# Conservation Commission | City of Auburn

**Conservation Commission Agenda**
**Meeting Date**: June 21, 2016, 6:00 PM

**I.** Roll Call

**II.** Approve Minutes of May 17, 2016 meeting

**III.** Sub Committee Reports
- a. Parks Committee
- b. LACFB Update
- c. Transportation & Environment Committee

**IV.** Open for Public Comments

**V.** Election of Officers for 2016-2017
- a. Chair
- b. Vice chair
- c. Secretary/Treasurer

**VI.** Old Business Items
- a. Project Canopy Update
- b. Policies and Procedures Update
- c. Annual Report Update

**VII.** New Business Items
- a. Calendar

**VIII.** Other
- a. Miscellaneous Correspondence – utility boxes

**IX.** Adjourn

The Conservation Commission meets the third Tuesday of each Month in Auburn City Hall at 6:00 PM.
The Lewiston Auburn Community Forest Board meets the third Thursday of each month at 7:00 PM.
The Parks Subcommittee meets on the last Wednesday of the month in Auburn City Hall at 6:30 PM.

City of Auburn
Conservation Commission
Meeting Minutes
May 17, 2016 - 6:00 pm

Chairman Pete Preble brought the meeting to order at 6:01 pm.

1. Roll call

   Members present: Tizz Crowley, Maurice Keene, Pete Preble, Bob Sipe, Jordan Tate, Leroy Walker, and Nichole White-Matson

   Absent: Chuck Lafean

   Others present: Tony Beaulieu, City Engineer and Sabrina Best, Recreation Director

2. Minutes

   The minutes of 3-15-16 were approved at the 4-19-16 meeting. The final draft was included with the packet.

   ACTION: Tizz Crowley seconded by Bob Sipe moved to accept the minutes of 4-19-16 as presented. The motion was unanimously approved.

   The ABC guidelines were not forwarded because a staff member questioned if they were required or not and *follow up with the city clerk is needed before they are distributed*.

3. Subcommittee Reports

   Parks Subcommittee

   - There was an event at Sullivan Square April 24. 12 people participated, a tree was planted, and a picnic table was donated.
   - Trail Day is June 4. The Conservation Commission was encouraged to participate. Information will be posted on the City's web site.

   LACFB Update

   - For Arbor Week, information tables will be set up at the Auburn and Lewiston City Halls and Lewiston Library (Auburn Library did not have space). There will be an event at the tree nursery to do some planting and maintenance and they are looking for volunteers. They received a new banner from Pepsi and are going to ask to hang it on Court Street next year.
   - A special tree contest is being developed that will probably run until November 1 where people can submit photos if they have a unique or especially beautiful tree.
   - The Tree Inventory will start in June, is a 4-5 week process, and the report will be ready by fall.
   - Jordan Tate emailed the Mayor asking if he has any updates regarding the FERC relicensing and how the Conservation Commission can contribute. Pete Preble had also spoken to him about that and how they have not figured out what their top priorities are going to be.

- v Eric Cousens sent Jordan the 2015 Lower Barker Electric Hydro Study. *She will forward it to everyone.*
- v River Day probably will not happen until fall. The walkway/trail on Mill Street along the Barker Arm Trail will be paved next week.

Transportation & Environment Committee
There was nothing to report on. The next meeting is 5/17/16.

4. Public Comments:
   Sabrina Best – Parks and Recreation Director
   The Parks and Recreation Committee are going to be re-implemented. Once it is established, the plan is to open the lines of communication and clearly define tasks and responsibilities for that committee, the Parks Sub-Committee, and any other related committees.

5. Old Business
   Project Canopy Update
   The work is expected to begin June 1st.

   Policies and Procedures Update
   Pete Preble made the suggested changes to the policy and procedures, forwarded it to the committee for review, and hope to be able to take action at the next meeting.

   Annual Report Update
   A draft of the Annual Report was distributed for members to review. The plan is to make adjustments over the next few weeks and have it completed for the June meeting. Nicole White-Matson would like to include a picture of the Sub-Committee, Lake Auburn, and possibly Taylor Pond.

   Priority Projects – Project Canopy, Barker Mill, Apatite Park, Trail Consolidation Efforts, Arbor Week, YMCA, LAWPC
   Pete Preble started assembling information from different websites like the Mt. Apatite Trail Map, Androscoggin Land Trust Interactive Map, City of Auburn Park Finder, and Maine Trail Finder for the Trail Consolidation Efforts. All agreed it is important to put "Park Finder" on Parks page of the website.

   ACTION: Tizz Crowley seconded by Bob Sipe moved to request that the city put a link to the parks finder link on the parks page of the city web site. The vote was unanimously approved

   It was suggested to create a working calendar for the Conservation Commission that identifies special weeks, like Arbor Week, and other activities to help define the work plan for the coming year so they can plan in advance to do something to acknowledge the special weeks, prioritize, and follow up. *Bob Sipe will start to put together a work calendar.*

*Jordan Tate does GIS for work and will communicate with the GIS personnel at City Hall to* express their interest and offer to assist with moving forward with the consolidation efforts on trails and information on trails in auburn and surrounding area

All agreed to identify and make a list of priority projects, rank them in order of importance, decide how they will approach the project(s), and identify people who may be the most interested and helpful for the project(s). It was noted that as they plan they need to keep in mind the tremendous changes that will take place with technology in next 5-10 years and to consider aging issues as well. They will have the first draft of the calendar of events next month. They will be able to see what is coming up and start to focus their efforts from it.

6. Other

Miscellaneous Correspondence - None

Reappointments – No Action

Next Meeting

The next meeting is June 21 at 6:00 p.m. *Pete Preble will invite the Androscoggin Land Trust to the next meeting.*

It was requested that the city provide a paper copy of materials if requested as they do with other board and committees.

7. Adjourn

ACTION: Nichole White-Matson seconded by Jordan Tate moved to adjourn at 7:31 pm. The motion was unanimously approved.

Submitted by:
Tammy Thatcher

# CITY OF AUBURN CONSERVATION COMMISSION POLICIES AND PROCEDURES

## ARTICLE I. Objectives

The objectives and purpose of the Conservation Commission of the City of Auburn, Maine, are those set forth in the Auburn City Charter, those powers and duties delegated to the Conservation Commission by the City Council in Chapter 2 Administration, Article 5 Boards, Commissions, and Committees, Division 5 Conservation Commission of the Auburn City Ordinances and those objectives and powers set forth in Maine Revised Statutes.

*Sec. 2-478. - Purpose.*

*The purpose of the conservation commission shall be to serve as a research, advisory and advocacy group on environmental and conservation issues relating to the city.*

*Sec. 2-480. - Powers and duties.*

*The commission:*

*(1) Shall keep records of its meetings and activities and make an annual report to the city council;*

*(2) Shall conduct research, in conjunction with the planning board, into local land areas, which shall be initiated by majority votes of both the commission and the planning board;*

*(3) Shall seek to coordinate the activities of conservation bodies organized for similar purposes;*

*(4) Shall keep an index of all open areas within the city, whether publicly or privately owned, including open marshlands, swamps and other wetlands, for the purpose of obtaining information relating to the proper protection, development or use of those open areas. The commission may recommend to the city council or to any board of the city or to any body politic or public agency of the state a program for the better protection, development or use of such open areas, which may include the acquisition of conservation easements;*

*(5) May advertise, prepare, print and distribute books, maps, charts, plans and pamphlets which it considers necessary, if municipal appropriations provide financial resources to do so;*

*(6) Shall assist staff in the preparation of park and trail plans, the identification of new sites to be added to the park system, recommendations on designation of open space areas, and grant assistance;*

*(7) Shall coordinate applications for grants from the federal or state governments, or private sources, to improve conservation assets for the city including parks, trail and the community forest.*

*(8) Shall undertake any other conservation or environmental activity referred to it by the city council.*

*(9) May recommend to the city council the acceptance of gifts in the municipality's name for any of the commission's purposes.*

*(10) Shall develop a plan for and provide advice to city staff and agencies regarding the management of the community forest including the anticipated impact of proposed development;*

*(11) Shall raise community awareness regarding the importance of the community forest;*

*(12) May raise funds to establish a community forest trust fund;*

*(13) Shall adopt by-laws to govern the internal affairs of the commission; and*

*(14) May perform such other functions as are permitted by this Code.*

*(Ord. No. 07-02022015, § 4, 2-17-2015)*

## ARTICLE II. Conservation Commission Membership

A. The membership and composition of the Conservation Commission shall be defined in the City of Auburn Code of Ordinances under Chapter2-Administration, Article 5 Boards, Commissions and Committees, Division 5-Conservation Commission , Section 2-477 .

*Sec. 2-477. - Commission established.*

*A conservation commission is hereby established pursuant to 30-A M.R.S.A. §§ 3261—3263 to consist of seven members appointed by the city council, all of whom shall be residents of the city. The terms of office shall be three years except that initial appointments after the date of adoption of the ordinance from which this division derives shall be such that the terms of no more than three members shall expire in any single year. For that purpose, the city council shall initially appoint three members for terms of one year, two members for terms of two years, and two members for terms of three years, such that the terms of approximately one-third of the members shall expire each year. There shall be one ex-officio member of the board consisting of the city manager or his/her designee.*

*(Ord. No. 07-02022015, § 1, 2-17-2015)*

B. Rules regarding the appointment of Conservation Commission members shall be defined in the City of Auburn Code of Ordinances under Chapter2-Administra-tion, Article 5 Boards, Commissions and Committees, Division 5-Conservation Commission.

C. Attendance at all Conservation Commission meetings (Public Hearings and Workshops) shall not drop below 50% within a 12 month period. If attendance does drop below this level, the Conservation Commission Chair will notify the member and the City Clerk that the seat is vacant and remove that Commission member. Three consecutive absences automatically terminate the member's term and the Chair will notify the City Clerk of the vacancy.

D. If a situation occurs that does not allow a Commission member to attend a meeting, a call or email to the Commission Chair or ~~Assistant~~ City Manager's office is required.

E. The Conservation Commission Chair may forward a recommendation to the City Council to remove a single Commission member for cause at any time

given that such action is taken under the consensus of the Conservation Commission.

## ARTICLE III. Officers and Their Duties

A. The Officers and their Duties of the Conservation Commission shall be defined in the City of Auburn Code of Ordinances under Chapter2-Administra-tion, Article 5 Boards, Commissions and Committees, Division 5-Conservation Commission , Section 2-481.

*Sec. 2-481. - Officers, meetings and records.*

*a) The members shall elect from their membership a chairperson, treasurer, a vice-chairperson and a secretary. Officers shall serve two-year terms.*

*(b) All meetings of the commission shall be open to the public, and notice, if required by law, should be provided to the public about such meetings.*

*(c) Minutes shall be kept of all meetings.*

*(Ord. No. 07-02022015, § 5, 2-17-2015)*

B. The Chair shall preside at all meetings and hearings of the Conservation Commission and shall have the duties normally conferred by parliamentary usage as written in "Roberts Rules of Order."

C. The Chair shall have the privilege of discussing all matters before the Commission and to vote thereon.

## ARTICLE IV. Election of Officers

A. Officers shall be nominated from the floor and elected at the regular June meeting. Election of Officers is to be listed as an agenda item.

B. If more than one member is nominated for the same position, then the Commission shall vote by private ballot.

C. A candidate receiving a majority vote of the membership of the Conservation Commission present at the meeting shall be declared elected and shall serve one year or until a successor shall take office.

D. Vacancies in offices shall be filled at the first possible regular meeting after the occurrence of the vacancy in the manner described in the previous Sections of this Article.

## ARTICLE V. Agenda Procedure

In order to be placed on the Conservation Commission agenda, topics shall be submitted to the Chair at least a week in advance of the regularly scheduled monthly meeting. Drafts of the agenda shall be distributed to the Vice Chair and the Secretary/Treasurer for review prior to distribution to Commission members.

## ARTICLE VI. Meetings

A. Date of Meeting

Regular meetings will be held on the third Tuesday of each month at 6:00 p.m. at Auburn Hall. The Commission may vote to hold its meeting on any other day in the month, or at any other place, or at any other time of day or upon confirmation of a majority of the Commission members.

B. Quorum and Voting *(comment: no quorum defined in our ordinance)*

. The basis for meeting a quorum, as well as taking action by voting, shall be defined ~~in the City of Auburn Code of Ordinances under Chapter __, Article __, Division __ Section __~~. A majority of the voting members of the Conservation Commission shall constitute a quorum for the transaction of business, but a smaller number may adjourn or compel attendance of absent members.

- As to any matter requiring a public hearing, no business shall be transacted by the planning board without a quorum, consisting of four members, being present. The concurring vote of at least four members shall be necessary to authorize any action by the board.
- (b)
- If less than a quorum is present, the hearing shall be rescheduled. The staff secretary shall notify in writing all members of the date of the reschedule hearing and shall notify such other interested parties as may be directed in the vote to reschedule.

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In addition, a tie vote shall be considered final action by the Commission and shall be deemed failed if the Commission's final action results in a tie vote. Voting shall be by roll call where requested by any member except on unanimous vote. A record of the roll call vote shall be kept as part of the record.

C. Special Meetings

Special meetings may be called by the Chair or by four members of the Commission. The notice of such a meeting shall specify the purposes for which it is called and no other business shall be considered except by unanimous consent if all Commission members are present. The Staff Secretary shall notify all members of the Commission at least two (2) days in advance of such special meeting.

D. No New Business

No new agenda items will begin after ~~7:30~~ 8:00 p.m. except with the unanimous consent of all Commission Members present.

E. Postponement Due to Time

If during the course of a Conservation Commission meeting it becomes apparent that the Commission will not reach certain agenda items, the Commission, prior to or after the 7:30 p.m. cut-off may postpone items or portions of items to the next scheduled meeting of the Commission by majority vote of members present at the meeting.

F. Associate Members

If seven regular Conservation Commission Members are not present, then the Associate Commission Members will take the place of the absent members for voting purposes in an alternating manner. The participating Associate Member(s) will have full voting privileges.

The voting Associate member shall be done in Alphabetical order, starting with the next Associate member in line that did not vote in the last occasion. The voting Associate member's name shall be noted in the minutes.

## ARTICLE VII. Order of Business

A. The normal order of business for the Commission shall be as follows:

1. Roll Call
2. Approval of Minutes
3. Public Hearings
4. Old Business
5. New Business
6. Public Comment
7. Miscellaneous
8. Adjournment

B. Changing the Order of Business

The normal order of business may be altered by consent of the Commission.

## ARTICLE VIII. Public Hearings

A. Additional Public Hearing

In addition to those required by law, the Commission may, at its discretion, hold public hearings when it decides that such hearings will be in the public interest.

B. Public Notice

The City shall publish in a newspaper, 2 public notices; the first at least 12 days before the hearing and the second notice at least 7 days before the hearing. Each notice shall state the time, date, place and general information on the subject to be heard.

The same notice shall be posted to the City website and any other social media forms used by the City. An e-alert shall be sent to all subscribers of the City website.

C. Additional Notification

The City Clerk's office shall post all available application materials on the City website by the Friday prior to the public hearing. In addition, notice may be sent by requests from identified community/neighborhood groups, City Councilors, other interested citizens or public agencies that might be interested or affected.

D. Policies and Procedures Manual

The Staff shall make Conservation Commission's Policies and Procedures Manual available to member of the Public during the application process and to interested parties on the City's website.

E. Preparation for the Public Hearing-

All the information, plans, reports and the like that may be presented or used at the public hearing shall be presented to the Commission Chair no later than end of day the Wednesday before the Conservation Commission meeting and shall be made available to the public by the close of business on the Friday preceding the hearing. The objective is to provide time for the staff, the Commission and the public to have a reasonable time period to review and analyze all the material. No information, plan, report or the like may be submitted on the day of or at the public hearing unless approved by the Conservation Commission.

The staff shall post all meeting materials including the agenda, draft minutes, the staff report, and all application materials, on the City of Auburn Conservation Commission website page by the close of business on the Friday preceding the hearing. All materials shall be available for inspection in the office of the Public Services Department during business hours.

Similarly, if members of the public have prepared written material or reports about an agenda item in a compatible electronic format, they should

coordinate with the staff in order for it to be included in the meeting material to be posted.

These Policies and Procedures will be posted on the City's website so the public will be aware how the hearing will be conducted.

F. Conduct at the Public Hearing

1. Status of Commission Members:

Any regular Commission member may want to recuse him/her self from acting on the agenda item because of a conflict of interest or personal reason. Any member who does shall surrender his/her seat and either leave the chamber or sit in the back of the room. Such member shall not communicate with other members of the Commission who are acting on an agenda item and shall not address the Commission if they are a party at interest who is potentially affected by agenda item.

In the case where a member does not have a conflict of interest, as defined by (Maine Revised Statutes, Title 1, Chapter 25 and M,R.S.A. Section 2605, Chapter 30-A, Conflict of Interest; and Auburn Code of Ordinances-, Chapter 2, Administration, Article III, Officers and Employees, Division 2, Ethics and Conflicts of Interest) but believes he/she may have the appearance of a conflict, the member shall state the situation and the remaining regular members of the Commission shall vote whether they believe a conflict does exist and the member should sit or not.

One Associate member shall be selected to hear and act upon the agenda item for each regular member who is absent or recuses him/her self. Sitting in a public hearing shall be alternated between the two Associate members.

In the case where a hearing is continued to a subsequent meeting and all of the members who sat on the original hearing are not present, a regular member who was absent at the earlier hearing may sit on the continued meeting provided he/she certifies that he/she has familiarized themselves with the testimony and proceedings of the previous hearing.

2. Staff Report:

A member of the staff shall present the report prepared by the staff or any other relevant information. Commission members may ask questions and seek clarification of the agenda item, potential impacts of the agenda item, if approved, provisions of any Ordinance or of other applicable regulations and laws. It is not appropriate, at this time, for Commission members to comment on the merits of the agenda item and whether it should be approved or not. Those comments should be reserved until after the presentation by the member of the Public and testimony given by the public. The Staff Report will also contain draft motions and findings for either approval or disapproval.

3. Presentation by the Petitioner/Member of the Public-

After the presentation of the staff report and questions about it from the Commission, the member of the Public shall make the case for ~~approval~~ the

petitioner's position on ~~of~~ the agenda item and any analysis of the potential impacts of the proposed recommendation. The member of the Public shall be prepared to respond to questions from the Commission or the staff member.

4. Public Participation and Comments:

A public hearing is an open meeting as described in (M.R.S.A., Title 1, Section403 and Auburn Code of Ordinances-, Chapter 2 – Administration, Article V, Commissions, Commissions and Committees, Divisions 4, Planning Commission). The public is entitled to listen to the proceedings. The public is invited to participate in the proceedings at times designated herein. An open meeting does not mean the public is allowed to participate in an ongoing dialogue with the Commission or the staff member throughout the meeting. Any person may speak; it is not limited to residents of Auburn. Any person who speaks may support, or oppose the agenda item or ask questions of the staff member, the Commission or the member of the Public.

The member of the Public, any member of the public, or any public official addressing the Commission shall use the microphones in the chamber. They shall first give their name and address and if representing and speaking in behalf of another party shall so state. All public hearings are recorded to be available for the record. If a person does not use the microphone their comments may not be recorded.

Any member of the public or any public official addressing the Commission shall be limited in speaking to 10 minutes. At the Chair's discretion, an

additional 10 minutes may be granted. A speaker should not repeat, at length, arguments or points made by previous speakers. They should briefly state their agreement or support for those positions. Reading of prepared speeches is not encouraged- but the information may be provided in writing and become part of the meeting materials. The Commission welcomes submittal of prepared written statements that will be included in the record.

This part of the hearing is not intended to be a debate, dialogue or rebuttal between the speaker and the Commission or staff. Primarily the Commission will listen to the testimony but may ask questions of the speaker for clarification of his/her position.

Speakers will be recognized in the order in which they come forward. The hearing is not arranged to hear all of the proponents and then all of the opponents, or vice versa.

It is not the practice of the Commission to take a poll of those in favor and those opposed. The number of people with a particular position is not a factor; the strength of their arguments is what matters.

In the interests of an orderly public hearing all persons speaking shall seek recognition from the chair and shall not speak directly to Commission members, staff or other members of the public except as the Chair may direct. Commission members and staff shall also seek recognition from the chair before speaking to other persons.

The objective of the hearing is to hear testimony. There will be time for dialogue and debate on the merits of the agenda item by the Conservation Commission later. After all persons who want to speak have done so, the Commission will move to close the public comment part of the hearing. After that motion, discussion will be limited to Commission members and staff.

