LIST OF ATTACHMENTS FROM LIHI RE-CERTIFICATION APPLICATION FOR RED BRIDGE PROJECT

1. Aerial Photographs of Red Bridge Project.
2. Aerial Photograph of Red Bridge Impoundment ZoE.
3. Aerial Photograph of Red Bridge Bypassed Reach ZoE.
4. Aerial Photograph of Red Bridge Tailrace Zoe
5. 2017 Demonstration of Minimum Flow, dated March 29, 2018.
6. FERC Environmental Inspection Report, dated June 17, 2015 **(CEII Protected).**
7. FERC Dam Safety Inspection Report, dated June 29, 2016 **(CEII Protected).**
8. Essential Power Letter, dated September 30, 2016.
9. FERC Follow-Up Letter, dated April 6, 2017.
10. Cogentrix Letter, dated April 13, 2017.
11. FERC Follow-Up Letter, dated May 17, 2017.
12. C. Slater Letter to Mark Noyes, dated February 15, 2000.
13. US F&WS Letter, dated June ____, 2018.
14. MDFW Letter, Dated June ____, 2018
15. MDEP Letter, dated June ___, 2018.
16. FERC E-Mail Correspondence Regarding Minimum Flow and Impoundment Fluctuation Monitoring Plan, dated July 24, 2012.
17. FERC Order Approving Minimum Flow and Impoundment Fluctuation Plan, dated August 3, 2012.
18. **Appendix 1-4, FWS letter setting minimum flows, dated July 14, 1989.**
19. **Appendix 1-5, DOI letter setting mandatory terms and conditions, dated July 31, 1992.**
20. **Appendix 3-2, Mode of Operation.**
21. **Appendix 3-4, Site Plan of the Facility.**
22. **Appendix A, Flows.**
23. **Appendix A-6, FWS E-mail, dated October 13, 2011.**
24. **Appendix A-7, MDEP Letter, dated October 19, 2011.**

25. **Appendix A-8, Minimum Flow and Impoundment Fluctuation Monitoring Plan, Dated February 20, 2012.**

26. Draft Massachusetts Year 2016 List of Integrated Waters.

27. **Appendix B, Water Quality.**

28. **Appendix B-1, Dissolved Oxygen at Gatehouse.**

29. **Appendix B-2, WMECO Exhibit E -- Environmental Report, dated November 1989.**

30. **Appendix B-3, WMECO Exhibit E -- Environmental Report, Appendix D -- Water Quality Report, dated November 1989.**

31. **Appendix B-4, Chicopee River Watershed 2003 Water Quality Assessment Report.**

32. Chicopee River, A Comprehensive Watershed Assessment, 2003, dated July 29, 2003.

33. **C. Slater E-mail to F. Ayer, dated May 11, 2012.**

34. **Appendix C, Fish Passage and Protection.**

35. Construction Photographs of Red Bridge Power Canal Wall

36. FERC Letter order authorizing NAEA Energy Massachusetts, LLC to proceed with construction at the Red Bridge and requesting them within 45 days of completion to submit a final construction report, dated October 3, 2012.

37. Essential Power Letter, dated March 22, 2013 **(CEII Protected).**

38. Kleinschmidt Letter, dated March 26, 2013.

39. **Appendix D, Watershed Protection.**

40. **Appendix D-1, Kleinschmidt Letter, dated March 19, 2001.**

41. US FWS Federally Listed Endangered and Threatened Species in Massachusetts, updated February 5, 2016.

42. MDFW E-mail regarding Red Bridge Project, dated May 31, 2018.

43. Reply to Red Bridge MESA Information Request, dated June 5, 2018

44. **Appendix E, Threatened and Endangered Species Protection.**

45. **Appendix E-1, MDFW Letter, dated October 26, 2011.**

46. FERC Letter to EP Energy Massachusetts, LLC regarding the pre-construction filing for the Red Bridge Penstock Repair Project, dated November 10, 2014.

47. **Appendix F, Cultural Resource Protection.**

48. **Appendix F-1, MHC Letter, dated July 2, 2002.**

49. **Appendix F-2, MHC Letter, dated September 27, 2011.**

50. **Appendix G, Recreation.**

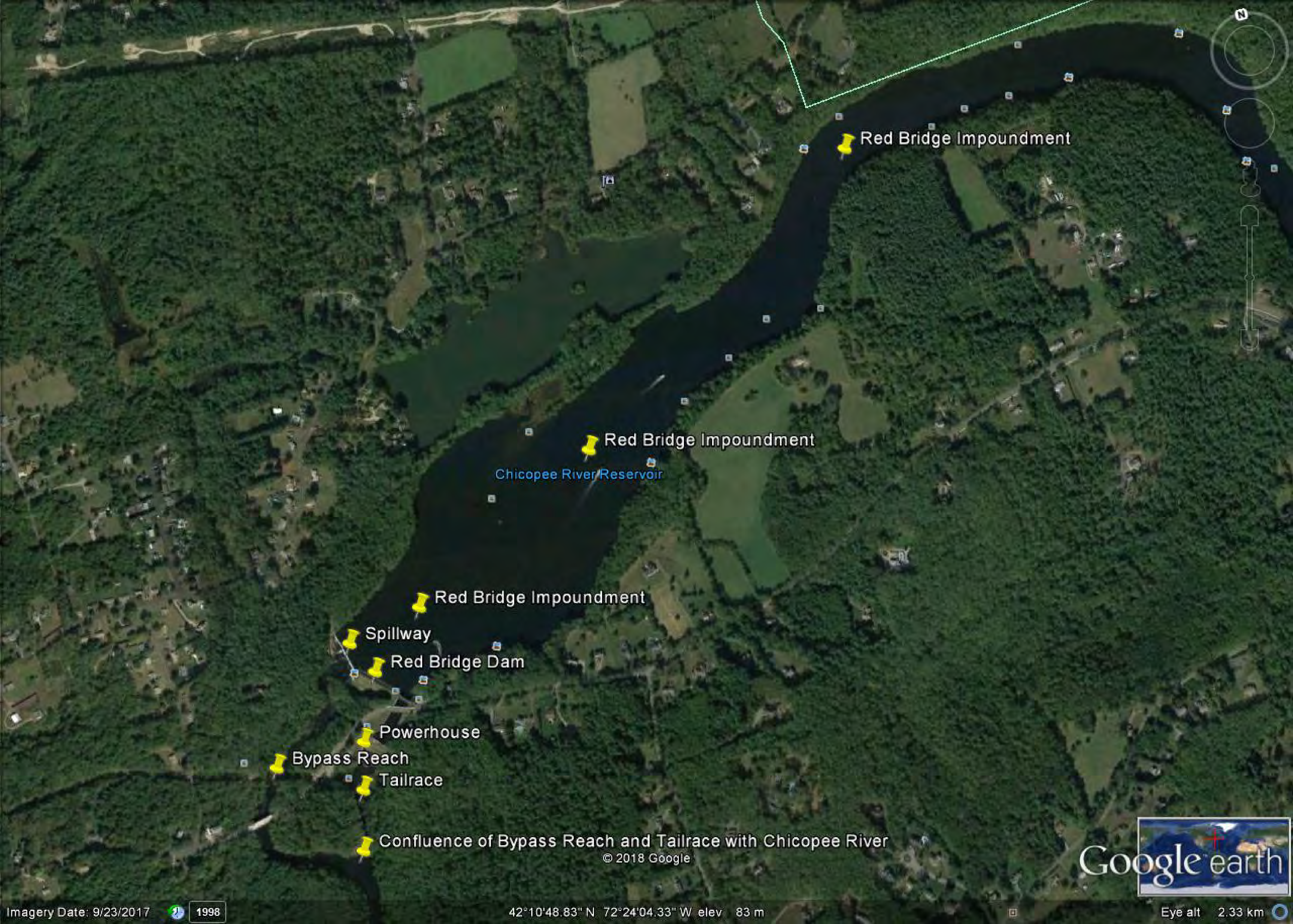
51. **Appendix G-1, Existing Recreational Facilities.**

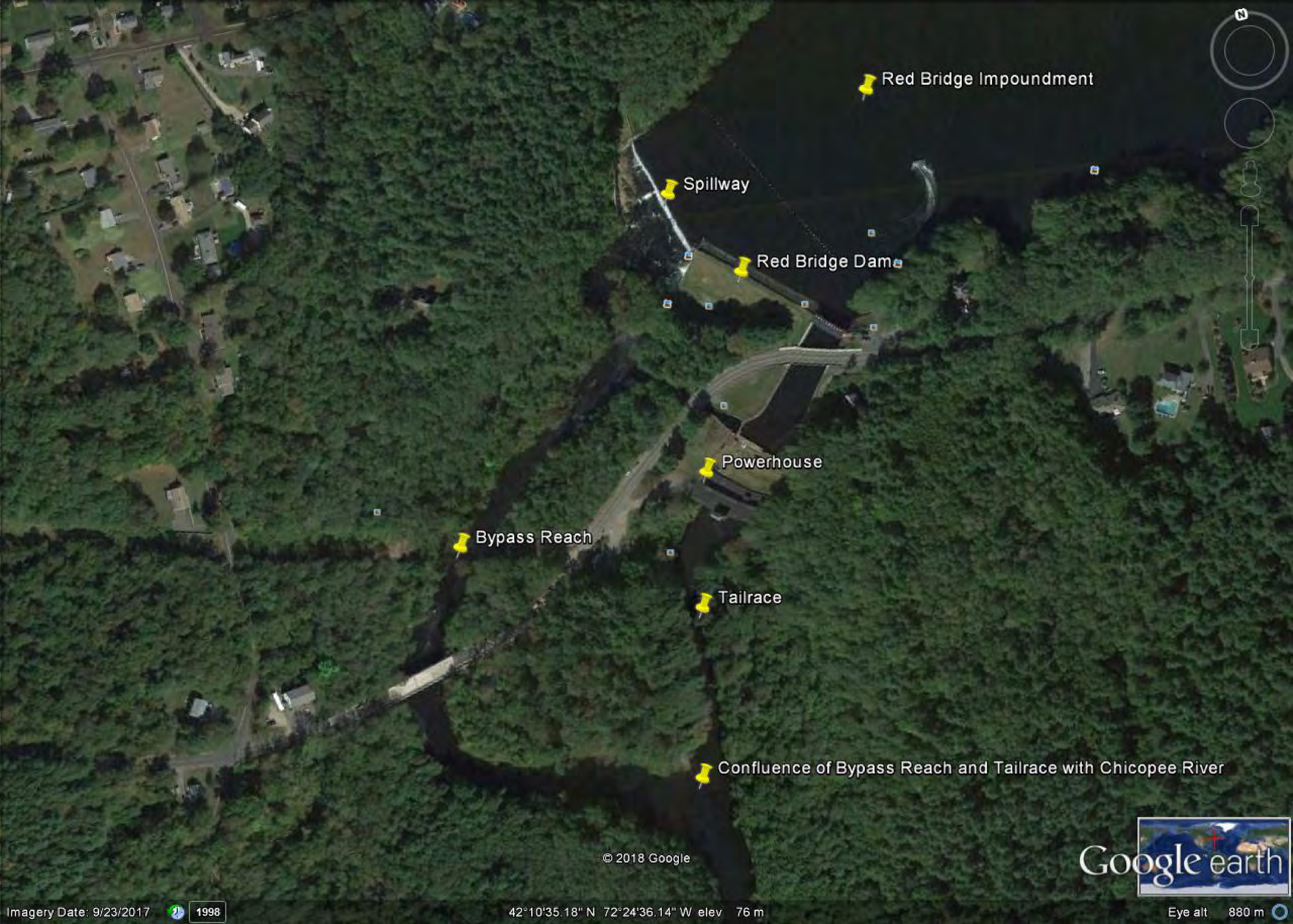
52. **Appendix G-2, FERC Environmental Inspection Report, dated November 4, 2010.**

53. **Appendix G-3, NAEA Letter, dated March 7, 2011.**

54. **Appendix G-4, FERC Letter, dated October 12, 2011.**

55. **Appendix G-5, MDFG Letter, dated December 1, 2011.**


Red Bridge Impoundment
Red Bridge Impoundment
Chicopee River Reservoir
Red Bridge Impoundment
Spillway
Red Bridge Dam
Powerhouse
Bypass Reach
Tailrace
Confluence of Bypass Reach and Tailrace with Chicopee River
© 2018 Google
Google earth
Imagery Date: 9/23/2017
1998
42°10'48.83" N 72°24'04.33" W elev 83 m
Eye alt 2.33 km


Red Bridge Impoundment
Spillway
Red Bridge Dam
Powerhouse
Bypass Reach
Tailrace
Confluence of Bypass Reach and Tailrace with Chicopee River
© 2018 Google
Google earth
Imagery Date: 9/23/2017
1998
42°10'35.18" N 72°24'36.14" W elev 76 m
Eye alt 880 m


Red Bridge Impoundment
Red Bridge Impoundment
Chicopee River Reservoir
Red Bridge Impoundment
Spillway
Red Bridge Dam
© 2018 Google
Google earth
Imagery Date: 9/23/2017
1998
42°10'52.69" N 72°24'06.11" W elev 82 m
Eye alt 1.54 km


Spillway
Red Bridge Dam
Powerhouse
Bypass Reach
Tailrace
Confluence of Bypass Reach and Tailrace with Chicopee River
© 2018 Google
Google earth
Imagery Date: 9/23/2017
1998
42°10'33.91" N 72°24'32.27" W elev 81 m
Eye alt 688 m


Powerhouse
Tailrace
Confluence of Bypass Reach and Tailrace with Chicopee River
Google earth
Imagery Date: 9/23/2017
1998
42°10'30.89" N 72°24'33.65" W elev 75 m
Eye alt 386 m

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF ENERGY PROJECTS
Division of Dam Safety and Inspections – New York Regional Office
19 West 34th Street – Suite 400
New York, New York 10001

Office No. (212) 273-5900 **FAX No. (212) 631-8124**

In reply refer to:
P-10676-MA
NATDAM# MA00723,

Red Bridge Development
Response to Plan and
Schedule for Right
Abutment Repair

May 17, 2017

Mr. Kim Marsili
EP Energy Massachusetts, LLC
15 Agawam Avenue
West Springfield, MA 01089

Dear Mr. Marsili:

We have reviewed your April 13, 2017 letter providing your plan and schedule to repair the ATV damage to the right abutment by November 1, 2017. We accept your plan and schedule to make these repairs.

Please provide a close-out letter by December 1, 2017 including photographs of the repaired area. If you have any questions, please contact Ms. Katherine Adnams at (212) 273-5912 or katherine.adnams@ferc.gov.

Sincerely,

John Spain, P.E.
Regional Engineer

Document Content(s)

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF ENERGY PROJECTS
Division of Dam Safety and Inspections – New York Regional Office
19 West 34th Street – Suite 400
New York, New York 10001

Office No. (212) 273-5900 **FAX No. (212) 631-8124**

In reply refer to:
P-10676-MA
NATDAM# MA00723,

Red Bridge Development
Response to 2016
Inspection Follow-up
Letter

April 6, 2017

Mr. Kim Marsili
EP Energy Massachusetts, LLC
15 Agawam Avenue
West Springfield, MA 01089

Dear Mr. Marsili:

We have reviewed your September 30, 2016 letter responding to our June 29, 2016 letter post inspection letter. We accept your responses and plan and schedule to address these items.

We have also discussed Item 3 for Red Bridge regarding the ATV induced erosion at the right abutment, and understand you will coordinate with the landowner, develop a repair and implement that repair. Please provide a plan and schedule for this work within 45 days of the date of this letter.

If you have any questions, please contact Ms. Katherine Adnams at (212) 273-5912 or katherine.adnams@ferc.gov.

Sincerely,

John Spain, P.E.
Regional Engineer

Document Content(s)

Cogentrix

Nautilus Hydro, LLC

15 Agawam Ave
West Springfield, MA 01089
413-730-4721
Fax 413-730-4769

April 13th, 2017

John Spain, P.E.
Federal Energy Regulatory Commission
19 West 34th Street, Suite 400
New York, NY 10001

RE: P-10676-MA NATDAM# MA00723 Red Bridge Development Response to 2016 Inspection Follow-up Letter

Dear Mr. Spain,

This letter is in regards to the letter dated April 6th, 2017 that details FERC's comments on the ATV traffic soil erosion at the right abutment of the Red Bridge hydroelectric facility.

Repair options will be evaluated and any ancillary work deemed necessary such as surveying and acquiring easements will be completed this summer with the intent to have the issue completed in a satisfactory manner no later than November 1st, 2017.

If you have any questions regarding these items, please contact me at (413) 730-4721.

Sincerely,

Kim C Marsili

Kim Marsili
General Manager
Red Bridge Station

cc: Katherine Adnams, FERC
cc: John Collins, VP Asset Management, Cogentrix
cc: Nick Hollister, Manager, Hydro Operations

Document Content(s)

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF ENERGY PROJECTS
Division of Dam Safety and Inspections – New York Regional Office
19 West 34th Street – Suite 400
New York, New York 10001

Office No. (212) 273-5900 **FAX No. (212) 631-8124**

In reply refer to:
P-10676-MA
NATDAM# MA00723,

Red Bridge Development
Response to Plan and
Schedule for Right
Abutment Repair

May 17, 2017

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EP Energy Massachusetts, LLC
15 Agawam Avenue
West Springfield, MA 01089

Dear Mr. Marsili:

We have reviewed your April 13, 2017 letter providing your plan and schedule to repair the ATV damage to the right abutment by November 1, 2017. We accept your plan and schedule to make these repairs.

Please provide a close-out letter by December 1, 2017 including photographs of the repaired area. If you have any questions, please contact Ms. Katherine Adnams at (212) 273-5912 or katherine.adnams@ferc.gov.

Sincerely,

John Spain, P.E.
Regional Engineer

Document Content(s)

FEDERAL ENERGY REGULATORY COMMISSION
MEMORANDUM

DATE: July 24, 2012

FROM: Kelly Houff, Environmental Protection Specialist
Division of Hydropower Administration and Compliance
Office of Energy Projects
(202) 502-6393

TO: Commission and public files for the Dwight Station, Red Bridge, Putts Bridge, and Indian Orchard hydroelectric projects (FERC Project Nos. P-10675-016, 10676-020, 10677-017, and 10678-020)

SUBJECT: Email correspondence record attached between Commission staff, Kelly Houff, and Mr. Kim Marsili, Station Manager, EP Energy Massachusetts, LLC, regarding the Minimum Flow and Impoundment Fluctuation Plan for the Dwight Station, Red Bridge, Putts Bridge, and Indian Orchard hydroelectric Projects located on the Chicopee River in Massachusetts.

Kelly Houff

From: Kim Marsili
Sent: Wednesday, July 18, 2012 10:45 AM
To: kelly.houff@ferc.gov
Subject: RE: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects 202 502 6393
Attachments: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects202 502... (15.1 KB); Min Flow and Impoundment Fluctuation Plan for Chicopee Projects202 502... (11.8 KB)

Kelly I received your voice mail. My apologies I thought you were cc'd on the responses I received back for the FWS and the MADEP. Please see the emails attached I believe this answers our concerns. I will give you a call back today.

Kim Marsili
Station Manager
EP *Energy* Massachusetts LLC
Email kim.marsili@essentialpowerllc.com
Office 413 730 4721
Cell 413 627 9960

From: Kim Marsili
Sent: Friday, June 08, 2012 1:51 PM
To: caleb.slater@state.ma.us; robert.kubit@state.ma.us
Cc: Melissa_Grader@fws.gov; Bill Short (w.shortiii@verizon.net); David Schmidt
Subject: FW: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects 202 502 6393
Importance: High

Caleb/Robert, I had a conversation with Kelly Houff from FERC. She is getting ready to file our revised Min-Flow and Impoundment Fluctuation Plan but needs me to provide her with a statement from your agencies. What FERC needs is a statement that we have answered the original concerns that where raised back in 2000/2001. For your convenience I have attached the new submittal of the plan we discussed. Could I trouble you to send me either hard copy or via e-mail that we have discussed the revised plan and that it meets expectations. I had sent the same request to Melissa earlier, however I forgot to cc you both. Please let me know if you need anything else. Thanks

Kim Marsili
Station Manager
EP *Energy* Massachusetts LLC
Email kim.marsili@essentialpowerllc.com
Office 413 730 4721
Cell 413 627 9960

From: Kelly Houff [mailto:kelly.houff@ferc.gov]

Sent: Monday, June 04, 2012 2:24 PM
To: Kim Marsili
Subject: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects 202 502 6393

Hi Kim,

I am just following up from our phone call that I am requesting written documentation of your consultation with the resource agencies (FWS, MADEP, MAFWS) that they have reviewed the updated minimum flow and impoundment fluctuation monitoring plan and they concur that there are no longer any issues with the Plan for the Chicopee River Projects, P-10675, 10676, 10677, and 10678. If you could please file the documentation electronically that would be most helpful. Thanks and I hope you have a great day!

Best regards,
Kelly Houff

Kelly Houff

From: Slater, Caleb (MISC) [caleb.slater@state.ma.us]
Sent: Tuesday, June 12, 2012 10:15 AM
To: Kim Marsili; Kubit, Robert (DEP)
Cc: Melissa_Grader@fws.gov; Bill Short(w.shortiii@verizon.net); David Schmidt
Subject: RE: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects202 502 6393
Follow Up Flag: Follow up
Flag Status: Flagged

Kim,

The attached min flow plan for the Chicopee projects looks good to me. It will fulfill your FERC requirements under your current terms and conditions. Please be aware that these terms and conditions may not be sufficient to gain Low Impact Hydroelectric Certification for these projects.

Caleb

Caleb Slater, PhD
Anadromous Fish Project Leader
Massachusetts Division of Fisheries and Wildlife
(508) 389-6331

From: Kim Marsili [mailto:Kim.Marsili@essentialpowerllc.com]
Sent: Friday, June 08, 2012 1:51 PM
To: Slater, Caleb (FWE); Kubit, Robert (DEP)
Cc: Melissa_Grader@fws.gov; Bill Short (w.shortiii@verizon.net); David Schmidt
Subject: FW: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects 202 502 6393
Importance: High

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Kim Marsili
Station Manager
EP *Energy* Massachusetts LLC
Email kim.marsili@essentialpowerllc.com
Office 413 730 4721

Cell 413 627 9960

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Best regards,
Kelly Houff

Kelly Houff

From: Kubit, Robert (DEP) [robert.kubit@state.ma.us]
Sent: Tuesday, June 12, 2012 3:55 PM
To: Kim Marsili
Subject: RE: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects202 502 6393
Follow Up Flag: Follow up
Flag Status: Flagged

Kim,

The Minimum Flow and Impoundment Fluctuation Plan for Projects #10675, 10676, 10677 and 10678 as presented appear adequate to meet FERC license conditions. We concur with the MA Division of Fisheries & Wildlife that compliance with FERC conditions does not by itself qualify a Project for Low Impact certification.

