facilities to be constructed at the project, a construction schedule, and cost estimates for the facilities. Within six months from the date of completion of construction of the fish passage facilities, Licensee shall file with the Commission "as built" drawings.

ARTICLE 31: Licensees shall, within two years following completion of construction of the fish passage facilities, in cooperation with the U. S. Fish and Wildlife Service, National Marine Fisheries Service, and the Massachusetts Division of Fisheries and Game, conduct or pay for others to conduct an operational study to determine the effectiveness of the fish passage facilities in assisting the migration of anadromous fish. A final report containing the results of the study, together with recommendations of any need for further studies or for changes in operation of fish passage facilities, shall be filed with the Commission within six months following completion of the study. The Commission reserves the right, after notice and opportunity for hearing, to require additional studies and require such reasonable changes in the project's fish passage facilities and operations as may be found necessary to maintain fish migration.

ARTICLE 32: Licensees shall maintain a continuous minimum flow of 951 cfs unless and until the reservoir water surface elevation is reduced below the crest of the dam; thereupon the minimum flow shall equal the inflow to the reservoir. The release of minimum flows from the reservoir shall be made at locations determined in cooperation with the U. S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Commonwealth of Massachusetts. A report developed in consultation and cooperation with these agencies, indicating the location and quantities to be released from project outlet works, shall be filed with the Commission within one year from the date of issuance of this order. Such established flows may be modified temporarily if required by operating emergencies and other emergencies beyond the control of the Licensees; and for short periods of time in the interest of recreation and protection of the fisheries resource, upon mutual agreement between the Licensees and the Massachusetts Division of Fisheries and Game.

These flow requirements may be altered by further order of the Commission, upon its own motion, or upon the recommendations of the Commonwealth of Massachusetts or the Secretary of the Interior, after notice and opportunity for hearing.

ARTICLE 33: Licensees shall, in cooperation with the U. S. Fish and Wildlife Service, the National Marine Fisheries Service and the Massachusetts Division of Fisheries and Game, monitor or arrange for the monitoring of the fish lift and passage facilities when in operation, for the purpose of determining the presence of threatened or endangered fish species such as the shortnose sturgeon, and, if any are found, Licensees shall implement measures to protect and conserve any such species that may pass through the project works. A monitoring plan shall be submitted to the Commission within one year after the initial operation of the project.

ARTICLE 34: Licensees shall, to the satisfaction of the Commission's authorized representative, install and operate any signs, lights, sirens, or other safety devices that may reasonably be needed to warn the public of fluctuations in flow from the project and protect the public in its recreational use of project lands and waters.

ARTICLE 35: In the interest of protecting and enhancing the scenic, recreational, and other environmental values of the project, Licensees: (1) shall supervise and control the use and occupancy of project lands and waters; (2) shall prohibit, without further Commission approval, the further use and occupancy of project lands and waters other than as specifically authorized by this license; (3) may authorize, without further Commission approval, the use and occupancy of project lands and waters for landscape plantings and the construction, operation, maintenance of access roads, power and telephone distribution lines, piers, landings, boat docks, or similar structures and facilities, and embankments, bulkheads, retaining walls, or other similar structures for erosion control to protect the existing shoreline; (4) shall require, where feasible and desirable, the multiple use and occupancy of facilities for access to project lands and waters; and (5) shall ensure to the satisfaction of the Commission's authorized representative that all authorized uses and occupancies of project lands and waters: (a) are consistent with shoreline aesthetic values, (b) are maintained in a good state of repair, and (c) comply with State and local health and safety regulations. Under item (3) of this Article, Licensees may, among other things, institute a program for issuing permits to a reasonable extent for the authorized types of use and occupancy of project lands and waters. Under appropriate circumstances, permits may be subject to the payment of a fee in a reasonable amount. Before authorizing construction of bulkheads or retaining walls, Licensees shall: (a) inspect the site of the proposed construction, (b) determine that the proposed construction is needed, and (c) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site. If an authorized use or occupancy fails to comply with the conditions of this Article, or with any reasonable conditions imposed by the Licensees for the protection of the environmental quality of project lands and waters, Licensees shall take appropriate action to correct the violations, including, if necessary, cancellation of the authorization and removal of any noncomplying structures or facilities. Licensees' consent to an authorized use or occupancy of project lands and waters shall not, without their express agreement, place upon the Licensees any obligation to construct or maintain any associated facilities. Within one year of issuance of this license, Licensees shall furnish a copy of their guidelines and procedures used to implement the provisions of this Article to the Commission's authorized representative and its Director, Office of Electric Power Regulation. Whenever Licensees make any modifications to those guidelines and procedures, they shall promptly furnish a copy to each of those persons. The Commission reserves the right to require modifications to these guidelines and procedures.