5. Discussion, Action by the Commission:

   After the presentation by the member of the Public and public comment, the Chair will call for a general discussion among the Commission to gauge their perspective on the agenda item. Members may, through the chair, direct a question to the member of the Public for clarification. Also, members may think the agenda item might be acceptable if subjected to certain limiting conditions. Through the chair, the member may ask the member of the Public whether such condition is acceptable.

   After general discussion, if it appears there is a consensus, a motion will be in order. After a motion is made and seconded, there will be discussion on the specific motion. Other members may suggest amendment to the original motion and ask the maker of the motion if it is acceptable.

   Following parliamentary procedure the Commission will decide, by vote, whether to approve, with or without conditions, disapprove or defer action on the agenda item. The vote of the Commission on the motion constitutes the decision of the Commission and for determining the timing of subsequent actions, such as appeals.

After the vote is taken and the decision made, the Chair shall announce that the member of the Public will receive written record of the decision within 5 working days of the decision, which shall also be posted on the City's website.

## ARTICLE IX. Jurisdiction and Duties

A. The jurisdiction and duties of the Conservation Commission shall be defined in the City of Auburn Code of Ordinances under Chapter 2 Administration, Article 5 Boards, Commissions, and Committees, Division 5 Conservation Commission

## ARTICLE IX. Amendments

These Policies and Procedures may be amended by a majority vote of the membership of the Conservation Commission present, to include both Regular and Associate members of the Commission, provided that a quorum, consisting of five members is met. An affirmative vote by at least five members shall be necessary to authorize any action to amend the By-Laws.

The Conservation Commission will review these Policies and Procedures every two years at its annual meeting in June.

* Disclaimer: These Policies and Procedures are for the benefit of the Auburn Conservation Commission, member of the Publics seeking Conservation Commission action, and the general public. Any conflict between the Auburn Conservation Commission's Policies and Procedures and State or Local laws shall be superseded by State or Local law.

These Policies and Procedures of the Conservation Commission for the City of Auburn were approved by the Conservation Commission on _____ and were approved by the City Council on _____.

2016

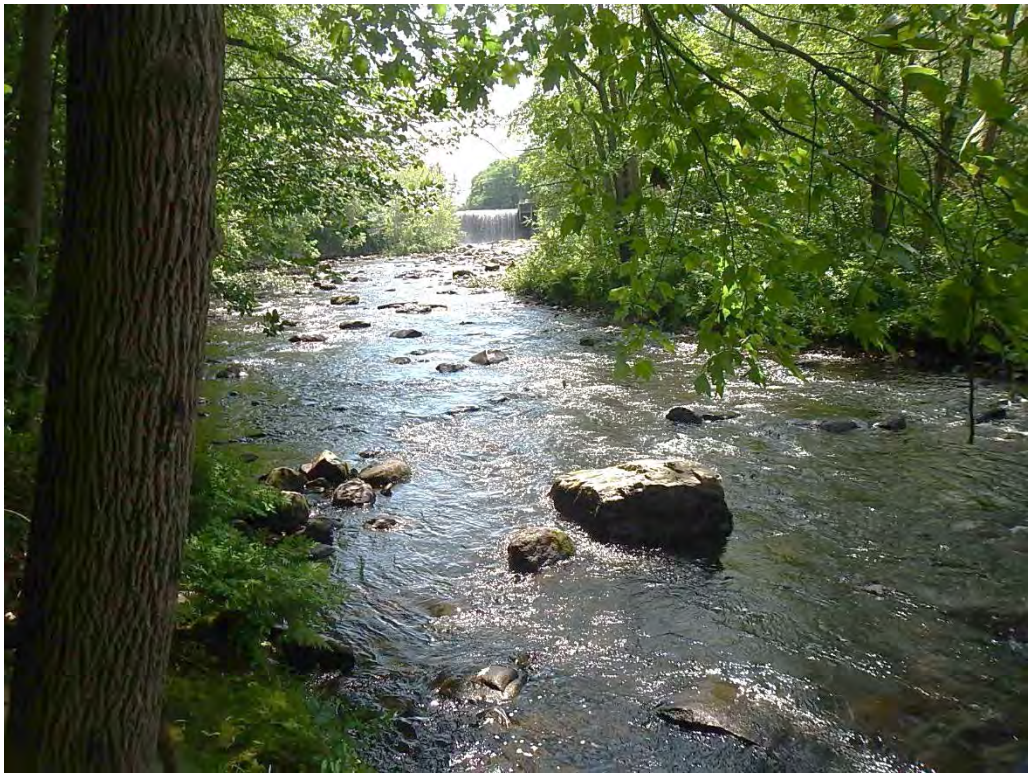
# JANUARY

| M | T | W | T | F | S | S |
|---|---|---|---|---|---|---|
| 28 | 29 | 30 | 31 | 1<br>**01/01/16** to 01/01/17<br>KEI Inc Creates draft of final License Application for Barker Mill Dam and reviews with community. | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21<br>Community Forest Subcomittee | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31<br>2019<br>FERC grants or refuses to grant new license for Barker Mill Dam. |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

# 2015 STUDY REPORT

## LOWER BARKER HYDROELECTRIC PROJECT

FERC NO. 2808



***Prepared for:***

## KEI (Maine) Power Management (III) LLC
## Lewiston, Maine

***Prepared by:***

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

May 2016

# 2015 STUDY REPORT

## LOWER BARKER HYDROELECTRIC PROJECT
## FERC NO. 2808

*Prepared for:*

KEI (Maine) Power Management (III) LLC
Lewiston, Maine

*Prepared by:*

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

May 2016

**2015 STUDY REPORT**

**LOWER BARKER HYDROELECTRIC PROJECT**
**FERC PROJECT NO. 2808**

**KEI (MAINE) POWER MANAGEMENT (III) LLC**
**LEWISTON, MAINE**

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**LOWER BARKER HYDROELECTRIC PROJECT**
**FERC PROJECT NO. 2808**

**KEI (MAINE) POWER MANAGEMENT (III) LLC**
**LEWISTON, MAINE**

# 1.0 INTRODUCTION

The Lower Barker Project (FERC No. 2808) is on the Little Androscoggin River approximately a half mile upstream of the confluence of the Little Androscoggin and Androscoggin rivers in Auburn, Maine (Figure 1). KEI (Maine) operates two hydroelectric turbine and generator units at the Lower Barker Project that can produce up to approximately 1.2 megawatts[1] of clean, renewable energy. KEI (Maine)'s average annual generation is approximately 5,250 megawatt hours of electricity. The Lower Barker Project has a maximum hydraulic capacity of 500 cubic feet a second (cfs) and a minimum hydraulic capacity of 150 cfs. A minimum flow of 20 cfs is conveyed to the bypassed reach. After passing through the turbine units, water discharges back into the Little Androscoggin River from a small powerhouse approximately 3,000 feet downstream of the dam.

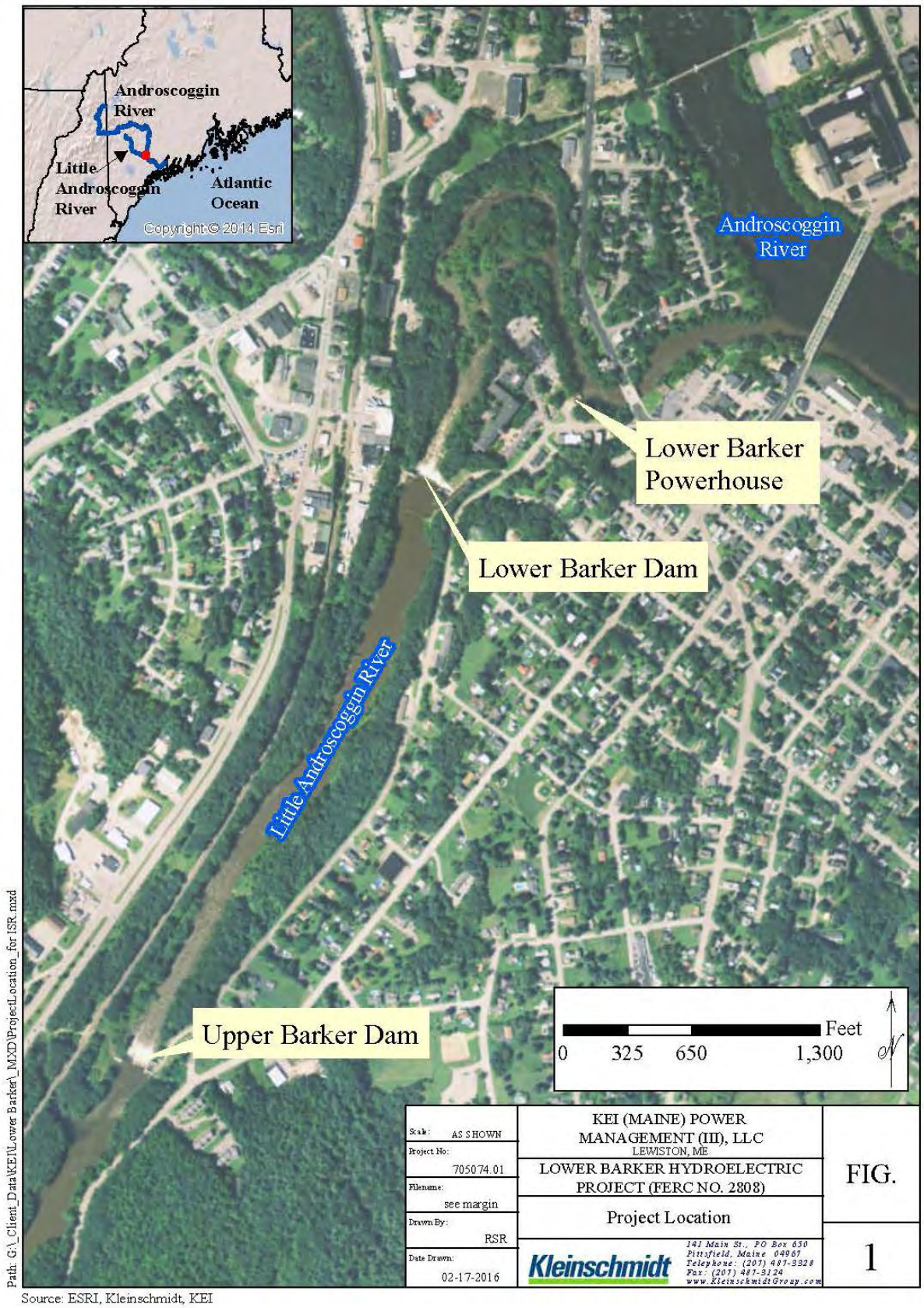
The Federal Energy Regulatory Commission (FERC) issued the original license to operate the Lower Barker Project on February 23, 1979, for a period of 40 years; the license expires on January 31, 2019. KEI (Maine), the current licensee, is in the process of developing an application to relicense the Lower Barker Project, which must be filed with FERC on or before January 20, 2017. KEI (Maine) is using FERC's Traditional Licensing Process (TLP).[2] KEI (Maine) filed a notice of intent and pre-application document (PAD) to initiate the relicensing of the Lower Barker Project on January 31, 2014. The PAD provides a complete description of the Lower Barker Project, including its structures, operations, and potential resource issues. KEI (Maine) distributed the PAD to federal and state resource agencies, local governments, Native American tribes, and others thought to be interested in the relicensing proceeding. KEI (Maine)

[1] Approximate maximum instantaneous generation capacity.
[2] As defined by Title 18 of the U.S. Code of Federal Regulations (CFR), Part 4. FERC approved KEI (Maine) to use the TLP on March 19, 2014.

held a joint agency and public scoping meeting and a site visit on July 30, 2014. KEI (Maine) also held a meeting with the fisheries agencies on December 5, 2014, to discuss goals for restoration, fish passage, and aquatic habitat for the Little Androscoggin River and the agencies' study requests. The PAD and the scoping process identified issues associated with the baseline environmental conditions at the Lower Barker Project for which the existing, relevant, and reasonably available information was insufficient.

KEI (Maine) issued a proposed study plan (PSP) on March 6, 2015, that outlined studies for collecting information about the potential effects of the Lower Barker Project on resources identified during scoping and consultation with the agencies and stakeholders in 2014. KEI (Maine) then developed a final study plan based on comments received from the stakeholders on the PSP and submitted it to the stakeholders and FERC on June 5, 2015. The final study plan included studies of (1) water quality, (2) benthic macroinvertebrates, (3) juvenile American eels, (4) bypassed reach aquatic habitat and minimum flow, (5) historic properties, (6) cultural resources, and (7) recreational needs. On November 6, 2015, KEI (Maine) hosted a meeting with state and federal resource agencies to discuss progress of studies completed during the 2015 field season.

Sections 3.0 through 6.0 of this report present the results of the studies of water quality, benthic macroinvertebrates, juvenile American eels, and minimum flow in the bypassed reach. The reports for the historic properties and the cultural resources studies contain confidential information and were provided to the Maine State Historic Preservation Office (SHPO) on February 24, 2016 and December 21, 2015, respectively; these reports will be filed with FERC under separate cover. Based upon SHPO review of the 2015 reconnaissance study report, it was determined that Phase 1 cultural study work should be conducted in 2016. The studies completed in 2015 and 2016 will provide the information necessary for the stakeholders to assess the potential effects of the Lower Barker Project on aquatic, fishery, and cultural resources.




Source: ESRI, Kleinschmidt, KEI

**FIGURE 1 LOWER BARKER HYDROELECTRIC PROJECT**

# 2.0 OVERALL PROGRESS OF STUDIES AND RELICENSING

## 2.1 IMPLEMENTATION OF STUDIES

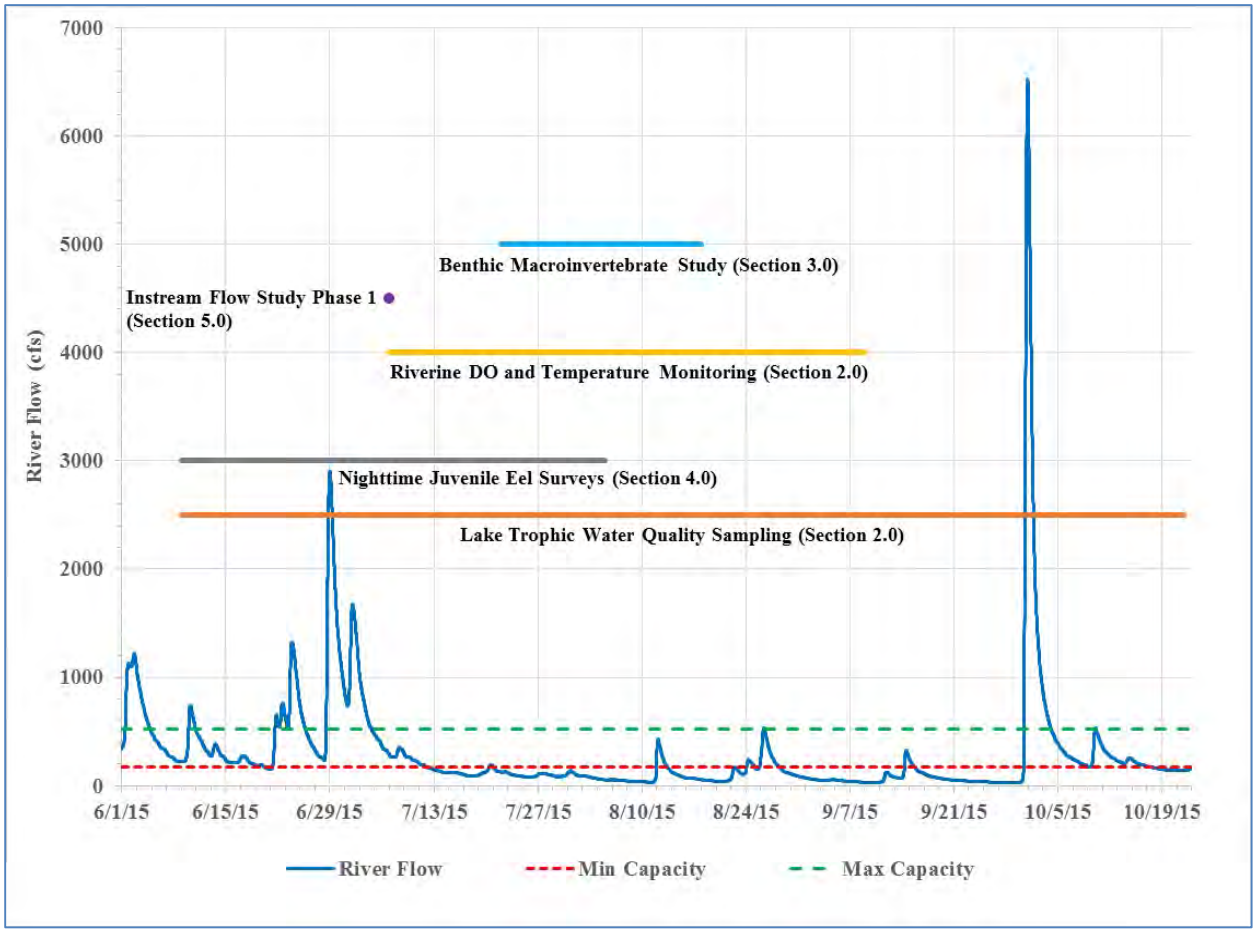
KEI (Maine) completed the 2015 water quality study, juvenile American eel study, benthic macroinvertebrate study, Phase 1 of the instream flow study, historic properties study, and cultural reconnaissance study in accordance with the methods described in the final study plan (Table 1). KEI (Maine) plans to complete Phase 2 of the instream flow study, the recreational needs study, and a Phase 1 cultural resources study in 2016

Figure 2 shows river flow as measured at the South Paris gauge (USGS Gage No. 01057000) prorated to the Lower Barker dam, the minimum and maximum hydraulic capacities of the project, and the corresponding time periods of the 2015 studies. River flow ranged from approximately 26 cfs to 6,528 cfs. The Lower Barker Project generates at river flows between 170 and 520 cfs; therefore, KEI (Maine) was not generating at the Lower Barker Project throughout most of the monitoring period. KEI (Maine) often does not generate in the summer because of naturally occurring low river flows (see Section 6.0).

**TABLE 1 DESCRIPTION AND STATUS OF INDIVIDUAL STUDIES FOR LOWER BARKER RELICENSING**

| STUDY DESCRIPTION | STATUS |
|---|---|
| Water Quality | Completed in 2015 – Study report in Section 3.0 |
| Benthic Macroinvertebrates | Completed in 2015 – Study report in Section 4.0 |
| Juvenile American Eels | Completed in 2015 – Study report in Section 5.0 |
| Minimum Flow in the Bypassed Reach | Phase 1 completed in 2015 – Study report in Section 6.0<br>Phase 2 to be completed in May 2016 |
| Historic Properties* | Completed in 2015 |
| Cultural Study* | Reconnaissance Study Completed in 2015<br>Phase 1 study to be completed in 2016 |
| Recreational Needs | To be completed in 2016 |

* These reports contains confidential information and are being provided to SHPO and FERC under separate cover.




Note: The drainage area at the USGS gauge is 73.5 square miles, and the drainage area at the Lower Barker dam is 357.4 square miles; therefore, the data from the gauge were prorate by a factor of 4.86.

**FIGURE 2 RIVER FLOW FROM USGS GAUGE 01057000 FROM JUNE 1 TO OCTOBER 31, 2015 AND DURING THE STUDIES CONDUCTED IN 2015**

## 2.2 PROJECT RELICENSING

KEI (Maine) intends to file the draft license application (DLA) by July 31, 2016, and it will include the application content required by Title 18 CFR 4.60 and 16.10. The DLA will include a detailed description of the existing and proposed project facilities, existing and proposed operations and maintenance, and a draft environmental analysis. Table 2 provides KEI (Maine)'s planned schedule for completing the relicensing effort.