Bob

Robert Kubit, P.E.
MassDEP
Division of Watershed Management
627 Main Street
Worcester MA 01608
Telephone: (508) 767-2854
Email: robert.kubit@state.ma.us
Fax: (508) 791-4131

From: Kim Marsili [mailto:Kim.Marsili@essentialpowerllc.com]
Sent: Friday, June 08, 2012 1:51 PM
To: Slater, Caleb (FWE); Kubit, Robert (DEP)
Cc: Melissa_Grader@fws.gov; Bill Short (w.shortiii@verizon.net); David Schmidt
Subject: FW: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects 202 502 6393
Importance: High

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Kim Marsili
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EP *Energy* Massachusetts LLC
Email kim.marsili@essentialpowerllc.com
Office 413 730 4721
Cell 413 627 9960

From: Kelly Houff [mailto:kelly.houff@ferc.gov]
Sent: Monday, June 04, 2012 2:24 PM
To: Kim Marsili
Subject: Min Flow and Impoundment Fluctuation Plan for Chicopee Projects 202 502 6393

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Best regards,
Kelly Houff

140 FERC ¶ 62,098
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

EP Energy Massachusetts, LLC — Project Nos. 10675-016, 10676-020, 10677-017, 10678-020

ORDER APPROVING MINIMUM FLOW AND IMPOUNDMENT FLUCTUATION MONITORING PLAN

(August 3, 2012)

1. On February 28, 2012, and supplemented on July 18, 2012, EP Energy Massachusetts, LLC (exemptee) filed a Minimum Flow and Impoundment Fluctuation Monitoring Plan (Plan) pursuant to the terms and conditions of the U.S. Fish and Wildlife Service (FWS), and the Massachusetts Division of Fisheries and Wildlife (MDFW) for the exemptions of the Dwight Station Project No. 10675, Red Bridge Project No. 10676, Putts Bridge Project No. 10677, and Indian Orchard Project No. 10678, collectively known as the Chicopee River projects.[1] The projects are located on the Chicopee River in Hampden and Hampshire counties, Massachusetts.

Background

2. Article 2 of the exemptions for the Chicopee River projects requires compliance with the terms and conditions prepared by federal and state fish and wildlife agencies. The FWS and MDFW modified the terms and conditions for the projects by letters dated January 27, 2000, and February 15, 2000, respectively as a result of the December 29, 1999 Order Amending Exemptions.[2] Condition 5 of the FWS terms and conditions, and Condition 6 of the MDFW, require the exemptee to submit within six months of the December 29, 1999 Order Amending Exemptions for the Chicopee River projects, a plan for monitoring project impoundment levels and instantaneous bypass flow releases. Following approval of the Plan, the exemptee shall measure and record impoundment

---

[1] *Western Massachusetts Electric Company*, 60 FERC ¶ 62,199 (1992), 60 FERC ¶ 62,198 (1992), 60 FERC ¶ 62,197 (1992), 60 FERC ¶ 62,196 (1992), respectively.

[2] *Consolidated Edison Energy Inc.*, 89 FERC ¶ 61,256 (1999).

levels and flows according to the Plan, and provide records of this data to the FWS within 30 days of a request.

3. In addition, the January 27, 2000, and February 15, 2000 letters require the Plan to: 1) detail the flow release structures and locations; 2) describe the mechanisms used to monitor head pond elevation and minimum flows; 3) specify how often maintenance and calibration of the monitoring and recording equipment will take place; 4) state how bypass flows will be maintained during any periodic maintenance activities that require the impoundment to be drawn down below the level of the flow release structures; and 5) state how frequently and in what form the data are recorded. A calculation sheet that verifies the discharge of each release structure (i.e., slide/canal gate, board notches and dam spill) under all operating ranges should be included.

4. On October 5, 2001, Consolidated Edison Energy Massachusetts, Inc., the exemptee of the Chicopee projects at the time, sent the FWS and MDFW a draft Plan for review and comment. By letter dated November 6, 2001, FWS commented on the draft Plan. FWS requested that the exemptee include additional information with respect to the impoundment fluctuations and release mechanisms in the Plan, as well as requested field calibration to occur as soon as possible to verify that the release structures were passing the required minimum flows. By letter dated November 15, 2001, MDFW commented that the Plan should specify the set points programmed into the Programmable Logic Controlling (PLC) device, specify the frequency of monitoring the pond elevation and changes to gate adjustments, based on the response to the data, and how frequently the pond level will be recorded. MDFW also sought clarification as to how long the data for the pond elevation will be kept, and requested calculations to quantify the flow to be released from the alternative flow devices used during periods of maintenance.

5. On April 18, 2001, Consolidated Edison Energy Massachusetts, Inc, in its letter to the FWS, agreed that the agencies had the authority to modify the terms and conditions of the exemptions, and indicated it would file the revised Plan by May 31, 2001. However, the exemptee never responded to FWS and MDFW's comments, nor did it file the Plan with the Commission.

6. By the February 28, 2012 filing, EP Energy Massachusetts, LLC attempts to correct the previous exemptee's noncompliance (EP Energy Massachusetts, LLC purchased the project from Consolidated Edison Energy of Massachusetts, LLC in 2008) with the federal and state terms and conditions of the exemptions for the Chicopee River projects.

Exemptee's Plan

Dwight Station Project

7. The Plan details the flow release structures and locations by describing that the exemptee is required to release a minimum flow of 258 cubic feet per second (cfs) (or inflow, if less) at the Dwight Dam. The flashboards have permanently been removed from the facility, thus the minimum flows will be passed over the dam crest. In addition, Condition 3 of the MDFW, and Condition 4 of the FWS, limit impoundment drawdown to a minimum of five inches above the dam crest, except for system emergencies or annual energy audits. During infrequent impoundment drawdown for major dam repairs, minimum flows will be maintained, and the mechanism for releasing the minimum flow will be outlined in a letter sent to the agencies prior to the impoundment drawdown.

8. The Plan also outlines that the impoundment levels would be continuously monitored through the use of an electronic pressure transducer located on the south shoreline, slightly upstream of the canal gatehouse. An electronic recording of the impoundment level, in addition to instantaneous visual displays in the gate house, will ensure compliance with the required impoundment limits. The canal headgates will be controlled by a PLC device located within the canal gate house that adjust the headgate opening based upon impoundment level, canal level, and unit operational status. The impoundment level control is proportional-integral-derivative based, and will be programmed to maintain an impoundment elevation of 77 feet, five inches above the permanent spillway crest level. The PLC will continually monitor impoundment level, and will record the level using a strip chart as the primary recording mechanism. A data logger will record the impoundment elevations every 15 minutes as a secondary recording mechanism.

9. The exemptee states in the Plan that maintenance to the monitoring systems would be performed on an as-needed basis with calibration of the instruments occurring every two years. At a minimum, operators would visit the project approximately twice per week to confirm proper station operation. The station is also equipped with unit alarms to notify operational personnel of equipment malfunctions.

Red Bridge Project

10. The Plan states that the required minimum flow of 237 cfs (or inflow, if less) would be released from a 7-foot-wide, 8.5-foot-high bottom discharge gate at the southern end of the spillway. The gate is equipped with an electric screw stem actuator capable of manual operation in the event of a power outage. Absent a power loss, the gate will be electronically controlled by a PLC device, which will continuously monitor impoundment elevations. Therefore, the gate positions will adjust automatically over the range of the impoundment fluctuations to consistently release the minimum flow of 237 cfs.

11. The exemptee is required to limit the impoundment drawdown to one foot below the crest of the dam, or an elevation of 272.24 feet from April 1 to June 30, and 2 feet

below the crest of the dam from July 1 to March 30, except for system emergencies or annual energy audits. The impoundment fluctuations will be measured through the use of an electronic pressure transducer located upstream of the canal headgates. Documentation of compliance with the impoundment limits will be by electronic recording of the level, and instantaneous visual displays in the powerhouse. The impoundment level and minimum flow gate will be continuously recorded using strip chats, and a secondary data logger will record the impoundment level every fifteen minutes as a backup.

12. During periods of gate maintenance or malfunctions, minimum flows will be maintained by spilling flows over the dam spillway and maintaining an impoundment level five inches above the crest level when the units are generating. During times of infrequent drawdown for major repairs, minimum flows will also be maintained, and the mechanism will be outlined in a letter sent to the resource agencies prior to the impoundment drawdown.

13. The Plan states that maintenance to the monitoring system will occur on an as-needed basis, with calibration of the instruments occurring approximately every two years. At a minimum, operators will visit the project twice per week to confirm proper station operation. The station is also equipped with alarms to notify operations personnel of equipment malfunctions.

<u>Putts Bridge Project</u>

14. The exemptee is required to release a minimum flow of 25 cfs (or inflow, if less) into the Putts Bridge bypassed reach. The Plan states that the minimum flow will be released through a single, six-foot-wide, eight-foot-high top discharge gate located on the dam's north abutment. The gate is electronically operated, and controlled by a PLC, which automatically adjusts the gate opening with fluctuating impoundment elevations to maintain a constant discharge over the top of the gate. The PLC will continuously monitor and record the gate position in addition to the impoundment elevation using strip charts.

15. Additionally, the exemptee is required to limit drawdown to one foot below the top of the flashboards, elevation 205.25 feet, from April to June 30, and 2 feet below the top of the flashboards for the remainder of the year, except for system emergencies or annual energy audits.

16. The Plan states that impoundment fluctuations will be measured through the use of electronic pressure transducers. Documentation of compliance with the impoundment limits will be supplied by hourly strip charts recording impoundment levels, in addition to instantaneous visual displays in the powerhouse.

17. During periodic maintenance activities to the minimum flow gate, flows will be discharged over the dam crest. In addition, during infrequent drawdown for major dam repairs, minimum flows will be maintained, and the mechanism for the flow releases will be outlined in a letter to the agencies prior to the impoundment drawdown. The Plan also states that maintenance to the monitoring and control systems will be performed on an as-needed basis, with calibration occurring approximately every two years. At a minimum, the operators will visit the project approximately twice per week to confirm proper station operation. The station is also equipped with alarms to notify operations personnel of equipment malfunctions.

Indian Orchard Project

18. The exemptee is required to release a minimum flow of 247 cfs (or inflow, if less) at the Indian Orchard Dam. The Plan indicates that the minimum flows will be released through the use of two canal drainpipes, located immediately downstream of the canal headgates, on the north side of the canal. Each drainpipe is 36-inch in diameter, corrugated metal, and has an invert of elevation 151.7 feet. Each pipe is equipped with a 2.5 foot square entrance control gate that is automatically operated based on impoundment level. The control gates are fully opened for impoundment levels at or above elevation 160.8 feet, while the units are generating. If the impoundment levels begin or continue to drop below an elevation of 160.5 feet, the gate closes in approximately five percent increments to restrict impoundment levels from dropping further. This control feature allows the passage of inflows to the project until inflows exceed the 247 cfs. Documentation of compliance with the minimum flow requirement is supplied by strip charts that continuously monitor the impoundment level in addition to instantaneous visual displays in the powerhouse.

19. The exemptee must also limit drawdown of the impoundment to 0.5 foot below the top of the flashboards, or dam crest if the boards are out, from April 1 to June 30, and 1 foot below the top of the flashboards, or dam crest if boards are out, for the remainder of the year, except for system emergencies or annual energy audits. The impoundment levels are controlled through the use of the project's turbines, which operate in automatic mode using impoundment level controls. The Plan states that the impoundment fluctuations will be measured through the use of electronic pressure transducers located upstream of the gatehouse. The levels will be continuously monitored and recorded on strip charts. As a secondary method, a data logger will also record the impoundment level every fifteen minutes.

20. During any periodic maintenance activities that require the canal to be dewatered, project generation is discontinued, and river flows are passed over the dam spillway. Any periodic maintenance to the flashboards requires the impoundment level to be lowered to approximately one foot below the crest of the dam, during which flows will be released via the canal drain gates. The Plan further states that the flows will be

subsidized with a pump to ensure minimum flows are maintained. During infrequent impoundment drawdown for major dam repairs, the minimum flow will be maintained, and the release mechanism will be outlined in a letter to the agencies prior to the drawdown. Maintenance to the impoundment level and drainpipe control gate systems will be performed on an as-needed basis, with calibration of the instruments being performed approximately every two years. At a minimum, operators will visit the project approximately twice a week to confirm proper station operation. The station is also equipped with alarms to notify operations personnel of equipment malfunctions.

Agency Consultation

21. On June 8, 2012, the exemptee re-submitted the Plan to the FWS, MDFW, and the Massachusetts Department of Environmental Protection (MDEP), requesting that the agencies confirm that the outstanding comments from 2000 were adequately addressed in the Plan, and requesting concurrence with the Plan. The MDFW and MDEP provided concurrence on the Plan on June 12, 2012 via email. No other comments were received.

Discussion and Conclusion

22. We reviewed the exemptees's Plan filed on February 28, 2012, and supplemented July 18, 2012, and it satisfies the requirements of Condition 5 of the FWS, and Condition 6 of the MDFW of the exemptions for the Chicopee River projects. The Plan adequately provides the details of the flow release structures and locations for the Dwight Station, Red Bridge, Putts Bridge, and Indian Orchard projects. The Plan also describes the mechanisms used to monitor head pond elevations and minimum flows, specifications of how often maintenance and calibration of the monitoring and recording equipment will occur, how bypass flows will be maintained during any periodic maintenance activities that require the impoundment to be drawn down below the level of the release structures, and how frequently and in what form the data will be recorded. The Minimum Flow and Impoundment Fluctuation Monitoring Plan should therefore be approved.

23. However, this Plan was required by the FWS and MDFW, and Article 2 of the exemption order over a decade ago. While the current exemptee is trying to fulfill the outstanding requirement, the fact that the Plan was required so long ago cannot be ignored. Nonetheless, we recognize that the current exemptee only recently realized that the requirement was outstanding. We note that in the future, the exemptee should comply with the requirements and timeframes set forth in the exemptions for the Chicopee River projects.

The Director orders:

(A) EP Energy Massachusetts, LLC's Minimum Flow and Impoundment Fluctuation Monitoring Plan, filed February 28, 2012, and supplemented July 18, 2012, pursuant to Article 2, and the terms and conditions of the U.S. Fish and Wildlife Service and the Massachusetts Department of Fisheries and Wildlife for the exemptions for the Dwight Station, Red Bridge, Putts Bridge, and Indian Orchard projects, is approved.

(B) This order constitutes final agency action. Any party may file a request for rehearing of this order within 30 days from the date of its issuance, as provided in section 313(a) of the Federal Power Act, 16 U.S.C. § 825*l* (2006), and the Commission's regulations at 18 C.F.R. § 385.713 (2012). The filing of a request for rehearing does not operate as a stay of the effective date of this order, or of any other date specified in this order. The exemptee's failure to file a request for rehearing shall constitute acceptance of this order.

William Guey-Lee
Chief, Engineering Resources Branch
Division of Hydropower Administration
and Compliance

Document Content(s)

56

United States Department of the Interior

FISH AND WILDLIFE SERVICE
400 RALPH PILL MARKETPLACE
22 BRIDGE STREET
CONCORD, NEW HAMPSHIRE 03301-4901

FILED
OFFICE OF THE
SECRETARY
1989 JUL 20 PM 4:43

FEDERAL ENERGY
REGULATORY COMMISSION

REF: Chicopee River Projects

July 14, 1989

Mr. Brandon H. Kulik
Kleinschmidt Associates
75 Main Street, P.O. Box 576
Pittsfield, Maine 04967

Dear Mr. Kulik:

This is in reference to your June 14 and June 30, 1989 hydrologic analysis for the Chicopee River, in regard to the Red Bridge (#10676), Putts Bridge (#10677), Indian Orchard (#10678), and Dwight (#10675) Hydro Projects, located in Hampshire and Hampden Counties, Massachusetts.

The objective of your analysis was to determine a hydrologically based approximation of the historic, unregulated August median flow for the Chicopee River. This was accomplished by examining gage data from tributaries to the Chicopee River, i.e., the Swift, Ware, and Quaboag Rivers. The entire period of record for these gages was then examined to find those periods that met the Fish and Wildlife Service's (Service) Aquatic Base Flow (ABF) criteria, viz., at least 25 years of essentially unregulated flow, data rated "good" by USGS, and a drainage area at the gage of at least 50 square miles.

Using this approach, a 27 year period of data from the Quaboag River and the entire period of record for the Ware River yielded an unregulated August median flow value of 0.36 cfsm. Extrapolation to the four hydro projects yields minimum instantaneous flow releases at the dam of 237 cfs for Red Bridge, 247 cfs for Putts Bridge, 247 cfs for Indian Orchard, and 258 cfs for Dwight. These flow releases will apply at the base of the dam, unless sampling indicates a need to spill water for water quality purposes. We would also like to view these flow releases at the time you are conducting water quality sampling.

Please contact Mr. Bob Scheirer of this office at (603) 225-1411 to arrange a flow demonstration, and for further coordination as your pre-licensing studies proceed.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Area

89 JUL 19

FERC
JUL 20 1989

8907250250

ORIGINAL

United States Department of the Interior

OFFICE OF THE SECRETARY
OFFICE OF ENVIRONMENTAL AFFAIRS
O'NEILL FEDERAL OFFICE BUILDING - ROOM 1022
10 CAUSEWAY STREET
BOSTON, MASSACHUSETTS 02222-1035

ER 92/596

REF: FERC No. 10676
Western Massachusetts Electric Company
COMMENTS, RECOMMENDATIONS AND TERMS AND CONDITIONS

July 31, 1992

FILED
92 AUG -4 AM 10:48
FEDERAL ENERGY REGULATORY COMMISSION

Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, DC 20426

Dear Ms. Cashell:

This is in response to the Notice of Application Filed with the Commission for the Red Bridge Project located on the Chicopee River in Hampden County, Massachusetts.

The following comments, recommendations and terms and conditions reflect the best information available to us. We reserve the right to supplement our terms and conditions as needed following review of any additional information or modifications to the proposed project submitted by the applicant.

FISH AND WILDLIFE RESOURCES

The Chicopee River is a tributary to the Connecticut River Basin. Resident fish species currently inhabit the river in the project area. In addition, anadromous fish currently have access to the lower Chicopee River to the base of the Dwight Project Dam (FERC No. 10675). Restoration of American shad, river herring and Atlantic salmon are ongoing in the Connecticut basin. No management activities are currently focussed on the Chicopee River, however, the Chicopee offers habitat for anadromous species. Future expansion of the restoration program to the Chicopee is likely.

IMPACTS AND MITIGATION

Fish Passage

Anadromous fish restoration activities in the Chicopee River would necessitate the installation of upstream and/or downstream fish passage facilities in the future. These facilities should be constructed in the future upon the request of the Fish and Wildlife Service, Massachusetts Division of Fisheries and Wildlife, and Connecticut River Atlantic Salmon Commission (CRASC).

Design of these facilities should be coordinated with these agencies and the final plans for the facilities approved by them. Plans and schedules for the construction, operation and monitoring of passage facilities will be needed and must also be developed in consultation with the agencies.

FERC DOCKETED
AUG 4 1992

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Minimum Bypass Flows

The project tailrace discharges 1,600 feet downstream from the dam, thereby reducing flows to this reach of the Chicopee River. To determine appropriate minimum flow release needed to protect fish and other aquatic resources in the bypass reach, the applicant conducted a hydrological analysis of the river. From this analysis, the median August flow of 237 cfs was calculated. This flow is the flow we consider to be the flow necessary to conserve and protect fish and other aquatic resources in the bypass reach. This flow should be released at the project dam, and can be provided through spill over the dam, through gates, or through minimum flow turbine as proposed in the application for exemption.

A plan to monitor minimum flow releases is needed to allow verification of compliance with the reservoir fluctuation limitations and the required minimum flow release.

Reservoir Fluctuations

Mapping and reconnaissance studies determined that wetlands and fish habitat would be adversely affected by dramatic reservoir fluctuations. To minimize this impact, the applicant has proposed limiting pond fluctuations to 1 foot or less from April 1 through June 30. Pond fluctuations should be limited to 2 feet the remainder of the year to protect and enhance fish and wildlife resources.

Recreational Access

The applicant proposes to construct a parking area and car-top boat access area to provide angler access to the area near the powerhouse. Signage will also be provided. The applicant should cooperate with state and local groups to provide trials where needed.

MANDATORY TERMS AND CONDITIONS

Section 30(c) of the Federal Power Act and Section 408 of the Energy Security Act require the inclusion in the exemption from licensing, all terms and conditions that are prescribed by the state and Federal fish and Wildlife agencies to prevent loss of, or damage to fish and wildlife resources. The following conditions of the Fish and Wildlife Service are provided in accordance with these provisions.

1. The Exemptee shall construct, operate, maintain and monitor upstream and downstream fish passage facilities when prescribed by the Fish and Wildlife Service (FWS) and/or the Massachusetts Division of Fisheries and Wildlife (MDFW).

   The Exemptee shall be responsible for the designs of the fish passage facilities which shall be developed in consultation with, and be approved by, the FWS, MDFW and Connecticut River Atlantic Salmon Commission (CRASC).

   Upstream and/or downstream passage facilities shall be constructed and operational within 2 years after being notified of their need by the FWS and/or MDFW.

2. The Exemptee shall develop plans for monitoring, maintaining and operating the upstream and downstream fish passage facilities in consultation with the FWS, MDFW, and CRASC. These plans shall be finalized and approved within two years after being notified of the need for passage facilities.

3. A minimum flow of 237 cubic feet per second, or inflow to the project, whichever is less, shall be continuously released at the project dam to the bypassed reach.

4. The exemptee shall operate the project to limit drawdown of the project impoundment to no more than one foot below the crest of the dam from April 1 through June 30. From July 1 through March 30, the Exemptee shall limit drawdown to no more than 2 feet below the crest of the dam, except for system emergencies or energy audits.

5. The licensee shall, within six months from the date of issuance of the exemption from licensing for this project, present to the Fish and Wildlife Service for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Fish and Wildlife Service within 30 days from a request for the records.

6. The Exemptee shall construct and operate a public parking facility as described in the draft application, and allow public access to the project area for utilization of fish and wildlife resources, subject to reasonable safety and liability limitations. Such access should be prominently posted so that its availability is made known to the public.

7. The Exemptee shall allow the Fish and Wildlife Service to inspect the project area at any time while the project operates under an exemption from licensing, in order to monitor compliance with the terms and conditions.

8. The Fish and Wildlife Service reserves the right to add and/or alter these terms and conditions as appropriate to carry out its responsibilities with respect to fish and wildlife resources. The Exemptee shall, within 30 days of receipt, file with the Federal Energy regulatory Commission any additional or modified mandatory terms and conditions.

9. The Exemptee shall incorporate the aforementioned fish and wildlife conditions in any conveyance; by lease, sale or otherwise; of its interests so as to legally assure compliance with said conditions for as long as the project operates under an exemption from licensing.

We appreciate this opportunity to comment on this application.

Sincerely yours,

William Patterson

William Patterson
Regional Environmental Officer

APPENDIX 3-2

Red Bridge Project

Mode of Operation

The Red Bridge project is situated upstream of five other hydroelectric facilities located on the Chicopee River and downstream of other dams on the Ware, Swift and Quaboag Rivers. Three of the other five downstream hydroelectric facilities are owned and operated by NAEA – Dwight Station Project (P-10675), Indian Orchard Project (P-10678) and Putts Bridge Project (P-10677).