ARTICLE 36: Licensees shall file, for Commission approval, revised Exhibit L drawings and an Exhibit M showing final designs and locations of project works. Licensees shall not begin construction of any such project structures until the Director, Office of Electric Power Regulation, has approved the Exhibit L drawings.

ARTICLE 37: Licensees shall, within one year from the date of issuance of this license, make additional investigations by subsurface explorations during the excavations for the powerhouse, to ensure that the dam is founded on competent rock and to verify that there has been no undercutting at the contact of the dam with the foundation bedrock. A final report containing the results of the investigation, together with a recommendation of any need for further studies or for remedial work, shall be filed with the Commission within six months following completion of the investigation. If the investigation shows a need for remedial work, Licensees shall submit as part of the final report a plan and schedule for such work for approval by the Director, Office of Electric Power Regulation.

ARTICLE 38: Pursuant to Section 10(d) of the Act, after the first 20 years of operation of the project under the license, the rate as computed below shall be the specified rate of return on the net investment in the project for determining surplus earnings of the project for the establishment and maintenance of amortization reserves. One-half of the project surplus earnings, if any, accumulated after the first 20 years of operation under the license, in excess of the specified rate of return per annum on the net investment, shall be set aside in a project amortization reserve account as of the end of each fiscal year: Provided, that, if and to the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year or years after the first 20 years of operation under the license, the amount of any surplus earnings accumulated thereafter until absorbed, and one-half of the remaining surplus earnings, if any, thus cumulatively computed, shall be set aside in the project amortization reserve account; and the amounts thus established in the project amortization reserve account shall be maintained until further order of the Commission.

The annual specified reasonable rate of return shall be the sum of the weighted cost components of long-term debt, preferred stock, and the cost of common equity, as defined herein. The weighted cost component for each element of the reasonable rate of return is the product of its capital ratios and cost rate. The current capital ratios for each of the above elements of the rate of return shall be calculated annually based on an average of 13 monthly balances of amounts properly includable in the Licensee's long-term debt and proprietary capital accounts as listed in the Commission's Uniform System of Accounts. The cost rates for such ratios shall be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity shall be the interest rate on 10-year government bonds (reported as the Treasury Department's 10-year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

Article 39: The Licensees shall pay the United States the following annual charge, effective as of the first day of the month in which this license is issued for the purpose of reimbursing the United States for the cost of administration of Part I of the Act: a reasonable annual charge as determined by the Commission in accordance with the provisions of its regulations, in effect from time to time The authorized installed capacity for such purposes is 19,700 horsepower.

Article 40. Licensees shall file with the Commission within one year from the date of issuance of this order, implement, and modify when appropriate, an emergency action plan designed to provide an early warning to upstream and downstream inhabitants and property owners if there should be an impending or actual sudden release of water caused by an accident to, or failure of, project works. That plan shall include: instructions to be provided on a continuing basis to operators and attendants for actions they are to take in the event of an emergency; detailed and documented plans for notifying law enforcement agents, appropriate Federal, State, and local agencies, operators of water-related facilities, and those residents and owners of properties that could be endangered; actions that would be taken to reduce the inflow to the reservoir, if possible, by limiting the outflow from upstream dams or control structures; and actions to reduce downstream flows by controlling the outflow from dams located on tributaries to the stream on which the project is located. Licensee shall also submit a summary of the study used as a basis for determining the areas that may be affected by an emergency, including criteria and assumptions used. Licensee shall monitor any changes in upstream or downstream conditions which may influence possible flows or affect areas susceptible to damage, and shall promptly make and file with the Commission appropriate changes in the emergency action plan. The Commission reserves the right to require modifications to the plan.

Article 41: The Licensees shall, within three years following the date of issuance of the license, file a revised Exhibit F and, for Commission approval, an Exhibit K to show the project as finally constructed and located pursuant to the Commission's regulations.

Article 42: The Licensees shall commence construction of the project within one year of the date of issuance of the license, and shall thereafter in good faith and with due diligence prosecute and complete construction of the project works within four years of the date of issuance.

(F) Licensees are authorized to engage in negotiations for the sale of securities subject to the following:

(1) Licensees are required to file a separate application requesting Commission approval for the issuance of securities pursuant to final negotiated terms;

(2) The authorization granted by this order is solely for the purpose of engaging in negotiations and shall have no other or further effect, and shall be without prejudice to the consideration on the merits of any application which may be filed; and

(3) The provisions hereof shall not be construed as dispensing with the necessity for full compliance with any of the applicable requirements of the Securities Act of 1933, the Securities Exchange Act of 1934, or any order, rule or regulation thereunder.