**TABLE 2 RELICENSING PROCESS PLAN AND SCHEDULE – LOWER BARKER PROJECT**

| RESPONSIBLE PARTY | TLP STEPS | TIMELINES | TARGET DATE |
|---|---|---|---|
| ***Licensee*** | ***Stage 1 - NOI/PAD Filed*** | ***Not later than 5 years prior to expiration*** | ***01/30/14*** |
| ***FERC*** | ***Commission Notice NOI Filed*** | ***30 days after PAD filed*** | ***03/01/14*** |
| ***Licensee*** | ***Notice of Joint Agency Meeting*** | ***15 days Prior to Joint Meeting*** | ***03/31/14*** |
| ***Licensee*** | ***Joint Agency and Public Meeting*** | ***45 days after NOI Notice*** | ***04/15/14*** |
| ***Stakeholders*** | ***Comments on PAD, study requests*** | ***60 days after meeting*** | ***06/14/14*** |
| ***Licensee*** | ***Stage 2 - Conduct First Year Studies*** | | ***09/12/14*** |
| ***Licensee*** | ***First Year Study Report Issued*** | | ***05/17/16*** |
| Licensee | Study Report Meeting | | As needed |
| Licensee | Complete Instream Flow, Recreation, and Cultural Studies | | Spring/Summer 2016 |
| Licensee | Issue Draft Application for Comment | | 7/31/16 |
| Licensee | Agency and Public Meetings | 60 days after Study Report | TBD |
| Stakeholders | Comments on Draft Application | 90 days after draft issued | 10/29/16 |
| Licensee | Agency meetings to resolve PME Measures | | TBD |
| Licensee | Prepare Final Application | | Dec/Jan 2017 |
| Licensee | Stage 3 - Final Application Filed with FERC | | 01/31/17 |
| | License Expiration | | 01/31/19 |

* Steps that are italicized bold have been completed.

# 3.0 WATER QUALITY STUDY

## 3.1 INTRODUCTION

The Maine Department of Environmental Protection (MDEP) requested that KEI (Maine) assess whether the operations of the Lower Barker Project affect water quality or the ability to provide for "recreation in and on the water" and "habitat for fish and other aquatic life," which are two designated uses of the waterway. Maine statute 38 MRSA §464-470 establishes the state of Maine's classification system for surface waters. The lower section of the Little Androscoggin River from South Paris, Maine, to the confluence with the Androscoggin River is a Class C waterway (Maine Legislature 1989). The quality of Class C waters must support the designated uses of drinking water supply after treatment, fishing, agriculture, recreation in and on the water, industrial process and cooling water supply, hydroelectric power generation, and habitat for fish and other aquatic life. Discharges in Class C waterways are permitted to cause some changes for aquatic life, provided that the receiving waters remain of sufficient quality to support all species of fish indigenous to the receiving waters and to maintain the structure and function of the resident biological community (Maine Legislature 1989, 38 MRSA§465).

Pursuant to the final study plan, KEI (Maine) completed lake trophic,[3] riverine, and benthic macroinvertebrate monitoring during the late spring, summer, and fall of 2015 to assess baseline water quality. KEI (Maine) employed lake trophic, riverine, and macroinvertebrate sampling methods in accordance with MDEP's protocols (MDEP 2014a). Table 3 lists the Class C water quality standards for parameters monitored during this study. Currently, the state of Maine has no established standards for nutrient concentrations in freshwater, but the state has drafted criteria based on nutrient concentrations and environmental response indicators.

[3] A means of classifying lakes in terms of their productivity.

**TABLE 3 ESTABLISHED AND PROPOSED MAINE WATER QUALITY STANDARDS FOR SELECT PARAMETERS**

| PARAMETER | CRITERIA | WATER CLASSIFICATION |
|---|---|---|
| Dissolved Oxygen | >5 mg/l or 60% saturation; 30-day average of 6.5 mg/l in salmonid spawning areas | Class C |
| Iron[b] | 1000 µg/l or 1 mg/l | Statewide |
| Chloride[b] | 230,000 µg/l or 230 mg/l | Statewide |
| Aluminum[b] | 87 µg/l or 0.087 mg/l | Statewide |
| Total Phosphorus[c] | ≤ 33 µg/l (0.033 mg/l) | Class C |
| Water Column Chlorophyll-a[c] | ≤ 8 µg/l (0.008 mg/l) | Class C |
| Secchi Disk Depth[c] | ≥ 2.0 m | Class C |
| pH[c] | 6.0 – 8.5 | Class C |

[a]Maine Legislature 1989
[b]MDEP 2012a
[c]MDEP 2012b

To meet the designated use "recreation in and on the water," lakes and ponds must have a stable or decreasing trophic state, be subject only to natural fluctuations, and be free of culturally induced algal blooms that impair their use and enjoyment (Maine Legislature 1989, 38 MRSA§465-A). Rivers and streams (including impoundments classified as such) must also be free of culturally induced algal blooms that impair their use and enjoyment. An algal bloom is defined as a planktonic growth of algae that causes Secchi disk transparency to be less than 2.0 meters or excessive chlorophyll-a concentrations (MDEP 1996). The lake trophic sampling protocol was developed to evaluate the trophic state and to determine the attainment status of the impoundment relative to the designated use "recreation in and on the water."

To meet the designated use of "habitat for fish and other aquatic life," existing hydropower impoundments classified as Great Ponds or as rivers and streams, and downstream river and stream reaches affected by hydropower projects are required to "maintain structure and function of the resident biological community" (Maine Legislature 1989, 38 MRSA§464). To assess whether the operation of the Lower Barker Project meets this designation," KEI (Maine) studied

benthic macroinvertebrate (Section 4.0) and is in the process of completing an instream flow habitat study in the bypassed reach below the dam (Section 6.0).

In accordance with the final study plan, the goal of this study was to collect baseline water quality information and to use the information to assess whether the Little Androscoggin River in the Lower Barker Project area meets applicable water quality standards. The objectives of the study were to assess:

- effects of the impoundment on the designated use "recreation in and on the water";
- effects of the project on the designated use "habitat for fish and aquatic life"; and
- effects of the project on dissolved oxygen (DO).

## 3.2 METHODS

### 3.2.1 IMPOUNDMENT SAMPLING

The impoundment is shallow and narrow with a total volume of approximately 150 acre-feet and a surface area of 16.5 acres. Prior to sampling, KEI (Maine) used a sounding weight to find the deepest spot in the impoundment to establish a sampling station. The sampling station was located approximately 200 feet (61 meters) upstream of the dam in approximately 13.1 feet (4 meters) of water. The water is nearly 30 feet deep immediately upstream of the dam; however, the sampling station was located upstream of the boat barrier because of safety concerns. A buoy was deployed to mark the sampling location for the monitoring period (Figure 3, Photo 1). KEI (Maine) collected water samples twice a month from June through October using an epilimnetic core.[4] All samples were collected in the afternoon between 12:15 and 16:05. As discussed in Section 3.3.3, the impoundment did not thermally stratify; therefore, each sample was an epilimnetic core of the entire water column. All water samples were stored on ice and delivered within 24 hours to the state of Maine's Health and Environmental Testing Laboratory (HETL) in Augusta for analysis of total alkalinity, color, pH, chlorophyll-a, and total phosphorus (Table 4). On August 13, 2015, and in accordance with MDEP protocols, KEI (Maine) collected and submitted additional water samples to HETL for analysis of conductivity, chloride, nitrate, sulfate, calcium, iron, magnesium, potassium, silica, sodium, aluminum, and dissolved organic carbon .

[4] Small-diameter hosing used to take a sample of the water column.

**TABLE 4 IMPOUNDMENT SAMPLING PARAMETERS AND REPORTING LIMITS**

| PARAMETER | SAMPLING METHOD | HETL REPORTING LIMIT |
|---|---|---|
| Secchi Disk Transparency | Water Scope | 0.1 meter |
| Temperature | Profile | 0.1C |
| Dissolved Oxygen | Profile | 0.1 mg/l |
| Total Phosphorus | Epilimnetic Core | 0.002 mg/l |
| Chlorophyll-a | Epilimnetic Core | 0.001 mg/l |
| Color | Epilimnetic Core | 5.0 platinum cobalt units |
| pH | Epilimnetic Core | field measure |
| Total Alkalinity | Epilimnetic Core | 1.0 mg/l |
| Nitrate | Epilimnetic Core | 0.05 mg/l |
| Dissolved Organic Carbon | Epilimnetic Core | 1.0 mg/l |
| Iron | Epilimnetic Core | 0.2 mg/l |
| Aluminum | Epilimnetic Core | 0.2 mg/l |
| Calcium | Epilimnetic Core | 1.0 mg/l |
| Magnesium | Epilimnetic Core | 1.0 mg/l |
| Sodium | Epilimnetic Core | 1.0 mg/l |
| Potassium | Epilimnetic Core | 1.0 mg/l |
| Silicon | Epilimnetic Core | 0.50 mg/l |
| Specific Conductance | Epilimnetic Core | 2 µs/cm |
| Chloride | Epilimnetic Core | 1 mg/l |
| Sulfate | Epilimnetic Core | 1 mg/l |

During each lake sampling event, KEI (Maine) collected Secchi disk transparency measurements and temperature and DO profiles at 1-meter intervals with a YSI 550A. The meter was calibrated in the field prior to each sampling event. The accuracy of the YSI 550A meter is ±0.3 mg/l or ±2% of reading, whichever is greater, for the DO concentration; ±2% air saturation or ±2% of reading, whichever is greater, for DO percent saturation; and ±0.3°C for temperature. KEI (Maine) also collected data at the deep spot in the Upper Barker Project (FERC No. 3562) impoundment in preparation for the upcoming relicensing.

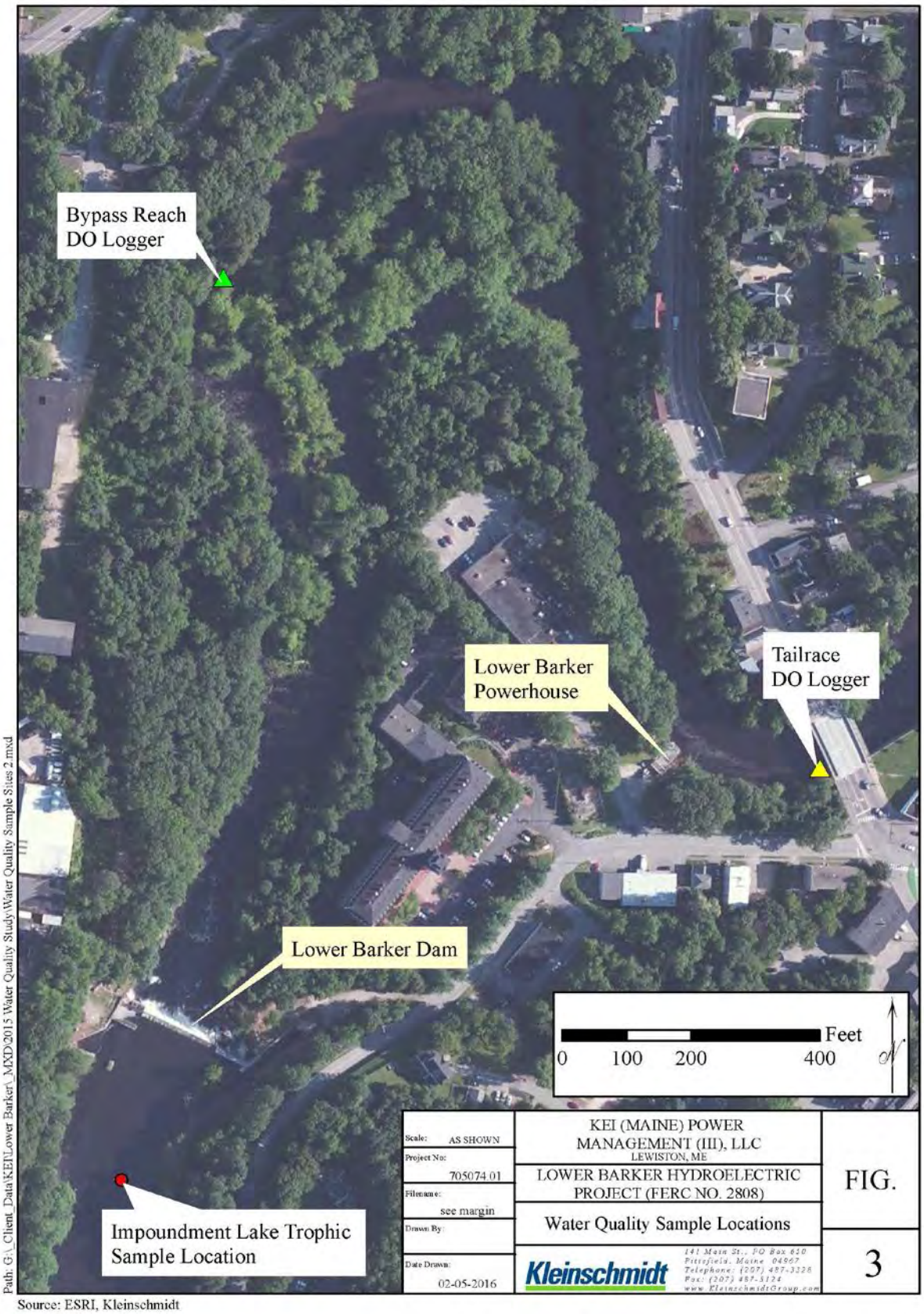



**FIGURE 3 2015 WATER QUALITY SAMPLING LOCATIONS, LOWER BARKER PROJECT**


**PHOTO 1 IMPOUNDMENT SAMPLING SITE AS SEEN FROM THE DAM**

### 3.2.2 RIVERINE SAMPLING

KEI (Maine) discharges water that is used for generation back into the Little Androscoggin River approximately 0.54 river mile (RM) downstream of dam, creating a small riverine bypassed reach. KEI (Maine) provides a minimum flow of 20 cfs to the bypassed reach when there is no spill over the dam. In accordance with the study plan, KEI (Maine) monitored DO and water temperature at two locations downstream from the dam using Onset Hobo U26-001 DO data loggers (Figure 3) One logger was on the river left[5] side of the bypassed reach approximately 1,250 feet (381 meters) downstream from the dam (Photo 2); the second logger was approximately 225 feet (69 meters) downstream from the powerhouse (Photo 3). Both DO loggers were enclosed in 2-inch-diameter perforated PVC pipe, attached with a cable, and anchored into rip-rap and tree trunks along the shoreline. The water depth at the sensors was approximately 2 to 4 feet depending on river flow and unit operations. The data loggers were equipped with a bio-fouling guard and were calibrated according to the manufacturer's specifications. The loggers were programmed to sample the DO concentration at 1-hour intervals

[5] All references to river left or river right are from the perspective of an observer looking downstream.

from July 7 to September 9, 2015, during the summer period of low flow and high temperature. Data downloads and system checks were performed every 1 to 2 weeks during the monitoring period. During each download, researchers measured DO with a hand held YSI 550A meter to compare to measurements of the Onset data logger and to assess whether the data logger needed additional calibration. The data logger was accurate to ±0.2 mg/l. A barometer was installed next to the powerhouse to measure real-time air pressure data used to calculate DO percent saturation.

MDEP requested that the DO loggers be positioned within salmonid spawning areas, if present. Potential spawning areas were identified based on the presence of suitable mesohabitat, such as unembedded gravel or cobble bars in riffles, during Phase 1 of the bypassed reach instream flow study conducted on July 7, 2015 (see Section 6.0). One potential spawning area was identified, and the DO logger for the bypassed reach was installed there (Photo 2 and Figure 3).


**PHOTO 2** **LOCATION OF DO LOGGER IN THE BYPASSED REACH OF THE LOWER BARKER PROJECT**


**PHOTO 3** **LOCATION OF DO LOGGER IN THE TAILRACE OF THE LOWER BARKER PROJECT AS SEEN FROM THE POWERHOUSE**

## 3.3 RESULTS

### 3.3.1 IMPOUNDMENT SAMPLING

**Total Phosphorus**

Total phosphorus is an indicator of nutrient levels and is a measurement of both organic and inorganic phosphorus in the water. Phosphorus is an important nutrient required for plant growth and is often a limiting nutrient; however, too much phosphorus can lead to algal blooms. In the Lower Barker impoundment, total phosphorus ranged from 0.013 to 0.031 mg/l with an average 0.021 mg/l (Table 5). Total phosphorus levels were below the proposed state standard upper limit of 0.033 mg/l for Class C waters (Table 5).

**Color**

Color is an indicator of water clarity and is a measure of the amount of dissolved organic acids and suspended matter in the water. Water with a color value greater than 25 platinum cobalt units (PCU) is considered to be colored and may have a reduced Secchi disk transparency. Throughout the sampling period, color ranged from 23 to 46 PCU with an average of 33.5 PCU (Table 5). The higher color values (greater than 40 PCU) in June and early July suggest that the impoundment was colored. Higher river flows (approximately 30 to 600 cfs) following spring runoff in June probably flushed soil and organic matter into the river, contributing to the high color values. Color values were lower in late July, August, and September (23 to 30 PCU) (Table 5). In addition, approximately 5 inches of rain fell in the region during a heavy storm on September 30, 2015(NRCC 2016), which probably resulted in the increased color value of 46 PCU in the sample collected on October 6, 2015.

**Chlorophyll-A**

Chlorophyll-a is a photosynthetic pigment found in algae and plants and is an indicator of algal levels and biological productivity in the water. Large concentrations of chlorophyll-a can be an indication of eutrophication (i.e., excessive nutrient inputs leading to algal blooms) that can adversely affect lacustrine or riverine processes or DO concentrations. Throughout the 2015 sampling, chlorophyll-a ranged from 0.0024 to 0.0037 mg/l with an average of 0.0030 mg/l (Table 5). The concentration of chlorophyll-a in the Lower Barker impoundment was less than the proposed state standard upper limit of 0.008 mg/l in all samples (Table 5).

## Alkalinity

Alkalinity (i.e., buffering capacity) is an indicator of the water's capacity to neutralize acids or buffer against changes in pH; water bodies with alkalinity values less than 10 mg/l are considered poorly buffered (MDEP 2015). Sources of alkalinity include rocks, soil, salts, and algal activity (MDEP 2015). Total alkalinity in the Lower Barker impoundment ranged from 12 to 23 mg/l with an average of 18.1 mg/l (Table 5) indicating that the water had adequate buffering capacity. Increased river flows and runoff may have contributed to the lower alkalinity values (i.e., reduced buffering capacity) in the June, early July, and October samples (15 mg/l or less) (Table 5).

## pH

pH is a measure of the acidity of water and regulates the biological processes that may occur in a water body. Maine's HETL recommends that pH should be analyzed immediately after sampling; therefore, HETL considers the results presented in Table 5 to be estimates. pH ranged from 6.5 to 7.0 with an average of 6.8 (Table 5). All pH values were within the recommended range of 6.0 to 8.5 for Class C waters.

## Secchi Disk

Secchi disk transparency is a measure of the clarity of water and is the distance that visible light penetrates through the water column. Transparency in a water column is influenced by suspended particles (e.g., algae, zooplankton, and silt) and water color and is an indirect measure of algal growth. In the Lower Barker impoundment, the Secchi disk transparency ranged from 1.3 to 4.1 meters with an average of 2.5 meters (Table 5). The Secchi disk transparency was less than the proposed standard of 2.0 meters on June 24, August 13, and October 22. In general, the lower Secchi disk readings (less than 3.0 meters) corresponded with periods of higher river flows, suggesting that increased amounts of soil or organic matter contributed to the reduced transparency levels rather than larger concentration of algae. The deepest Secchi disk readings (3.0 meters or deeper) coincided with lower color levels (24 to 25 PCU), higher alkalinity (21 to 23 mg/l), and lower total phosphorus (0.013 to 0.016 mg/l) in mid to late August and September (Table 5).

**TABLE 5 EPILIMNETIC CORE SAMPLE RESULTS FOR LOWER BARKER IMPOUNDMENT**

| SAMPLE DATE | SAMPLE TIME | TOTAL PHOSPHORUS (MG/L) | CHLOROPHYLL -A (MG/L) | TOTAL ALKALINITY (MG/L) | COLOR (PCU) | PH | SECCHI DISK (M) |
|---|---|---|---|---|---|---|---|
| 6/9 | 13:40 | 0.021 | 0.0028 | 15 | 40 | 6.7 | 2.7 |
| 6/24 | 14:45 | 0.031 | 0.0024 | 15 | 42 | 6.7 | 1.4 |
| 7/7 | 16:05 | 0.021 | 0.0029 | 15 | 42 | 6.6 | 2.3 |
| 7/23 | 14:50 | 0.022 | 0.0030 | 20 | 30 | 7 | 2.5 |
| 8/13 | 13:50 | 0.023 | 0.0034 | 23 | 25 | 7 | 1.3 |
| 8/26 | 13:20 | 0.016 | 0.0029 | 23 | 25 | 7 | 3.4 |
| 9/9 | 13:30 | 0.014 | 0.0029 | 21 | 24 | 7 | 4.1 |
| 9/22 | 13:20 | 0.013 | 0.0037 | 22 | 23 | 6.9 | 3.0 |
| 10/6 | 12:15 | 0.026 | 0.0026 | 12 | 46 | 6.6 | 2.3 |
| 10/22 | 13:20 | 0.023 | 0.0034 | 15 | 38 | 6.5 | 1.9 |
| AVERAGE | | 0.021 | 0.0030 | 18.1 | 33.5 | 6.8 | 2.5 |
| MEDIAN | | 0.022 | 0.0029 | 17.5 | 34 | 6.8 | 2.4 |
| MINIMUM | | 0.013 | 0.0024 | 12.0 | 23 | 6.5 | 1.3 |
| MAXIMUM | | 0.031 | 0.0037 | 23.0 | 46 | 7.0 | 4.1 |

## Trophic State

Total phosphorus, chlorophyll-a, and Secchi disk transparency are often used as indicators of trophic state, or the biological productivity in a water body, particularly a lake (MDEP 2014b). An oligotrophic lake is one with low productivity; a mesotrophic lake has medium productivity, and a eutrophic lake is highly productive. Table 6 lists the criteria used to classify the trophic state of lakes in Maine (MDEP 2014b).