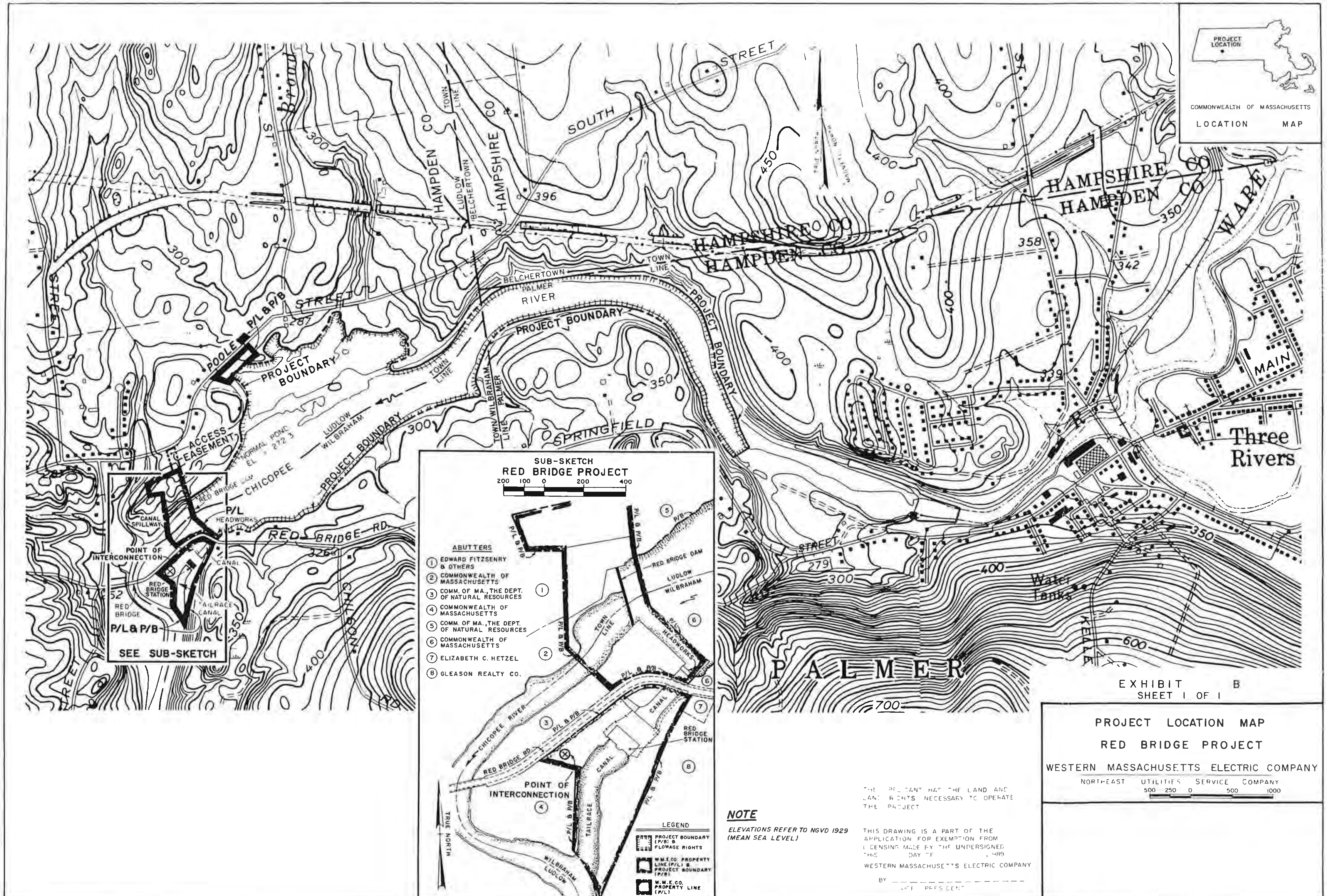
Immediately downstream of the Red Bridge Project is Collins Dam Project (P-6544) while immediately upstream of Dwight Station Project is Chicopee Falls Dam (P-6522). The Project and the other NAEA dams on the Chicopee River have little to no control over their inflows. Collins Hydro and Chicopee Falls dams are owned and controlled by unrelated entities as are all of the hydroelectric projects on the upstream tributaries of the Chicopee River.

The Red Bridge project is operated in a limited pond-and-release mode, utilizing the storage capacity (185 acre-feet) afforded by a maximum 1.0 foot drawdown during the second quarter and 2.0 foot drawdown during the balance of the year.[1] The station is operated semi-automatically by a PLC. The operating mode of the Red Bridge project does not change during dry, mean or high water years. As flows vary at the Project, the number of turbines operating and the duration of operation changes, increasing and decreasing the amount of generation realized.

The exemption requires a continuous minimum flow release of 237 cfs, or inflow if less, at the base of the spillway. The exemption also limits pond drawdowns to one foot below the crest from April to June and two feet for the remainder of the year. During a June 22, 1999 meeting, the resource agencies indicated the drawdowns would not likely have an adverse impact on fish habitat, but could adversely impact the existing boat launch. Also, FWS indicated the present flow release mechanism is inadequate for a permanent measure due to large fluctuations in actual release amounts.

In response, CEEI installed an automated slide gate at the spillway. The new slide gate is capable of releasing the required minimum flow from a single point on the spillway during full and low pond conditions. The CEEI indicated in its December 6, 1999 letter that the use of a new slide gate at the spillway was also acceptable to both the FWS and the MDFW.

[1] Id.



PROJECT LOCATION
COMMONWEALTH OF MASSACHUSETTS
LOCATION MAP
SOUTH STREET
HAMPDEN CO
HAMPSHIRE CO
TOWN LINE
LUDLOW
BELCHERTOWN
HAMPSHIRE CO
HAMPDEN CO
WARE
BELCHERTOWN
PALMER
RIVER
PROJECT BOUNDARY
POOLE
P/L & P/B
STREET
PROJECT BOUNDARY
ACCESS EASEMENT
NORMAL POND EL = 272.3
CHICOPEE
LUDLOW
WILBRAHAM
PROJECT BOUNDARY
TOWN LINE
TOWN/WILBRAHAM LINE PALMER
SPRINGFIELD
RED BRIDGE DAM
P/L
HEADWORKS
RED BRIDGE RD.
CANAL SPILLWAY
POINT OF INTERCONNECTION
CANAL
RED BRIDGE
RED BRIDGE STATION
TAILRACE CANAL
P/L & P/B
SEE SUB-SKETCH
CHILSON
MAIN
Three Rivers
STREET
Water Tanks
KELLEY
PALMER
SUB-SKETCH
RED BRIDGE PROJECT
200 100 0 200 400
ABUTTERS
1 EDWARD FITZSENRY & OTHERS
2 COMMONWEALTH OF MASSACHUSETTS
3 COMM. OF MA., THE DEPT. OF NATURAL RESOURCES
4 COMMONWEALTH OF MASSACHUSETTS
5 COMM. OF MA., THE DEPT. OF NATURAL RESOURCES
6 COMMONWEALTH OF MASSACHUSETTS
7 ELIZABETH C. HETZEL
8 GLEASON REALTY CO.
CHICOPEE RIVER
RED BRIDGE RD
POINT OF INTERCONNECTION
TAILRACE
CANAL
RED BRIDGE STATION
TRUE NORTH
WILBRAHAM
LUDLOW
LEGEND
PROJECT BOUNDARY (P/B) & FLOWAGE RIGHTS
W.M.E.CO. PROPERTY LINE (P/L) & PROJECT BOUNDARY (P/B)
W.M.E.CO. PROPERTY LINE (P/L)
NOTE
ELEVATIONS REFER TO NGVD 1929 (MEAN SEA LEVEL)
THIS DRAWING IS A PART OF THE APPLICATION FOR EXEMPTION FROM LICENSING MADE BY THE UNDERSIGNED
WESTERN MASSACHUSETTS ELECTRIC COMPANY
EXHIBIT B
SHEET 1 OF 1
PROJECT LOCATION MAP
RED BRIDGE PROJECT
WESTERN MASSACHUSETTS ELECTRIC COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
500 250 0 500 1000

APPENIDX A

Red Bridge Project

Flows

The Facility is in compliance with resource agency recommendations issued after December 31, 1986 regarding flow conditions for fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow variations) for both the reach below the tailrace and all bypassed reaches.

Section 30(c) of the Federal Power Act and Section 408 of the Energy Security Act required the inclusion in the Red Bridge exemption from licensing, all terms and conditions that are prescribed by state and federal fish and wildlife agencies to prevent loss of, or damage to fish and wildlife resources.

With respect to minimum flow at the Red Bridge Project, the FWS specifically mandated the following conditions:

- The Exemptee agreed to release from Red Bridge dam a minimum flow of 237 cfs, or inflow to the project reservoir, whichever is less, at the base of the spillway for the protection and enhancement of fish resources in the bypassed reach of the Chicopee River.

- The FWS reserved the right to add and/or alter these terms and conditions as appropriate in order to carry out its responsibilities with respect to fish and wildlife resources. The Exemptee agreed, within 30 days of receipt, to file with the Commission any additional or modified mandatory terms and conditions.

- The Exemptee agreed to operate the project to limit draw down of the Project impoundment to no more than one foot below the crest of the dam from April 1 through June 30. From July 1 through March 30 [31], the Exemptee agree to limit drawdown to no more than 2 feet below the crest of the dam, except during system emergencies or energy audits.[1]

- The Licensee [Exemptee] agreed, within six months from the date of issuance of the exemption from licensing for the Project, present to the FWS for approval, a plan for monitoring project impoundment level and instantaneous bypass releases. Following approval of the plan, the Exemptee agree to measure and record impoundment level and flows according to the plan and provides records of these data to the FWS within 30 days from a request for the records.

- The Exemptee agreed to incorporate the aforementioned fish and wildlife conditions in any conveyance; by lease, sale or otherwise; of its interests so as to legally assure compliance with said conditions for as long as the Project operates under an exemption from licensing.

[1] Id.

To date, the Exemptee has not been notified by the FWS and/or MDFW of the need to modify, increase or decrease its minimum flow.

The exemption requires a continuous minimum flow release of 237 cfs, or inflow, at the base of the spillway. The exemption also limits pond drawdowns to one foot below the crest from April to June and two feet for the remainder of the year.[2] During a June 22, 1999 meeting, the resource agencies indicated the drawdowns would not likely have an adverse impact on fish habitat, but could adversely impact the existing boat ramp. Also, FWS indicated the present flow release mechanism is inadequate for a permanent measure due to large fluctuations in actual release amounts.

As a result of these comments, the Exemptee decided to implement limitations for the pond level and reviewed whether a one or two foot drawdown would affect the existing boat ramp. In response, CEEI installed an automated slide gate at the spillway. The new slide gate is capable of releasing the required minimum flow from a single point on the spillway during full and low pond conditions. The CEEI indicated in its December 6, 1999 letter that the use of a new slide gate at the spillway was also acceptable to both the FWS and the MDFW.

The Red Bridge Project consists of a dam site located on the Chicopee River. The 18-mile long Chicopee River originates at the confluence of the Ware and Quaboag Rivers, 2.8 miles upstream, and discharges into the Connecticut River 15.2 miles downstream of the project area at Springfield, Massachusetts. The following flow parameters are extrapolated from 53 years of United States Geological Survey ("USGS") (1929-1982) records from hydrologic gaging station No. 01177000, located on the Chicopee River at Indian Orchard, Massachusetts, located approximately 8 miles downstream of the Red Bridge dam site. The drainage area at this gage is 689 square miles and the drainage area at the hydropower project site is 664 square miles. The mean annual flow at the project is 877 cfs (914 cfs at the gage) with a minimum and maximum historical discharge of 16 cfs, recorded on various dates between 1929 and 1931, and 43,400 cfs, recorded in September 21, 1938, respectively. Additional flow parameters for the Chicopee River related to the project area are as follows:

- high flow: approximately 1,465 cfs (approximately 1,525 cfs at the gage at Indian Orchard); flow exceeded 10 percent of the time;[3]
- low flow: approximately 215 cfs (approximately 225 cfs at the gage at Indian Orchard); flow exceeded 90 percent of the time;[4]
- 7Q10 flow: 237 cfs (the 7Q10 flow refers to the minimum 7-day average flow rate expected to occur once every 10 years and is based on 0.36 cfs per square mile of drainage area).

The dam creates an average 17.3-foot deep, 185-acre impoundment that is 1.8 mile long, with a normal surface elevation of 272.3 feet USGS datum, normal tailwater elevation of 222.7 feet and average gross head of 49.6 feet.

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[2] Id.

[3] See Appendix A-2 for a Flow Duration Curve for the Chicopee River at Indian Orchard.

[4] Id.

During the In-take Review, it was discovered that CEEI had not completed the "Minimum Flow and Impoundment Fluctuation Monitoring Plan" as well as performed the requisite six months of empirical study of the spillway flows subsequent to the installation of the automated slide gate. Accordingly, on February 20, 2012, Essential Power, with the concurrence of FWS, MDEP and MDFW, filed with FERC a "Minimum Flow and Impoundment Fluctuation Monitoring Plan" for the Project. In lieu of performing a six-month study of the spillway flows, Essential Power agreed to supply monthly, for six months, starting March 1, 2012, pond elevation, gate position and station generation data to FWS.

In summary, the Exemptee operates the Red Bridge Project in a limited pond-and-release mode for the protection of water quality, aquatic resources, and aesthetic values in the Chicopee River. This operation may be temporarily modified, if required, by operating emergencies beyond the control of the Exemptee, or for short periods while performing energy audits.

Bill Short

From: Melissa_Grader@fws.gov
Sent: Thursday, October 13, 2011 11:26 AM
To: w.shortiii@verizon.net
Cc: Robert.Kubit@state.ma.us; caleb.slater@state.ma.us; John_Warner@fws.gov
Subject: Fw: LIHI certification for the Red Bridge Project; FERC No. 10676

Dear Mr. Short,

This responds to your various requests for information necessary for NAEA to complete its application for Low Impact Hydropower Institute (LIHI) Certification. We have reviewed the project file and filings contained on the FERC Online database, and offer the following:

1. Threatened and Endangered Species
According to the FWS/New England Field Office's online database (http://www.fws.gov/newengland/EndangeredSpec-Consultation.htm), there are no federally listed T&E species known to occur in the project area.

2. Minimum Flow
The Red Bridge Project is required to release a continuous flow of 237 cfs (or inflow, if less) to the 1,600 foot-long bypass reach. Originally this flow was passed via uniform spill at the dam, but in 2002 the previous owners (Consolidated Edison Energy Massachusetts, Inc.; or CEEMI) installed a slide gate to pass the bypass flow. In a letter to CEEMI's consultant (Kleinschmidt Associates) dated March 13, 2001, the FWS requested that once the slide gate was installed and operational, CEEMI should provide data for the first six months to verify that the project was complying with its bypass flow requirement. The FWS also requested that CEEMI provide a method to allow visual verification of gate discharge. By letter dated March 19, 2001, Kleinschmidt agreed to these requests. To date, it appears that neither of these requests have been fulfilled; therefore, we are unable to determine whether the project is in compliance with its minimum flow requirement.

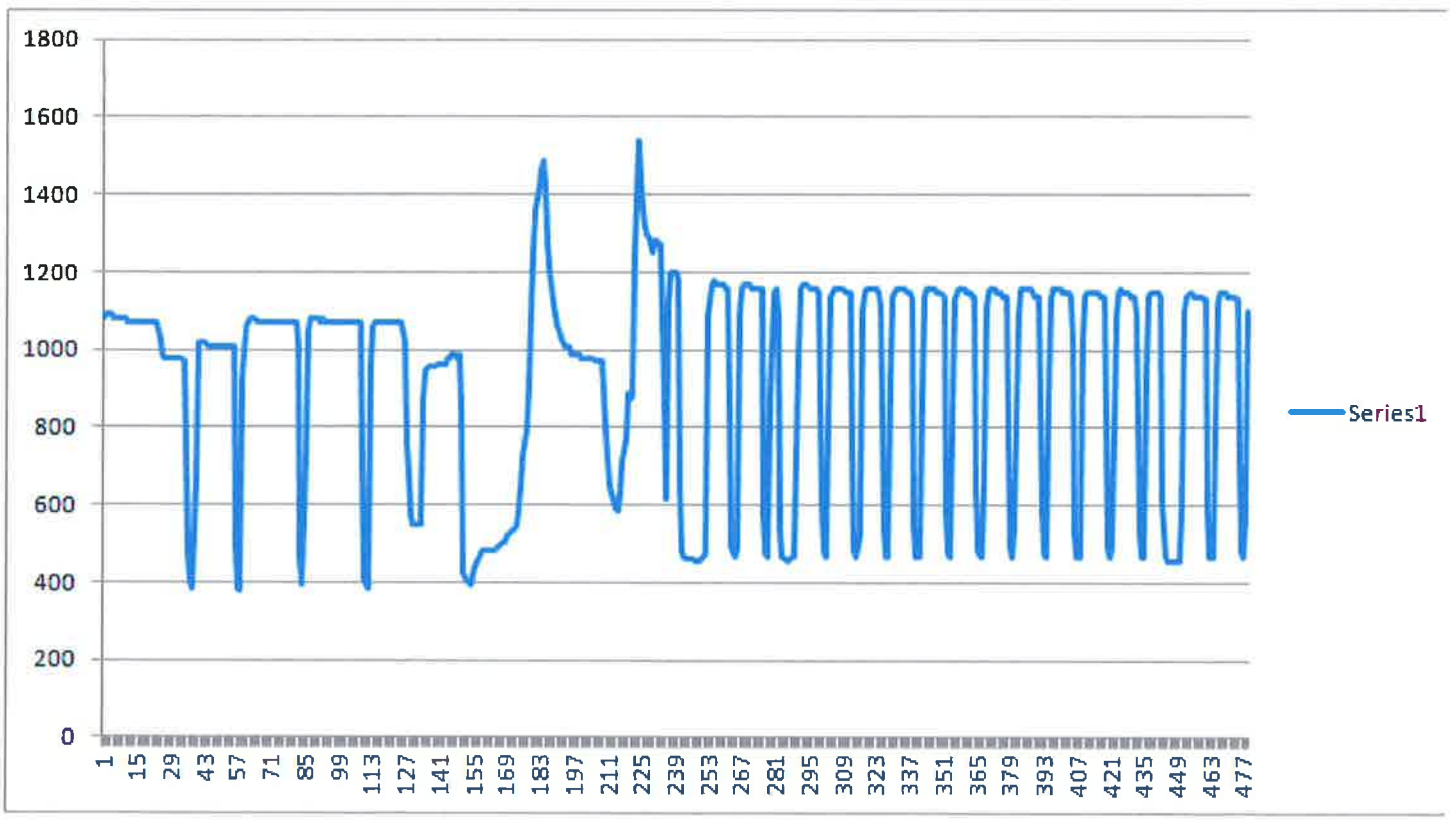
In January of 2000, the FWS submitted modified terms and conditions (T&Cs) for the Red Bridge Project. One of those T&Cs was a requirement to submit a plan to monitor impoundment level and bypass flow releases at the project. Kleinschmidt Associates prepared a draft Minimum Flow and Impoundment Fluctuation Monitoring Plan for all four of CEEMI's Chicopee River projects (including Red Bridge) in October of 2001. The FWS provided comments on that plan by letter dated November 6, 2001. That letter contained a number of issues/concerns that the Service recommended be addressed in the final plan. There is no indication in our files that a revised plan addressing the comments received by the Service was ever submitted for our approval; therefore it appears that the project is not in compliance with Condition #5 of the exemption.

3. Fish Passage
The original terms and conditions set for this project by the Service on July 31, 1992 contained a requirement that the Exemptee construct, operate, maintain and monitor upstream and downstream fish passage facilities when prescribed by the Service and/or the Massachusetts Division of Fisheries and Wildlife. Currently there are no active migratory fish management efforts within the Chicopee River watershed. The Red Bridge Project is the most upstream of NAEA's Chicopee projects. While it is likely that the lower dams will need fish passage facilities in the near future, it likely will be a number of years before passage will be required at Red Bridge. Therefore, the project appears to be in compliance with respect to fish passage.

4. Watershed Protection
The Service did not set any mandatory terms and conditions relative to watershed protection. The Commonwealth of Massachusetts is the appropriate agency to respond to this particular information request.

5. Below-project Flows

The Red Bridge Project is allowed to fluctuate the headpond up to one foot from April 1 through June 30, and up to 2 feet from July 1 through March 30. According to documents in our project file, in the early post-licensing days it appears that the project did not do drawdowns (although allowed to) because the impoundment level needed to be kept higher than the dam crest in order to provide the required bypass flow. However, the agencies were concerned that the uniform dam spill method of providing the bypass flow was not satisfactory, because the project still operated with an approximate three-inch fluctuation, which resulted in times when less than 237 cfs was being provided to the bypass reach. Therefore, a new method of providing the bypass flow (via a deep slide gate) was agreed to. Since it was installed, this new bypass flow mechanism has provided the project with the ability to utilize the allowable drawdown limits. While the Service does not know exactly how Red Bridge operates, viewing the downstream Indian Orchard USGS streamflow gauge indicates that at least some projects on the river are operating in a cycling mode: the units turn off and on several times a day, leaving only the minimum flow in the river. Below is a hydrograph for the period June 15 through June 19, 2011 (provisional data). It appears that the agencies may have inadvertently facilitated the conversion of Red Bridge operations from one of more or less run-of-river under uniform spill, back to a store and release mode of operation under the slide gate method. We raise this issue because, although the project may be operating in compliance with the terms and conditions of its exemption, and therefore may meet requirements of LIHI certification under the existing criteria, this may not be the case under future revisions to LIHI criteria.



In developing this response to your request, we identified several information gaps relative to the project facilities. We would appreciate it if NAEA could provide us with the following:

- the type of units at the project, and their minimum and maximum hydraulic capacities;
- trashrack specifications (wetted area and clear spacing);
- as-built plans of the slide gate.

We hope this has been responsive to your requests. If you have any questions or require further information please feel free to contact me.

Sincerely,
Melissa Grader

Melissa Grader
Fish and Wildlife Biologist
US FWS/New England Field Office
c/o CT River Coordinator's Office
103 East Plumtree Road
Sunderland, MA 01375
413-548-8002, x124
413-548-9622 (FAX)
melissa_grader@fws.gov
www.fws.gov/newengland

October 19 , 2011

William P. Short III
on behalf of North American Energy Alliance, LLC
P.O. Box 237173
New York, NY 10023-7008

Re: Request For Conditional Approval
Red Bridge Hydro, FERC #10676

Dear Mr. Short,

In pursuit of certification from the Low Impact Hydropower Institute, North American Energy Alliance, LLC has requested the MA Department of Environmental Protection (the Department) to confirm (1) the Red Bridge Hydro facility (Project) is not expected to cause or contribute to violations of state water quality standards; (2) the automated slide gate that releases minimum flows was installed and is operating properly; and (3) that the Department approves of the monitoring approach being used to verify minimum flow.

(1) The Department does not possess water quality data collected at the Red Bridge Hydro facility beyond that submitted with this request. However, the Department does have data collected in the vicinity and believes the presence of wet weather combined sewer overflows upstream of the Project is likely the cause of upstream waters requiring a TMDL for pathogens. The Department believes the Project does not cause nor contribute to the presence of pathogens, escherchia coli and fecal coliform both immediately upstream and downstream of or in the Project area.

Based on the upstream impoundment estimated retention time of approximately one day and information from the 1989 Environmental Report and Water Quality Report prepared for the FERC exemption application, the Department does not expect the Project to cause or contribute to violations of state water quality standards due to water chemistry, either downstream or in the impoundment.

(2) The Department did not issue a water quality certificate for the Red Bridge Hydro exemption in 1992 and was not a participant in the exemption amendment of 1999 (the Supreme Court decision incorporating water quality certificates into FERC licenses was issued in 1994). We are not now requiring any information from the owner and cannot judge whether the slide gate is operating properly. We note however, via email from Melissa Grader to you October 13, 2011

that the U.S. Fish & Wildlife Service states the slide gate was installed in 2002 but they are unable to determine whether the Project is in compliance with its minimum flow requirement.