(G) This order shall become final 30 days from the date of its issuance unless application for rehearing shall be filed as provided in Section 313(a) of the Act, and failure to file such an application shall constitute acceptance of the license for Project No. 2800. In acknowledgment of this acceptance of the license and its terms and conditions, the license shall be signed for the Licensees and returned to the Commission within 60 days from the date of issuance of this order.

By the Commission.

(S E A L)

Lois D. Cashell,
Acting Secretary.

Project No. 2800

In Testimony of its acknowledgement of acceptance of all provisions, terms and conditions of the foregoing order, Lawrence Hydroelectric Associates this ______ day of ______________, 197__, has caused its partnership name to be signed hereto by ______________________________, Partner and authorized representative and attested by _____________ _______________ Partner, pursuant to a resolution of its members duly adopted on the __________ day of ______________, 197__, a certified copy of the record of which is attached hereto.

By ____________________________

Partner and authorized representative

Attest:

____

Partner

(Executed in Quadruplicate)

Project No. 2800

In Testimony of its acknowledgement of acceptane of all provisions, terms and conditions of the foregoing order, the Essex Company this ______ day of ________________ , 197__, has caused its corporate name to be signed hereto by ________________________, Chairman of the Board of Directors and its Corporate Seal to be affixed hereto and attested by ________________________, its _________________Secretary, pursuant to a resolution of its Board of Directors duly adopted on the ____ day of ____________, 197__, a certified copy of the record of which is attached hereto.

By ______________________________

Chairman of the Board
of Directors

Attest:

____

Secretary

(Executed in Quadruplicate)

Form L-4
(Revised October, 1975)

FEDERAL ENERGY REGULATORY COMMISSION

TERMS AND CONDITIONS OF LICENSE FOR UNCONSTRUCTED MAJOR PROJECT AFFECTING NAVIGABLE WATERS OF THE UNITED STATES

Article 1. The entire project, as described in this order of the Commission, shall be subject to all of the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, specifications, and statements described and designated as exhibits and approved by the Commission in its order as a part of the license until such change shall have been approved by the Commission: Provided, however, That if the Licensee or the Commission deems it necessary or desirable that said approved exhibits, or any of them, be changed, there shall be submitted to the Commission for approval a revised, or additional exhibit or exhibits covering the proposed changes which, upon approval by the Commission, shall become a part of the license and shall supersede, in whole or in part, such exhibit or exhibits theretofore made a part of the license as may be specified by the Commission.

Article 3. The project works shall be constructed in substantial conformity with the approved exhibits referred to in Article 2 herein or as changed in accordance with the provisions of said article. Except when emergency shall require for the protection of navigation, life, health, or property, there shall not be made without prior approval of the Commission any substantial alteration or addition not in conformity with the approved plans to any dam or other project works under the license or any substantial use of project lands and waters not authorized herein; and any emergency alteration, addition, or use so made shall thereafter be subject to such modification and change as the Commission may direct. Minor changes in project works, or in uses of project lands and waters, or divergence from such approved exhibits may be made if such changes will not result in a decrease in efficiency, in a material increase in cost, in an adverse environmental impact, or in impairment of the general scheme of development; but any of such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of such results, shall be subject to such alteration as the Commission may direct.

Upon the completion of the project, or at such other time as the Commission may direct, the Licensee shall submit to the Commission for approval revised exhibits insofar as necessary to show any divergence from or variations in the project area and project boundary as finally located or in the project works as actually constructed when compared with the area and boundary shown and the works described in the license or in the exhibits approved by the Commission, together with a statement in writing setting forth the reasons which in the opinion of the Licensee necessitated or justified variation in or divergence from the approved exhibits. Such revised exhibits shall, if and when approved by the Commission, be made a part of the license under the provisions of Article 2 hereof.

Article 4. The construction, operation, and maintenance of the project and any work incidental to additions or alterations shall be subject to the inspection and supervision of the Regional Engineer, Federal Power Commission, in the region wherein the project is located, or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall cooperate fully with said representative and shall furnish him a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of the project and for any subsequent alterations to the project. Construction of the project works or any feature or alteration thereof shall not be initiated until the program of inspection for the project works or any such feature thereof has been approved by said representative. The Licensee shall also furnish to said representative such further information as he may require concerning the construction, operation, and maintenance of the project, and of any alteration thereof, and shall notify him of the date upon which work will begin, as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of work for a period of more than one week, and of its resumption and completion. The Licensee shall allow said representative and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties. The Licensee shall comply with such rules and regulations of general or special applicability as the Commission may prescribe from time to time for the protection of life, health, or property.