**TABLE 6 CRITERIA FOR CLASSIFYING THE TROPHIC STATE OF LAKES IN MAINE**

| TROPHIC STATE | CHLOROPHYLL-A (MG/L) | TOTAL PHOSPHORUS (MG/L) | SECCHI DISK (M) |
|---|---|---|---|
| Oligotrophic | < 0.0015 | < 0.0045 | > 8 |
| Mesotrophic | 0.0015 - 0.007 | 0.0045 - 0.02 | 4 - 8 |
| Eutrophic | > 0.007 | > 0.02 | < 4 |

The Maine Trophic State Index (TSI) for a water body with color greater than 30 PCU can be calculated as (MDEP 1996):

$$TSI = 70*\log(\text{mean chlorophyll-a} + 0.7)$$

Using the average chlorophyll-a concentration for the entire sampling period (Table 5), the TSI for the Lower Barker impoundment is 40, which is categorized as mesotrophic.

The Lower Barker impoundment had characteristics of all three trophic states. Considering the entire data set, the chlorophyll-a and total phosphorus values were consistent with medium and high productivity; however, when considering only the samples collected during mid to late August and September that correspond to the summertime period of high temperature and low flow period, the total phosphorus concentration fell into the range for oligotrophic water.

### 3.3.2 Late Summer Conductivity, Metals, and Nutrients Sample

**Conductivity**

Conductivity is a measure of the concentration of dissolved ions in water and is an indicator of the presence of pollutants. Conductivity was 135 µS/cm in the single sample collected in the Lower Barker impoundment (Table 7). This result reflects an influence from pollution sources (see Section 3.3.5).

**Dissolved Metals and Nutrients**

Table 6 lists the concentrations of metals and nutrients in the samples from the Lower Barker impoundment. The concentrations of iron (0.65 mg/l) and chloride (23 mg/l) were less than the established standards (Table 7). The concentration of aluminum was below the detection limit and is assumed to have been below the standard of 0.087 mg/l. Maine has no established standards for the other parameters.

**TABLE 7 CONCENTRATIONS OF DISSOLVED METALS AND NUTRIENTS IN LOWER BARKER IMPOUNDMENT, AUGUST 13, 2015**

| PARAMETER | UNIT | VALUE |
|---|---|---|
| Conductivity | µS/cm | 135 |
| Chloride | mg/l | 23 |
| Nitrate | mg/l | 0.09 |
| Sulfate | mg/l | 4 |
| Calcium | mg/l | 8.7 |
| Iron | mg/l | 0.65 |
| Magnesium | mg/l | 1.7 |
| Potassium | mg/l | 1.5 |
| Silica | mg/l | 4.2 |
| Sodium | mg/l | 12 |
| Aluminum | mg/l | <0.2 |
| DOC | mg/l | 1.7 |

### 3.3.3 WATER TEMPERATURE AND DISSOLVED OXYGEN PROFILES

The temperature was uniform throughout the water column during the profiles measured on June 9 (17.2°C to 17.3°C or 63.0°F to 63.1°F) and June 24 (19.3°C to 19.4°C or 66.7°F to 66.9°F) (Table 8). The water temperature increased through July and early August. The highest water temperatures were observed on August 26 (23.2°C to 23.9°C or 73.8°F to 75.0°F) and September 9 (21.9°C to 24.7°C or 71.4°F to 76.5°F). The water temperature then decreased throughout the remainder of September and October. During the last profile on October 22, the water temperature ranged from 9.3°C to 9.5°C (48.7°F to 49.1°F) (Table 8).

The concentrations and percent saturation of DO were uniform throughout the water column during each profile (Table 8 and Table 9). During the June 9 and June 24 profiles, DO ranged from 9.16 mg/l to 9.28 mg/l and from 9.36 mg/l to 9.40 mg/l, respectively. Concentrations and percent saturation of DO decreased slightly from the surface to the bottom of the impoundment in the profiles measured on July 23 (range 7.91 mg/l to 8.56 mg/l, 92.2 percent to 101.2 percent), August 26 (range 7.84 mg/l to 8.73 mg/l, 91.9 percent to 103.4 percent), and September 9 (range 7.87 mg/l to 8.64 mg/l,; 89.7 percent to 103.7 percent) profiles (Table 9 and Table 10). The

lowest DO concentrations coincided with the warmest water temperatures on August 26 and September 9. The highest DO levels were observed in the profiles measured on October 6 (10.58 mg/l to 10.70 mg/l) and October 22 (10.40 mg/l to 10.67 mg/l) profiles (Table 9). Throughout the monitoring period, the DO percent saturation ranged from 89.7 percent to 103.7 percent (Table 9). The DO measurements exceeded the state standard for Class C waters of 5 mg/l or 60 percent saturation throughout the June to October sampling period, demonstrating that the water of the Lower Barker impoundment is well oxygenated.

A seasonal epilimnion is defined as a 1°C change in temperature over a 1 meter change in depth. An ephemeral epilimnion can form in the top 2 to 3 meters following a few calm, warm days. The greatest changes in the water column temperature occurred on August 13 and September 9 when the water temperature decreased by 2.3°C and 2.8°C, respectively, from the surface to the bottom of the impoundment (Table 8). Given the shallowness of the impoundment and that DO concentrations remained fairly consistent throughout the water column (values were above 7.87 mg/l on August 13 and September 9) (Table 9), no evidence for the formation of a seasonal epilimnion was observed.

**TABLE 8 PROFILES OF WATER TEMPERATURE (°C) IN LOWER BARKER IMPOUNDMENT, JUNE – OCTOBER, 2015**

| DEPTH (M) | 6/9 | 6/24 | 7/7 | 7/23 | 8/13 | 8/26 | 9/9 | 9/22 | 10/6 | 10/22 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 13:05 | 14:25 | 15:45 | 14:50 | 13:10 | 13:10 | 13:45 | 13:10 | 12:05 | 13:10 |
| 0 | 17.4 | 19.4 | 22.3 | 23.8 | 24.1 | 23.9 | 24.7 | 20.1 | 13.2 | 9.5 |
| 1 | 17.3 | 19.3 | 22.0 | 23.3 | 22.5 | 23.7 | 24.5 | 19.9 | 12.9 | 9.4 |
| 2 | 17.3 | 19.3 | 22.0 | 23.1 | 22.1 | 23.5 | 23.7 | 19.8 | 12.8 | 9.4 |
| 3 | 17.3 | 19.3 | 21.8 | 23.1 | 21.8 | 23.2 | 21.9 | 19.7 | 12.7 | 9.3 |
| 4 | 17.2 | – | – | – | – | 23.2 | – | – | – | – |
| **AVG (°C)** | **17.3** | **19.3** | **22.0** | **23.3** | **22.6** | **23.5** | **23.7** | **19.9** | **12.9** | **9.4** |
| **AVG (°F)** | **63.1** | **66.8** | **71.6** | **74.0** | **72.7** | **74.3** | **74.7** | **67.8** | **55.2** | **48.9** |

**TABLE 9 PROFILES OF DO CONCENTRATION (MG/L) IN LOWER BARKER IMPOUNDMENT, JUNE – OCTOBER, 2015**

| DEPTH (M) | 6/9 | 6/24 | 7/7 | 7/23 | 8/13 | 8/26 | 9/9 | 9/22 | 10/6 | 10/22 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 13:05 | 14:25 | 15:45 | 14:50 | 13:10 | 13:10 | 13:45 | 13:10 | 12:05 | 13:10 |
| 0 | 9.28 | 9.36 | 8.74 | 8.56 | 8.60 | 8.62 | 8.63 | 8.67 | 10.70 | 10.67 |
| 1 | 9.23 | 9.39 | 8.73 | 8.33 | 8.75 | 8.73 | 8.64 | 8.77 | 10.63 | 10.56 |
| 2 | 9.21 | 9.40 | 8.68 | 8.15 | 8.91 | 8.69 | 8.47 | 8.68 | 10.62 | 10.49 |
| 3 | 9.19 | 9.37 | 8.69 | 7.91 | 8.62 | 8.06 | 7.87 | 8.60 | 10.58 | 10.40 |
| 4 | 9.16 | – | – | – | – | 7.84 | – | – | – | – |
| **AVG** | **9.2** | **9.4** | **8.7** | **8.2** | **8.7** | **8.4** | **8.4** | **8.7** | **10.6** | **10.5** |

**TABLE 10 PROFILES OF DO PERCENT SATURATION (%) IN LOWER BARKER IMPOUNDMENT, JUNE – OCTOBER, 2015**

| DEPTH (M) | 6/9 | 6/24 | 7/7 | 7/23 | 8/13 | 8/26 | 9/9 | 9/22 | 10/6 | 10/22 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 13:05 | 14:25 | 15:45 | 14:50 | 13:10 | 13:10 | 13:45 | 13:10 | 12:05 | 13:10 |
| 0 | 96.7 | 101.6 | 100.3 | 101.2 | 102.4 | 102.1 | 103.7 | 95.8 | 101.5 | 93.3 |
| 1 | 96.4 | 101.8 | 99.8 | 97.7 | 102.0 | 103.4 | 103.6 | 96.2 | 100.8 | 92.2 |
| 2 | 96.0 | 101.8 | 99.3 | 95.0 | 102.1 | 102.4 | 99.7 | 95.1 | 100.3 | 91.7 |
| 3 | 95.6 | 101.4 | 99.0 | 92.2 | 98.2 | 94.5 | 89.7 | 94.2 | 99.9 | 90.4 |
| 4 | 95.1 | – | – | – | – | 91.9 | – | – | – | – |
| **AVG** | **96.0** | **101.7** | **99.6** | **96.5** | **101.2** | **98.9** | **99.2** | **95.3** | **100.6** | **91.9** |

### 3.3.4 RIVERINE SAMPLING

#### 3.3.4.1 WATER TEMPERATURE

The water temperature in the bypassed reach ranged from 20.0°C (68.0°F) to 26.4°C (79.6°F) with an average of 23.1°C (73.7°F) throughout the sampling period (i.e., July 7 – September 9) (Table 11 and Figure 4). The minimum temperature in the bypassed reach was recorded on June 9 at 6 am, and the highest temperature was observed on August 19 at 3 pm. The water temperature in the tailrace ranged from 17.5°C (63.5°F) on July 7 at 10 pm to 26.4°C (79.6°F) on August 19 at 5 pm with an average of 22.5°C (72.6°F). The minimum values observed on July 7, July 9 (18.2°C), and July 16 (18.2°C) (Figure 4) correspond to operational changes made during nighttime eel surveys being conducted downstream from the dam (i.e., a slight increase in generation to reduce spill in the bypassed reach for a few hours to allow surveyors to survey the

dam area for eels; Section 5.0). From the beginning of sampling through July 23, the average water temperature in the bypassed reach (22.9°C) was approximately 2°C warmer than water temperature in the tailrace (20.8°C).

**TABLE 11 WATER TEMPERATURE DOWNSTREAM OF THE LOWER BARKER DAM, JULY 7 – SEPTEMBER 9, 2015**

| | BYPASSED REACH | |
|---|---|---|
| | T (°C ) | T (°F) |
| Average | 23.1 | 73.7 |
| Median | 23.1 | 73.6 |
| Minimum | 20.0 | 68.0 |
| Maximum | 26.4 | 79.6 |

| | TAILRACE | |
|---|---|---|
| | T (°C ) | T (°F) |
| Average | 22.5 | 72.6 |
| Median | 22.6 | 72.6 |
| Minimum | 17.5 | 63.5 |
| Maximum | 26.4 | 79.6 |

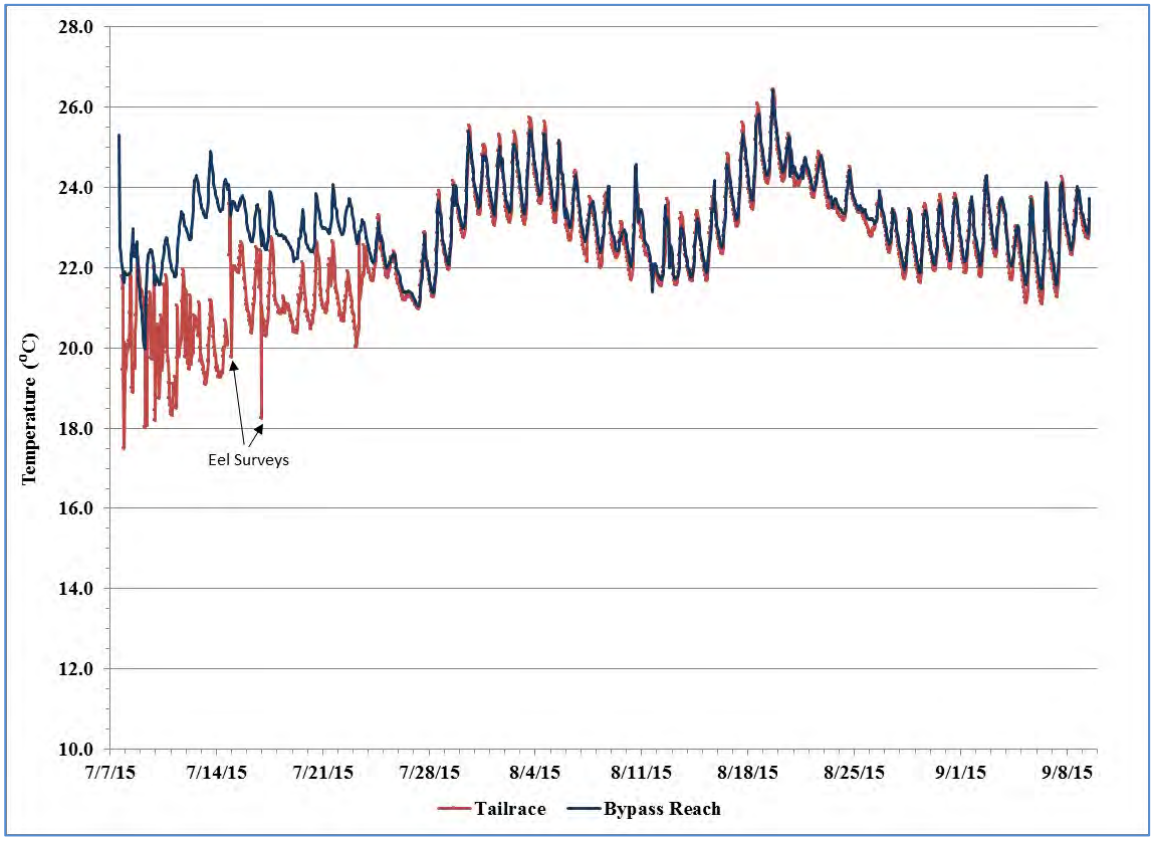



**FIGURE 4 HOURLY WATER TEMPERATURE TIME SERIES IN THE TAILRACE AND BYPASSED REACH, JULY 7 – SEPTEMBER 9, 2015**

### 3.3.4.2 DISSOLVED OXYGEN

Some erratic DO measurements (values between 4.5 to 7.0 mg/l) occurred in the bypassed reach data set from August 12 at 8 pm to August 13 at 4 pm. Possible explanations for these readings include fouling, sedimentation on the logger, or equipment malfunction. Erratic patterns in DO data are consistent with sedimentation or fouling on the loggers (personal communications, Onset Hobo Data Logger technical support, August 6, 2015 and February 5, 2016). No concurrent erratic patterns were observed in the temperature data for the bypassed reach or in the DO and temperature data for the tailrace. Furthermore, DO values in the impoundment on the afternoon of August 13 ranged from 8.60 to 8.91 mg/l; DO concentrations were within a similar range in the tailrace. Based on professional experience and comparisons between DO and temperature patterns in the impoundment and tailrace, the erratic measurements of DO in the bypassed reach are considered to be the result of equipment error or fouling and were removed from the final data set.

The DO concentration recorded each hour in the bypassed reach ranged from 6.36 to 9.37 mg/l with an average of 8.50 mg/l (Table 12 and Figure 5). The DO percent saturation ranged from 75.3 to 107.7 percent with an average of 99.9 percent (Table 12 and Figure 6). In the tailrace, DO ranged from 7.15 to 9.69 mg/l with an average of 8.32 mg/l, and the percent saturation ranged from 80.9 to 108.4 percent with an average of 96.6 percent. The concentration of DO decreased rapidly to less than 7 mg/l in the bypassed reach briefly on the afternoon of August 10; this preceded a less pronounced decrease in DO concentrations in the tailrace (Figure 5). The lowest DO concentration in the tailrace (7.15 mg/l) was observed on August 25 and coincided with a period of elevated river flows.

**TABLE 12 CONCENTRATION AND SATURATION OF DISSOLVED OXYGEN DOWNSTREAM OF THE LOWER BARKER DAM, JUNE 7 – SEPTEMBER 9, 2015**

| | BYPASSED REACH | |
|---|---|---|
| | DO Concentration (mg/l) | DO Saturation (%) |
| Average | 8.50 | 99.9 |
| Median | 8.52 | 100.1 |
| Minimum | 6.36 | 75.3 |
| Maximum | 9.37 | 107.7 |

| | TAILRACE | |
|---|---|---|
| | DO Concentration (mg/l) | DO Saturation (%) |
| Average | 8.32 | 96.6 |
| Median | 8.32 | 97.0 |
| Minimum | 7.15 | 80.9 |
| Maximum | 9.69 | 108.4 |


**FIGURE 5 HOURLY DO CONCENTRATION (MG/L) TIME SERIES IN THE TAILRACE AND BYPASSED REACH, JULY 7 TO SEPTEMBER 9, 2015**

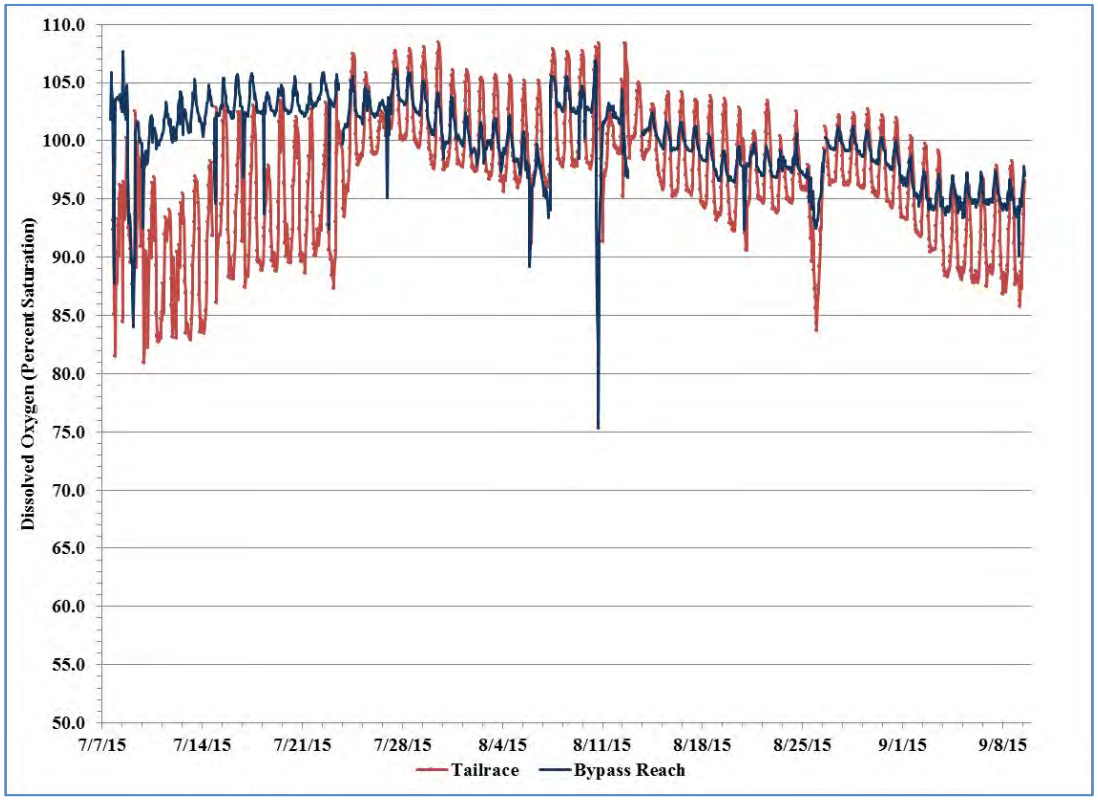



**FIGURE 6 HOURLY DO PERCENT SATURATION TIME SERIES IN THE TAILRACE AND BYPASSED REACH, JULY 7 – SEPTEMBER 9, 2015**

### 3.3.5 COMPARISON TO PREVIOUS SAMPLING

As part of a study of water quality of the Lower Androscoggin River Basin, MDEP collected data at the confluence of the Little Androscoggin River with the Androscoggin River (approximately 0.75 river mile downstream of the Lower Barker Project) during the summer of 2010 (MDEP 2011). The concentrations of chlorophyll-a and total phosphorus were within the range observed in the Lower Barker impoundment in 2015 (Table 13). The MDEP Biomonitoring Unit sampled water quality in July and August 2014 and July 2015 approximately 8.3 river miles upstream of the Lower Barker dam (Table 14). Those results were consistent with the temperature, DO, pH, total phosphorus, and alkalinity values measured in the Lower Barker impoundment in 2015. The conductivity values (83 to 98.5 µS/cm, Table 14) were lower than observed in the Lower Barker impoundment.