(3) For reasons described in (2) above the Department cannot approve of the monitoring approach being used to verify minimum flow.

The Department can respond to approval requests (2) and (3) above when we receive the information identified as missing in the U.S. Fish & Wildlife Service email dated October 13, 2011, specifically:

1. A revised final Minimum Flow and Impoundment Fluctuation Monitoring Plan that addresses the comments contained in the U.S. Fish & Wildlife Service letter to Kleinschmidt Associates dated November 6, 2001;
2. Provide a method to allow visual verification of gate discharge.

In view of your Low Impact Hydropower Institute certification application, the Department notes this facility uses a peaking mode of operation. The Department intends to require all Projects to be operated at all times in a run-of-river mode with inflows equal to outflows and a stable pond level within a narrow band. While this Project may be in compliance with FERC exemption flow requirements, the Department has concerns that a peaking facility would be considered a low impact hydropower facility.

If you have any questions, please contact me at 508-767-2854.

Sincerely,

Robert Kubit, P.E.

Cc: Caleb Slater/MADFW
Melissa Grader/USFWS

February 20, 2012

VIA FEDERAL EXPRESS

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 1st Street, NE, Room 1A
Washington, DC 20426

Chicopee River Projects: No. 10675, 10676, 10677, and 10678
Minimum Flow and Impoundment Fluctuation Monitoring Plan

Dear Secretary:

EP Energy Massachusetts, LLC™ (formally NAEA Energy Massachusetts, LLC) owns and operates four hydroelectric stations on the Chicopee River. Specifically Dwight Station (FERC Project No. 10675), Red Bridge (FERC Project No. 10676), Putts Bridge (FERC Project No. 10677), and Indian Orchard (FERC Project No. 10678). The attached plan is being filed to outline EP Energy Massachusetts, LLC. measures to ensure compliance with USFWS Terms and Conditions dated January 15, 2000, and MDFW Terms and Conditions dated February 15, 2000.

The plan has been reviewed by the US Fish and Wildlife Service, Massachusetts Department of Environmental Protection, and the Massachusetts Division of Fisheries and Wildlife. As of a February 8, 2012 conference call, all parties agreed the plan meets the minimum flow and impoundment fluctuation requirements of the license exemption order.

Sincerely,

David Schmidt
Senior Station Engineer
EP Energy Massachusetts, LLC.

Attachments: Min Flow Plan-02-08-2012 , Min Flow Plan-02-08-2012-Appendix
cc: John Bahrs, Cynthia Lane
cc via email: Kim Marsili, Chung-Yao Hsu (FERC)

EP ENERGY MASSACHUSETTS, LLC™

CHICOPEE RIVER PROJECTS

MINIMUM FLOW AND IMPOUNDMENT FLUCTUATION MONITORING PLAN

FOR

FERC PROJECT NO. 10675 - DWIGHT
FERC PROJECT NO. 10676 - RED BRIDGE
FERC PROJECT NO. 10677 - PUTTS BRIDGE
FERC PROJECT NO. 10678 - INDIAN ORCHARD

FEBRUARY 2012

INTRODUCTION

EP Energy Massachusetts, LLC™ (Essential Power™) owns and operates the Dwight Project (FERC No. 10675), the Red Bridge Project (FERC No. 10676), the Putts Bridge Project (FERC No. 10677), and the Indian Orchard Project (FERC No. 10678), known collectively as the Chicopee River Projects, located on the Chicopee River in Massachusetts. The projects are required to operate under the Terms and Conditions established by the US Fish and Wildlife Service (USFWS) and the Massachusetts Division of Fisheries and Wildlife (MDFW). Each project's Terms and Conditions limit the impoundment fluctuation and require the release of minimum flows into the bypass river reaches. The projects currently operate under an interim agreement outlined in the April 3, 1997 MDFW letter.

The USFWS and MDFW modified the Terms and Conditions for the projects by letters dated January 27, 2000 and February 15, 2000 respectively (copies in Appendix A). MDFW Condition 6 (Condition 5 for USFWS) required the submission of a plan for monitoring project impoundment level and instantaneous bypass flow releases. By letter dated October 5, 2001 a draft of this plan was distributed to the MDFW and USFWS for review and comment. Comments received from the agencies are provided in Appendix B and have been addressed in this final plan.

As requested by the MDFW and USFWS Terms and Conditions, this plan includes the following information:

(1) Details of the flow release structures and locations;

(2) Descriptions of the mechanisms used to monitor head pond elevations and minimum flows;

(3) Specifications of how often maintenance and calibration of the monitoring and recording equipment will take place;

(4) Description of how bypass flows will be maintained during any periodic maintenance activities that require the impoundment to be drawn down below the level of the flow release structures, and;

(5) How frequently and in what form the data are recorded.

Appendix C contains sample calculations used to determine the settings for the release mechanisms at the four projects.

DWIGHT (FERC NO. 10675)

Dwight Station is located at river mile 1.2 on the Chicopee River in the City of Chicopee. The station was constructed in 1920 and was most recently purchased in 2008 by Essential Power from Consolidated Edison Energy of Massachusetts, LLC. The station has 3 units, each rated for 480 KW, with hydraulic capacities of 254 cfs.

MDFW Condition 2 (Condition 3 of USFWS) for the Dwight Project requires the release of a minimum flow of 258 cubic-feet-per-second (cfs) (or inflow, if less) at the Dwight Dam. The flashboards have permanently been removed from the facility, so minimum flows are passed over the dam crest. Revised MDFW Condition 3 (Condition 4 of USFWS) limits impoundment draw down to a minimum of five inches above the dam crest, except for system emergencies or annual energy audits.

Impoundment Fluctuation

Impoundment levels are continuously monitored through the use of an electronic pressure transducer located on the south shoreline, slightly upstream of the canal gatehouse. Documentation of compliance with the impoundment limits is supplied by electronic recording of the impoundment level in addition to instantaneous visual displays in the canal gatehouse. The canal headgates are controlled by a Programmable Logic Controlling (PLC) device located within the canal gate house that adjust the headgate opening based upon pond level, canal level and unit operational status. The pond level control is proportional–integral–derivative **(**PID) based and is programmed to maintain a pond level of El. 77.0’; 5 inches above the permanent spillway crest level. As the pond level increases, the system increases unit load and/or brings additional units online. As the pond level falls, load is decreased and units are taken offline. The PLC continually monitors pond level and records the pond level using a strip chart as the primary recording mechanism. The sensitivity of the measurement is +/- 0.01 ft. As a secondary monitoring system, a data logger records the pond elevations every 15 minutes. The flashboards on the dam at Dwight have been removed, the minimum flow release is provided by overtopping the dam. The project’s turbines operate in an automatic mode using impoundment level controls which curtail operation when the lower impoundment level limits are reached and do not resume operation until impoundments levels are reestablished within the operable limits.

Release Mechanism

Minimum flows are released over the dam's spillway. The appropriate flow release is controlled by maintaining a headpond 5 inches above the crest of the spillway. All flows pass directly into the bypass reach.

During infrequent impoundment draw down for major dam repairs minimum flows will be maintained. The minimum flow release mechanism will be outlined in a letter sent prior to the impoundment draw down.

Instrumentation Maintenance and Calibration

Maintenance to the monitoring system is performed on an as-needed basis with calibration of the instruments being performed approximately every two years. At a minimum, operators visit the project approximately twice per week to confirm proper station operation. The station is also equipped with unit alarms to notify operational personnel of equipment malfunctions.

RED BRIDGE (FERC NO. 10676)

Red Bridge Hydro Station is located at river mile 15.2 on the Chicopee River in the towns of Wilbraham, Ludlow, and Palmer. The station was constructed in 1901 and was most recently purchased in 2008 by Essential Power from Consolidated Edison Energy of Massachusetts, LLC. The station has 2 units, each rated for 1,800 KW, with hydraulic capacities of 615 cfs.

MDFW Condition 2 (Condition 3 of USFWS) for the Red Bridge Project requires the release of a minimum flow of 237 cubic-feet-per-second (cfs) (or inflow, if less) at the project's spillway. MDFW Condition 3 (Condition 4 of USFWS) limits impoundment drawdown to 1-ft below the crest of the dam (El. 272.24) from April 1 to June 30, and a 2-ft impoundment draw down below the crest of the dam from July 1 to March 30, except for system emergencies or annual energy audits.

Impoundment Fluctuation

Impoundment fluctuations will be measured through the use of an electronic pressure transducer located upstream of the canal headgates. Documentation of compliance with the impoundment limits will be by electronic recording of the impoundment level in addition to instantaneous visual displays in the powerhouse. Essential Power limits impoundment draw down through the use of the project's turbines. The project's turbines operate in an automatic mode using pond level controls which curtail operation when the minimum impoundment level limits are reached and do not resume operation until acceptable operating impoundment levels are reestablished.

Release Mechanism

Essential Power has installed a bottom discharge gate at the southern end of the spillway to permit minimum flow release within the permitted impoundment fluctuations. The gate is 7 ft. wide and 8.5 ft. high with a sill elevation of 264.74 (7.5 feet below crest). The gate is equipped with an electric screw stem actuator capable of manual operation in the event of power loss. The gate is electronically controlled by a PLC device. The PLC continuously monitors impoundment level elevations and gate positions will be adjusted automatically over the range of impoundment fluctuations to consistently release the minimum flow of 237 cfs. The impoundment level indicator is located in the impoundment adjacent to the canal headgate house. The pond level and minimum flow gate position are continuously recorded using strip chart mechanism. The sensitivity of the measurement is +/- 0.01 ft. A secondary data logger is used to record the pond level every 15 minutes, if required.

During periods of gate maintenance or malfunction, minimum flows will be maintained by spilling flows over the dam spillway maintaining a pond level 5 inches above the crest level when the units are generating. During infrequent impoundment draw down for major dam repairs minimum flows will be maintained. The minimum flow release mechanism will be outlined in a letter sent prior to the impoundment draw down.

Instrumentation Maintenance and Calibration

Maintenance to the system is performed on an as-needed basis with calibration of the instruments being performed approximately every two years. As a minimum, operators visit the project approximately twice per week to confirm proper station operation. The station is also equipped with various alarms to notify operations personnel of equipment malfunctions.

PUTTS BRIDGE (FERC NO. 10677)

Putts Bridge Hydro Station is located at river mile 9.2 on the Chicopee River in the town of Ludlow and the City of Springfield. The station was constructed in 1918 and was most recently purchased in 2008 by Essential Power from Consolidated Edison Energy of Massachusetts, LLC. The station has 2 units, each rated for 1,600 KW, with hydraulic capacities of 725 cfs.

Revised MDFW Condition 2 (Condition 3 of USFWS) for the Putts Bridge Project requires the release of a minimum flow of 25 cubic-feet-per-second (cfs) (or inflow, if less) at the project's bypass reach. MDFW Condition 3 (Condition 4 of USFWS) limits drawdown to 1-ft below the top of flashboards (El. 205.25) from April 1 to June 30, and a 2-ft draw down below the top of flashboards from July 1 to March 30, except for system emergencies or annual energy audits.

The revised condition regarding the 25-cfs minimum flow amount was noted as being subject to change based on the results of a water quality study conducted in the bypass. The study results were issued to the MDFW and USFWS on November 6, 2000. The water quality study concluded that the 25-cfs flow maintained water quality standards within the bypass and an increase was not warranted.

Impoundment Fluctuations

Impoundment fluctuations are measured through the use of electronic pressure transducers. Documentation of compliance with the impoundment limits is supplied by hourly strip charts recording pond levels in addition to instantaneous visual displays in the powerhouse. Essential Power limits impoundment draw down through the use of the project's turbines. The project's turbines operate in an automatic mode using impoundment level float controls which curtail operation when the lower impoundment level limits are reached and do not resume operation until operating impoundment levels are reestablished.

Release Mechanism

Minimum flows are released through a single, top discharge gate located on the dam's north abutment. The steel gate is 6 ft. wide and 8 ft. high and is capable of opening approximately 4- feet below the dam crest. The gate is electronically operated, and controlled by a PLC (located in the powerhouse) which automatically adjust the gate opening with fluctuating impoundment elevations to maintain a constant discharge over the top of the gate (approximately 15 inches or 25 cfs). The PLC continuously monitors and records impoundment level elevations and gate position through the use of strip charts. The sensitivity of the measurement is +/- 0.01 ft. In addition, an impoundment level indicator is located at the head gate structure adjacent to the gate.

During periodic maintenance activities to the minimum flow gate flows are discharged over the dam crest. During infrequent impoundment draw down for major dam repairs minimum flows will be maintained. The minimum flow release mechanism will be outlined in a letter sent prior to the impoundment draw down.

If a situation occurs where the headpond elevation is low, and the inflow into the site is less than the minimum flow then, the station is taken offline and the PLC regulates the min flow gate to inflow by maintaining pond level. Units are left offline until river flows return and the pond is allowed to refill.

Instrumentation Maintenance and Calibration

Maintenance to the monitoring and control systems is performed on an as-needed basis with calibration of the instruments being performed approximately every two years. As a minimum, operators visit the project approximately twice per week to confirm proper station operation. The station is also equipped with alarms to notify operations personnel of equipment malfunctions. These alarms include malfunction of the minimum flow gate and an alarm to designate that the gate control is in manual versus automatic mode.

INDIAN ORCHARD (FERC NO. 10678)

Indian Orchard Station is located at river mile 7.8 on the Chicopee River in the City of Springfield and the Town of Ludlow. The station was constructed in 1896 and was most recently purchased in 2008 by Essential Power from Consolidated Edison Energy of Massachusetts, LLC. The station has 2 units, Unit 3 rated for 1,500 KW, with a hydraulic capacity of 625 cfs; and Unit 4 rated for 2,200 KW, with a hydraulic capacity of 900 cfs.

MDFW Condition 2 (Condition 3 of USFWS) for the Indian Orchard Project requires the release of a minimum flow of 247 cubic-feet-per-second (cfs) (or inflow, if less) at the Indian Orchard Dam. Revised MDFW Condition 3 (Condition 4 of USFWS) limits drawdown to 0.5-ft below the top of the flashboards (or dam crest if boards are out) from April 1 to June 30. Drawdowns are limited to 1-ft below the top of the flashboards (or dam crest if boards are out) from July 1 to March 30, except for system emergencies or annual energy audits.

Impoundment Fluctuations

Impoundment fluctuations are measured through the use of electronic pressure transducers. The transducer is located upstream of the gatehouse and continually monitors and records impoundment elevation on strip charts. Documentation of compliance with the minimum flow requirement is supplied by strip charts that continuously monitor the pond level in addition to instantaneous visual displays in the powerhouse. The sensitivity of the measurement is +/- 0.01 ft. A data logger also records the head pond level every 15 minutes.

Essential Power currently controls impoundment levels through the use of the project's turbines. The project's turbines operate in an automatic mode using impoundment level controls that curtail operation when the impoundment limits are reached. Unit operation does not resume until acceptable impoundment levels are reestablished.

Release Mechanism

Minimums flows are released through the use of two canal drainpipes, located immediately downstream of the canal headgates, on the north side of the canal. Each drainpipe is

36-inch in diameter, corrugated metal, and has an invert of El.151.7’ (approximately 10’ below the top of flashboards). Each pipe is equipped with a 2-ft-6-inch square entrance control gate that is automatically operated based on pond level. The control gates are fully opened for pond levels at or above elevation 160.8’ (while the units are generating). If impoundment levels begin or continue to drop below elevation 160.5’ (unit motoring setting), the gates close in approximately 5% increments to restrict pond levels from dropping further. This control feature allows the passage of inflows to the project until inflows exceed the 247 cfs.

During any periodic maintenance activities that require the canal to be dewatered, project generation is discontinued and river flows are passed over the dam spillway. Periodic maintenance to Flashboards requires the pond level be lowered to approximately 1 foot below the crest of the dam. During these activities, flows will be released via the canal drain gates. Flows will be subsidized with a pump to ensure minimum flows are maintained. During infrequent impoundment draw down for major dam repairs minimum flows will be maintained. The minimum flow release mechanism will be outlined in a letter sent prior to the impoundment draw down.

Instrumentation Maintenance and Calibration

Maintenance to the impoundment level and drainpipe control gate systems is performed on an as-needed basis with calibration of the instruments being performed approximately every two years. As a minimum, operators visit the project approximately twice per week to confirm proper station operation. The station is also equipped with alarms to notify operations personnel of equipment malfunctions.

OTHER PROVISIONS

As indicated in the new Condition 10, Essential Power will attempt to maintain minimum flow releases under all operating conditions. Unless impossible (i.e. emergency circumstances or equipment malfunction), Essential Power will obtain written authorization from the MDFW and USFWS prior to any interruption of the minimum flow and impoundment fluctuation limits greater than 24 hours. If minimum flows or impoundment levels can not be maintained at any time for a duration greater than 24 hours (aside from board maintenance or replacement), Essential Power will notify the MDFW and USFWS within ten days of the violation. The notification will include a discussion of the reasons for the violation and the corrective actions taken by Essential Power.

Data on impoundment elevation, station output, and min flow gate settings will be made available to the MDFW and USFWS within 30 days of the agency's request. Essential Power will retain data on impoundment elevation, unit output, and gate settings for a 3 year period.

Summary of Operating Conditions and Pertinent Data:

	Dwight	Red Bridge	Putts Bridge	Indian Orchard
Req'd Flow (cfs)	258 (or inflow)	237 (or inflow)	25 (or inflow)	247 (or inflow)
Top of Boards	None	None	205.25	161.0
Dam Crest	76.5'	272.24	203.58	159.35
Gate Sill El	Not Applicable	264.74	199.74	151.7
Drawdown limits	5" overtopping required	1-ft (4/1-6/30) 2-ft (7/1 – 3/30)	1-ft (4/1-6/30) 2-ft (7/1 – 3/30)	0.5-ft (4/1-6/30) 1-ft (7/1 – 3/30)
Release Mechanism(s)	Spillway Overtopping	Bottom discharge gate and/or Spillway	Spillway and/or Top discharge gate	Spillway and/or 2 Canal drain pipes

APPENDIX A

REVISED TERMS AND CONDITIONS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

REF: FERC Nos. 11675 - Dwight
11676 - Red Bridge
11677 - Putts Bridge
11678 - Indian Orchard
Consolidated Edison Energy Massachusetts, Inc.

January 27, 2000

Mark Noyes
CEEMI
111 Broadway, 16th Floor
New York, NY 10006

Dear Mr. Noyes:

This is in response to the Federal Energy Regulatory Commission's December 29, 1999 Order Amending Exemptions for the Red Bridge, Putts Bridge, Indian Orchard and Dwight Projects, located on the Chicopee River in Massachusetts. We originally were going to respond to the November 23, 1999 memorandum prepared by Kleinschmidt Associates which provides the results of an assessment of the effect operations at Putts Bridge has on the ability of Indian Orchard to meet its minimum flow requirement. As the FERC order addresses and accepts the findings of the assessment, we instead will comment on modifications to the original terms and conditions we prescribed for the exemptions that we believe are necessary, given that minimum flows and headpond fluctuations have changed at some sites.

As originally exempted, each project had specific minimum flows and allowable impoundment drawdowns.

Originally Exempted

- Red Bridge
  237 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1 - June 30 and 2-ft. from July 1 - March 30
- Putts Bridge
  247 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1 - June 30 and 2-ft. from July 1 - March 30
- Indian Orchard
  247 cfs min. flow (or inflow, if less), 1-ft. drawdown year-round

- Dwight
  258 cfs min. flow (or inflow, if less), 1-ft. drawdown year-round

Proposed
- Red Bridge
  237 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1- June 30 and 2-ft. from July 1 - March 30.
- Putts Bridge
  25 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1- June 30 and 2-ft. from July 1 - March 30.
- Indian Orchard
  247 cfs min. flow (or inflow, if less), 0.5-ft. drawdown April 1- June 30 and 1-ft. drawdown from July 1 - March 30.
- Dwight
  258 cfs min. flow (or inflow, if less), 0.25-ft. drawdown when boards are up and no fluctuation when boards are down.

As originally exempted, the mandated flows were to be released via special minimum flow turbines. This idea was subsequently found to be uneconomical, and alternative release mechanisms were investigated. Also, in order to meet the requirements for being exempted, project capacity upgrades are necessary. CEEMI submitted a development plan in June, 1999 that outlined how upgrading the existing facilities would result in meeting that criterion.

To date, we believe the following issues have been resolved to our satisfaction:
- Bypass flow rates and release mechanisms at each project, with the exception of Putts Bridge.
- Impoundment fluctuation levels. The proposed changes to limit drawdowns at Indian Orchard to 0.5-ft from April 1 - June 30, and at Dwight to within 0.25-ft. when boards are up, should ensure that continuous and stable minimum flows are maintained below those projects.
- Proposed capacity upgrades. None of the upgrades should influence the minimum flows or drawdown limits for each project.

Two issues that remain outstanding include:
- The Putts Bridge bypass flow. We never approved the reduced flow as a permanent measure. Before approving this change as a permanent condition of the exemption, a water quality study must be performed to verify that the lower flow will protect water quality in the bypass reach. It is our understanding that the study will occur this summer. Once we receive the study results we will make a final decision on the minimum bypass flow needed at Putts Bridge.
- A revised Monitoring Plan. A condition of each exemption was the development of a plan to monitor headpond elevations and bypass flows. On March 11, 1993 the previous owner of the projects submitted a Monitoring Plan for our review. Since the original plans were filed and approved, major changes in the methods of releasing the bypass flows have been made

at the projects, requiring the development of a revised Monitoring Plan. You should provide us with a plan that (1) details the flow release structures and locations, (2) describes the mechanisms used to monitor headpond elevation and minimum flows, (3) specifies how often maintenance and calibration of the monitoring and recording equipment takes place, (4) states how bypass flows will be maintained during any periodic maintenance activities that require the impoundment to be drawn down below the level of the flow release structures, and (5) states how frequently and in what form the data are recorded. A calculation sheet that verifies the discharge of each release structure (i.e., slide/canal gate, board notches and dam spill) under all operating ranges should be included.

Per Condition 8 of the Exemptions from Licensing, we hereby modify our original terms and conditions for the subject exemptions as follows:

Red Bridge

Modify the following conditions to read:

5. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Fish and Wildlife Service for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Fish and Wildlife Service within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Putts Bridge

Modify the following conditions to read:

3. An interim minimum flow of 25 cubic feet per second, or inflow to the project, whichever is less, shall be continuously released at the project dam to the bypassed reach. This release may be modified if results of a water quality study indicate that 25 cfs is insufficient to protect water quality in the bypass reach.

5. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Fish and Wildlife Service for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according

to the plan and provide records of these data to the Fish and Wildlife Service within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Indian Orchard

Modify the following conditions to read:

4. The exemptee shall operate the project to limit drawdown of the project impoundment to no more than 0.5-feet below the top of the flashboards (or dam crest if boards are out) from April 1 through June 30. From July 1 through March 30, the Exemptee shall limit drawdown to no more than one foot below the top of the flashboards (or dam crest if boards are out).

5. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Fish and Wildlife Service for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Fish and Wildlife Service within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Dwight

Modify the following conditions to read:

4. The Exemptee shall operate the project to limit drawdown of the project impoundment to no more than 0.25 feet below the top of the flashboards. When boards are out, the Exemptee shall maintain a minimum of five inches of spill over the dam crest to maintain the minimum bypass flow specified in Condition #3.

5. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Fish and Wildlife Service for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Fish and Wildlife Service within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Thank you for this opportunity to comment. If you have any questions, please contact Melissa Grader of this office at (603) 225-1411.