Article 5. The Licensee, within five years from the date of issuance of the license, shall acquire title in fee or the right to use in perpetuity all lands, other than lands of the United States, necessary or appropriate for the construction, maintenance, and operation of the project. The Licensee or its successors and assigns shall, during the period of the license, retain the possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and none of such properties shall be voluntarily sold, leased, transferred, abandoned, or otherwise disposed of without the prior written approval of the Commission, except that the Licensee may lease or otherwise dispose of interests in project lands or property without specific written approval of the Commission pursuant to the then current regulations of the Commission. The provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear; and mortgage or trust deeds or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article.

Article 6. In the event the project is taken over by the United States upon the termination of the license as provided in Section 14 of the Federal Power Act, or is transferred to a new licensee or to a non-power licensee under the provisions of Section 15 of said Act, the Licensee, its successors and assigns shall be responsible for, and shall make good any defect of title to, or of right of occupancy and use in, any of such project property that is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and shall pay and discharge, or shall assume responsibility for payment and discharge of, all liens or encumbrances upon the project or project property created by the Licensee or created or incurred after the issuance of the license: Provided, That the provisions of this article are not intended to require the Licensee, for the purpose of transferring the project to the United States or to a new licensee, to acquire any different title to, or right of occupancy and use in, any of such project property than was necessary to acquire for its own purposes as the Licensee.

Article 5. The Licensee, within five years from the date of issuance of the license, shall acquire title in fee or the right to use in perpetuity all lands, other than lands of the United States, necessary or appropriate for the construction, maintenance, and operation of the project. The Licensee or its successors and assigns shall, during the period of the license, retain the possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and none of such properties shall be voluntarily sold, leased, transferred, abandoned, or otherwise disposed of without the prior written approval of the Commission, except that the Licensee may lease or otherwise dispose of interests in project lands or property without specific written approval of the Commission pursuant to the then current regulations of the Commission. The provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear; and mortgage or trust deeds or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article.

Article 6. In the event the project is taken over by the United States upon the termination of the license as provided in Section 14 of the Federal Power Act, or is transferred to a new licensee or to a non-power licensee under the provisions of Section 15 of said Act, the Licensee, its successors and assigns shall be responsible for, and shall make good any defect of title to, or of right of occupancy and use in, any of such project property that is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and shall pay and discharge, or shall assume responsibility for payment and discharge of, all liens or encumbrances upon the project or project property created by the Licensee or created or incurred after the issuance of the license: Provided, That the provisions of this article are not intended to require the Licensee, for the purpose of transferring the project to the United States or to a new licensee, to acquire any different title to, or right of occupancy and use in, any of such project property than was necessary to acquire for its own purposes as the Licensee.

Article 7. The actual legitimate original cost of the project, and of any addition thereto or betterment thereof, shall be determined by the Commission in accordance with the Federal Power Act and the Commission's Rules and Regulations thereunder.

Article 8. The Licensee shall install and thereafter maintain gages and stream-gaging stations for the purpose of determining the stage and flow of the stream or streams on which the project is located, the amount of water held in and withdrawn from storage, and the effective head on the turbines; shall provide for the required reading of such gages and for the adequate rating of such stations; and shall install and maintain standard meters adequate for the determination of the amount of electric energy generated by the project works. The number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, shall at all times be satisfactory to the Commission or its authorized representative. The Commission reserves the right, after notice and opportunity for hearing, to require such alterations in the number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, as are necessary to secure adequate determinations. The installation of gages, the rating of said stream or streams, and the determination of the flow thereof, shall be under the supervision of, or in cooperation with, the District Engineer of the United States Geological Survey having charge of stream-gaging operations in the region of the project, and the Licensee shall advance to the United States Geological Survey the amount of funds estimated to be necessary for such supervision, or cooperation for such periods as may be mutually agreed upon. The Licensee shall keep accurate and sufficient records of the foregoing determinations to the satisfaction of the Commission, and shall make return of such records annually at such time and in such form as the Commission may prescribe.

Article 9. The Licensee shall, after notice and opportunity for hearing, install additional capacity or make other changes in the project as directed by the Commission, to the extent that it is economically sound and in the public interest to do so.

Article 10. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other projects or power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 11. Whenever the Licensee is directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of the headwater improvement for such part of the annual charges for interest, maintenance, and depreciation thereof as the Commission shall determine to be equitable, and shall pay to the United States the cost of making such determination as fixed by the Commission. For benefits provided by a storage reservoir or other headwater improvement of the United States, the Licensee shall pay to the Commission the amounts for which it is billed from time to time for such headwater benefits and for the cost of making the determinations pursuant to the then current regulations of the Commission under the Federal Power Act.