In addition, the single conductivity measurement in the Lower Barker impoundment was higher than the mean of 46 µS/cm (range 10 to 807 µS/cm) observed in more than 1,000 lakes in Maine (MDEP 2014a) and higher than measured at 7 sites in the lower Androscoggin River (60 to 120 µS/cm, mean 60 to 81 µS/cm) in spring-early fall 2014 (MDEP 2015).

**TABLE 13 MDEP'S WATER QUALITY MONITORING RESULTS FROM JULY AND AUGUST 2010 DOWNSTREAM OF THE LOWER BARKER PROJECT**

| DATE | CHLOROPHYLL-A (MG/L) | TOTAL PHOSPHORUS (MG/L) |
|---|---|---|
| 07/13/2010 | 0.0025 | 0.021 |
| 07/15/2010 | 0.0036 | 0.019 |
| 07/16/2010 | 0.0028 | 0.019 |
| 08/02/2010 | 0.0025 | 0.019 |
| 08/03/2010 | 0.0028 | 0.022 |
| 08/04/2010 | 0.0028 | 0.018 |

Source: MDEP 2011

**TABLE 14 MDEP'S WATER QUALITY MONITORING UPSTREAM OF THE LOWER BARKER PROJECT**

| DATE | TEMPERATURE (°C) | DO (MG/L) | PH | TOTAL PHOSPHORUS (MG/L) | TOTAL ALKALINITY (MG/L) | CONDUCTIVITY (µS/CM) |
|---|---|---|---|---|---|---|
| 7/14/2014 | 25.0 | 7.9 | 7.14 | – | – | 83 |
| 7/22/2014 | 22.2 | 7.4 | 6.06 | 0.020 | 15 | 97 |
| 8/12/2014 | 22.3 | 8.4 | 6.9 | 0.017 | – | 84 |
| 7/15/2015 | 23.6 | 7.8 | 7.13 | 0.019 | 17 | 98.5 |

Source: MDEP Biomonitoring Unit; http://www.maine.gov/dep/water/monitoring/biomonitoring/data.htm

## 3.4 SUMMARY

Impoundment and riverine sampling in 2015 demonstrated that the Lower Barker Project impoundment meets the established state standard for DO in Class C waters of 5 mg/l or 60 percent saturation. Temperature and DO profiles demonstrated that the impoundment did not thermally stratify and showed no evidence of a seasonal epilimnion. According to the state standard, the 30-day average DO concentration criterion for Class C waters is 6.5 mg/l to ensure that water quality is sufficient for spawning and to protect the growth of indigenous fish. The average DO concentrations in the bypassed reach for July, August, and September were 8.74, 8.40, 8.19 mg/l, respectively. In the one identified potential salmonid spawning area in the bypassed reach, the DO concentration exceeded the established standard throughout the sampling period. Given that measurements were taken during the period of low flow and high temperature, DO is expected to be suitable for salmonids throughout the cooler fall and winter months.

The low Secchi disk transparency results (less than 2.0 meters) in early to mid-summer and fall may have resulted from increased runoff and sediment loadings rather than algal blooms. Furthermore, concentrations of chlorophyll-a and total phosphorus in all samples were less than the proposed state standards.

In summary, the sampling completed by KEI (Maine) in 2015 demonstrates that the Little Androscoggin River at the Lower Barker Project meets the designated use of "recreation in and on the water" and meets applicable water quality standards for Class C waters.

## 3.5 REFERENCES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# 4.0 BENTHIC MACROINVERTEBRATE STUDY

## 4.1 INTRODUCTION

MDEP requested that KEI (Maine) perform an aquatic life criteria study (i.e., benthic macroinvertebrate sampling) to assess whether the Little Androscoggin River attains Class C water quality standards and the designated use of "habitat for fish and other aquatic life" at the Lower Barker Hydroelectric Project. According to 38 MRSA §464(9) and (10), existing hydropower impoundments classified as Great Ponds or as river and streams, and downstream reaches of river and streams that are influenced by hydropower projects must only meet the requirements of MRSA §465 (4)(C) of Class C waters (i.e., "maintain structure and function of the resident biological community"). The term "resident biological community" is defined as "aquatic life expected to exist in a habitat which is free from the influence of the discharge of any pollutant" (38 M.R.S.A. § 466(10)).

The characteristics of the benthic macroinvertebrate community are indicators of overall stream health, and changes in species metrics often occur because of deterioration of or improvements in water quality. In general, an unpolluted waterbody has a higher percentage of taxa from the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies); whereas, pollution tolerant taxa (e.g., chironomids – midge flies) dominate the community in poor-quality waters.

The objectives of the study were to:

- evaluate whether the Little Androscoggin River attains Class C water quality standards at the Lower Barker Project based on the composition of the benthic macroinvertebrate community; and
- determine whether the current operating regime and minimum flow requirements are maintaining the structure and function of the resident benthic macroinvertebrate community.

## 4.2 METHODS

The field and laboratory procedures for this study followed *Methods for Biological Sampling and Analysis of Maine's Inland Waters* (Davies and Tsomides 2002). MDEP's standard rock bags were installed at two sites downstream of the Lower Barker dam (Figure 7). Site 1 was approximately 850 feet below the Lower Barker Dam in the bypassed reach between the dam and the powerhouse (Photo 4 to Photo 6). Site 2 was approximately 1,750 feet downstream of the dam and approximately 400 feet downstream of the powerhouse (Photo 7 to Photo 9).


**FIGURE 7 BENTHIC MACROINVERTEBRATE SAMPLING SITES DOWNSTREAM OF THE LOWER BARKER DAM, JULY – AUGUST 2015**

**PHOTO 4 BENTHIC MACROINVERTEBRATE SAMPLE SITE 1 VIEW SOUTHWEST (UPSTREAM), JULY 22, 2015**

**PHOTO 5 BENTHIC MACROINVERTEBRATE SAMPLE SITE 1 VIEW NORTHEAST (DOWNSTREAM), JULY 22, 2015**

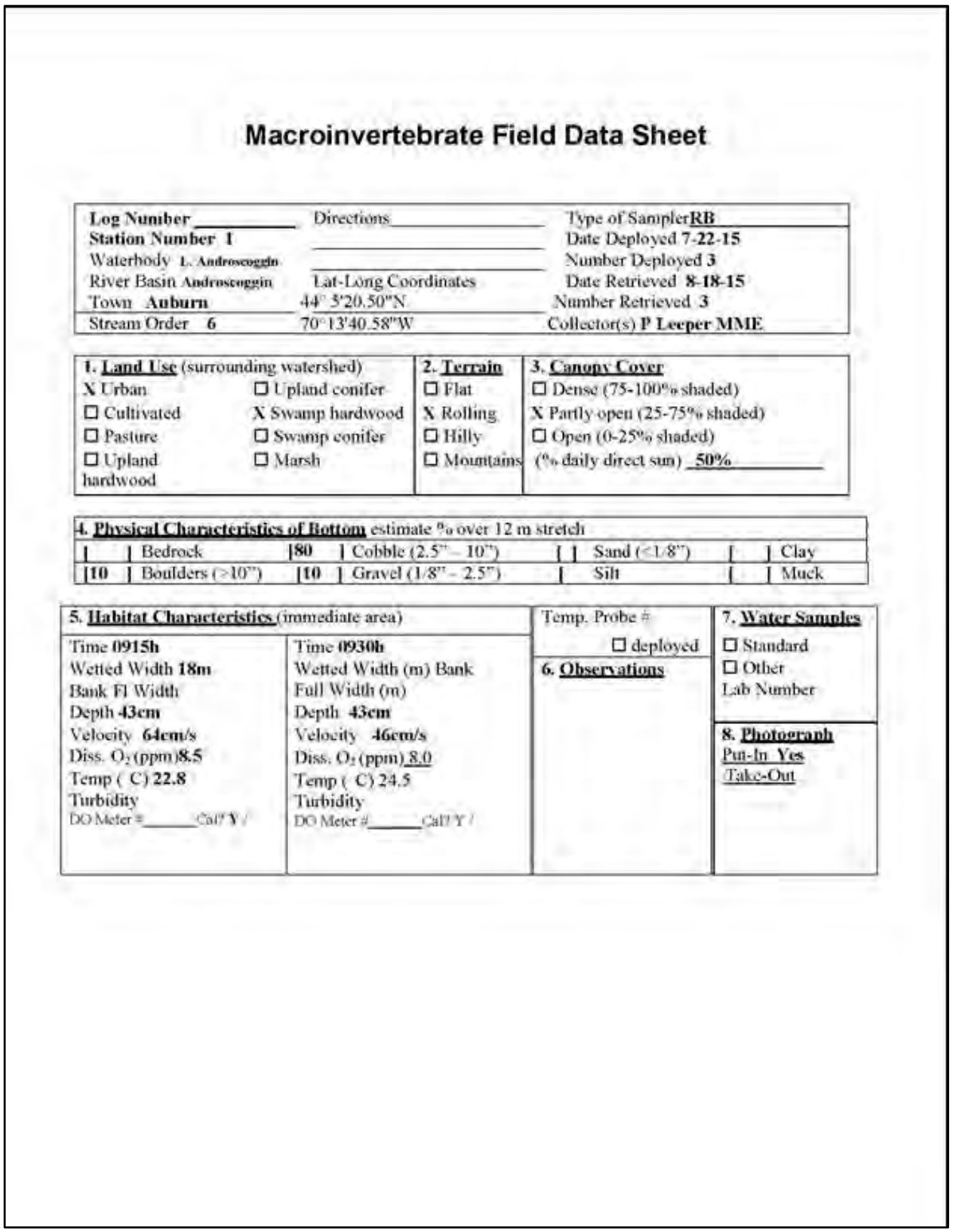
**PHOTO 6 BENTHIC MACROINVERTEBRATE SAMPLE 1 VIEW WEST, JULY 22, 2015**

**PHOTO 7 BENTHIC MACROINVERTEBRATE SAMPLE SITE 2 VIEW SOUTHWEST (UPSTREAM), JULY 22, 2015**

**PHOTO 8** **BENTHIC MACROINVERTEBRATE SAMPLE SITE 2 VIEW NORTHWEST, JULY 22, 2015**

**PHOTO 9** **BENTHIC MACROINVERTEBRATE SAMPLE SITE 2 VIEW NORTHEAST (DOWNSTREAM), JULY 22, 2015**

The rock bag samplers hold approximately 16 pounds of clean, washed, bank-run cobble that is graded to a uniform diameter range of 1.5 to 3 inches. Three samplers were placed at each sample site on July 22, 2015, and were left in the river for approximately 28 days (± 4 days) to allow for invertebrate colonization. The samplers were retrieved on August 18, 2015, using an aquatic D-net. The net was placed directly downstream of a sampler; the sampler was then picked up and placed in the net. The contents of each sampler and the net were washed through a sieve bucket and preserved in labeled jars. The samples were transported to Moody Mountain Environmental laboratory. Habitat measurements including substrate type, depth, and temperature were collected on the day of sampler retrieval (Figure 8 and Figure 9). The three samplers (replicates) from each site were sorted, identified, and enumerated.



## Macroinvertebrate Field Data Sheet

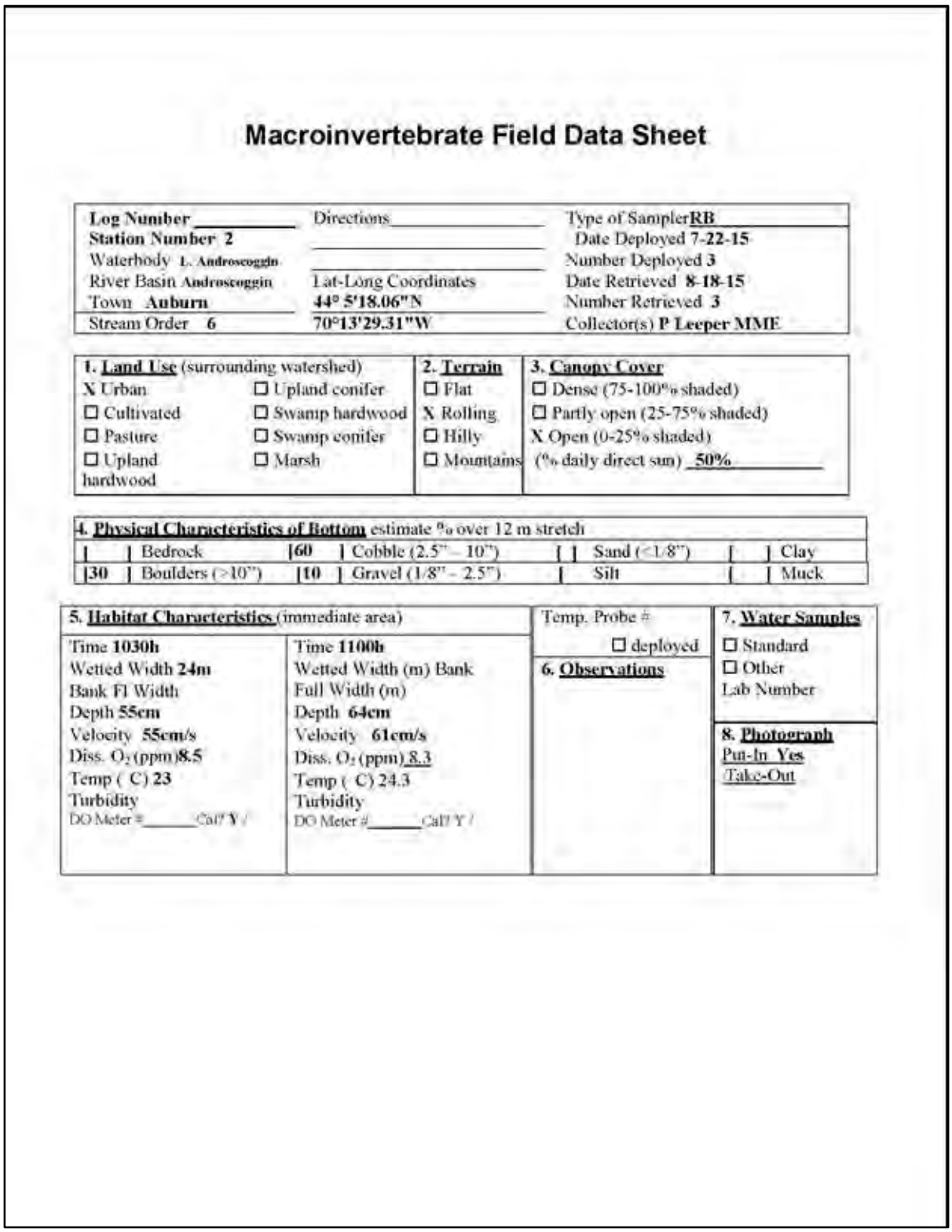
| | | |
|---|---|---|
| **Log Number** _____ | Directions_____ | Type of Sampler**RB** |
| **Station Number 1** | _____ | Date Deployed **7-22-15** |
| Waterbody **L. Androscoggin** | _____ | Number Deployed **3** |
| River Basin **Androscoggin** | Lat-Long Coordinates | Date Retrieved **8-18-15** |
| Town **Auburn** | 44° 5'20.50"N | Number Retrieved **3** |
| Stream Order **6** | 70°13'40.58"W | Collector(s) **P Leeper MME** |

| 1. **Land Use** (surrounding watershed) | | 2. **Terrain** | 3. **Canopy Cover** |
|---|---|---|---|
| X Urban | ☐ Upland conifer | ☐ Flat | ☐ Dense (75-100% shaded) |
| ☐ Cultivated | X Swamp hardwood | X Rolling | X Partly open (25-75% shaded) |
| ☐ Pasture | ☐ Swamp conifer | ☐ Hilly | ☐ Open (0-25% shaded) |
| ☐ Upland hardwood | ☐ Marsh | ☐ Mountains | (% daily direct sun) **50%** |

| 4. **Physical Characteristics of Bottom** estimate % over 12 m stretch | | | | | |
|---|---|---|---|---|---|
| [ ] Bedrock | [**80**] Cobble (2.5" – 10") | [ ] Sand (<1/8") | [ ] Clay |
| [**10**] Boulders (>10") | [**10**] Gravel (1/8" – 2.5") | [ ] Silt | [ ] Muck |

| 5. **Habitat Characteristics** (immediate area) | | Temp. Probe # ☐ deployed | 7. **Water Samples** |
|---|---|---|---|
| Time **0915h** | Time **0930h** | | ☐ Standard |
| Wetted Width **18m** | Wetted Width (m) Bank | 6. **Observations** | ☐ Other |
| Bank Fl Width | Full Width (m) | | Lab Number |
| Depth **43cm** | Depth **43cm** | | |
| Velocity **64cm/s** | Velocity **46cm/s** | | 8. **Photograph** |
| Diss. $O_2$ (ppm)**8.5** | Diss. $O_2$ (ppm) 8.0 | | Put-In **Yes** |
| Temp ( C) **22.8** | Temp ( C) 24.5 | | Take-Out |
| Turbidity | Turbidity | | |
| DO Meter #_____Cal? Y / | DO Meter #_____Cal? Y / | | |

**FIGURE 8 SITE 1 HABITAT MEASUREMENTS IN THE LITTLE ANDROSCOGGIN RIVER DOWNSTREAM OF LOWER BARKER DAM**



## Macroinvertebrate Field Data Sheet

| | | |
|---|---|---|
| **Log Number** _____ | Directions_____ | Type of Sampler**RB** |
| **Station Number 2** | _____ | Date Deployed **7-22-15** |
| Waterbody **L. Androscoggin** | _____ | Number Deployed **3** |
| River Basin **Androscoggin** | Lat-Long Coordinates | Date Retrieved **8-18-15** |
| Town **Auburn** | **44° 5'18.06"N** | Number Retrieved **3** |
| Stream Order **6** | **70°13'29.31"W** | Collector(s) **P Leeper MME** |

| 1. **Land Use** (surrounding watershed) | | 2. **Terrain** | 3. **Canopy Cover** |
|---|---|---|---|
| X Urban | ☐ Upland conifer | ☐ Flat | ☐ Dense (75-100% shaded) |
| ☐ Cultivated | ☐ Swamp hardwood | X Rolling | ☐ Partly open (25-75% shaded) |
| ☐ Pasture | ☐ Swamp conifer | ☐ Hilly | X Open (0-25% shaded) |
| ☐ Upland hardwood | ☐ Marsh | ☐ Mountains | (% daily direct sun) **50%** |

| 4. **Physical Characteristics of Bottom** estimate % over 12 m stretch | | | | | | | |
|---|---|---|---|---|---|---|---|
| [ ] | Bedrock | [60 ] | Cobble (2.5" – 10") | [ ] | Sand (<1/8") | [ ] | Clay |
| [30 ] | Boulders (>10") | [10 ] | Gravel (1/8" – 2.5") | [ ] | Silt | [ ] | Muck |

| 5. **Habitat Characteristics** (immediate area) | | Temp. Probe # ☐ deployed | 7. **Water Samples** ☐ Standard ☐ Other Lab Number |
|---|---|---|---|
| Time **1030h** | Time **1100h** | 6. **Observations** | 8. **Photograph** Put-In Yes Take-Out |
| Wetted Width **24m** | Wetted Width (m) Bank | | |
| Bank Fl Width | Full Width (m) | | |
| Depth **55cm** | Depth **64cm** | | |
| Velocity **55cm/s** | Velocity **61cm/s** | | |
| Diss. $O_2$ (ppm) **8.5** | Diss. $O_2$ (ppm) 8.3 | | |
| Temp ( C) **23** | Temp ( C) 24.3 | | |
| Turbidity | Turbidity | | |
| DO Meter #_____Cal? Y / | DO Meter #_____Cal? Y / | | |

**FIGURE 9 SITE 2 HABITAT MEASUREMENTS IN THE LITTLE ANDROSCOGGIN RIVER DOWNSTREAM OF THE LOWER BARKER DAM**

## 4.3 RESULTS

The benthic macroinvertebrate communities sampled downstream of the Lower Barker dam were moderately abundant and very rich in taxa (Table 15 and Table 16). The community at Site 1 was populated with 36 different taxa with a mean total abundance of 252 (Table 17). The Site 2 community was more numerous (total abundance of 334) but was slightly less rich, with 34 taxa (Table 17). Filter-feeding caddisflies constituted more than 34 percent of the total abundance at Site 1 and more than 57 percent at Site 2. The communities were relatively diverse and had Shannon-Weiner Diversity values of 2.63 (Site 1) and 2.65 (Site 2).