Sincerely,

Michael J. Bartlett
Supervisor
New England Field Office

cc: John Labiak, CEEMI
Caleb Slater, MA DFW
FERC/DLC
FERC/OHL
Reading File

es: MGrader:1-27-00:(603)225-1411

Commonwealth of Massachusetts

MASTER FILE

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director*

February 15, 2000

RE: Chicopee River Projects:
Dwight – 11675
Red Bridge – 11676
Putts Bridge – 11677
Indian Orchard - 11678

Mark Noyes
CEEMI
111 Broadway, 16th Floor
New York, NY 10006

Dear Mr. Noyes,

The Massachusetts Division of Fisheries and Wildlife (Division) is the state agency responsible for the protection and management of the fish and wildlife resources of the Commonwealth. As such, we have prepared the following comments in response to the Federal Energy Regulatory Commission's December 29, 1999 Order Amending Exemptions for the Red Bridge, Putts Bridge, Indian Orchard, and Dwight Projects, located on the Chicopee River in Massachusetts.

As originally exempted, each project had specific minimum flows and allowable impoundment drawdowns.

Original Conditions

Red Bridge

237 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1- June 30 and 2-ft. from July 1 - March 30

Putts Bridge

247 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1- June 30 and 2-ft. from July 1 - March 30

Indian Orchard

247 cfs min. flow (or inflow, if less), 1-ft. drawdown year-round

Dwight

258 cfs min. flow (or inflow, if less), 1-ft. drawdown year-round

Proposed Conditions

Red Bridge

237 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1- June 30 and 2-ft. from July 1 - March 30.

Putts Bridge

25 cfs min. flow (or inflow, if less), 1-ft. drawdown April 1- June 30 and 2-ft. from July 1 - March 30.

Indian Orchard

247 cfs min. flow (or inflow, if less), 0.5-ft. drawdown April 1- June 30 and 1-ft. drawdown from July 1 - March 30.

Dwight

258 cfs min. flow (or inflow, if less), 0.25-ft. drawdown when boards are up and no fluctuation when boards are down.

The original exemptions required that the minimum flows were to be released via new minimum flow turbines. This idea was subsequently found to be uneconomical, and alternative release mechanisms were investigated. The original exemptions also required project capacity upgrades. CEEMI submitted a development plan in June 1999 that outlined how upgrading the existing facilities would result in meeting that criterion.

We believe the following issues have been adequately addressed:

Minimum bypass flows and release mechanisms at each project, with the exception of Putts Bridge.

Impoundment fluctuation levels, specifically the proposed changes to limit drawdowns at Indian Orchard to 0.5-ft from April 1 - June 30, and at Dwight to within 0.25-ft. when boards are up, should ensure that continuous and stable minimum flows are maintained below those projects.

The proposed capacity upgrades should influence the minimum flows or drawdown limits for each project.

Unresolved issues:

The Putts Bridge bypass flow. We have not agreed to the reduced flow as a permanent condition of the exemption. Before we do so, a water quality study must be performed to verify that the lower flow will protect water quality in the bypass reach. It is our understanding that the study will occur this summer. Once we receive the study results we will make a final decision on the minimum bypass flow needed at Putts Bridge.

Revised Monitoring Plan. A condition of each exemption was the development of a plan to monitor headpond elevations and bypass flows. On March 11, 1993 the previous owner of the projects submitted a Monitoring Plan for our review. Since that time, major changes in the methods of releasing the bypass flows have been made at the projects. We believe that these changes require the development of a new Monitoring Plan. You should provide us with a plan that (1) details the flow release structures and locations, (2) describes the mechanisms used to monitor headpond elevation and minimum flows, (3) specifies how often maintenance and calibration of the monitoring and recording equipment takes place, (4) states how bypass flows will be maintained during any periodic maintenance activities that require the impoundment to be drawn down below the level of the flow release structures, and (5) states how frequently and in what form the data are recorded. A calculation sheet that verifies the discharge of each release structure (i.e., slide/canal gate, board notches and dam spill) under all operating ranges should be included.

Per Condition 8 of the Exemptions from Licensing, we hereby modify our original terms and conditions for the subject exemptions as follows:

Red Bridge

Modify the following conditions to read:

6. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Division for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Division within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Putts Bridge

Modify the following conditions to read:

2. An interim minimum flow of 25 cubic feet per second, or inflow to the project, whichever is less, shall be continuously released at the project dam to the bypassed reach. This release may be modified if results of a water quality study indicate that 25 cfs is insufficient to protect water quality in the bypass reach.

6. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Division for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Division within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Indian Orchard

Modify the following conditions to read:

3. The exemptee shall operate the project to limit drawdown of the project impoundment to no more than 0.5-feet below the top of the flashboards (or dam crest if boards are out) from April 1 through June 30. From July 1 through March 30, the Exemptee shall limit drawdown to no more than one foot below the top of the flashboards (or dam crest if boards are out).

6. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Division for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Division within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Dwight

Modify the following conditions to read:

3. The Exemptee shall operate the project to limit drawdown of the project impoundment to no more than 0.25 feet below the top of the flashboards. When boards are out, the Exemptee shall maintain a minimum of five inches of spill over the dam crest to maintain the minimum bypass flow specified in Condition #3.

6. The Exemptee shall, within six months from the date of issuance of the Order Amending Exemptions, present to the Division for approval, a plan for monitoring project impoundment level and instantaneous bypass flow releases. Following approval of the plan, the Exemptee shall measure and record impoundment level and flows according to the plan and provide records of these data to the Division within 30 days from a request for the records.

The following new condition is to be added to the original nine.

10. In the event that any dam maintenance or emergency drawdown is required, the Exemptee shall continue to operate the project such that the minimum flows are maintained downstream of the project at all times. If during reservoir refilling, inflow to the project is less than the required minimum flow, the Exemptee shall withhold not more than 10% of project inflow.

All other conditions are to be retained in their entirety.

Sincerely,

Caleb Slater, Ph.D.
Anadromous Fish Project Leader

cc: John Labiak, CEEMI
Melissa Grader, USFWS
FERC

APPENDIX B

AGENCY CORRESPONCES

(BJN Copy)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

November 6, 2001

REF: FERC Nos. 10675, 10676, 10677, 10678
Consolidated Edison Energy Massachusetts, Inc.

Alfred Nash, P.E.
Kleinschmidt Associates
75 Main Street, P.O. Box 576
Pittsfield, ME 04967

Dear Mr. Nash:

This responds to your October 5, 2001 cover letter and accompanying Minimum Flow and Impoundment Fluctuation Monitoring Plan for the Dwight, Red Bridge, Putts Bridge and Indian Orchard Projects, located on the Chicopee River in Massachusetts. The Plan was developed pursuant to revised terms and conditions submitted by this office and the Massachusetts Division of Fisheries and Wildlife (MADFW) for the project exemptions. We have reviewed the plans and have the following comments.

Dwight

Impoundment Fluctuation

Please include the impoundment level set points (stop, start and run) that will be programmed into the PLC system for both the boards-in and boards-out condition. Given the fine level of control that will be needed (within 3 inches with boards up and 5 inches with boards out), it is necessary to specify the equipment's sensitivity (e.g., +/- 0.1 ft.). Final set-points should take this margin of error into account. Also, please specify how frequently pond level is recorded, and how long the recorded readings are kept on file.

Release Mechanism

Please provide calculations that quantify how much flow the two canal sluice gates can discharge in the event of an impoundment drawdown for dam maintenance/repair. This section of the Plan should also describe how downstream flows will be maintained while the pond is being refilled.

General

Field calibration should occur as soon as possible to verify that the release structures are passing the required minimum flows. This information should be provided to both this office and the MADFW.

Red Bridge

Impoundment Fluctuation

Please include the impoundment level set-points (stop, start and run) that will be programmed into the PLC system for the April 1 to June 30, and July 1 to March 30 time periods. The equipment's sensitivity (e.g., +/- 0.1 ft.) should also be stated. Final set-points should take this margin of error into account. Also, please specify how frequently pond level is recorded, and how long the recorded readings are kept on file.

Release Mechanism

The Plan states that the PLC will continuously monitor pond levels. Please indicate how frequently the system takes readings and adjusts the gate (e.g., every 15 minutes).

We request that you provide calculations for the following:

- The depth of flow necessary to pass 237 cfs over the spillway.
- The amount of flow the canal drain gate and/or the drain gates at the units can pass in the event the pond is drawn down for major repairs or emergencies.

This section of the Plan should also describe how downstream flows will be maintained while the pond is being refilled.

General

Field calibration should occur as soon as possible to verify that the release structures are passing the required minimum flows. This information should be provided to both this office and the MADFW.

Putts Bridge

In the first paragraph, the second sentence should read, "...limits drawdown to 1-ft below the top of the flashboards from April 1 to June 30, and a 2-ft draw down below the top of the flashboards from July 1 to March 30..."

In the summary table on page 11, the dam crest elevation is listed as 203.54, but on the minimum flow gate calculation sheet it is listed as 203.58. Please clarify which elevation is correct.

Impoundment Fluctuation

Please include the impoundment level set-points (stop, start and run) that will be programmed into the PLC system for the April 1 to June 30, and July 1 to March 30 time periods. The equipment's sensitivity (e.g., +/- 0.1 ft.) should also be stated. Final set-points should take this margin of error into account. Also, please specify how frequently pond level is recorded, and how long the recorded readings are kept on file.

Release Mechanism

The Plan states that the PLC will continuously monitor pond levels. Please indicate how frequently the system takes readings and adjusts the gate (e.g., every 15 minutes).

Please provide calculations for the following:

- The depth of spill required to pass 25 cfs over the spillway.
- The amount of flow the low level sluice gate can pass.

This section of the Plan should also describe how downstream flows will be maintained while the pond is being refilled.

General
Field calibration should occur as soon as possible to verify that the release structures are passing the required minimum flows. This information should be provided to both this office and the MADFW.

Indian Orchard

Impoundment Fluctuation
This section needs to be updated to reflect the new fluctuation restrictions. As written, the sensor equipment is only programmed for a 1-ft drawdown. It must accommodate both a 0.5-ft and 1.0-ft drawdown for both board conditions. Please revise this section, and include the impoundment level set-points (stop, start and run) that will be programmed into the PLC system. The equipment's sensitivity (e.g., +/- 0.1 ft.) should also be stated. Final set-points should take this margin of error into account.

We are unclear what is meant by hourly strip charts; does this mean once per hour an impoundment elevation is recorded on a strip chart? Please specify how frequently pond level is recorded, and how long the recorded readings are kept on file.

Release Mechanism
The minimum flow release structures proposed are adequate for periods when the pond level is at or above the dam crest. The Plan needs to describe how bypass flows will be maintained during periods of normal operation when boards are out, or when the pond is drawn down below dam crest for repairs/maintenance activity.

Please include calculations indicating that the canal drain gates and/or the drain gates at the units can pass at least 247 cfs, in the event the pond is drawn down for major repairs or emergencies.

This section of the Plan should also describe how downstream flows will be maintained while the pond is being refilled.

General
Field calibration should occur as soon as possible to verify that the release structures are passing the required minimum flows. This information should be provided to both this office and the MADFW.

Thank you for this opportunity to comment. If you have any questions, please contact Melissa Grader of this office at (207) 781-8364, or e-mail at melissa_grader@fws.gov.

Sincerely,

William J. Neidermyer
Assistant Supervisor
Federal Activities
New England Field Office

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director*

November 15, 2001

RE: FERC Nos. 10675, 10676, 10677, 10678

Alfred Nash, P.E.
Kleinschmidt Associates
75 Main Street, PO Box 576
Pittsfield, ME 04967

Dear Mr. Nash,

This letter is in response to your report, *Chicopee River Projects: Minimum Flow and Impoundment Fluctuation Monitoring Plan,* dated October 2001. We have reviewed the plan and have the following comments.

For each project: How long kept for

Please specify the set points (stop, start and run) that will be programmed into the PLC systems.

Please specify how frequently the PLC systems monitor the pond elevation and/or how frequently changes to gate adjustments/unit operations are made in response to this data. cont no 5 min

Please specify how frequently the pond level will be recorded and how this data is kept. cont strip chart

Please provide calculations that quantify the flow to be released from the alternative flow devices to be used during maintenance drawdowns (i.e. how much flow will be provided via spillway or drain gates [and their settings] at the range of anticipated pond elevations).

Field calibration of minimum flows should occur as soon as possible to verify that the devices are functioning as required.

Sincerely,

Caleb Slater, Ph.D.
Anadromous Fish Project Leader

cc FERC
John Warner, USFWS
Melissa Grader, USFWS
John Labiak, CEEMI

Division of Fisheries & Wildlife
Field Headquarters, One Rabbit Hill Road, Westborough, MA 01581 (508) 792-7270 • Fax 792-7275
An Agency of the Department of Fisheries, Wildlife & Environmental Law Enforcement

APPENDIX C

CALCULATIONS

Kleinschmidt
Energy & Water Resource Consultants
141 Main St P.O. Box 650
Pittsfield, Maine 04967
Tel: 207.487.3328
Fax: 207.487.3174

Page:
Project No: 803-004
By: JSJ Date: 12-9-2011
Checked: MCS Date: 12-12-2011

Project: Chicopee River Projects - Minimum Flow
Subject: Dwight Minimum Flow

Analysis Description:
Calculating the gate settings required to release the minimum flow.

Assumptions:
Minimum flow of 258 cfs required
Flow is released through 2 canal sluice gates
Sluice gates only used when WSEL is below crest
Bottoms of fully opened sluice gates are estimated to be El. 66.5' (approximately 10-ft below crest).
Weir or Orifice flow possible
Orifice flow occurs when depth at crest (critical depth, 2/3 of head on crest) rises above bottom of fully opened sluice gate.
Formula for orifice flow: (2/3)*Cd*((2g)^0.5)*L*(((H1)^1.5)-((H2)^1.5)): H1=Head over the invert and H2=Head over the top of the gate
Formula for weir flow: C*L*H^3/2

Analysis:
Flow through canal sluice gates at a range of headpond elevations

Bare Crest/Invert Elevation (ft) =	66.5
Top Elevation (ft) =	71.5
Height (ft) =	5
Width (ft) =	5
Weir Coefficient (C) =	3
Orifice Coefficient (Cd) =	0.64
Gravity g (ft/s^2) =	32.2

Headpond Elev (ft)	Flow Condition	Total Flow (cfs)
66.5	Weir	0
67	Weir	5
67.5	Weir	14
68	Weir	26
68.5	Weir	39
69	Weir	53
69.5	Weir	69
70	Weir	84
70.5	Weir	101
71	Weir	117
71.5	Weir	134
72	Weir	151
72.5	Weir	168
73	Weir	184
73.5	Weir	200
74	Weir	216
74.5	Weir	231
75	Weir	245
75.5	Weir	259
76	Weir	272
76.5	Weir	285
77	Weir	296
77.5	Weir	306
78	Weir	316
78.5	Weir	324

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Page:
Project No: 803-004
By: JSJ Date: 12-9-2011
Checked: MCS Date: 12-12-2011

Project: Chicopee River Projects - Minimum Flow
Subject: Putts Bridge Minimum Flow

Analysis Description:
Calculating the gate settings required to release the minimum flow.

Assumptions:
25 cfs Minimum flow requirement
Minimum flow passed through a top discharge gate
Gate is 6-ft wide and 8-ft high
Gate controlled by PLC
C from Bureau of Reclaimation Design of Small Dams p. 373
Spillway crest elevation is 203.58'
Gate Invert Elevation is 199.74'
Flashboard Elevation is 205.25'
Low Level Sluice no longer in use

Analysis:

Minimum Flow Top Discharge Gate
Effective Width
L=L'-2(N*kp+kq)He

Kp	0.02	
Ka	0.2	
N	2	
He	1.2	ft
L'	6	ft
L	5.424	ft

Required Gate Setting
$Q=CLH^{(3/2)}$

Q	25	cfs
C	3.3	
L	5.4	ft
H	1.25	ft

Must maintain an opening of
1'-3" to release minimum flow
of 25 cfs

Kleinschmidt
Energy & Water Resource Consultants

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Page:
Project No: 803-004
By: JSJ Date: 12-9-2011
Checked: MCS Date: 12-12-2011

Project: Chicopee River Projects - Minimum Flow
Subject: Red Bridge Minimum Flow

Analysis Description:
Calculating the minimum flow.

Assumptions:
237 cfs minimum flow is required
Minimum flow is passed through a minimum flow gate
Minimum flow can be passed over the spillway as an alternative
C from Bureau of Reclaimation Design of Small Dams p. 373
Spillway Crest elevation is 272.24'
Gate elevation is 264.7'
Gate is 7' wide x 8.5' high

Analysis:

Depth required to maintain minimum flow over the spillway - Backup

Effective Spillway Width
L=L'-2(N*kp+kq)He

Kp	0.02	
Kq	0.2	
N	2	
He	2	ft
L'	300	ft
L	299.04	ft

Required Gate Setting
$Q=CLH^{(3/2)}$

Q	237	cfs
C	2.9	
L	299.04	ft
H	0.42	ft

Must maintain 5" of overtopping to release minimum flow

Flow through minimum flow gates at a range of headpond elevations - Primary Min Flow

Bare Crest/Invert Elevation (ft) =	264.7
Top Elevation (ft) =	273.2
Height (ft) =	8.5
Width (ft) =	7
Weir Coefficient (C) =	3
Orifice Coefficient (Cd) =	0.64
Gravity g (ft/s^2) =	32.2

Headpond Elev (ft)	Flow Condition	Total Flow (cfs)
264.7	Weir	0
264.75	Weir	0
264.8	Weir	1
265	Weir	3
265.5	Weir	15
266	Weir	30
266.5	Weir	48
267	Weir	68
267.5	Weir	91
268	Weir	114
268.5	Weir	139
269	Weir	164
269.5	Weir	191
270	Weir	217
270.5	Weir	245
271	Weir	272
271.5	Weir	300
272	Weir	328
272.5	Weir	356
273	Weir	383
273.5	Weir	410
274	Weir	437
274.5	Weir	464
275	Weir	490

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Page:
Project No: 803-004
By: JSJ — Date: 12-9-2011
Checked: MCS — Date: 12-12-2011

Project: Chicopee River Projects - Minimum Flow
Subject: Indian Orchard Minimum Flow

Analysis Description:
Calculating the gate settings required to release the minimum flow.

Assumptions:
247 cfs minimum flow requirement
Minimum flow passed through 2-36" diameter CM pipes
Gate for minimum flow pipes is a 30" sqaure opening.
Invert of pipes is El 151.7'
Impoundment Fluctionation = 0.5-ft drawdown (4/1-6/30), 1-ft drawdown (7/1-3/30)
C based on a short pipe, from 6th edition of Elementary Fluid Mechanics p. 535

Analysis:
Checking Pipe Flow at a range of elevations
$Q=CA*\sqrt{(2gh)}$
$A=(pi*d^2)/4$

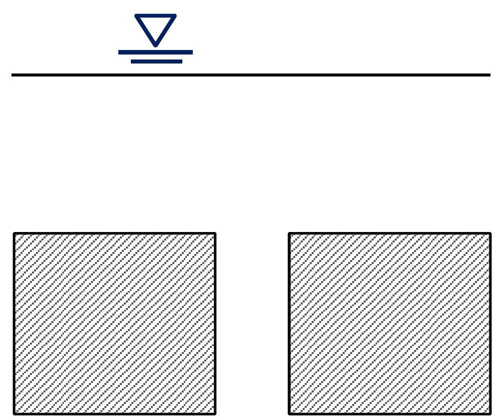
Min Flow	247	cfs
C	0.8	
A	7.07	sq-ft
d	3	ft
g	32.2	
Invert El	151.7	ft
Pipe CL El	153.2	ft

Headpond	h (ft)	Q (cfs)
161	7.8	253
160.9	7.7	252
160.8	7.6	250
160.7	7.5	249
160.6	7.4	247
160.5	7.3	245
159.6	6.4	230
158.35	5.15	206

Min Flow Calculations at
Dwight Station
Provided by US Fish and Wildlife

Dwight Dam Sluice Gate Discharge

Q_{min}	258.0	(ft^3/s)	Minimum flow release requirement
EL_1	66.5	(ft MSL)	Elevation of sluice gate sill
EL_2	71.5	(ft MSL)	Elevation of top of sluice gate opening
WS	77.0	(ft MSL)	Normal pond elevation
EL_{crest}	76.58	(ft MSL)	Dam crest elevation
H_g	5.0	(ft)	Gate opening height
W_g	5.0	(ft)	Gate opening width; also serves as L', weir length; L' modified below by Ka in tables
C_w	3.087	$(ft^{0.5}/s)$	Weir coefficient (through gate); broad-crested chute flow; also appropriate for partially submerged discharge
C_o	0.65	(-)	Orifice coefficient; p. 454 Design of Small Dams, w/development >1.25' and less than 2.5'
K_a	0.1	(-)	Abutment coefficient; p. 373 Design of Small Dams, assumes headwall at 90d to flow
K_p	0.02	(-)	Pier coefficient; p. 373 Design of Small Dams



WS (ft)	Gate Elevation and Opening (ft)										
	66.5	67.0	67.5	68.0	68.5	69.0	69.5	70.0	70.5	71.0	71.5
	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Flow Condition (Weir flow or Orifice flow)										
66.5	orifice	weir	weir	weir	weir	weir	weir	weir	weir	weir	weir
67.0	orifice	orifice	weir	weir	weir	weir	weir	weir	weir	weir	weir
67.5	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir	weir	weir
68.0	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir	weir
68.5	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir
69.0	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir
69.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir
70.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir
70.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir
71.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir
71.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
72.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
72.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
73.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
73.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
74.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
74.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
75.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
75.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
76.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
76.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
76.58	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
77.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
77.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
78.0	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
78.5	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice

WS	Gate Elevation and Opening (ft)										
	66.5	**67.0**	**67.5**	**68.0**	**68.5**	**69.0**	**69.5**	**70.0**	**70.5**	**71.0**	**71.5**
	0.0	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**
(ft)	**Head (ft)**										
66.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67.0	0.50	0.25	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
67.5	1.00	0.75	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
68.0	1.50	1.25	1.00	0.75	1.50	1.50	1.50	1.50	1.50	1.50	1.50
68.5	2.00	1.75	1.50	1.25	1.00	2.00	2.00	2.00	2.00	2.00	2.00
69.0	2.50	2.25	2.00	1.75	1.50	1.25	2.50	2.50	2.50	2.50	2.50
69.5	3.00	2.75	2.50	2.25	2.00	1.75	1.50	3.00	3.00	3.00	3.00
70.0	3.50	3.25	3.00	2.75	2.50	2.25	2.00	1.75	3.50	3.50	3.50
70.5	4.00	3.75	3.50	3.25	3.00	2.75	2.50	2.25	2.00	4.00	4.00
71.0	4.50	4.25	4.00	3.75	3.50	3.25	3.00	2.75	2.50	2.25	4.50
71.5	5.00	4.75	4.50	4.25	4.00	3.75	3.50	3.25	3.00	2.75	2.50
72.0	5.50	5.25	5.00	4.75	4.50	4.25	4.00	3.75	3.50	3.25	3.00
72.5	6.00	5.75	5.50	5.25	5.00	4.75	4.50	4.25	4.00	3.75	3.50
73.0	6.50	6.25	6.00	5.75	5.50	5.25	5.00	4.75	4.50	4.25	4.00
73.5	7.00	6.75	6.50	6.25	6.00	5.75	5.50	5.25	5.00	4.75	4.50
74.0	7.50	7.25	7.00	6.75	6.50	6.25	6.00	5.75	5.50	5.25	5.00
74.5	8.00	7.75	7.50	7.25	7.00	6.75	6.50	6.25	6.00	5.75	5.50
75.0	8.50	8.25	8.00	7.75	7.50	7.25	7.00	6.75	6.50	6.25	6.00
75.5	9.00	8.75	8.50	8.25	8.00	7.75	7.50	7.25	7.00	6.75	6.50
76.0	9.50	9.25	9.00	8.75	8.50	8.25	8.00	7.75	7.50	7.25	7.00
76.5	10.00	9.75	9.50	9.25	9.00	8.75	8.50	8.25	8.00	7.75	7.50
76.6	10.08	9.83	9.58	9.33	9.08	8.83	8.58	8.33	8.08	7.83	7.58
77.0	10.50	10.25	10.00	9.75	9.50	9.25	9.00	8.75	8.50	8.25	8.00
77.5	11.00	10.75	10.50	10.25	10.00	9.75	9.50	9.25	9.00	8.75	8.50
78.0	11.50	11.25	11.00	10.75	10.50	10.25	10.00	9.75	9.50	9.25	9.00
78.5	12.00	11.75	11.50	11.25	11.00	10.75	10.50	10.25	10.00	9.75	9.50