Article 12. The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial public uses, including recreational purposes, and the Licensee shall release water from the project reservoir at such rate in cubic feet per second, or such volume in acre-feet per specified period of time, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

Article 13. On the application of any person, association, corporation, Federal agency, State or municipality, the Licensee shall permit such reasonable use of its reservoir or other project properties, including works, lands and water rights, or parts thereof, as may be ordered by the Commission, after notice and opportunity for hearing, in the interests of comprehensive development of the waterway or waterways involved and the conservation and utilization of the water resources of the region for water supply or for the purposes of steam-electric, irrigation, industrial, municipal or similar uses. The Licensee shall receive reasonable compensation for use of its reservoir or other project properties or parts thereof for such purposes, to include at least full reimbursement for any damages or expenses which the joint use causes the Licensee to incur. Any such compensation shall be fixed by the Commission either by approval of an agreement between the Licensee and the party or parties benefiting or after notice and opportunity for hearing. Applications shall contain information in sufficient detail to afford a full understanding of the proposed use, including satisfactory evidence that the applicant possesses necessary water rights pursuant to applicable State law, or a showing of cause why such evidence cannot concurrently be submitted, and a statement as to the relationship of the proposed use to any State or municipal plans or orders which may have been adopted with respect to the use of such waters.

Article 14. In the construction or maintenance of the project works, the Licensee shall place and maintain suitable structures and devices to reduce to a reasonable degree the liability of contact between its transmission lines and telegraph, telephone and other signal wires or power transmission lines constructed prior to its transmission lines and not owned by the Licensee, and shall also place and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling or obstructing traffic or endangering life. None of the provisions of this article are intended to relieve the Licensee from any responsibility or requirement which may be imposed by any other lawful authority for avoiding or eliminating inductive interference.

Article 15. The Licensee shall, for the conservation and development of fish and wildlife resources, construct, maintain, and operate, or arrange for the construction, maintenance, and operation of such reasonable facilities, and comply with such reasonable modifications of the project structures and operation, as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing.

Article 16. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of the Licensee's lands and interests in lands, reservoirs, waterways and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be reasonably prescribed by the Commission in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

Article 17. The Licensee shall construct, maintain, and operate, or shall arrange for the construction, maintenance, and operation of such reasonable recreational facilities, including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities, and utilities, giving consideration to the needs of the physically handicapped, and shall comply with such reasonable modifications of the project, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal or State agencies, after notice and opportunity for hearing.

Article 18. So far as is consistent with proper operation of the project, the Licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and for outdoor recreational purposes, including fishing and hunting: Provided, That the Licensee may reserve from public access such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property.

Article 19. In the construction, maintenance, or operation of the project, the Licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion on lands adjacent to streams or other waters, stream sedimentation, and any form of water or air pollution. The Commission, upon request or upon its own motion, may order the Licensee to take such measures as the Commission finds to be necessary for these purposes, after notice and opportunity for hearing.

Article 20. The Licensee shall consult with the appropriate State and Federal agencies and, within one year of the date of issuance of this license, shall submit for Commission approval a plan for clearing the reservoir area. Further, the Licensee shall clear and keep clear to an adequate width lands along open conduits and shall dispose of all temporary structures, unused timber, brush, refuse, or other material unnecessary for the purposes of the project which results from the clearing of lands or from the maintenance or alteration of the project works. In addition, all trees along the periphery of project reservoirs which may die during operations of the project shall be removed. Upon approval of the clearing plan all clearing of the lands and disposal of the unnecessary material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission and in accordance with appropriate Federal, State, and local statutes and regulations.

Article 21. Material may be dredged or excavated from, or placed as fill in, project lands and/or waters only in the prosecution of work specifically authorized under the license; in the maintenance of the project; or after obtaining Commission approval, as appropriate. Any such material shall be removed and/or deposited in such manner as to reasonably preserve the environmental values of the project and so as not to interfere with traffic on land or water. Dredging and filling in a navigable water of the United States shall also be done to the satisfaction of the District Engineer, Department of the Army, in charge of the locality.

Article 22. Whenever the United States shall desire to construct, complete, or improve navigation facilities in connection with the project, the Licensee shall convey to the United States, free of cost, such of its lands and rights-of-way and such rights of passage through its dams or other structures, and shall permit such control of its pools, as may be required to complete and maintain such navigation facilities.

Article 23. The operation of any navigation facilities which may be constructed as a part of, or in connection with, any dam or diversion structure constituting a part of the project works shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including control of the level of the pool caused by such dam or diversion structure, as may be made from time to time by the Secretary of the Army.

Article 24. The Licensee shall furnish power free of cost to the United States for the operation and maintenance of navigation facilities in the vicinity of the project at the voltage and frequency required by such facilities and at a point adjacent thereto, whether said facilities are constructed by the Licensee or by the United States.

Article 25. The Licensee shall construct, maintain, and operate at its own expense such lights and other signals for the protection of navigation as may be directed by the Secretary of the Department in which the Coast Guard is operating.