Indices of the communities' tolerance to poor water quality suggested good water quality. Sensitive mayflies and stoneflies represented a considerable segment of the community; 13 taxa at Site 1 and 12 taxa at Site 2 represented 38 percent and 30 percent of the communities, respectively (Table 17). Hilsenhoff Biotic Index values of 3.41 at Site 1 and 3.51 at Site 2 indicated very good to excellent water quality (Hilsenhoff 1987).

Table 18 lists the dominant organisms (i.e., taxa representing more than 5 percent of total abundance) in each community arranged from the most sensitive organisms to the organisms that are most tolerant of poor water quality. The community at Site 1 had six sensitive to intermediate organisms that constituted 59 percent of the total abundance and one tolerant organism that represented 16 percent of the total abundance (Table 18). This community was dominated by sensitive and intermediate organisms. At Site 2, eight organisms constituted 78 percent of the community; sensitive organisms dominated the community, and no tolerant genera were dominant.

**TABLE 15 BENTHIC MACROINVERTEBRATES, LITTLE ANDROSCOGGIN RIVER SAMPLING SITE 1, JULY – AUGUST, 2015**

| TAXON NAME | | REPLICATE 1 | REPLICATE 2 | REPLICATE 3 | MEAN | % |
|---|---|---|---|---|---|---|
| Planariidae | | 28 | 26 | 70 | 41.3 | 16.4% |
| Acroneuria | | 2 | 7 | 2 | 3.7 | 1.5% |
| Perlesta | | 0 | 2 | 0 | 0.7 | 0.3% |
| Agnetina | | 2 | 1 | 1 | 1.3 | 0.5% |
| Procloeon | | 13 | 50 | 6 | 23.0 | 9.1% |
| Plauditus | | 44 | 45 | 3 | 30.7 | 12.2% |
| Heptageniidae | | 15 | 12 | 1 | 9.3 | 3.7% |
| Stenacron | | 0 | 8 | 0 | 2.7 | 1.1% |
| Maccaffertium | | 7 | 16 | 13 | 12.0 | 4.8% |
| Stenonema | | 2 | 12 | 2 | 5.3 | 2.1% |
| Isonychia | | 0 | 0 | 2 | 0.7 | 0.3% |
| Ephemerella | | 3 | 5 | 2 | 3.3 | 1.3% |
| Eurylophella | | 4 | 0 | 0 | 1.3 | 0.5% |
| Caenis | | 3 | 0 | 0 | 1.0 | 0.4% |
| Chimarra | | 103 | 33 | 11 | 49.0 | 19.5% |
| Neureclipsis | | 2 | 0 | 1 | 1.0 | 0.4% |
| Cheumatopsyche | | 22 | 16 | 15 | 17.7 | 7.0% |
| Hydropsyche | | 21 | 15 | 6 | 14.0 | 5.6% |
| Macrostemum | | 6 | 3 | 6 | 5.0 | 2.0% |
| Rhyacophila | | 1 | 1 | 0 | 0.7 | 0.3% |
| Micrasema | | 1 | 1 | 0 | 0.7 | 0.3% |
| Lepidostoma | | 1 | 0 | 1 | 0.7 | 0.3% |
| Oecetis | | 1 | 1 | 1 | 1.0 | 0.4% |
| Chironomidae | | 0 | 1 | 0 | 0.3 | 0.1% |
| Eukiefferiella | | 0 | 1 | 0 | 0.3 | 0.1% |
| Rheotanytarsus | | 3 | 2 | 2 | 2.3 | 0.9% |
| Endochironomus | | 0 | 1 | 0 | 0.3 | 0.1% |
| Microtendipes | | 1 | 1 | 0 | 0.7 | 0.3% |
| Polypedilum | | 1 | 2 | 0 | 1.0 | 0.4% |
| Stenochironomus | | 0 | 1 | 0 | 0.3 | 0.1% |
| Simulium | | 21 | 23 | 0 | 14.7 | 5.8% |
| Psephenus | | 3 | 3 | 3 | 3.0 | 1.2% |
| Elmidae | ADULTS | 2 | 0 | 0 | 0.7 | 0.3% |
| Microcylloepus | ADULTS | 0 | 0 | 2 | 0.7 | 0.3% |
| Promoresia | | 0 | 0 | 2 | 0.7 | 0.3% |
| Orconectes limosus | | 0 | 1 | 1 | 0.7 | 0.3% |
| | | | | RICHNESS | 36 | |
| | | | | TOTAL ABUNDANCE | 251. 7 | |

**TABLE 16 BENTHIC MACROINVERTEBRATES, LITTLE ANDROSCOGGIN RIVER SAMPLING SITE 2, JULY – AUGUST, 2015**

| TAXON NAME | | REPLICATE 1 | REPLICATE 2 | REPLICATE 3 | MEAN | % |
|---|---|---|---|---|---|---|
| Planariidae | | 0 | 2 | 3 | 1.7 | 0.5% |
| Perlidae | | 0 | 1 | 0 | 0.3 | 0.1% |
| Acroneuria | | 1 | 2 | 1 | 1.3 | 0.4% |
| Agnetina | | 0 | 3 | 3 | 2.0 | 0.6% |
| Baetidae | | 6 | 4 | 0 | 3.3 | 1.0% |
| Plauditus | | 22 | 4 | 40 | 22.0 | 6.6% |
| Heptageniidae | | 17 | 10 | 51 | 26.0 | 7.8% |
| Maccaffertium | | 7 | 12 | 34 | 17.7 | 5.3% |
| Stenonema | | 5 | 18 | 30 | 17.7 | 5.3% |
| Isonychia | | 7 | 5 | 12 | 8.0 | 2.4% |
| Ephemerella | | 1 | 0 | 0 | 0.3 | 0.1% |
| Serratella | | 0 | 1 | 1 | 0.7 | 0.2% |
| Caenis | | 0 | 0 | 1 | 0.3 | 0.1% |
| Chimarra | | 44 | 19 | 39 | 34.0 | 10.2% |
| Neureclipsis | | 11 | 12 | 17 | 13.3 | 4.0% |
| Polycentropus | | 1 | 0 | 0 | 0.3 | 0.1% |
| Cheumatopsyche | | 41 | 22 | 41 | 34.7 | 10.4% |
| Hydropsyche | | 46 | 29 | 111 | 62.0 | 18.6% |
| Macrostemum | | 35 | 25 | 81 | 47.0 | 14.1% |
| Rhyacophila | | 0 | 0 | 1 | 0.3 | 0.1% |
| Lepidostoma | | 0 | 0 | 3 | 1.0 | 0.3% |
| Ceraclea | | 0 | 0 | 2 | 0.7 | 0.2% |
| Oecetis | | 1 | 2 | 0 | 1.0 | 0.3% |
| Corydalus | | 0 | 0 | 1 | 0.3 | 0.1% |
| Rheotanytarsus | | 9 | 2 | 5 | 5.3 | 1.6% |
| Microtendipes | | 2 | 0 | 0 | 0.7 | 0.2% |
| Polypedilum | | 8 | 2 | 5 | 5.0 | 1.5% |
| Simulium | | 13 | 1 | 20 | 11.3 | 3.4% |
| Psephenus | | 2 | 2 | 2 | 2.0 | 0.6% |
| Microcylloepus | | 0 | 0 | 1 | 0.3 | 0.1% |
| Promoresia | | 5 | 9 | 4 | 6.0 | 1.8% |
| Stenelmis | ADULTS | 7 | 3 | 9 | 6.3 | 1.9% |
| Stenelmis | | 0 | 0 | 1 | 0.3 | 0.1% |
| Hydrobiidae | | 0 | 0 | 2 | 0.7 | 0.2% |
| | | | | RICHNESS | 34 | |
| | | | | TOTAL ABUNDANCE | 334.0 | |

**TABLE 17 INDICES OF COMMUNITY STRUCTURE FOR THE AQUATIC INVERTEBRATE COMMUNITY DOWNSTREAM OF THE LOWER BARKER DAM, JULY – AUGUST 2015**

| PARAMETER | | SITE 1 | SITE 2 |
|---|---|---|---|
| Total Abundance | | 251.7 | 334.0 |
| Taxa Richness | | 36 | 34 |
| Shannon-Weiner Diversity | | 2.63 | 2.65 |
| Hilsenhoff Biotic Index (HBI) | | 3.41 | 3.51 |
| Water Quality Indication from HBI | | Excellent | Very Good |
| Mayfly, Stonefly, Caddisfly (EPT) Richness | | 22 | 22 |
| Mayfly, Stonefly (EP) | Richness | 13 | 12 |
| | % Abundance | 37.7 | 29.8 |
| Midge | Richness | 7 | 3 |
| | % Abundance | 2.1 | 3.3 |

**TABLE 18 DOMINANT AQUATIC INVERTEBRATE ORGANISMS DOWNSTREAM OF THE LOWER BARKER DAM, JULY – AUGUST 2015**

| | SITE 1 | | SITE 2 | |
|---|---|---|---|---|
| **Sensitivity to Poor Water Quality** | **Dominant Organism** | **% of Community** | **Dominant Organism** | **% of Community** |
| Sensitive | Chimarra | 19 | Chimarra | 10 |
| | Hydropsyche | 6 | Hydropsyche | 19 |
| | _ | _ | Macrostemum | 14 |
| | _ | _ | Maccaffertium | 5 |
| | _ | _ | Stenonema | 5 |
| Intermediate | Plauditus | 12 | Plauditus | 7 |
| | Procloeon | 9 | _ | _ |
| | Cheumatopsyche | 7 | Cheumatopsyche | 10 |
| | Simulium | 6 | _ | _ |
| | _ | _ | Heptageniidae | 8 |
| Tolerant | Planariidae | 16 | _ | _ |

The community structure and function downstream of the Lower Barker dam on the Little Androscoggin River provides some evidence for organic enrichment and filter-feeder dominance, which is a common phenomenon below lake outlets and impoundments (Hynes 1970; Spence and Hynes 1971; Parker and Voshell 1983). However, the presence of sensitive stoneflies and mayflies indicates no loss of genera and no excessive dominance by any group.

Enrichment and caddisfly dominance downstream of lake outlets and dam outlets is a common phenomenon that has long been reported in the literature. Illies (1956 in Spence and Hynes 1971) reported an increase in the number of filter-feeding Trichoptera below a lake when compared to upstream communities and attributed it to an increase in food availability. Filter-feeding organisms, such as *Cheumatopsyche* and *Neureclipsis,* are often the dominant organisms in streams and rivers (Hynes 1970) and are frequently very abundant at lake outlets (Carlsson et al. 1977; Valett and Stanford 1987). The density or biomass of these filter-feeders typically declines farther downstream (Osgood 1979). This blossoming and decline of the aquatic community may be a response to a gradient in the quantity or quality of the food resources. Filter-feeders near the lake outlet process the high-quality lake seston (i.e., particulate matter in the water), which typically is made up of algal cells, and may transform it to lower-quality detritus (Benke and Wallace 1980; Valett and Stanford 1987).

The enrichment and dominance of caddisfly also has been long observed at impoundment outlets. Spence and Hynes (1971) reported increased numbers of Hydropsychidae (*Cheumatopsyche* is a genus in the family Hydropsychidae) and other organisms downstream of an impoundment and stated that the downstream differences were comparable to mild organic enrichment. Parker and Voshell (1983) reported production of the filter-feeding Trichoptera to be greater closest to the dam than at sites farther downstream and sites on free-flowing rivers. They concluded that not only the amount of high-quality food, but also the specific size of the seston, contributed to the ability of the caddisflies to occupy this niche.

## 4.4 SUMMARY

The benthic macroinvertebrate communities sampled downstream of the Lower Barker dam were abundant and rich in taxa. Filter-feeders represented a sizable proportion of the communities.

The dominance of filter-feeders is a natural response to the food resource exiting the upstream impoundment. The community structure and function found downstream of the Lower Barker dam, specifically the presence of stoneflies and mayflies, indicates that there has been little, if any, change in the resident biological community. The macroinvertebrate community downstream of Lower Barker dam on the Little Androscoggin River attains Class C aquatic life standards and maintains the structure and function of the resident benthic macroinvertebrate community. Based on MDEP model results (Appendix 1), the benthic macroinvertebrate community in the bypassed reach and the Little Androscoggin River downstream of the powerhouse is representative of Class A aquatic life standards.

## 4.5 REFERENCES


Benke, A.C. and J.B. Wallace. 1980. Trophic basis of production among net-spinning caddisflies in a southern Appalachian stream. Ecology 61: 108-118.

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Parker, C.R. and J.R. Voshell Jr. 1983. Production of filter-feeding Trichoptera in an impounded and a free-flowing river. Can. J. Zool. 61:70-87.

Spence, J.A., and H.B.N. Hynes. 1971. Differences in benthos upstream and downstream of an impoundment. J. Fish. Res. Bd. Canada 28: 35-43.

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# 5.0 JUVENILE AMERICAN EEL STUDY

## 5.1 INTRODUCTION

The U.S. Fish and Wildlife Service (USFWS), Maine Department of Marine Resources (MDMR), and the National Marine Fisheries Service (NMFS) requested that KEI (Maine) study upstream passage of American eels. Prior to reaching the Lower Barker Project, juvenile eels must pass the Brunswick Hydroelectric Project (FERC No. 2284), Pejepscot Hydroelectric Project (FERC No. 4784), and Worumbo Hydroelectric Project (FERC No. 3428). An upstream eel ladder is installed at the Worumbo Project, which is approximately 14 river miles downstream of the Lower Barker Project. There are no other dedicated upstream eel passage systems on the Androscoggin or Little Androscoggin River dams. No site specific information is available about historical eel abundance, size distribution, or behavior at the Lower Barker Project.

The goal of this study was to assess the need and potential location(s) for a dedicated upstream passage facility for American eels at the Lower Barker Project. The objectives of the study were to:

- conduct systematic nighttime surveys to identify eel presence, abundance, distribution, and behavior at the Lower Barker Project;
- identify areas where eels congregate or attempt to ascend wetted structures; and
- identify potential locations for an upstream eel passage system.

## 5.2 METHODS

KEI (Maine) conducted nighttime visual surveys to collect information about the abundance, behavior, and location of juvenile American eels at the Lower Barker Project during their upstream migration. Observations at other hydroelectric projects in Maine suggest that juvenile eels typically move upstream during dusk and evening hours from early June to mid-August. Therefore, KEI (Maine) planned to conduct two nighttime surveys a week from June 1 through June 30 and, if needed, one survey a week between July 1 and the middle of August. Researchers were unable to complete all planned surveys because of flow conditions. Eleven surveys were

completed between June 9 and August 5. In accordance with the study plan, KEI (Maine) elected to stop surveying in early August because of the consistently low numbers of eels observed.

Researchers used binoculars and spotlights to search for juvenile eels along the downstream face of the dam and spillway, the waste gate section, and bedrock outcrops immediately downstream of the dam (Photo 10). Each survey lasted 1 to 1.5 hours and took place after sunset between approximately 20:30 and 22:15. Researchers noted the location of congregating eels, the approximate number and size class of eels at each location, behavior patterns, and weather conditions.

**PHOTO 10 PRIMARY SURVEY AREAS ON RIVER RIGHT (LEFT PHOTO) AND RIVER LEFT (RIGHT PHOTO) DOWNSTREAM OF THE LOWER BARKER DAM**

## 5.3 RESULTS

River flow during the study period (i.e., June, July, and August 2015) as measured at the South Paris gauge (USGS Gage No. 01057000) and prorated to the Lower Barker dam ranged from approximately 31 cfs to 2,899 cfs (Figure 2); therefore, the project was not generating throughout most of the study period. The single unit in the powerhouse was turned on prior to the start of the surveys to reduce spill so that researchers could safely access and observe the dam and spillway, except for the surveys on June 18 and June 25.

Researchers observed 44 juvenile eels during the 2015 study (Table 19). The largest number of eels was observed on July 14, constituting approximately 55 percent of the total 44 eels observed

throughout the study. Ten eels (23 percent) were observed on June 16, and five (11 percent) were observed on July 7 (Table 19). Nearly all eels were observed in pools near the base of the dam or climbing the bedrock falls immediately downstream of the dam and stop-log gates on river right (Figure 10). Most eels ranged from approximately 75 to 150 mm (3 to 6 inches); one yellow eel (600 mm or 24 inches) was observed in the plunge pool below the dam, and one 300-mm (12-inch) eel was seen in the pool below the dam on river left (Table 19).

**TABLE 19 SUMMARY OF NIGHTTIME JUVENILE EEL MONITORING AT THE LOWER BARKER DAM IN JUNE, JULY, AND AUGUST 2015**

| DATE | START TIME | END TIME | RIVER RIGHT IN POOLS | RIVER RIGHT ON BEDROCK | RIVER LEFT IN POOL | LENGTH (MM) |
|---|---|---|---|---|---|---|
| June 9 | 20:40 | 22:15 | 0 | 0 | 0 | |
| June 11 | 20:35 | 21:45 | 0 | 0 | 0 | – |
| June 16 | 20:45 | 22:05 | 5 | 5 | 0 | 100-150 (4-6 inches) |
| June 18 | 20:35 | 21:30 | 0 | 0 | 0 | – |
| June 25 | 21:10 | 22:05 | 0 | 0 | 0 | – |
| July 7 | 20:35 | 21:45 | 4 | 0 | 1 | 3 eels 75-150 mm (3-6 inches), 1 eel 300 mm (12 inches), 1 eel 600 mm (24 inches) |
| July 9 | 20:45 | 21:50 | 0 | 0 | 0 | – |
| July 14 | 21:00 | 22:10 | 14 | 10 | 0 | 75-150 (3-6 inches) |
| July 16 | 20:55 | 21:45 | 1 | 0 | 0 | – |
| July 29 | – | – | 1 | 0 | 0 | – |
| August 5 | – | – | 3 | 0 | 0 | – |
| | | **TOTAL** | **28** | **15** | **1** | |

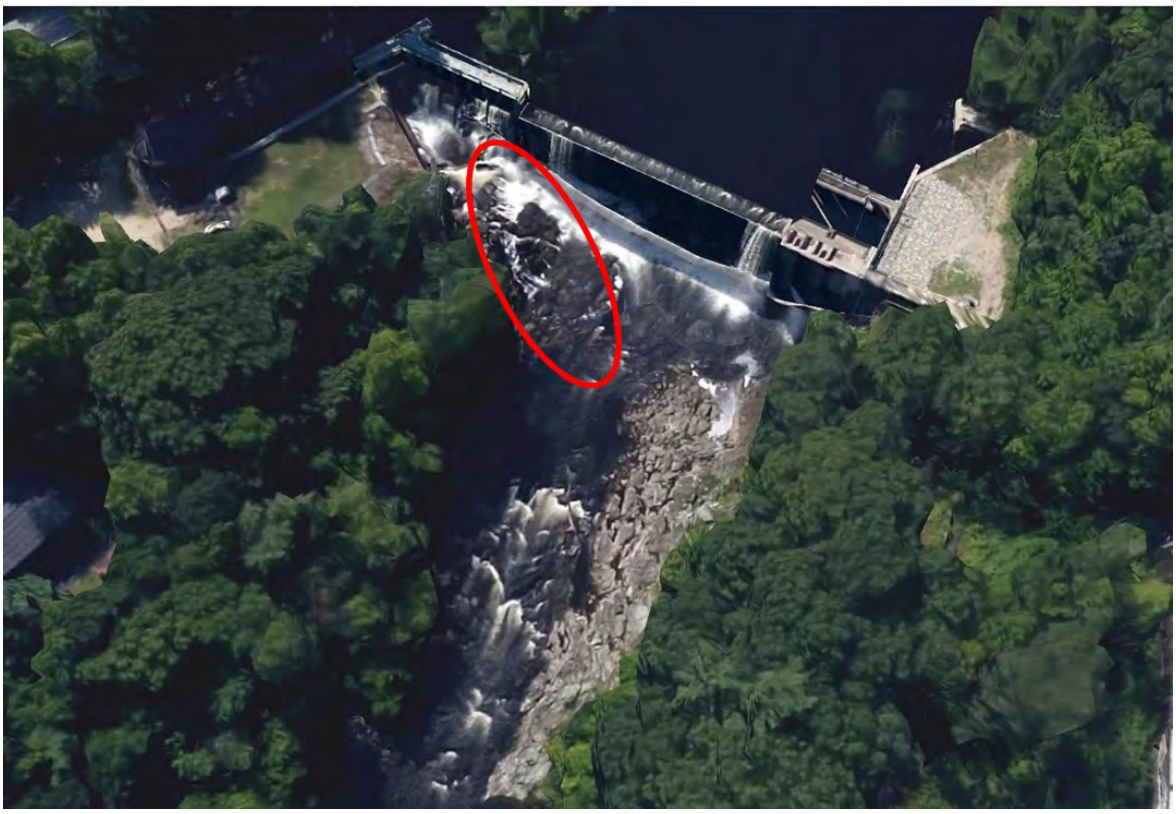


**FIGURE 10 PRIMARY LOCATION (AREA WITHIN RED CIRCLE) OF OBSERVED JUVENILE EELS AT LOWER BARKER DAM IN 2015**

## 5.4 SUMMARY

KEI (Maine) successfully completed 11 nighttime surveys during June, July, and August 2015, to identify locations where juvenile American eels congregate below the Lower Barker dam and attempt to migrate past the dam. All surveys were conducted following the schedule and methods outlined in the final study plan. A small number of eels was observed (total of 44 eels); most were within pools and along the bedrock falls on river right. Previous studies in the Androscoggin River have documented a relatively low number of eels. For example, the upstream eel passage facility at the Worumbo Project captured 17 eels and 131 eels during the 2012 and 2013 monitoring periods, respectively (Miller Hydro Group 2013, 2014). Furthermore, American eels were one of the predominant species observed in riverine reaches of the Kennebec River compared to the Androscoggin River where juvenile eels were only documented downstream of Brunswick (MBI 2006). Therefore, a low number of juvenile eels would be expected to migrate upstream to the Little Androscoggin River. The few juvenile eels

documented downstream of the Lower Barker dam do not warrant installing an upstream eel passage system at this time.