WS	Gate Elevation and Opening (ft)										
	66.5	67.0	67.5	68.0	68.5	69.0	69.5	70.0	70.5	71.0	71.5
	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
(ft)	Orifice Flow Cross-Sectional Area (ft^2)										
66.5	0										
67.0	0	2.5									
67.5	0	2.5	5								
68.0	0	2.5	5	7.5							
68.5	0	2.5	5	7.5	10						
69.0	0	2.5	5	7.5	10	12.5					
69.5	0	2.5	5	7.5	10	12.5	15				
70.0	0	2.5	5	7.5	10	12.5	15	17.5			
70.5	0	2.5	5	7.5	10	12.5	15	17.5	20		
71.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	
71.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
72.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
72.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
73.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
73.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
74.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
74.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
75.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
75.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
76.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
76.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
76.58	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
77.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
77.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
78.0	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
78.5	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25

WS	Gate Elevation and Opening (ft)										
	66.5	67.0	67.5	68.0	68.5	69.0	69.5	70.0	70.5	71.0	71.5
	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
(ft)	Weir Flow Effective Length (ft)										
66.5		5	5	5	5	5	5	5	5	5	5
67.0			4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88
67.5				4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
68.0					4.64	4.64	4.64	4.64	4.64	4.64	4.64
68.5						4.52	4.52	4.52	4.52	4.52	4.52
69.0							4.4	4.4	4.4	4.4	4.4
69.5								4.28	4.28	4.28	4.28
70.0									4.16	4.16	4.16
70.5										4.04	4.04
71.0											3.92
71.5											
72.0											
72.5											
73.0											
73.5											
74.0											
74.5											
75.0											
75.5											
76.0											
76.5											
76.58											
77.0											
77.5											
78.0											
78.5											

WS	Gate Elevation and Opening (ft)										
	66.5	67.0	67.5	68.0	68.5	69.0	69.5	70.0	70.5	71.0	71.5
	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
(ft)	Discharge per Sluice Gate (cfs)										
66.5	0	0	0	0	0	0	0	0	0	0	0
67.0	0	7	5	5	5	5	5	5	5	5	5
67.5	0	11	18	15	15	15	15	15	15	15	15
68.0	0	15	26	34	26	26	26	26	26	26	26
68.5	0	17	32	44	52	39	39	39	39	39	39
69.0	0	20	37	52	64	73	54	54	54	54	54
69.5	0	22	41	59	74	86	96	69	69	69	69
70.0	0	23	45	65	82	98	111	121	84	84	84
70.5	0	25	49	70	90	108	124	137	147	100	100
71.0	0	27	52	76	98	117	135	151	165	176	116
71.5	0	28	55	81	104	126	146	164	181	195	206
72.0	0	30	58	85	111	134	156	177	195	211	226
72.5	0	31	61	90	117	142	166	188	209	227	244
73.0	0	33	64	94	122	149	175	199	221	242	**261**
73.5	0	34	66	98	128	156	183	209	233	256	**277**
74.0	0	35	69	102	133	163	192	219	245	**269**	**291**
74.5	0	36	71	105	138	169	199	228	255	**281**	**306**
75.0	0	37	74	109	143	175	207	237	**266**	**293**	**319**
75.5	0	39	76	112	147	181	214	246	**276**	**305**	**332**
76.0	0	40	78	116	152	187	221	254	**286**	**316**	**345**
76.5	0	41	80	119	156	193	228	**262**	**295**	**327**	**357**
76.6	0	41	81	119	157	194	229	**263**	**296**	**328**	**359**
77.0	0	42	82	122	161	198	235	**270**	**304**	**337**	**369**
77.5	0	43	84	125	165	204	241	**277**	**313**	**347**	**380**
78.0	0	44	86	128	169	209	247	**285**	**321**	**357**	**391**
78.5	0	45	88	131	173	214	253	**292**	**330**	**366**	**402**

257	Flow is below minimum required
258	Flow meets requirement

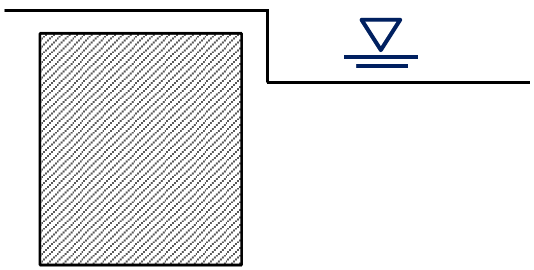
WS (ft)	Gate Elevation and Opening (ft)										
	66.5	67.0	67.5	68.0	68.5	69.0	69.5	70.0	70.5	71.0	71.5
	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Discharge for both Sluice Gates (cfs)										
66.5	0	0	0	0	0	0	0	0	0	0	0
67.0	0	13	11	11	11	11	11	11	11	11	11
67.5	0	23	37	29	29	29	29	29	29	29	29
68.0	0	29	52	68	53	53	53	53	53	53	53
68.5	0	34	64	87	104	79	79	79	79	79	79
69.0	0	39	74	103	128	146	107	107	107	107	107
69.5	0	43	82	117	147	172	192	137	137	137	137
70.0	0	47	90	130	165	196	221	241	168	168	168
70.5	0	50	98	141	181	216	247	**274**	**295**	200	200
71.0	0	54	104	151	195	235	**271**	**303**	**330**	**352**	231
71.5	0	57	111	161	209	252	**293**	**329**	**361**	**389**	**412**
72.0	0	60	117	170	221	**269**	**313**	**353**	**390**	**423**	**452**
72.5	0	63	122	179	233	**284**	**332**	**376**	**417**	**454**	**488**
73.0	0	65	128	188	245	**299**	**350**	**398**	**442**	**484**	**521**
73.5	0	68	133	196	255	**313**	**367**	**418**	**466**	**511**	**553**
74.0	0	70	138	203	**266**	**326**	**383**	**438**	**489**	**538**	**583**
74.5	0	73	143	211	**276**	**339**	**399**	**456**	**511**	**563**	**611**
75.0	0	75	147	218	**286**	**351**	**414**	**474**	**532**	**587**	**639**
75.5	0	77	152	225	**295**	**363**	**428**	**491**	**552**	**610**	**665**
76.0	0	79	156	231	**304**	**374**	**442**	**508**	**571**	**632**	**690**
76.5	0	81	161	238	**313**	**386**	**456**	**524**	**590**	**653**	**714**
76.6	0	82	161	239	**314**	**387**	**458**	**527**	**593**	**657**	**718**
77.0	0	83	165	244	**321**	**396**	**469**	**540**	**608**	**674**	**737**
77.5	0	85	169	250	**330**	**407**	**482**	**555**	**626**	**694**	**760**
78.0	0	87	173	256	**338**	**417**	**495**	**570**	**643**	**714**	**782**
78.5	0	89	177	**262**	**346**	**427**	**507**	**584**	**659**	**733**	**803**

257	Flow is below minimum required
258	Flow meets requirement

Min Flow Calculations at
Red Bridge
Provided by US Fish and Wildlife

Red Bridge Dam Min. Flow Gate Discharge

Q_{min}	237.0	(ft^3/s)	Minimum flow release requirement
EL_1	264.7	(ft MSL)	Elevation of min flow discharge gate sill
EL_2	273.2	(ft MSL)	Elevation of top of min flow discharge gate opening
EL_{crest}	272.24	(ft MSL)	Spillway crest elevation
H_g	8.5	(ft)	Gate opening height
W_g	7.0	(ft)	Gate opening width; also serves as L', weir length; L' modified below by Ka in tables
C_w	3.087		Weir coefficient; assumed for broad-crested chute flow; also appropriate for partially submerged discharge
C_o	0.65	(-)	Orifice coefficient; p. 454 Design of Small Dams, w/development >1.25' and less than 2.5'
K_a	0.1	(-)	Abutment coefficient; p. 373 Design of Small Dams, assumes headwall at 90d to flow



These tables do not include the spillway discharge.
Spillway is used only during maintenance or outages.

WS (ft)	264.7 0.0	265.7 1.0	266.7 2.0	267.7 3.0	268.7 4.0	269.7 5.0	270.7 6.0	271.7 7.0	272.2 7.5	272.7 8.0	273.2 8.5
	Gate Elevation and Opening (ft)										
	Head (ft)										
264.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
265.2	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
265.7	1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
266.2	1.50	1.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
266.7	2.00	1.50	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
267.2	2.50	2.00	1.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
267.7	3.00	2.50	2.00	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00
268.2	3.50	3.00	2.50	2.00	3.50	3.50	3.50	3.50	3.50	3.50	3.50
268.7	4.00	3.50	3.00	2.50	2.00	4.00	4.00	4.00	4.00	4.00	4.00
269.2	4.50	4.00	3.50	3.00	2.50	4.50	4.50	4.50	4.50	4.50	4.50
269.7	5.00	4.50	4.00	3.50	3.00	2.50	5.00	5.00	5.00	5.00	5.00
270.2	5.50	5.00	4.50	4.00	3.50	3.00	5.50	5.50	5.50	5.50	5.50
270.7	6.00	5.50	5.00	4.50	4.00	3.50	3.00	6.00	6.00	6.00	6.00
271.2	6.50	6.00	5.50	5.00	4.50	4.00	3.50	6.50	6.50	6.50	6.50
271.7	7.00	6.50	6.00	5.50	5.00	4.50	4.00	3.50	7.00	7.00	7.00
272.2	7.50	7.00	6.50	6.00	5.50	5.00	4.50	4.00	3.75	7.50	7.50
272.7	8.00	7.50	7.00	6.50	6.00	5.50	5.00	4.50	4.25	4.00	8.00
273.2	8.50	8.00	7.50	7.00	6.50	6.00	5.50	5.00	4.75	4.50	4.25
273.7	9.00	8.50	8.00	7.50	7.00	6.50	6.00	5.50	5.25	5.00	4.75
274.2	9.50	9.00	8.50	8.00	7.50	7.00	6.50	6.00	5.75	5.50	5.25
274.7	10.00	9.50	9.00	8.50	8.00	7.50	7.00	6.50	6.25	6.00	5.75
275.2	10.50	10.00	9.50	9.00	8.50	8.00	7.50	7.00	6.75	6.50	6.25
275.7	11.00	10.50	10.00	9.50	9.00	8.50	8.00	7.50	7.25	7.00	6.75
276.2	11.50	11.00	10.50	10.00	9.50	9.00	8.50	8.00	7.75	7.50	7.25
276.7	12.00	11.50	11.00	10.50	10.00	9.50	9.00	8.50	8.25	8.00	7.75

WS (ft)	Gate Elevation and Opening (ft) 264.7 / 0.0	265.7 / 1.0	266.7 / 2.0	267.7 / 3.0	268.7 / 4.0	269.7 / 5.0	270.7 / 6.0	271.7 / 7.0	272.2 / 7.5	272.7 / 8.0	273.2 / 8.5
	Flow Condition (Weir flow or Orifice flow)										
264.7	orifice	weir	weir	weir	weir	weir	weir	weir	weir	weir	weir
265.2	orifice	weir	weir	weir	weir	weir	weir	weir	weir	weir	weir
265.7	orifice	orifice	weir	weir	weir	weir	weir	weir	weir	weir	weir
266.2	orifice	orifice	weir	weir	weir	weir	weir	weir	weir	weir	weir
266.7	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir	weir	weir
267.2	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir	weir	weir
267.7	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir	weir
268.2	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir	weir
268.7	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir
269.2	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir	weir
269.7	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir
270.2	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir	weir
270.7	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir
271.2	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir	weir
271.7	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir	weir
272.2	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir	weir
272.7	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	weir
273.2	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
273.7	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
274.2	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
274.7	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
275.2	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
275.7	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
276.2	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice
276.7	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice	orifice

WS	Gate Elevation and Opening (ft)										
	264.7	**265.7**	**266.7**	**267.7**	**268.7**	**269.7**	**270.7**	**271.7**	**272.2**	**272.7**	**273.2**
	0.0	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**7.5**	**8.0**	**8.5**
(ft)	**Weir Flow Effective Length (ft)**										
264.7		7	7	7	7	7	7	7	7	7	7
265.2		6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
265.7			6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
266.2			6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
266.7				6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
267.2				6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
267.7					6.4	6.4	6.4	6.4	6.4	6.4	6.4
268.2					6.3	6.3	6.3	6.3	6.3	6.3	6.3
268.7						6.2	6.2	6.2	6.2	6.2	6.2
269.2						6.1	6.1	6.1	6.1	6.1	6.1
269.7							6	6	6	6	6
270.2							5.9	5.9	5.9	5.9	5.9
270.7								5.8	5.8	5.8	5.8
271.2								5.7	5.7	5.7	5.7
271.7									5.6	5.6	5.6
272.2										5.5	5.5
272.7											5.4
273.2											
273.7											
274.2											
274.7											
275.2											
275.7											
276.2											
276.7											

WS	Gate Elevation and Opening (ft)										
	264.7	265.7	266.7	267.7	268.7	269.7	270.7	271.7	272.2	272.7	273.2
	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	7.5	8.0	8.5
(ft)	Orifice Flow Cross-Sectional Area (ft^2)										
264.7	0										
265.2	0										
265.7	0	7									
266.2	0	7									
266.7	0	7	14								
267.2	0	7	14								
267.7	0	7	14	21							
268.2	0	7	14	21							
268.7	0	7	14	21	28						
269.2	0	7	14	21	28						
269.7	0	7	14	21	28	35					
270.2	0	7	14	21	28	35					
270.7	0	7	14	21	28	35	42				
271.2	0	7	14	21	28	35	42				
271.7	0	7	14	21	28	35	42	49			
272.2	0	7	14	21	28	35	42	49	52.5		
272.7	0	7	14	21	28	35	42	49	52.5	56	
273.2	0	7	14	21	28	35	42	49	52.5	56	59.5
273.7	0	7	14	21	28	35	42	49	52.5	56	59.5
274.2	0	7	14	21	28	35	42	49	52.5	56	59.5
274.7	0	7	14	21	28	35	42	49	52.5	56	59.5
275.2	0	7	14	21	28	35	42	49	52.5	56	59.5
275.7	0	7	14	21	28	35	42	49	52.5	56	59.5
276.2	0	7	14	21	28	35	42	49	52.5	56	59.5
276.7	0	7	14	21	28	35	42	49	52.5	56	59.5

WS	**Gate Elevation and Opening (ft)**										
	264.7	**265.7**	**266.7**	**267.7**	**268.7**	**269.7**	**270.7**	**271.7**	**272.2**	**272.7**	**273.2**
	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	7.5	8.0	8.5
(ft)	**Discharge for Min. Flow Gate (cfs)**										
264.7	0	0	0	0	0	0	0	0	0	0	0
265.2	0	8	8	8	8	8	8	8	8	8	8
265.7	0	26	21	21	21	21	21	21	21	21	21
266.2	0	36	38	38	38	38	38	38	38	38	38
266.7	0	45	73	58	58	58	58	58	58	58	58
267.2	0	52	89	79	79	79	79	79	79	79	79
267.7	0	58	103	134	103	103	103	103	103	103	103
268.2	0	63	115	155	127	127	127	127	127	127	127
268.7	0	68	126	173	206	153	153	153	153	153	153
269.2	0	73	137	190	231	180	180	180	180	180	180
269.7	0	77	146	205	**253**	**289**	207	207	207	207	207
270.2	0	82	155	219	**273**	**316**	235	235	235	235	235
270.7	0	86	163	232	**292**	**341**	**379**	**263**	**263**	**263**	**263**
271.2	0	89	171	**245**	**310**	**365**	**410**	**292**	**292**	**292**	**292**
271.7	0	93	179	**257**	**326**	**387**	**438**	**478**	**320**	**320**	**320**
272.2	0	97	186	**268**	**342**	**408**	**465**	**511**	**530**	**349**	**349**
272.7	0	100	193	**279**	**358**	**428**	**490**	**542**	**564**	**584**	**377**
273.2	0	103	200	**290**	**372**	**447**	**514**	**571**	**597**	**619**	**640**
273.7	0	106	206	**300**	**386**	**465**	**536**	**599**	**627**	**653**	**676**
274.2	0	109	213	**310**	**400**	**483**	**558**	**626**	**656**	**685**	**711**
274.7	0	112	219	**319**	**413**	**500**	**579**	**651**	**684**	**715**	**744**
275.2	0	115	225	**328**	**426**	**516**	**600**	**676**	**711**	**744**	**776**
275.7	0	118	231	**337**	**438**	**532**	**619**	**700**	**737**	**772**	**806**
276.2	0	121	237	**346**	**450**	**547**	**638**	**723**	**762**	**800**	**835**
276.7	0	124	**242**	**355**	**462**	**562**	**657**	**745**	**786**	**826**	**864**

236	Flow is below minimum required
237	Flow meets requirement

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

DESIGN OF SMALL DAMS

A Water Resources Technical Publication

Second Edition
1973
Revised Reprint
1977

196. Discharge Over An Uncontrolled Overflow Ogee Crest.—(a) *General.*—The discharge over an ogee crest is given by the formula:

$$Q=CLH_e^{3/2} \qquad (3)$$

where:

Q=discharge,
C=a variable coefficient of discharge,
L=effective length of crest, and
H_e=total head on the crest, including velocity of approach head, h_a.

The discharge coefficient, C, is influenced by a number of factors, such as (1) the depth of approach, (2) relation of the actual crest shape to the ideal nappe shape, (3) upstream face slope, (4) downstream apron interference, and (5) downstream submergence. The effect of these various factors is discussed in section 197.

The total head on the crest, H_e, does not include allowances for approach channel friction losses or other losses due to curvature of the upstream channel, entrance loss into the inlet section, and inlet or transition losses. Where the design of the approach channel results in appreciable losses, they must be added to H_e to determine reservoir elevations corresponding to the discharges given by the above equation.

(b) *Pier and Abutment Effects.*—Where crest piers and abutments are shaped to cause side contractions of the overflow, the effective length, L, will be less than the net length of the crest. The effect of the end contractions may be taken into account by reducing the net crest length as follows:

$$L=L'-2(NK_p+K_a)H_e \qquad (4)$$

where:

L=effective length of crest,
L'=net length of crest,
N=number of piers,
K_p=pier contraction coefficient,
K_a=abutment contraction coefficient, and
H_e=total head on crest.

The pier contraction coefficient, K_p, is affected by the shape and location of the pier nose, the thickness of the pier, the head in relation to the design head, and the approach velocity. For conditions of design head, H_o, average pier contraction coefficients may be assumed as follows:

	K_p
For square-nosed piers with corners rounded on a radius equal to about 0.1 of the pier thickness	0.02
For round-nosed piers	0.01
For pointed-nose piers	0

The abutment contraction coefficient is affected by the shape of the abutment, the angle between the upstream approach wall and the axis of flow, the head in relation to the design head, and the approach velocity. For conditions of design head, H_o, average coefficients may be assumed as follows:

	K_a
For square abutments with headwall at 90° to direction of flow	0.20
For rounded abutment with headwall at 90° to direction of flow, when $0.5H_o \geqq r \geqq 0.15H_o$	0.10
For rounded abutments where $r>0.5H_o$ and headwall is placed not more than 45° to direction of flow	0.0

where r=radius of abutment rounding.

197. Coefficient of Discharge for Uncontrolled Ogee Crests.—(a) *Effect of Depth of Approach.*—For a high sharp-crested weir placed in a channel, the velocity of approach is small and the under side of the nappe flowing over the weir attains maximum vertical contraction. As the approached depth is decreased, the velocity of approach increases and the vertical contraction diminishes. For sharp-crested weirs whose heights are not less than about one-fifth the heads producing flow over them, the coefficient of discharge remains fairly constant with a value of about 3.3 although the contraction diminishes. For weir heights less than about one-fifth the head, the contraction of the flow becomes increasingly suppressed and the crest coefficient decreases. When the weir height becomes zero, the contraction is entirely suppressed and the overflow weir becomes in effect a channel or a broad-crested weir, for which the theoretical coefficient of discharge is 3.087. If the sharp-crested weir coefficients are related to the head measured from the point of maximum contraction instead of to the head above the sharp crest, coefficients applicable

HYDRAULIC DESIGN CRITERIA

SHEET 320-1

CONTROL GATES

DISCHARGE COEFFICIENTS

1. General. The accompanying Hydraulic Design Chart 320-1 represents test data on the discharge coefficients applicable to partial openings of both slide and tractor gates. The basic orifice equation is expressed as follows:

$H' = \Delta H - CG_o$
G_o = GATE OPENING HT. (IN FT.)
B = GATE WIDTH (FEET)
g = 32.2 FT/SEC

$$Q = C\,G_o\,B\sqrt{2gH'}$$

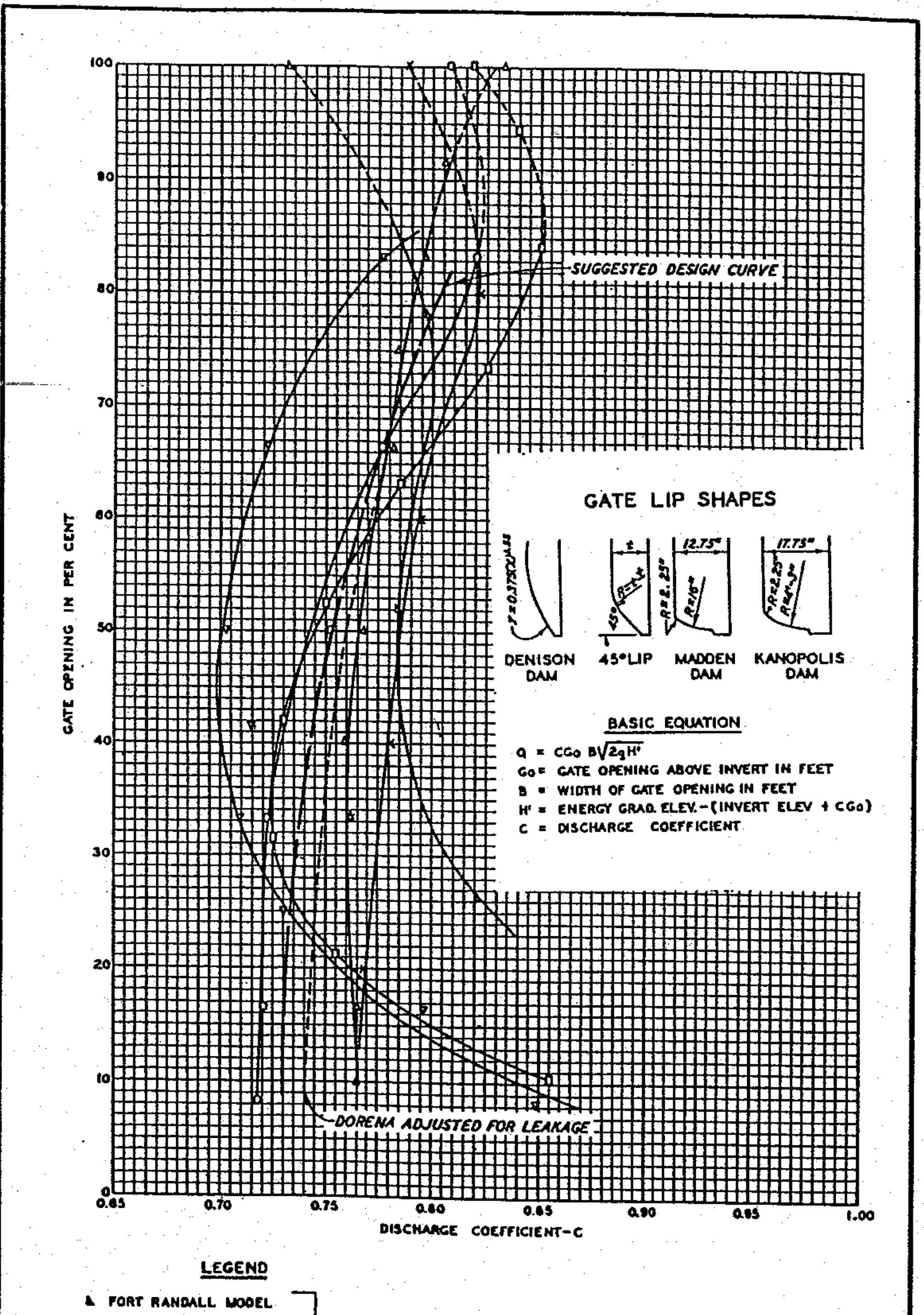
The coefficient C is actually a contraction coefficient if the gate is located near the tunnel entrance and the entrance energy loss is neglected. When the gate is located near the conduit entrance the head (H') is measured from the reservoir water surface to the top of the vena contracta. However, when the gate is located a considerable distance downstream of the conduit entrance, H' should be measured from the energy gradient just upstream of the gate to the top of the vena contracta because of appreciable losses upstream of the gate. The evaluation of H' requires successive approximation in the analysis of test data. However, the determination of H' in preparation of a rating curve can be easily accomplished by referring to the chart for C.