Article 26. If the Licensee shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without adequate replacement, or shall abandon or discontinue good faith operation of the project or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address of the Licensee or its agent, the Commission will deem it to be the intent of the Licensee to surrender the license. The Commission, after notice and opportunity for hearing, may require the Licensee to remove any or all structures, equipment and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the United States agency having jurisdiction over its lands or the Commission's authorized representative, as appropriate, or to provide for the continued operation and maintenance of nonpower facilities and fulfill such other obligations under the license as the Commission may prescribe. In addition, the Commission in its discretion, after notice and opportunity for hearing, may also agree to the surrender of the license when the Commission, for the reasons recited herein, deems it to be the intent of the Licensee to surrender the license.

Article 27. The right of the Licensee and of its successors and assigns to use or occupy waters over which the United States has jurisdiction, or lands of the United States under the license, for the purpose of maintaining the project works or otherwise, shall absolutely cease at the end of the license period, unless the Licensee has obtained a new license pursuant to the then existing laws and regulations, or an annual license under the terms and conditions of this license.

Article 28. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

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THE COMMONWEALTH OF MASSACHUSETTS

WATER RESOURCES COMMISSION

DIVISION OF WATER POLLUTION CONTROL

110 TREMONT STREET, BOSTON 02108

OFFICE OF THE DIRECTOR

July 5, 1978

Dr. Kenneth Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street
Washington, D.C. 20426

Re: Water Quality Certification
Lawrence Hydroelectric Project
FERC License Application P-2800
Lawrence, Mass.

Dear Dr. Plumb:

This letter is written at the request of Lawrence Hydroelectric Associates, developers of a proposed 14.1 Megawatt generating station on the Merrimack River at Lawrence, Mass. The Associates have requested a letter from this Division as to the effect of the operation of the proposed facility on the water quality of the Merrimack River below the project.

The proposed development will be located at the existing Essex Dam in Lawrence, approximately two miles upstream of the outfall from the recently-completed Greater Lawrence Sanitary District Wastewater Treatment Plant. This plant was designed to produce an effluent of such quality and characteristics that, with a 7-day, 10-year low flow on the Merrimack River at the outfall, the assigned "B" classification of the river would be attained. The Division was concerned lest the regimen of the river would be so changed through the operation of the proposed facility that the Class B standard would be violated.

Staff of this Division have had numerous meetings and correspondence with staff of the developers. As a result, this Division has now received reasonable assurances from the applicant that the proposed project will be operated in a manner which will not cause a violation of applicable water quality standards adopted by this Division under authority of Section 27 (5) of Chapter 21 of the Massachusetts General Laws.

Therefore, based on these assurances and our own investigations, this Division hereby issues this Water Quality Certification relative to this project, in accordance with the provisions of Section 401 of the Federal Water Pollution Control Act as amended (Public Law 95-217), subject to the following conditions:

1. A minimum flow of 951 c.f.s. (equivalent to approximately 1,000 c.f.s. at the Greater Lawrence Sanitary District Wastewater Treatment Plant outfall) shall be continuously released from the impoundment behind the Essex Dam by whatever means or combination of means necessary to accomplish this release, unless or until the pool elevation behind the dam is so drawn down that it reaches the crest of the dam.

2. At such times, outflow released from the dam shall be equal to inflow as recorded at the U.S.G.S. Lowell gage, during the period the flow is less than 951 c.f.s. When the flow exceeds 951 c.f.s., the excess flow over 951 c.f.s. may be utilized to refill the impoundment to the top of flashboards, whereupon Condition 1 above will again go into effect.

Should any violation of the water quality standards or the terms of this Certification occur as a result of the proposed activity, the Division will direct that the condition be corrected. Non-compliance on the part of the permittee will be cause for this Division to recommend the revocation of the permit(s) issued therefor or to take such other action as is authorized by the General Laws of the Commonwealth.

Very truly yours,

Thomas C. McMahon
Director

TCM/WAS/rew

cc: Gordon A. Marker, Lawrence Hydroelectric Associates, 8 Arlington Street, Boston 02116
David Standley, Commissioner, Department of Environmental Quality Engineering, 100 Cambridge Street, Boston 02202
Barbara Ingle, Deputy Commissioner, Department of Environmental Quality Engineering, 100 Cambridge Street, Boston 02202
Morgan Rees, Chief, Permits Branch, Corps of Engineers, 424 Trapelo Road, Waltham 02154
John J. Hannon, Director, Division of Land & Water Use, Department of Environmental Quality Engineering, 100 Nashua Street, Boston 02114
Matthew Connolly, Director, Division of Fisheries & Wildlife, 100 Cambridge Street, Boston 02202