## 5.5 REFERENCES

Midwest Biodiversity Institute (MBI). 2006. The Spatial and Relative Abundance Characteristics the Fish Assemblages in Three Maine Rivers: 2002 and 2003. Technical report MBI/12-05-1. September 1, 2006.

Miller Hydro Group. 2013. Worumbo Project Annual Fish Passage Status Report. July 29, 2013

Miller Hydro Group. 2014. Worumbo Project Annual Fish Passage Status Report. July 11, 2014.

# 6.0 BYPASSED REACH MINIMUM FLOW STUDY

## 6.1 INTRODUCTION

KEI (Maine) operates the Lower Barker Project as run-of-river, which protects aquatic resources in upstream and downstream river reaches by minimizing fluctuations in water surface elevations in the impoundment and providing stable downstream flows that match the natural hydrologic regime. KEI (Maine) discharges water that is used for generation back into the Little Androscoggin River approximately 0.54 river mile downstream of the Lower Barker dam, creating a riverine bypassed reach between the dam and the powerhouse. A year-round minimum flow of 20 cfs (or inflow if less) is provided from one of a series of rectangular stop-log gates on the river right side of the dam to support aquatic habitat in the bypassed reach and to provide downstream fish passage. Water leaking from the remaining gates provides additional water to the bypassed reach during non-spill conditions.

KEI (Maine) can generate electricity at river flows ranging from approximately 150 cfs to 500 cfs, which are the turbine's approximate minimum and maximum hydraulic capacities. KEI (Maine) passes river flow that is less than 150 cfs or greater than 500 cfs over the dam or through existing gates into the bypassed reach of the Little Androscoggin River. Based on prorated daily average flows from 1980 to 2015 (USGS Gage No. 01057000, South Paris, Maine), river flow typically exceeds the maximum capacity of the turbine 35 percent of the time and is less than the minimum capacity of the turbine approximately 25 percent of the time (Table 20). Therefore, river flow in the bypassed reach is typically greater than the 20-cfs minimum flow provided by KEI (Maine) during approximately 60 percent of any given year, depending on water-year type.

**TABLE 20 TYPICAL PERCENTAGE OF TIME BY MONTH THAT RIVER FLOW IS OUTSIDE THE HYDRAULIC CAPACITY RANGE OF THE LOWER BARKER PROJECT (150 – 500 CFS)**

| MONTH | PERCENT OF TIME LESS THAN 150 CFS | PERCENT OF TIME GREATER THAN 500 CFS | CUMULATIVE PERCENT |
|---|---|---|---|
| Jan | 17% | 18% | 35% |
| Feb | 13% | 16% | 28% |
| Mar | 6% | 54% | 60% |
| Apr | 0% | 94% | 94% |
| May | 2% | 64% | 65% |
| Jun | 20% | 29% | 49% |
| Jul | 57% | 14% | 71% |
| Aug | 65% | 12% | 76% |
| Sep | 73% | 7% | 80% |
| Oct | 38% | 23% | 61% |
| Nov | 8% | 50% | 58% |
| Dec | 5% | 39% | 45% |
| **ANNUAL** | **25%** | **35%** | **60%** |

The Maine Department of Inland Fisheries and Wildlife (MDIFW) manages the lower Little Androscoggin River primarily for trout angling. The MDIFW stocked the bypassed channel with brook and brown trout until 2000, when stocking was suspended because of low flows and issues with public access. The MDIFW currently stocks brown and rainbow trout upstream of the Lower Barker Project in Auburn, Minot, and Mechanic Falls, and a successful trout fishery has developed. Approximately 22,000 brown and rainbow trout were stocked in both 2013 and 2014 to support a put-grow-and-take fishery; approximately 4,100 brown and rainbow trout were stocked in 2015 (John Perry, MDIFW, letter dated May 5, 2014; MDIFW 2015). Atlantic salmon occurred historically in the Little Androscoggin River.

During scoping and consultation in 2014, USFWS, MDMR, NMFS, MDIFW, and MDEP requested that KEI (Maine) conduct an instream flow study in the bypassed reach of the Lower Barker Project to evaluate habitat suitability for target species under a range of flow releases.

During the December 5, 2014, fish passage and study planning meeting, the fisheries agencies generally agreed that a semi-quantitative instream flow study would be an appropriate method. In accordance with the final study plan, the study is being conducted in phases. The goals and objectives of the study are to:

- **PHASE 1**: Determine the existing available aquatic habitat by field documenting and mapping existing aquatic habitat in the bypass reach to help inform the placement of transects for investigation of flows; and

- **PHASE 2**: Evaluate the relationship between river flow and habitat suitability by determining the fish species of management interest and assessing the available habitat and impediments to passage in the bypass reach at the selected transects across a range of flow releases.

## 6.2 METHODS

Researchers completed the first phase of the instream flow study on July 7, 2015. The USFWS and MDIFW participated in the survey. River flow as measured at the South Paris gauge (USGS Gage No. 01057000) was approximately 55 cfs; this equates to a river flow of approximately 265 cfs at the dam. KEI (Maine) was generating hydropower at the Lower Barker Project during the survey; water released through the minimum flow gate, leakage through gates, and some spill over the top of the dam provided water to the bypassed reach during the survey.

Surveyors waded downstream from the dam to the confluence with the tailwater pool to identify mesohabitats based on their predominant physical and hydraulic characteristics. Within each mesohabitat, surveyors measured water depth and stream width, identified dominant and secondary substrate types, looked for potential spawning gravel for salmonid species (e.g., rainbow trout, brown trout, and Atlantic salmon), established global positing system (GPS) points at the top and bottom of each mesohabitat unit, and took photographs. KEI (Maine) submitted a Phase 1 summary memo report to the stakeholders on July 24, 2015.

## 6.3 RESULTS

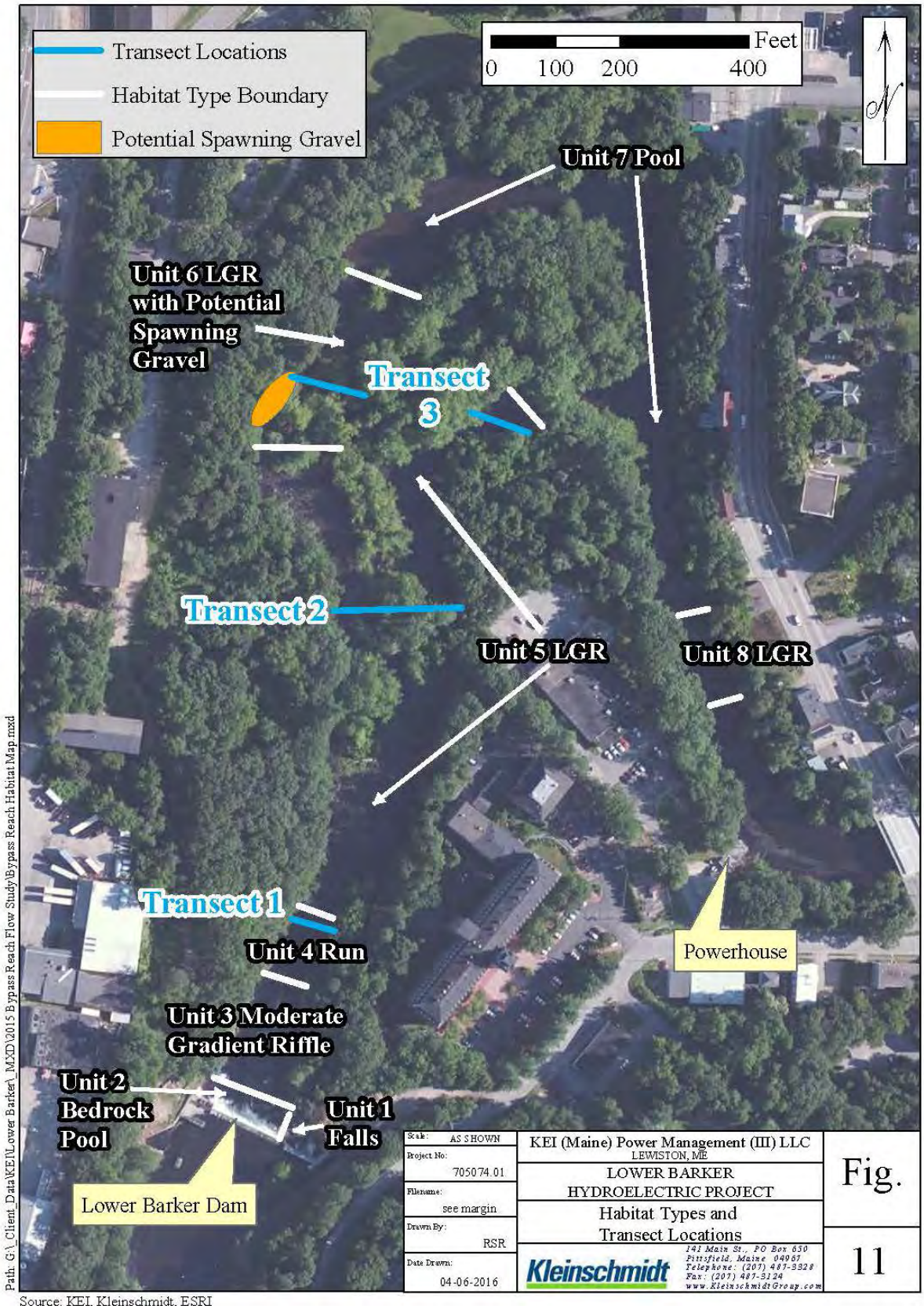
The total length of the Little Androscoggin River between the dam and the powerhouse is approximately 3,000 feet, and the area contains eight individual mesohabitat units (Table 21, Figure 11):

- small set of falls immediately below the dam on the river right (Habitat Unit 1, Photo 11);
- plunge pool immediately downstream of the falls and dam (Habitat Unit 2, Photo 11);
- moderate-gradient riffle or rapid (Habitat Unit 3, Photo 12);
- short run (Habitat Unit 4, Photo 13);
- low-gradient riffle (LGR) and braided channel complex (Habitat Units 5 and 6, Photo 14, Photo 15, and Photo 16);
- large pool (Habitat Unit 7, Photo 17); and
- low-gradient riffle immediately upstream of the powerhouse (Habitat Unit 8, Photo 18).

The first 300 feet of the reach closest to the dam has a moderate gradient with some fast water; then the reach becomes primarily low gradient. Portions of Habitat Unit 6 contain some gravel beds that may be suitable for salmonid spawning (i.e., gravel beds with small to medium sized substrates approximately 0.5 inch to 2 inches in diameter, low embeddedness). Habitat in most of the reach is pool (46.3 percent) and riffle (46.7 percent); the remainder is bedrock falls (3.3 percent) and run (3.7 percent) (Figure 12). Cover for fish and other aquatic life is provided by boulders, depth, undercut banks, canopy, understory, and woody debris. The reach contains a variety of substrates to promote macroinvertebrate communities and forage.

**TABLE 21 RIVERINE MESOHABITAT TYPES IN THE BYPASSED REACH DOWNSTREAM OF THE LOWER BARKER DAM**

| UNIT # | HABITAT TYPE | PREDOMINANT SUBSTRATES | LENGTH (FEET) | BANK TO BANK WIDTH (FEET) | MAXIMUM DEPTH (FEET) |
|---|---|---|---|---|---|
| 1 | Bedrock falls below dam | Bedrock | 100 | 50 | Approx. 4 ft (plunge pool) |
| 2 | Plunge pool beneath dam | Bedrock | 40 | 140 | > 6 |
| 3 | Riffle – moderate gradient /rapid | Bedrock and large boulder | 175 | 110 | 4 |
| 4 | Run | Large and small boulder | 110 | 120 | 5 |
| 5 | Riffle – low gradient; braided channel | Small boulder and cobble | 825 | 130 | 2 |
| 6 | Riffle with spawning gravels – low gradient | Cobble and gravel | 280 | 100 | 2 |
| 7 | Pool | Sand, fines | 1,350 | 150 | > 4 |
| 8 | Riffle – low gradient | Large and small boulder | 120 | 100 | 2 |




Source: KEI. Kleinschmidt. ESRI

**FIGURE 11 RIVERINE HABITAT AND TRANSECT LOCATIONS, LITTLE ANDROSCOGGIN RIVER, LOWER BARKER PROJECT**

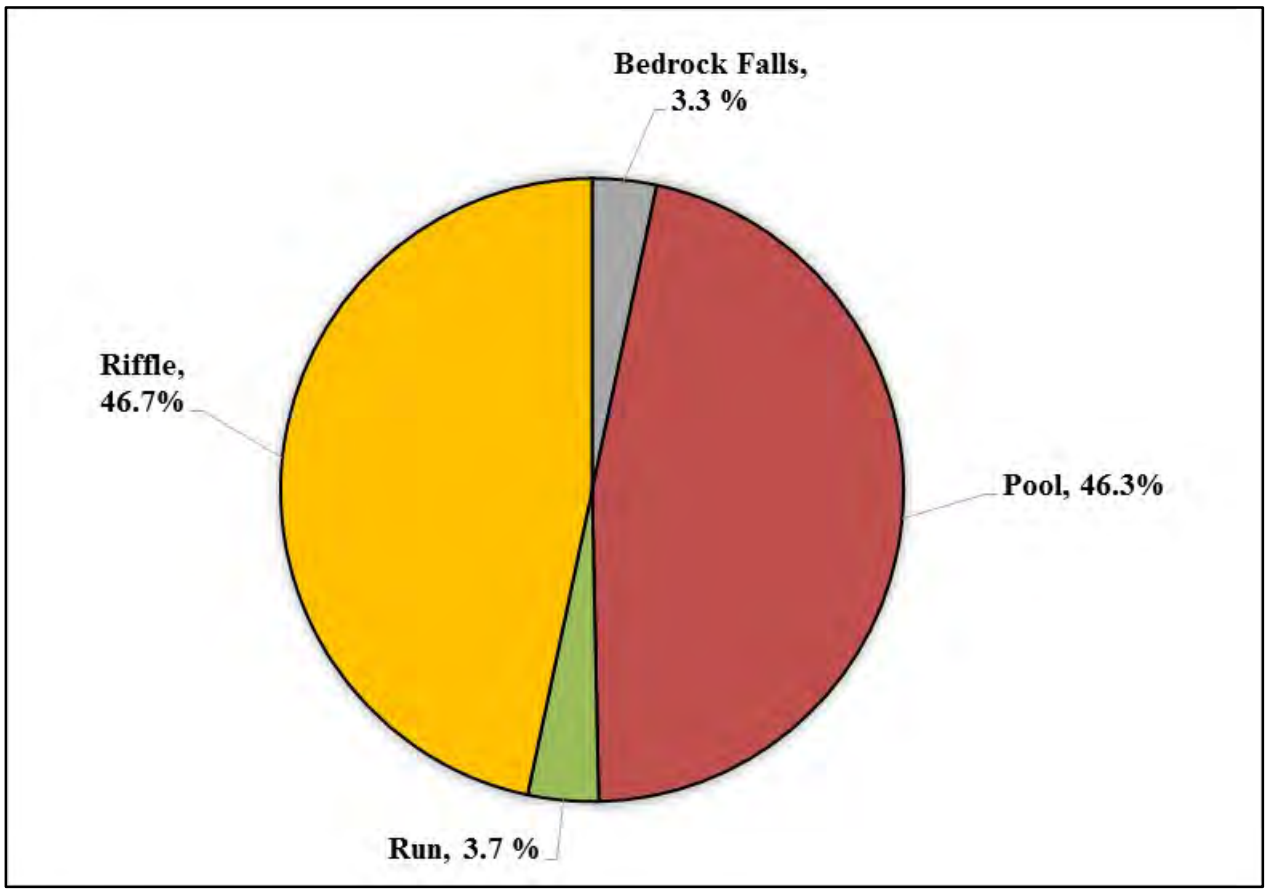



**FIGURE 12 TYPE AND PERCENTAGE OF MESOHABITATS IN THE LOWER BARKER PROJECT BYPASSED REACH**

During the Phase 1 survey, surveyors marked potential locations for three river transects for Phase 2 of the instream flow study based on input received from the USFWS and MDIFW. The transects are within Habitat Unit 4 (run), Habitat Unit 5 (low-gradient riffle), and Habitat Unit 6 (low gradient riffle) (Figure 11). The transects were selected because they are representative of the reach as a whole and will allow for measuring incremental changes in physical habitat (e.g., water depth and velocity) across the range of flows being evaluated during Phase 2 of the study. In addition, Transect 3 crosses the area with potential spawning gravel in Habitat Unit 6 (Figure 11).


**PHOTO 11 BEDROCK FALLS (HABITAT UNIT 1) AND PLUNGE POOL (HABITAT UNIT 2) IMMEDIATELY DOWNSTREAM OF THE LOWER BARKER DAM**


**PHOTO 12 RAPID/MODERATE GRADIENT RIFFLE IN THE LOWER BARKER BYPASSED REACH (HABITAT UNIT 3)**

**PHOTO 13 RUN HABITAT IN THE LOWER BARKER BYPASSED REACH (HABITAT UNIT 4)**

**PHOTO 14 LOW GRADIENT RIFFLE AND BRAIDED CHANNEL IN THE LOWER BARKER BYPASSED REACH (HABITAT UNIT 5)**

**PHOTO 15 LOW GRADIENT RIFFLE IN THE LOWER BARKER BYPASSED REACH (HABITAT UNIT 5)**

**PHOTO 16 LOW GRADIENT RIFFLE WITH SPAWNING SIZED GRAVELS IN THE LOWER BARKER BYPASSED REACH (HABITAT UNIT 6)**

**PHOTO 17 LONG POOL IN THE LOWER BARKER BYPASSED REACH (HABITAT UNIT 7)**

**PHOTO 18 LOW GRADIENT RIFFLE UPSTREAM OF POWERHOUSE (HABITAT UNIT 8)**

## 6.4 SUMMARY

The short reach of the Little Androscoggin River bypassed by the Lower Barker Project contains a diversity of aquatic habitat types (riffle, run, and pools), cover for fish and other aquatic organisms, a variety of substrates to promote macroinvertebrate communities and forage, complex braided channel form, and some areas that may support salmonid spawning.