2. Discharge Coefficients. Discharge coefficients for tractor and slide gates are sensitive to the shape of the gate lip. Also, coefficients for small gate openings are materially affected by leakage over and around the gate. Chart 320-1 presents discharge coefficients determined from tests on model and prototype structures having various gate clearances and lip shapes. The points plotted on the 100 per cent opening are not affected by the gate but rather by friction and other loss factors in the conduit. For this reason the curves are shown by dashed lines above 85 per cent gate opening.

3. Suggested Criteria. Model and prototype tests prove that the 45° gate lip is hydraulically superior to other gate lip shapes. Therefore, the 45° gate lip has been recommended for high head structures. In the 1949 model tests leakage over the gate was reduced to a minimum. Correction of the Dorena Dam data for leakage results in a discharge coefficient curve that is in close agreement with the 1949 curve. The average of these two curves shown on Chart 320-1 is the suggested design curve. For small gate openings special allowances should be made by the designer for any expected excessive intake friction losses and gate leakage.

4. Values from the suggested design curve are tabulated below for the convenience of the designer.

Gate Opening, Per Cent	Discharge Coefficient
10	0.73
20	0.73
30	0.74
40	0.74
50	0.75
60	0.77
70	0.78
80	0.80



CONTROL GATES

DISCHARGE COEFFICIENTS

HYDRAULIC DESIGN CHART 320-1

WES 4-1-52

ı contracta remains at a
her decrease of Reynolds
ıu resistance.
ıu.. ratios, equation 5.23
pressure connection is at
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t pressure taps will be
ferences at the end of the

sı merged orifice of Fig.
r ınto another. Here with
ssuming a perfect fluid and
v r and section 2,

$- h_2)$

h rostatic[30] in the down-
event the attainment of this

replaced by C_cA:

$(h_1 - h_2)$ (11.18)

the orifice. When the orifice
oı es zero and the equation

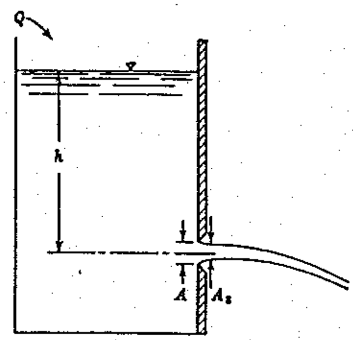
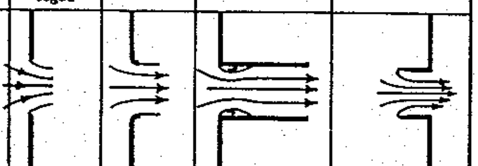


Fig. **11.28** Orifice discharging freely.

$$Q = C_c C_v A \sqrt{2g_n h} = CA \sqrt{2g_n h}$$

The dependence of the various orifice coefficients on shape of orifice is illustrated by Fig. 11.29. The coefficients given are nominal values for large orifices ($d > 1$ in. or 25 mm) operating under comparatively large heads of water ($h > 4$ ft or 1.2 m). Above these limits of head and size, various experiments have shown that the coefficients are practically constant. Coefficients for sharp-edged orifices over a wide range of Reynolds numbers are given in Fig. 11.30, which shows the same trend of values (for the same reasons) as that of Fig. 11.26. The plot of Fig. 11.30, although convenient and applicable to the flow of all fluids, has a certain limitation in orifice size caused by the action of surface tension. Surface-tension effects (although impossible to predict except in idealized situations) will increase with decreasing orifice size; the plotted values are valid only where such effects are negligible and, thus, cannot be applied to very small orifices.

Orifices and their Nominal Coefficients

	Sharp edged	Rounded	Short tube	Borda
				
C	0.61	0.98	0.80	0.51
C_c	0.62	1.00	1.00	0.52
C_v	0.98	0.98	0.80	0.98

$C = C_c * C_v$

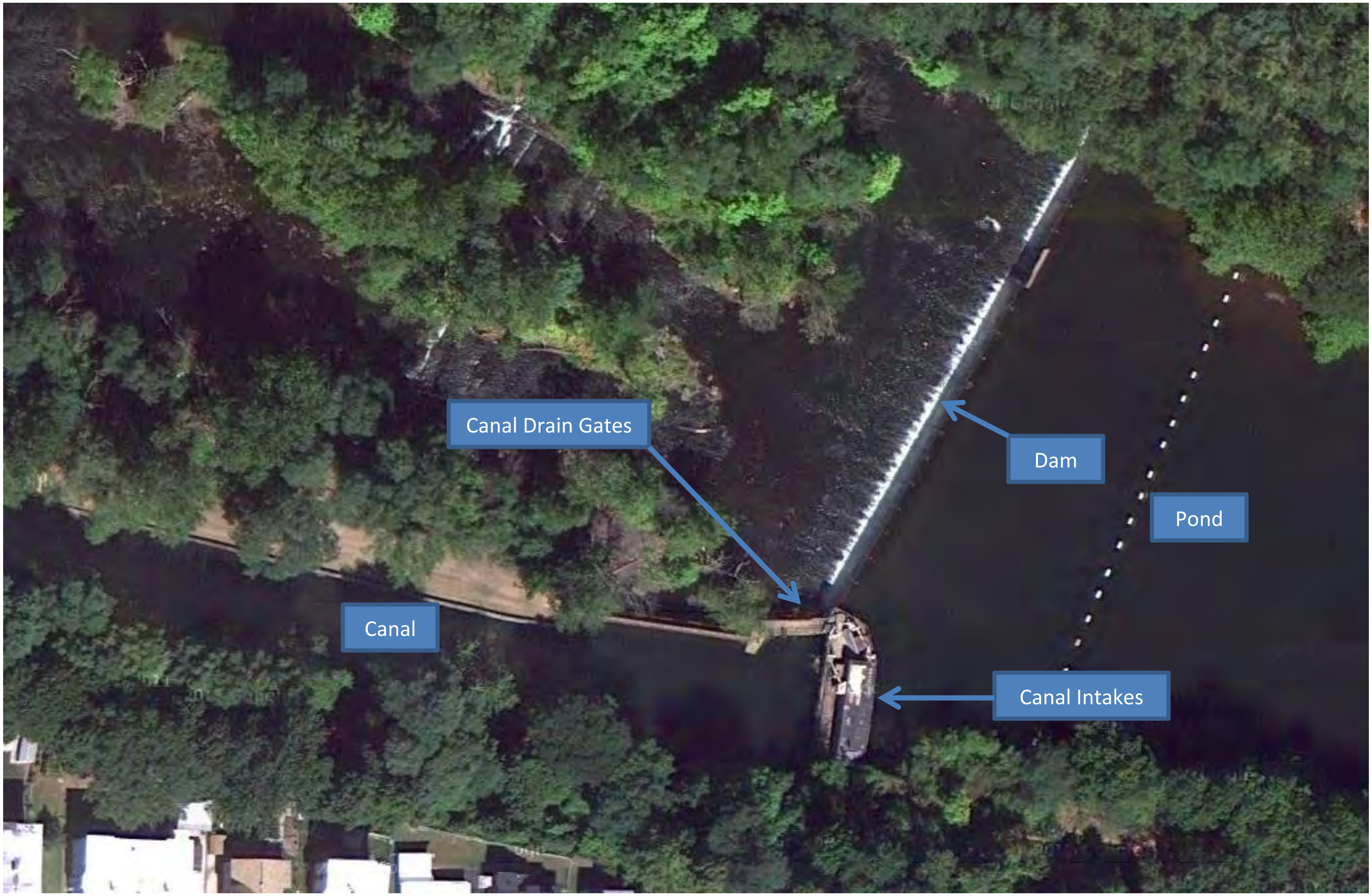
Fig. **11.29**

APPENDIX D

SATELITE PHOTOS

(PHOTOS CURTISEY OF GOOGLE MAPS)

Dwight Dam



Indian Orchard Dam

Putts Bridge

Red Bridge


Dam
Pond
Min Flow Gate
Canal Intakes
Canal Drain Gates
Canal
Red Bridge Rd
Red Bridge Rd
Red Bridge Rd

Document Content(s)

CHICOPEE RIVER WATERSHED
2003 WATER QUALITY ASSESSMENT REPORT

Ware River, Ware, Massachusetts

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
IAN BOWLES, SECRETARY
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
LAURIE BURT, COMMISSIONER
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GLENN HAAS, ACTING ASSISTANT COMMISIONER
DIVISION OF WATERSHED MANAGEMENT
GLENN HAAS, DIRECTOR

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DIVISION OF WATERSHED MANAGEMENT
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http://www.mass.gov/dep/water/resources/wqassess.htm#wqar

Furthermore, at the time of first printing, eight copies of each report published by this office are submitted to the State Library at the State House in Boston; these copies are subsequently distributed as follows:

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- Microfilmed retained at the State Library;
- Delivered to the Boston Public Library at Copley Square;
- Delivered to the Worcester Public Library;
- Delivered to the Springfield Public Library;
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- Delivered to the Library of Congress in Washington, D.C.

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A complete list of reports published since 1963 is updated annually and printed in July. This report, entitled, "Publications of the Massachusetts Division of Watershed Management – Watershed Planning Program, 1963-(current year)", is also available by writing to the DWM in Worcester.

CHICOPEE RIVER WATERSHED

2003 WATER QUALITY ASSESSMENT REPORT

Prepared by
Matthew Reardon

Massachusetts Department of Environmental Protection
Division of Watershed Management

Report Number:

36-AC-3

DWM Control Number:

CN 106.5

Massachusetts Department of Environmental Protection
Division of Watershed Management
Worcester, Massachusetts

OCTOBER 2008

ACKNOWLEDGEMENTS

Coordination of local, state and federal agencies and private organizations is fundamental to the success of the Massachusetts watershed management approach.

Data and information used in this report was provided in part by the following agencies and organizations.

State
- Massachusetts Department of Environmental Protection (MassDEP)
  - Bureau of Strategic Policy and Technology, Wall Experiment Station (WES)
  - Bureau of Resource Protection (BRP)
  - Bureau of Waste Prevention (BWP)
  - Bureau of Waste Site Cleanup (BWSC)
- Massachusetts Department of Public Health (MDPH)
- Massachusetts Department of Fish and Game (MassWildlife)
  Division of Fisheries and Wildlife (MDFW)
- Massachusetts Department of Conservation and Recreation (MA DCR)

Federal
- United States Environmental Protection Agency (EPA)
- United States Geological Survey (USGS)
  - Water Resources Division

Much appreciation is extended to the many MassDEP employees for their contributions: Therese Beaudoin, Warren Kimball, Alice Rojko, Kenneth Dominick, Jane Ryder, Laurie Kennedy, Susan Connors and Rick McVoy and Arthur Screpetis.

It is impossible to thanks all those who helped in the assessment process and all their contributions are appreciated.

Cover Photo Credit: Ware River – Therese Beaudoin, MassDEP

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List of Acronyms and Abbreviations

7Q10'..........Lowest mean flow for seven consecutive days to be expected once in ten years
ACOE Army Corps of Engineers
ADB ....Assessment Database
BRP..............Bureau of Resource Protection
BMP..............Best Management Practices
BOD..............Biological Oxygen DemandF
BWSC..........Bureau of Waste Site Cleanup
CERO........... Central Environmental Regional Office
C-NOEC ....Chronic No Observe Effect Concentration
CSO .... Combined Sewer Overflow
DO ....Dissolved Oxygen
EOEA ....Executive Office of Environmental Affairs
EPA................United States Environmental Protection Agency
FERC.............Federal Energy Regulatory Commission
LC_{50}................Lethal concentration to 50% of the test organisms
MA DCR Massachusetts Department of Conservation and Recreation.
MassDEP.......Massachusetts Department of Environmental Protection
MA DFG.........Department of Fish and Game (formerly the Department of Fisheries, Wildlife and Environmental Law Enforcement)
MA DPH.........Massachusetts Department of Public Health
MDC Metropolitan District Commission
MDL.............. Method Detection Limit
MWRA........... Massachusetts Water Resources Authority
NOAA..........National Oceanic and Atmospheric Adminsitration
NPDES.......... National Pollutant Discharge Elimination System
PALIS............ Pond and Lake Information System
PCB.............. Polychlorinated Biphenyl
QAPP .... Quality Assurance Project Plan
RBP.............. Rapid Bioassessment Protocol
SARIS .... Stream and River Inventory System
SMART .... Strategic Monitoring and Assessment for River Basin ....Teams
SRF............... State Revolving Fund
SWQS........... Surface Water Quality Standards
TMDL .... Total Maximum Daily Load
TOXTD.......... MassDEP DWM Toxicity Testing Database
TRC ....Total Residual Chlorine
TSS .... Total Suspended Solids
USFWS.........United States Fish and Wildlife Service
USGS............ United States Geological Survey
WBID............. Waterbody Identification Code
WBS.............. Waterbody System Database
WMA .... Water Management Act
WWTP........... Wastewater treatment plant

List of Units

cfs .... cubic feet per second
cfu.................... colony forming unit
MGD................ million gallons per day
mg/L .... milligram per liter
NTU................. nephelometric turbidity units
ppm .... parts per million
SU .... standard units
µS/cm.............. microsiemens per centimeter
µg/g .... microgram per gram
kg/ha/year........ kilogram per hectacre per year

Table of Fish Scientific Names

Common name	*Scientific name*	Common name	*Scientific name*
Alewife	*Alosa pseudoharengus*	Largemouth bass	*Micropterus salmoides*
American Eel	*Anguilla rostrata*	Longnose dace	*Rhinichthys cataractae*
Black crappie	*Pomoxis nigromaculatus*	Northern pike	*Esox lucius*
Eastern blacknose dace	*Rhinichthys atratulus*	Pumpkinseed	*Lepomis gibbosus*
Banded Sunfish	*Enneacanthus obesus*	Rainbow trout	*Oncorhynchus mykiss*
Bluegill	*Lepomis macrochirus*	Redbreasted Sunfish	*Lepomis auritus*
Brook trout	*Salvelinus fontinalis*	Redfin x Chain Pickerel	*Esox americanus x niger*
Brown bullhead	*Ameiurus nebulosus*	Rock bass	*Ambloplites rupestris*
Brown trout	*Salmo trutta*	Smallmouth Bass	*Micropterus dolomieu*
Chain pickerel	*Esox niger*	Tesselated Darter	*Etheostoma olmstedi*
Common Shiner	*Luxilus cornutus*	Tadtpole Madtom	*Noturus gyrinus*
Creek Chubsucker	*Erimyzon oblongus*	Yellow Bullhead	*Ameiurus natalis*
Fallfish	*Semotilus corporalis*	Yellow Perch	*Perca flavens*
Golden shiner	*Notemigonus crysoleucas*	White sucker	*Catostomus commersonii*

Executive Summary

This assessment report presents a summary of current water quality data and information used to assess the status of the designated uses as defined in the Massachusetts Surface Water Quality Standards (SWQS) for the Chicopee River Watershed for reporting to EPA in the Integrated List of Waters, updates the assessments from the 1998 Water Quality Assessment Report (Mass DEP 2001), and provides basic information that can be used to focus resource protection and remediation activities later in the watershed management planning process.

The SWQS designate the most sensitive uses for which surface waters in the Commonwealth shall be protected. The designated uses, where applicable, include: *Aquatic Life, Fish Consumption, Drinking Water, Shellfish Harvesting, Primary* and *Secondary Contact Recreation* and *Aesthetics*. The assessment of current water quality conditions provides a determination of whether or not each designated use of a particular water body is ***supported*** or ***impaired***. When too little current data/information exist or quality-assured data are unavailable, the use is ***not assessed***. However, if there is some indication of water quality impairment, which is not considered to be naturally occurring, the use is identified with an "Alert Status". It is important to note that many lakes and river miles do not have an assigned assessment segment and the status of the designated uses of these unassessed waters has never been reported to the EPA in the Commonwealth's Summary of Water Quality Report (305(b) Report) nor is information on these waters maintained by the Massachusetts Department of Environmental Protection in the Water Body System (WBS) or Assessment Database (ADB).

In 2003 the Massachusetts Department of Environmental Protection (MassDEP), Division of Watershed Management (DWM), conducted water quality sampling and baseline lakes sampling, in the Chicopee River Watershed under Environmental Protection Agency (EPA) approved Quality Assurance Project Plans (QAPPs). The water quality monitoring data are available in a technical memorandum (DeCesare 2006, Appendix B). The lakes data are available in the technical memorandum entitled *Baseline Lakes 2003 Technical Memo* (MassDEP 2007a, Appendix C).

The data generated by DWM, together with other sources of information, were utilized to assess the status of water quality conditions of rivers and lakes in the Chicopee River Watershed in accordance with EPA's and MassDEP's use assessment methods. It is important to note that assessment methodologies have changed over time and a direct comparison between current and previous assessments of this watershed is not possible.

This report includes information on 29 freshwater rivers, stream or brooks (the term "rivers will hereafter be used to include all). The assessed rivers represent approximately 46% of the named rivers in the Chicopee River Basin that have been assigned SARIS (Stream and River Information System) code numbers (Halliwell *et al*. 1982). Numerous rivers have never been assessed, and are not included in this report. This report also includes information on seventy-four lakes, ponds, or impoundments that have been assigned a Pond and Lake Identification System (PALIS) number in the Chicopee River Watershed, representing 93% of the total lake acreage

A summary of the use assessments for the rivers and lakes in the Chicopee River Watershed is provided in Table 1. See also Figures 1-5 for a summary of the designated use assessments detailed in this report.

Table 1. River miles and lake acreage in the ChicopeeRiver Basin assessed as support, impaired, or not assessed for each use (with percentage of total river miles or acreage in report).

	River (Total Length included in report - 212.6 miles		
Use	**Support**	**Impaired**	**Not Assessed**
Aquatic Life	116.1 (55%)	2.4 (1%)	94.1 (44%)
Fish Consumption	0 (0%)	0.3 (0. 1%)	212.3 (99.9%)
Drinking Water	Not Assessed in this Report[1]		
Primary Contact	77.0 (36%)	24.2 (11%)	111.4 (52%)
Secondary Contact	98.2 (46%)	3.0 (1%)	111.4 (52%)
Aesthetics	192.9 (91%)	0 (0%)	19.7 (9%)
	Lakes (Total Acreage included in report--29798[2]		
Use	**Support**	**Impaired**	**Not Assessed**
Aquatic Life	0 (0%)	25630 (89%)	3268 (11%)
Fish Consumption	0 (0%)	25936 (87%)	3862 (13%)
Drinking Water	Not Assessed in this Report[1]		
Primary Contact	24012 (80.6%)	544 (1.8%)	5242 (17.6%)
Secondary Contact	24012 (80.6%)	544 (1.8%)	5242 (17.6%)
Aesthetics	24239 (81%)	544 (2%)	5015 (17%)

1- While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at http://www.mass.gov/dep/water/drinking.htm and from local public water suppliers
2 – Quabbin Reservoir (20412 acres) constitutes 81 percent of the lake acreage in the Chicopee River basin.
.

Fish Consumption Use

The following waterbodies in the Chicopee River Basin are impaired for the *Fish Consumption Use*: Ware River (MA36-03), Pottapaug Pond Basin (MA36125), Quabbin Reservoir (MA36129), Lake Lashaway (MA36079), Quaboag Pond (MA36130), Quacumquasit Pond (MA36131), Wickaboag Pond (MA36166). There is also currently a statewide fish consumption advisory (see Figure 2, MA DPH 2001). A TMDL, a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for certain regional waterbodies to meet and maintain compliance with state and federal water quality standards, was recently approved for mercury by the U.S. EPA.

The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). All of the waterbodies impaired for *Fish Consumption Use* and listed above with the exception of Ware River (MA36-03) and Quaboag Pond (MA361630) are covered by this TMDL. The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new on-going monitoring and air deposition data. Final targets will be determined at that time. It should be noted that not all river segments or lakes will have specific recommendations. Numerous general recommendations detailed below apply to these river segments or lakes.

GENERAL RECOMMENDATIONS
Bacteria source tracking studies should be conducted as appropriate in the seven river segments that are impaired for *Primary Contact Recreation Use*.

Continue to conduct biological and water quality monitoring to evaluate the effect(s), if any of National Pollution Discharge Elimination (NPDES) discharges, water withdrawals, and non-point sources of pollution and to document any changes in water quality as a result of infrastructure improvements/pollution abatement controls. Specific attention should be given towards gauging *Primary* and *Secondary Contact Recreation Uses* in segments impaired for these uses and those segments affected by CSO discharges.

Baseline sampling and aquatic macrophyte mapping should be conducted to evaluate the status of designated uses of lakes in the basin with special attention to sampling lakes with suspected infestations of non-native aquatic macrophytes.