UNITED STATES OF AMERICA72 FERC •62,215
FEDERAL ENERGY REGULATORY COMMISSION

Lawrence Hydroelectric Associates and Essex Company — Project No. 2800-018, Massachusetts

ORDER AMENDING ORDER APPROVING REVISED EXHIBIT R

Issued September 8, 1995

On August 17, 1995, Lawrence Hydroelectric Associates and Essex Company, licensees for the Lawrence Project, FERC No. 2800, filed a request for clarification of an Order Approving Revised Exhibit R issued on August 1, 1995.1

In this order, it states that "in the proposed revised Exhibit R, the licensees will provide educational information through tours of the powerhouse and fish lifting area. These tours are to be scheduled on an as-needed basis. . . Interpretive displays will be erected to explain different aspects of the project's operation and exhibits will be constructed in the North Canal Carriage House which will display educational information. In addition, a portable fence will be provided to safely direct tour groups past the intake and fish lift area to the dam overlook. The Department of Environmental Management of the Commonwealth of Massachusetts (DEM) and Lawrence Heritage State Park (LHSP) suggested that a clearly marked walkway be painted on the pavement to direct tours to points of interest. The licensees agreed to provide a marked walkway and signage at the site."

The licensees requested clarification of two sections of this order. First, instead of providing tours of the powerhouse and fish lifting area, the order should state that the licensees will provide tours through the North Canal Carriage House. These tours will provide the same information as stated in the August 1 order, but will occur in safer areas of the project. Second, the licensees agreed to paint markings and provide signage to the Carriage House as requested by the LHSP and DEM, but will not erect a portable fence to direct tour groups past the intake and fish lift area since these areas are no longer being used for tours.

These clarifications do not change the recreation facilities that are being provided by the licensees or the intent of the August 1 order. They should be incorporated into the order to clearly state what the licensees intend to provide.

1 See 72 FERC 62,074.

The Director orders:

(A) The Order Approving Revised Exhibit R issued August 1, 1995 is amended to state that: the licensees will provide tours through the North Canal Carriage House. Further, the licensees will paint markings on the paved walkway and provide signage to direct visitors to the Carriage House. The portable fence will not be installed to direct tour groups past the intake and fish lift areas.

(B) This order constitutes final Commission action. Requests for rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. • 385.713.

J. Mark Robinson
Director, Division of Project
Compliance and Administration

119 FERC ¶ 62,243
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Essex Company and Lawrence Hydroelectric Associates — Project No. 2800-037

ORDER AMENDING LICENSE

(Issued June 19, 2007)

On January 10, 2007, Essex Company and Lawrence Hydroelectric Associates, licensees for the Lawrence Hydroelectric Project, FERC No. 2800,[1] filed an application to amend its license by proposing to replace the existing wooden flashboards on the crest of the project's Essex Dam with an inflatable flashboard system. The project is located on the Merrimack River in Lawrence, Essex County, Massachusetts.

BACKGROUND

The project consists of 900-foot-long stone-masonry gravity dam (Essex or Great Stone Dam) dam with 5-foot high wooden flashboards supported by irregularly spaced steel pins. The impoundment created by the dam and flashboards covers an area of about 655 acres. According to the licensees, maintenance of the flashboard system over the years has been limited almost exclusively to the replacement of flashboards and flashboard pins which are damaged during high flow events. The replacement of the flashboards results in drawdown of impoundment for extended periods of time. In order to reduce the number, extent and duration of impoundment drawdowns, the licensees are proposing to replace the existing wooden flashboards on the crest of the Essex Dam with an inflatable flashboard system.

The proposed flashboard system would consist of multiple-operating-zone inflatable system anchored into the dam crest, separated by at least two concrete piers. By controlling air pressure within the bladder, the flashboard height can be increased or decreased to maintain normal headpond elevation.

[1] 5 FERC ¶61,202 Order Issuing Major License and Authorizing Negotiations for Sale of Securities, issued December 4, 1978.

AGENCY CONSULTATION

By a letter dated October 25, 2006, the licensees requested comments from state and federal resource agencies on their proposal to replace the wooden flashboards with an inflatable flashboard system. Responses were received from the Massachusetts Historical Commission (MAHC), U.S. Fish & Wildlife Service (FWS), Massachusetts Division of Marine Fisheries (MAMF), Massachusetts Division of Fisheries & Wildlife (MAFWS), and Massachusetts Department of Environmental Protection (MADEP).

The MAHC stated that the proposed project is unlikely to affect significant historic or archeological resources. The MADEP expressed its support for the project and reminded the licensees that they need approval from the fishery resource agencies regarding appropriate construction timing, and should comply with the provisions of the Wetlands Protection Act, and notify appropriate conservation commission prior to work. The MAFWS strongly endorsed the licensees' proposal.