KEI (Maine) established three transects in the bypassed reach for Phase 2 of the instream flow study, which will conducted in spring or summer 2016. KEI (Maine) will use one or more of the transects to evaluate the MDEP's ¾-wetted-width criterion.

## 6.5 REFERENCES

Maine Department of Inland Fisheries and Wildlife (MDIFW). 2015. Fish Stocking Reports. http://www.maine.gov/ifw/fishing/reports/stocking/stocking.htm. Accessed April 6, 2016.

# APPENDIX 1

# MDEP AQUATIC LIFE CLASSIFICATION ATTAINMENT REPORTS

# Maine Department of Environmental Protection
## Biological Monitoring Program
## Aquatic Life Classification Attainment Report

### Station Information

**Station Number: S-1082**
Waterbody: Little Androscoggin River - Station 1082
Town: Auburn
Directions: 850 FT BELOW THE LOWER BARKER DAM

River Basin: Androscoggin
HUC8 Name: Lower Androscoggin
Latitude: 44 5 20.5 N
Longitude: 70 13 40.58 W
Stream Order: 4

### Sample Information

**Log Number: 2428** Type of Sample: ROCK BAG Date Deployed: 7/22/2015
Subsample Factor: X1 Replicates: 3 Date Retrieved: 8/18/2015

### Classification Attainment

**Statutory Class: C** **Final Determination: A** Date: 4/20/2016
Model Result with P≥0.6: A **Reason for Determination: Model**
Date Last Calculated: 4/12/2016 Comments:

### Model Probabilities

| First Stage Model | | | |
|---|---|---|---|
| Class A | 0.82 | Class C | 0.00 |
| Class B | 0.17 | NA | 0.00 |

| C or Better Model | |
|---|---|
| Class A, B, or C | 1.00 |
| Non-Attainment | 0.00 |

| B or Better Model | |
|---|---|
| Class A or B | 1.00 |
| Class C or Non-Attainment | 0.00 |

| A Model | |
|---|---|
| Class A | 0.97 |
| Class B or C or Non-Attainment | 0.03 |

### Model Variables

| | |
|---|---|
| 01 Total Mean Abundance | 255.33 |
| 02 Generic Richness | 33.00 |
| 03 Plecoptera Mean Abundance | 5.67 |
| 04 Ephemeroptera Mean Abundance | 89.33 |
| 05 Shannon-Wiener Generic Diversity | 3.77 |
| 06 Hilsenhoff Biotic Index | 3.43 |
| 07 Relative Abundance - Chironomidae | 0.02 |
| 08 Relative Generic Richness Diptera | 0.21 |
| 09 *Hydropsyche* Abundance | 14.00 |
| 11 *Cheumatopsyche* Abundance | 17.67 |
| 12 EPT Generic Richness/ Diptera Generic Richness | 3.00 |
| 13 Relative Abundance - Oligochaeta | 0.00 |
| 15 Perlidae Mean Abundance (Family Functional Group) | 5.67 |
| 16 Tanypodinae Mean Abundance (Family Functional Group) | 0.00 |
| 17 Chironomini Abundance (Family Functional Group) | 2.49 |
| 18 Relative Abundance Ephemeroptera | 0.35 |
| 19 EPT Generic Richness | 21.00 |
| 21 Sum of Abundances: *Dicrotendipes, Micropsectra, Parachironomus, Helobdella* | 0.00 |
| 23 Relative Generic Richness- Plecoptera | 0.09 |
| 25 Sum of Abundances: *Cheumatopsyche, Cricotopus, Tanytarsus, Ablabesmyia* | 17.67 |
| 26 Sum of Abundances: *Acroneuria, Maccaffertium, Stenonema* | 29.09 |
| 28 EP Generic Richness/14 | 0.86 |
| 30 Presence of Class A Indicator Taxa/7 | 0.14 |

### Five Most Dominant Taxa

| Rank | Taxon Name | Percent |
|---|---|---|
| 1 | *Chimarra* | 19.19 |
| 2 | Planariidae | 16.19 |
| 3 | *Plauditus* | 12.01 |
| 4 | *Procloeon* | 9.01 |
| 5 | *Cheumatopsyche* | 6.92 |

# Maine Department of Environmental Protection
## Biological Monitoring Program
## Aquatic Life Classification Attainment Report

**Station Number: S-1082** Town: Auburn Date Deployed: 7/22/2015
**Log Number: 2428** Waterbody: Little Androscoggin River - Station 1082 Date Retrieved: 8/18/2015

### Sample Collection and Processing Information

Sampling Organization: MOODY MOUNTAIN ENVIRONMENTAL

Taxonomist: PAUL LEEPER (MOODY MOUNTAIN ENV

| Waterbody Information - Deployment | | Waterbody Information - Retrieval | |
|---|---|---|---|
| Temperature: | 22.8 deg C | Temperature: | 24.5 deg C |
| Dissolved Oxygen: | 8.5 mg/l | Dissolved Oxygen: | 8 mg/l |
| Dissolved Oxygen Saturation: | | Dissolved Oxygen Saturation: | |
| Specific Conductance: | | Specific Conductance: | |
| Velocity: | 64 cm/s | Velocity: | 46 cm/s |
| pH: | | pH: | |
| Wetted Width: | 18 m | Wetted Width: | |
| Bankfull Width: | | Bankfull Width: | |
| Depth: | 43 cm | Depth: | 43 cm |

### Water Chemistry

### Summary of Habitat Characteristics

| Landuse Name | Canopy Cover | Terrain | |
|---|---|---|---|
| Swamp Hardwood | Partly Open | Rolling | |
| Urban | | | |
| **Potential Stressor** | **Location** | **Substrate** | |
| Regulated Flows | Below Dam | Boulder | 10 % |
| | | Gravel | 10 % |
| | | Rubble/Cobble | 80 % |

### Landcover Summary - 2004 Data

### Sample Comments

**Maine Department of Environmental Protection**
**Biological Monitoring Program**

## Aquatic Life Taxonomic Inventory Report

**Station Number: S-1082** Waterbody: Little Androscoggin River - Station 1082 Town: Auburn

**Log Number: 2428** Subsample Factor: X1 Replicates: 3 Calculated: 4/12/2016

| Taxon | Maine Taxonomic Code | Count (Mean of Samplers) Actual | Count (Mean of Samplers) Adjusted | Hilsenhoff Biotic Index | Functional Feeding Group | Relative Abundance % Actual | Relative Abundance % Adjusted |
|---|---|---|---|---|---|---|---|
| Planariidae | 03010101 | 41.33 | 41.33 | | -- | 16.2 | 16.2 |
| *Orconectes* | 09010301008 | | 0.67 | | CG | | 0.3 |
| *Orconectes limosus* | 09010301008013 | 0.67 | | | -- | 0.3 | |
| *Acroneuria* | 09020209042 | 3.67 | 3.67 | 0 | PR | 1.4 | 1.4 |
| *Perlesta* | 09020209046 | 0.67 | 0.67 | 5 | PR | 0.3 | 0.3 |
| *Agnetina* | 09020209050 | 1.33 | 1.33 | 2 | PR | 0.5 | 0.5 |
| *Procloeon* | 09020401010 | 23.00 | 23.00 | | CG | 9.0 | 9.0 |
| *Plauditus* | 09020401012 | 30.67 | 30.67 | | CG | 12.0 | 12.0 |
| Heptageniidae | 09020402 | 9.33 | | | -- | 3.7 | |
| *Stenacron* | 09020402014 | 2.67 | 3.91 | 7 | SC | 1.0 | 1.5 |
| *Maccaffertium* | 09020402015 | 12.00 | 17.60 | 4 | SC | 4.7 | 6.9 |
| *Stenonema* | 09020402016 | 5.33 | 7.82 | 4 | SC | 2.1 | 3.1 |
| *Isonychia* | 09020404018 | 0.67 | 0.67 | 2 | CF | 0.3 | 0.3 |
| *Ephemerella* | 09020410035 | 3.33 | 3.33 | 1 | CG | 1.3 | 1.3 |
| *Eurylophella* | 09020410036 | 1.33 | 1.33 | 3 | CG | 0.5 | 0.5 |
| *Caenis* | 09020412040 | 1.00 | 1.00 | 7 | CG | 0.4 | 0.4 |
| *Chimarra* | 09020601003 | 49.00 | 49.00 | 2 | CF | 19.2 | 19.2 |
| *Neureclipsis* | 09020603008 | 1.00 | 1.00 | 7 | CF | 0.4 | 0.4 |
| *Cheumatopsyche* | 09020604015 | 17.67 | 17.67 | 5 | CF | 6.9 | 6.9 |
| *Hydropsyche* | 09020604016 | 14.00 | 14.00 | 4 | CF | 5.5 | 5.5 |
| *Macrostemum* | 09020604018 | 5.00 | 5.00 | 3 | CF | 2.0 | 2.0 |
| *Rhyacophila* | 09020605019 | 0.67 | 0.67 | 2 | PR | 0.3 | 0.3 |
| *Micrasema* | 09020609044 | 0.67 | 0.67 | 2 | SH | 0.3 | 0.3 |
| *Lepidostoma* | 09020611064 | 0.67 | 0.67 | 1 | SH | 0.3 | 0.3 |
| *Oecetis* | 09020618078 | 1.00 | 1.00 | 8 | PR | 0.4 | 0.4 |
| Chironomidae | 09021011 | 0.33 | | | -- | 0.1 | |
| *Eukiefferiella* | 09021011041 | 0.33 | 0.36 | 8 | CG | 0.1 | 0.1 |
| *Rheotanytarsus* | 09021011072 | 2.33 | 2.49 | 6 | CF | 0.9 | 1.0 |
| *Endochironomus* | 09021011087 | 0.33 | 0.36 | 10 | SH | 0.1 | 0.1 |
| *Microtendipes* | 09021011094 | 0.67 | 0.71 | 6 | CF | 0.3 | 0.3 |
| *Polypedilum* | 09021011102 | 1.00 | 1.07 | 6 | SH | 0.4 | 0.4 |
| *Stenochironomus* | 09021011105 | 0.33 | 0.36 | 5 | CG | 0.1 | 0.1 |
| *Simulium* | 09021012047 | 14.67 | 14.67 | 4 | CF | 5.7 | 5.7 |
| *Psephenus* | 09021108058 | 3.00 | 3.00 | 4 | SC | 1.2 | 1.2 |
| Elmidae | 09021113 | 0.67 | | | -- | 0.3 | |
| *Microcylloepus* | 09021113066 | 4.33 | 4.91 | 3 | -- | 1.7 | 1.9 |
| *Promoresia* | 09021113069 | 0.67 | 0.76 | | -- | 0.3 | 0.3 |

# Maine Department of Environmental Protection
# Biological Monitoring Program
## Aquatic Life Classification Attainment Report

### Station Information

**Station Number: S-1083**
Waterbody: Little Androscoggin River - Station 1083
Town: Auburn
Directions: 1750 FT DOWNSTREAM OF DAM, ~400 FT DOWNSTREAM OF POWERHOUSE

River Basin: Androscoggin
HUC8 Name: Lower Androscoggin
Latitude: 44 5 18.06 N
Longitude: 70 13 29.32 W
Stream Order: 4

### Sample Information

**Log Number: 2429** Type of Sample: ROCK BAG Date Deployed: 7/22/2015
Subsample Factor: X1 Replicates: 3 Date Retrieved: 8/18/2015

### Classification Attainment

**Statutory Class: C** **Final Determination: A** Date: 4/20/2016
Model Result with P≥0.6: A **Reason for Determination: Model**
Date Last Calculated: 4/12/2016 Comments:

### Model Probabilities

| First Stage Model | | | |
|---|---|---|---|
| Class A | 0.63 | Class C | 0.02 |
| Class B | 0.36 | NA | 0.00 |

| C or Better Model | |
|---|---|
| Class A, B, or C | 1.00 |
| Non-Attainment | 0.00 |

| B or Better Model | |
|---|---|
| Class A or B | 1.00 |
| Class C or Non-Attainment | 0.00 |

| A Model | |
|---|---|
| Class A | 0.71 |
| Class B or C or Non-Attainment | 0.29 |

### Model Variables

| | |
|---|---|
| 01 Total Mean Abundance | 334.00 |
| 02 Generic Richness | 31.00 |
| 03 Plecoptera Mean Abundance | 3.67 |
| 04 Ephemeroptera Mean Abundance | 96.00 |
| 05 Shannon-Wiener Generic Diversity | 3.71 |
| 06 Hilsenhoff Biotic Index | 3.87 |
| 07 Relative Abundance - Chironomidae | 0.03 |
| 08 Relative Generic Richness Diptera | 0.13 |
| 09 *Hydropsyche* Abundance | 62.00 |
| 11 *Cheumatopsyche* Abundance | 34.67 |
| 12 EPT Generic Richness/ Diptera Generic Richness | 5.00 |
| 13 Relative Abundance - Oligochaeta | 0.00 |
| 15 Perlidae Mean Abundance (Family Functional Group) | 3.67 |
| 16 Tanypodinae Mean Abundance (Family Functional Group) | 0.00 |
| 17 Chironomini Abundance (Family Functional Group) | 5.67 |
| 18 Relative Abundance Ephemeroptera | 0.29 |
| 19 EPT Generic Richness | 20.00 |
| 21 Sum of Abundances: *Dicrotendipes, Micropsectra, Parachironomus, Helobdella* | 0.00 |
| 23 Relative Generic Richness- Plecoptera | 0.06 |
| 25 Sum of Abundances: *Cheumatopsyche, Cricotopus, Tanytarsus, Ablabesmyia* | 34.67 |
| 26 Sum of Abundances: *Acroneuria, Maccaffertium, Stenonema* | 62.80 |
| 28 EP Generic Richness/14 | 0.71 |
| 30 Presence of Class A Indicator Taxa/7 | 0.14 |

### Five Most Dominant Taxa

| Rank | Taxon Name | Percent |
|---|---|---|
| 1 | *Hydropsyche* | 18.56 |
| 2 | *Macrostemum* | 14.07 |
| 3 | *Cheumatopsyche* | 10.38 |
| 4 | *Chimarra* | 10.18 |
| 5 | *Maccaffertium* | 9.18 |
| 6 | *Stenonema* | 9.18 |

# Maine Department of Environmental Protection
## Biological Monitoring Program
## Aquatic Life Classification Attainment Report

**Station Number:** **S-1083** Town: Auburn Date Deployed: 7/22/2015
**Log Number:** **2429** Waterbody: Little Androscoggin River - Station 1083 Date Retrieved: 8/18/2015

### Sample Collection and Processing Information

Sampling Organization: MOODY MOUNTAIN ENVIRONMENTAL

Taxonomist: PAUL LEEPER (MOODY MOUNTAIN ENV

| Waterbody Information - Deployment | | Waterbody Information - Retrieval | |
|---|---|---|---|
| Temperature: | 23 deg C | Temperature: | 24.3 deg C |
| Dissolved Oxygen: | 8.5 mg/l | Dissolved Oxygen: | 8.3 mg/l |
| Dissolved Oxygen Saturation: | | Dissolved Oxygen Saturation: | |
| Specific Conductance: | | Specific Conductance: | |
| Velocity: | 55 cm/s | Velocity: | 61 cm/s |
| pH: | | pH: | |
| Wetted Width: | 24 m | Wetted Width: | |
| Bankfull Width: | | Bankfull Width: | |
| Depth: | 55 cm | Depth: | 64 cm |

### Water Chemistry

### Summary of Habitat Characteristics

| Landuse Name | Canopy Cover | Terrain | |
|---|---|---|---|
| Swamp Hardwood | Open | Rolling | |
| Urban | | | |
| **Potential Stressor** | **Location** | **Substrate** | |
| Regulated Flows | Below Dam | Boulder | 30 % |
| | | Gravel | 10 % |
| | | Rubble/Cobble | 60 % |

### Landcover Summary - 2004 Data

### Sample Comments

**Maine Department of Environmental Protection**
**Biological Monitoring Program**

## Aquatic Life Taxonomic Inventory Report

**Station Number: S-1083** Waterbody: Little Androscoggin River - Station 1083 Town: Auburn

**Log Number: 2429** Subsample Factor: X1 Replicates: 3 Calculated: 4/12/2016

| Taxon | Maine Taxonomic Code | Count (Mean of Samplers) | | Hilsenhoff Biotic Index | Functional Feeding Group | Relative Abundance % | |
|---|---|---|---|---|---|---|---|
| | | Actual | Adjusted | | | Actual | Adjusted |
| Planariidae | 03010101 | 1.67 | 1.67 | | -- | 0.5 | 0.5 |
| Perlidae | 09020209 | 0.33 | | | -- | 0.1 | |
| *Acroneuria* | 09020209042 | 1.33 | 1.47 | 0 | PR | 0.4 | 0.4 |
| *Agnetina* | 09020209050 | 2.00 | 2.20 | 2 | PR | 0.6 | 0.7 |
| Baetidae | 09020401 | 3.33 | 3.33 | | -- | 1.0 | 1.0 |
| *Plauditus* | 09020401012 | 22.00 | 22.00 | | CG | 6.6 | 6.6 |
| Heptageniidae | 09020402 | 26.00 | | | -- | 7.8 | |
| *Maccaffertium* | 09020402015 | 17.67 | 30.67 | 4 | SC | 5.3 | 9.2 |
| *Stenonema* | 09020402016 | 17.67 | 30.67 | 4 | SC | 5.3 | 9.2 |
| *Isonychia* | 09020404018 | 8.00 | 8.00 | 2 | CF | 2.4 | 2.4 |
| *Ephemerella* | 09020410035 | 0.33 | 0.33 | 1 | CG | 0.1 | 0.1 |
| *Serratella* | 09020410037 | 0.67 | 0.67 | 2 | CG | 0.2 | 0.2 |
| *Caenis* | 09020412040 | 0.33 | 0.33 | 7 | CG | 0.1 | 0.1 |
| *Chimarra* | 09020601003 | 34.00 | 34.00 | 2 | CF | 10.2 | 10.2 |
| *Neureclipsis* | 09020603008 | 13.33 | 13.33 | 7 | CF | 4.0 | 4.0 |
| *Polycentropus* | 09020603010 | 0.33 | 0.33 | 6 | PR | 0.1 | 0.1 |
| *Cheumatopsyche* | 09020604015 | 34.67 | 34.67 | 5 | CF | 10.4 | 10.4 |
| *Hydropsyche* | 09020604016 | 62.00 | 62.00 | 4 | CF | 18.6 | 18.6 |
| *Macrostemum* | 09020604018 | 47.00 | 47.00 | 3 | CF | 14.1 | 14.1 |
| *Rhyacophila* | 09020605019 | 0.33 | 0.33 | 2 | PR | 0.1 | 0.1 |
| *Lepidostoma* | 09020611064 | 1.00 | 1.00 | 1 | SH | 0.3 | 0.3 |
| *Ceraclea* | 09020618072 | 0.67 | 0.67 | 3 | CG | 0.2 | 0.2 |
| *Oecetis* | 09020618078 | 1.00 | 1.00 | 8 | PR | 0.3 | 0.3 |
| *Corydalus* | 09020701002 | 0.33 | 0.33 | 6 | PR | 0.1 | 0.1 |
| *Rheotanytarsus* | 09021011072 | 5.33 | 5.33 | 6 | CF | 1.6 | 1.6 |
| *Microtendipes* | 09021011094 | 0.67 | 0.67 | 6 | CF | 0.2 | 0.2 |
| *Polypedilum* | 09021011102 | 5.00 | 5.00 | 6 | SH | 1.5 | 1.5 |
| *Simulium* | 09021012047 | 11.33 | 11.33 | 4 | CF | 3.4 | 3.4 |
| *Psephenus* | 09021108058 | 2.00 | 2.00 | 4 | SC | 0.6 | 0.6 |
| *Microcylloepus* | 09021113066 | 0.33 | 0.33 | 3 | -- | 0.1 | 0.1 |
| *Promoresia* | 09021113069 | 6.00 | 6.00 | | -- | 1.8 | 1.8 |
| *Stenelmis* | 09021113070 | 6.67 | 6.67 | 5 | SC | 2.0 | 2.0 |
| Hydrobiidae | 10010104 | 0.67 | 0.67 | | -- | 0.2 | 0.2 |