The FWS stated that based on their experience at the Holyoke Project, it would be beneficial to have more small bladders than three large ones to provide greater flexibility in the distribution of spill flows across the dam, which is critical for effective upstream fish passage.

The MAMF recommended that construction be completed in the low flow period between July 15 and September 15, outside of spring and fall upstream passage seasons.

REVIEW

The project is operated as run-of-river and has no useable storage capacity. The proposed flashboard system will not change the authorized headpond elevation or the project mode of operation.

Our review found that the inflatable flashboard system would (a) allow the licensees to more consistently maintain water levels and thereby enhancing the efficiency and generation capabilities of the project, (b) improve upstream fish passage, (c) eliminate dangers associated with the replacement of wooden flashboards, and (d) enhance the aesthetics.

Prior to the start of construction of the inflatable flashboard system, the licensees must file for Commission approval contract plans and specifications and cofferdam construction drawings as we are requiring in the ordering paragraphs (C) and (D) of this order. Ordering paragraph (E) of this order requires the licensees to file for review and comment operating procedures describing how the flashboards will be operated to control water levels.

After the construction is completed, the licensee must file as-built exhibit drawings for Commission's approval as we are requiring in ordering paragraph (F) of this order. The exhibit drawings must be prepared in accordance with Commission’s regulations at 18 C.F.R. §§4.39 and 4.41

The Director orders:

(A) The license for the Lawrence Project is amended as provided by this order effective the day this order is issued.

(B) The licensee's request to replace a wooden flashboard system with an inflatable flashboard system is approved. Ordering Paragraph (B) (ii) of the license is revised in part to read as follows:

> (ii) Project works consisting of: (1) the existing 33-foot high and 900-foot-long dam of rubble masonry construction with five-foot-high inflatable flashboard system; (2) an existing 9.8-mile-long reservoir having a surface area of 655 acres at normal high water elevation 44.17 feet mean sea level (msl) and a maximum storage capacity of approximately 19,900 acre-feet; (3) the existing South Canal approximately 35 feet wide and 10 feet deep, originating at the south abutment of the Essex Dam and generally paralleling the Merrimack River bed, below the Essex Dam, for a distance of approximately 2,750 feet; (4) the existing North Canal, approximately 95 feet wide and 15 feet deep, originating at the north abutment of the dam and paralleling the Merrimack River below the dam for a distance of approximately 5,300 feet; (5) a fish elevator installed at the dam and a fish ladder; (6) a powerhouse containing two 7.4 MW hydroelectric generating units and a tailrace channel extending into the Merrimack River Channel; (7) a single-circuit overhead 13.8-5V power line to the Massachusetts Electric Company's Lawrence No. 1 substation; and (8) appurtenant facilities …..

(C) *Contract Plans and Specifications*. At least 60 days prior to the start of construction of the inflatable flashboard system, the licensee shall submit one copy of its plans and specifications and supporting design report to the Commission’s Division of Dam Safety and Inspections (D2SI) – New York Regional Engineer, and two copies to the Commission (one of these shall be a courtesy copy to the Director, D2SI). The submittal must also include as part of preconstruction requirements: a Quality Control and Inspection Program, Temporary Construction Emergency Action Plan, and Soil Erosion and Sediment Control Plan. The licensee may not begin construction until the D2SI-New

York Regional Engineer has reviewed and commented on the plans and specifications, determined that all preconstruction requirements have been satisfied, and authorized start of construction.

(D) *Cofferdam Construction Drawings.* Before starting construction of the inflatable flashboard system, the licensee shall review and approve the design of contractor-designed cofferdams and deep excavations and shall make sure construction of cofferdams and deep excavations is consistent with the approved design. At least 30 days before starting construction of the cofferdam, the licensee shall submit one copy to the Commission's D2SI-New York Regional Engineer and two copies to the Commission (one of these copies shall be a courtesy copy to the Commission's Director, D2SI), of the approved cofferdam construction drawings and specifications and the letters of approval.

(E) *Operating Procedures.* At least 60 days prior to completing construction of the inflatable flashboard system, the licensee shall submit for review and comment one copy to the Division of Dam Safety and Inspections – New York Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections) of operating procedures describing how the flashboards will be operated to control water levels. The procedures should explain the water surface elevations that will trigger deflating and inflating the system.

(F) *As-built Drawing*s. Within 90 days of completion of all construction activities, the licensee shall file for Commission approval, revised exhibit L drawings to describe and show those project facilities as built. A courtesy copy shall be filed with the Commission’s D2SI-New York Regional Engineer, and the Director, D2SI.

(G) This order constitutes final agency action. Requests for rehearing by the commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. §385.713.

Mohamad Fayyad
Engineering Team Lead
Division of Hydropower Administration
and Compliance