Fish passage should be encouraged at both hydropower plants and other dams in the watershed. In addition, dam removal should be encouraged to promote ecological continuity as feasible.

The Northeast Regional Mercury Total Maximum Daily Load (TMDL) should be successfully implemented, with a minimum of a 90 percent control on out-of region coal-fired power plants emissions and successful control of in-state/regional reductions in mercury sources (NEIWPCC 2007). Fish toxics monitoring should be conducted in waterbodies impaired for the *Fish Consumption Use*

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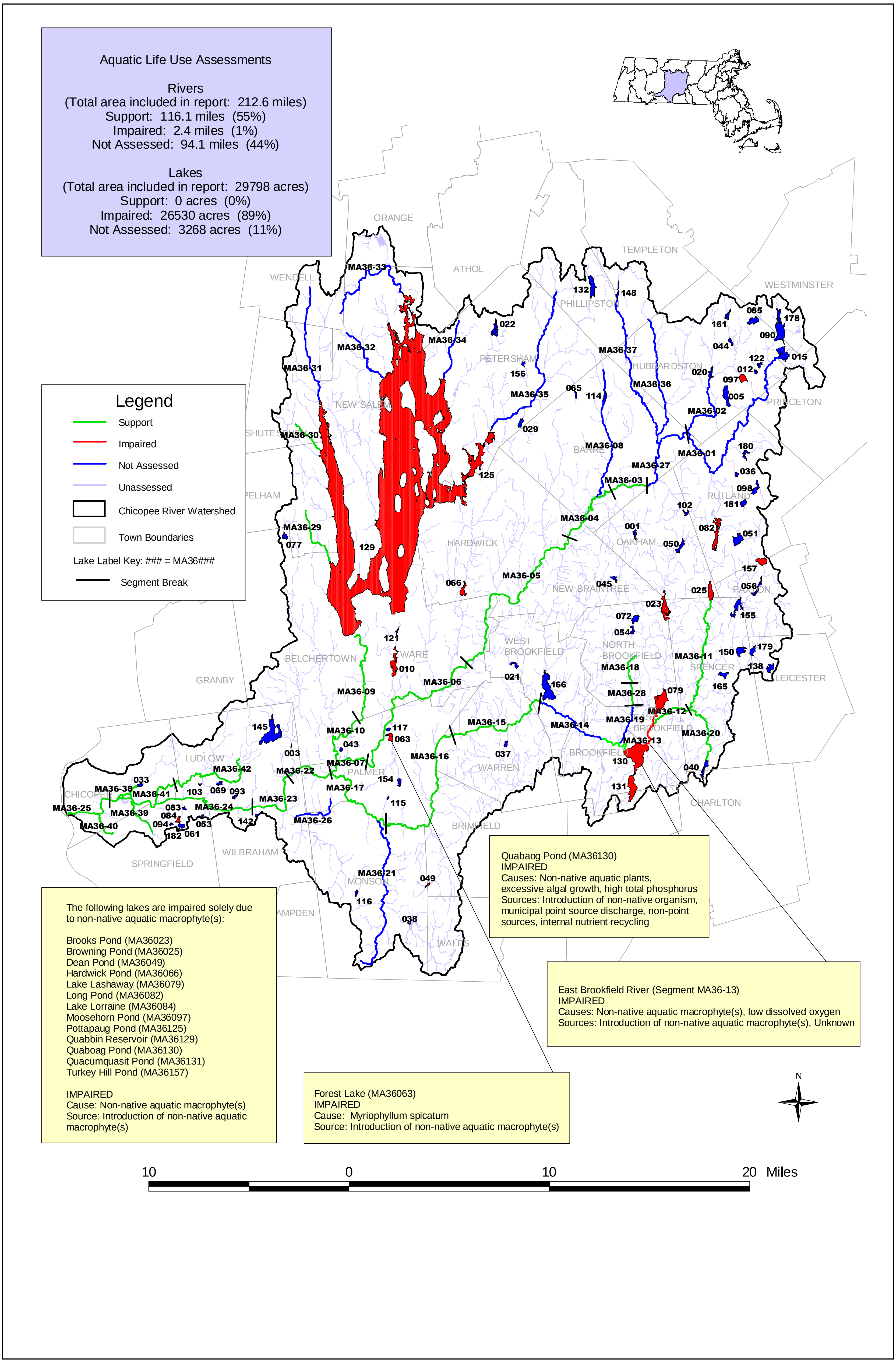

Figure 1: Chicopee River Basin *Aquatic Life Use* Summary

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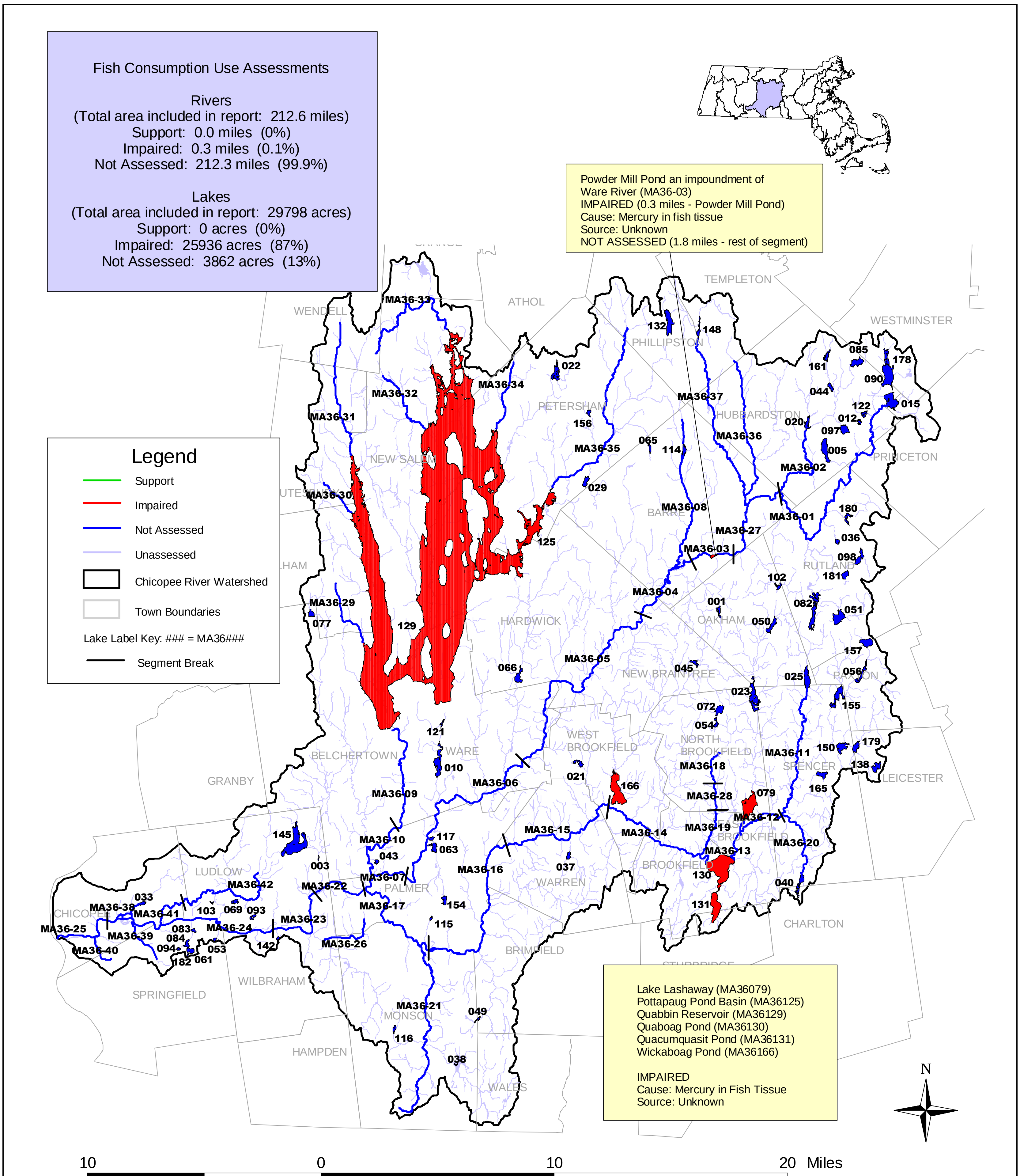

The current MA DPH statewide advisory (MA DPH 2001):

In July 2001 MA DPH issued new consumer advisories on fish consumption and mercury contamination. The MA DPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers, and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MA DPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age. Finally, MA DPH is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers, and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to two (2) cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury."

MA DPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

Since the statewide advisory encompasses all freshwaters in Massachusetts, the Fish Consumption Use for waterbodies cannot be assessed as support.

Northeast Regional Mercury TMDL: On 20 December 2007 the U.S. EPA approved the Northeast Regional Mercury Total Maximum Daily Load (TMDL). This TMDL is a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards. It was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers inland waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new on-going monitoring and air deposition data. Final targets will be determined at that time.

Figure 2: Chicopee River Basin *Fish Consumption Use* Assessment Summary

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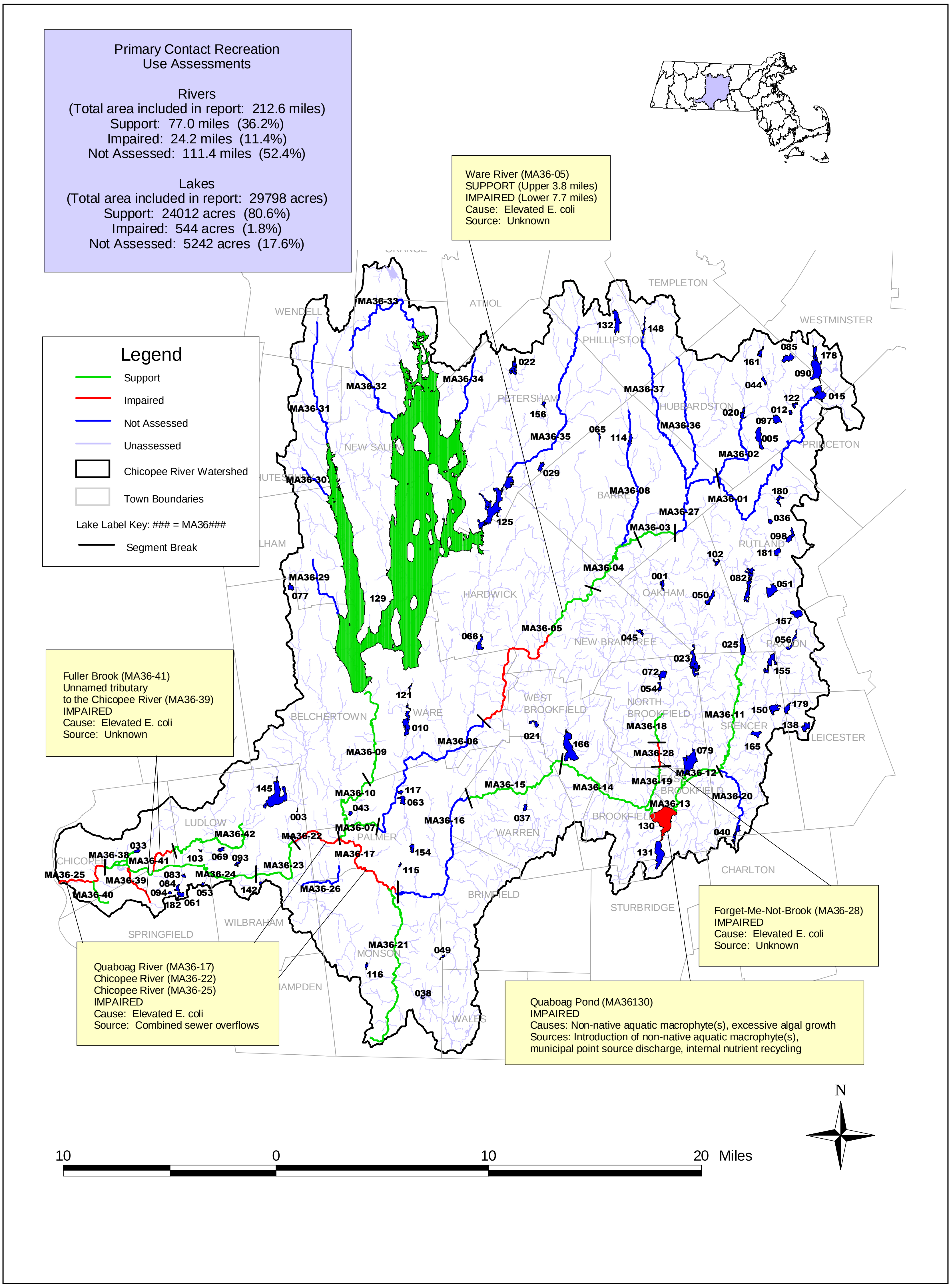

Figure 3: Chicopee River Basin *Primary Contact Recreational Use* Assessment Summary

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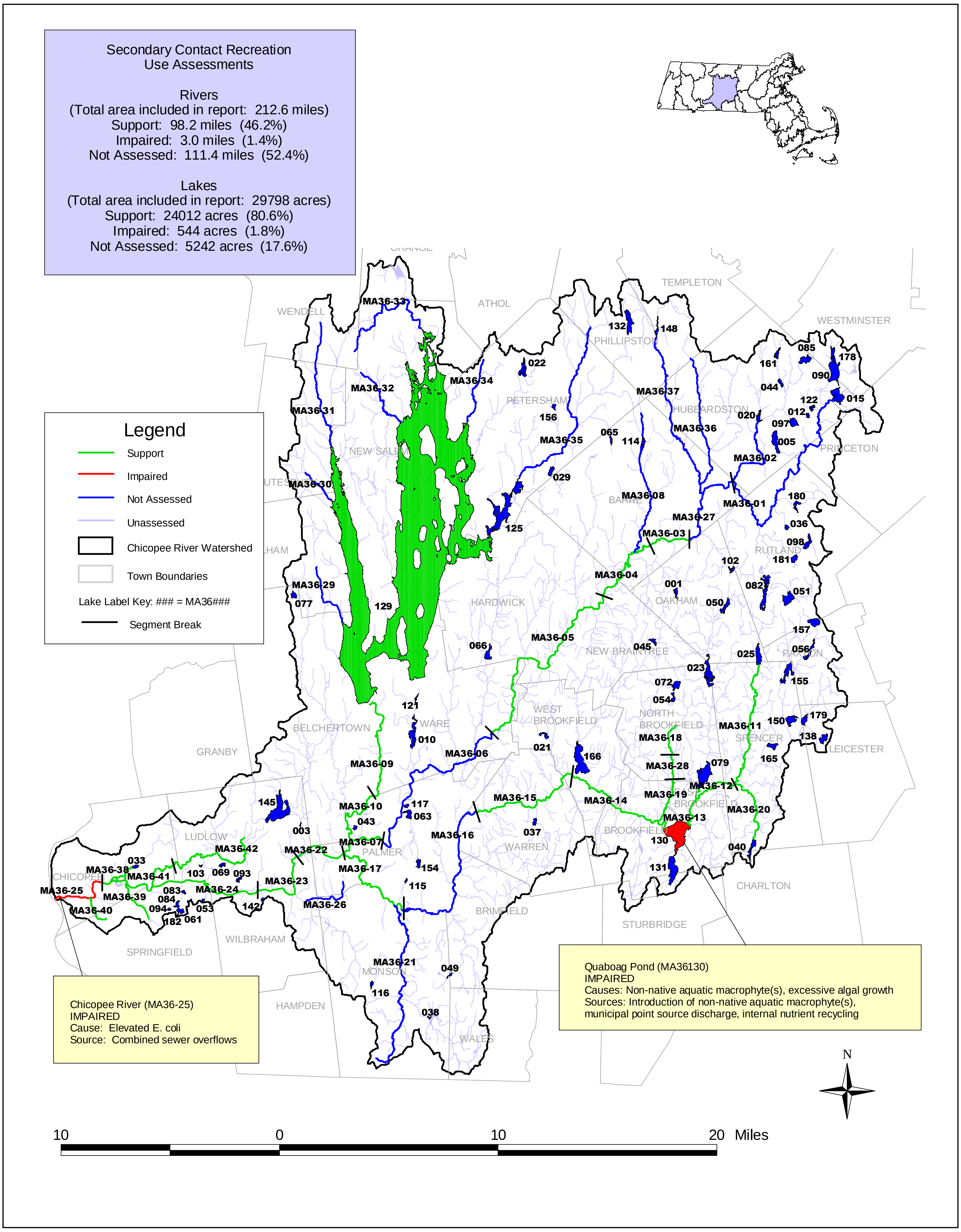

Figure 4: Chicopee River Basin *Secondary Contact Recreation Use* Assessment Summary

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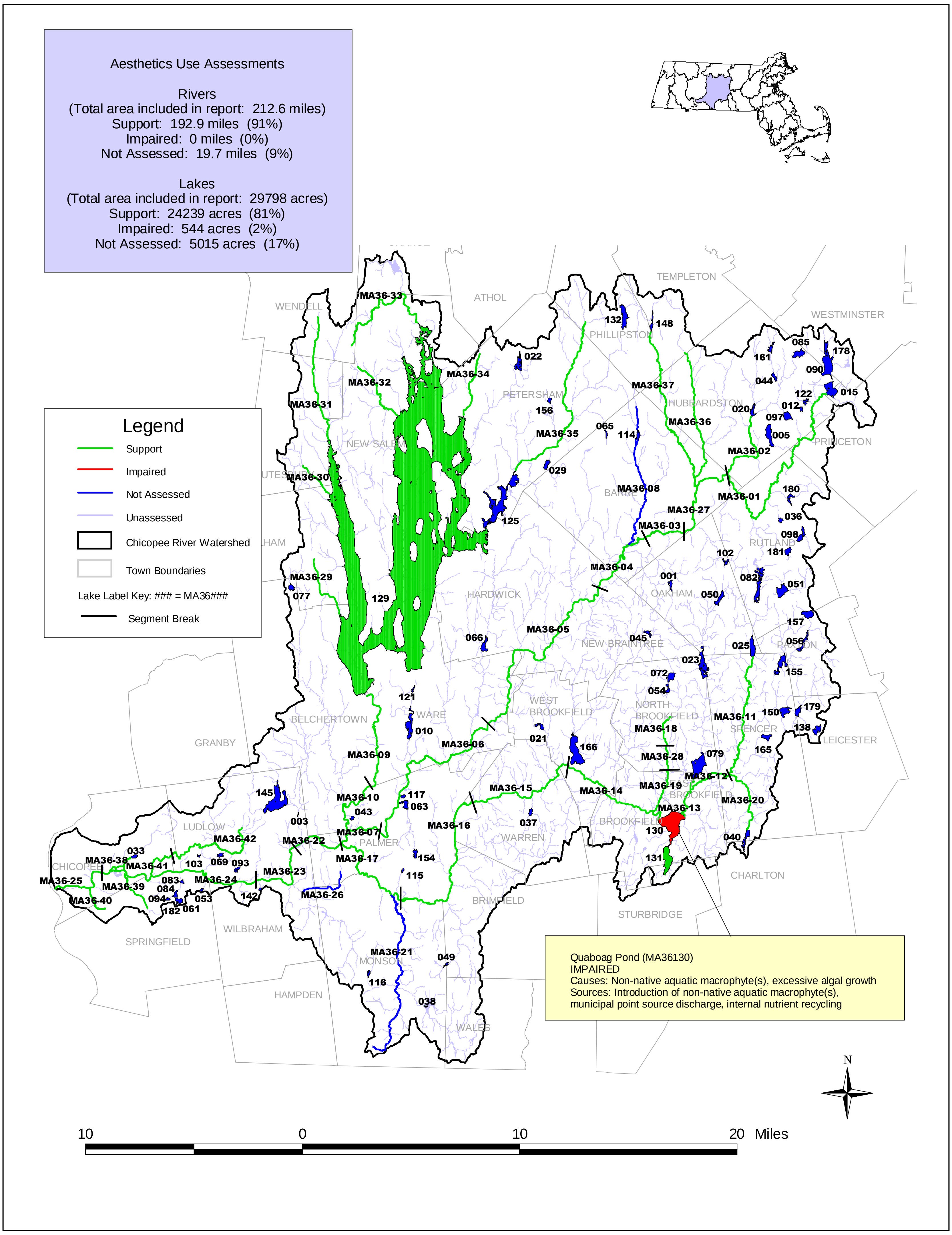

Figure 5: Chicopee River Basin *Aesthetics Use* Assessment Summary

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Chicopee River Basin Description

The Chicopee River Basin covers an area of 723 square miles in Franklin, Hampshire, Hampden, and Worcester counties in central Massachusetts (Wandle 1984). It encompasses all or parts of 39 communities: Athol, Barre, Belchertown, Brimfield, Brookfield, Charlton, Chicopee, East Brookfield, Granby, Hampden, Hardwick, Hubbardston, Leicester, Ludlow, Monson, New Braintree, New Salem, North Brookfield, Oakham, Orange, Palmer, Paxton, Pelham, Petersham, Phillipston, Princeton, Rutland, Shutesbury, Spencer, Springfield, Sturbridge, Templeton, Wales, Ware, Warren, Wendell, West Brookfield, Westminster, and Wilbraham. It is bordered by the Connecticut River Basin on the west and the Millers River Basin on the north, the Nashua River Basin on the northeast, a small portion of the Blackstone River Basin on the east, and the French and Quinebaug river basins to the southeast.

The Chicopee River Basin includes three major subbasins (the Swift, Ware, and Quaboag river systems) that merge to form the mainstem Chicopee River. The Swift River has three upper branches that flow into the Quabbin Reservoir, a manmade reservoir that serves as one of the major water supplies for metropolitan Boston. From the outlet of Quabbin Reservoir, the Swift River flows in a southerly direction to its confluence with the Ware River. The Ware River is formed by the confluence of east and west branches in Barre, and it flows in a generally southwest direction until joining the Quaboag River. The Quaboag River originates at the outlet of Quaboag Pond in Brookfield and flows southwest until it joins the Ware River. The Chicopee River is formed at the confluence of the Ware and Quaboag rivers in the village of Three Rivers in Palmer. It flows generally west to its confluence with the Connecticut River in Chicopee, MA. The Chicopee River contributes an average annual flow of 909 cubic feet per sec (cfs) to the Connecticut River (USGS 2007).

The topography of the Chicopee River Basin is characterized by rolling hills and alluvial plains with numerous natural and artificial lakes. The topography rises to heights of over 1,500 feet above mean sea level in the northern portion of the basin and drops to only 40 feet in the Connecticut Valley lowlands in the southwest. Granite and metamorphic rocks underlie most of the basin, while red sandstones, dark shales, and other sedimentary rocks are found near the Connecticut River (Kimball 1975).

There are 136 named rivers in the Chicopee River Basin that have been assigned SARIS (Stream and River Information System) code numbers (Halliwell *et al*. 1982). These streams and rivers flow an estimated 464.2 miles. There are approximately 1,200 river miles in the Chicopee River Basin according to the 1:24,000 National Hydrography Data coverage (Meek 2007). A total of 174 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned Pond and Lake Information System (PALIS) code numbers in the Chicopee River Basin (Ackerman 1989 and MassDEP 2000). The total surface area of the catalogued Chicopee River Basin lakes is 32,099 acres. For a map of river segments and lakes detailed in this report see Figure 6.

In the Swift River Subbasin the Swift River and Old Beaver Brook were impounded by Windsor Dam and Goodnough Dike in 1946 to form the Quabbin Reservoir. The Quabbin Reservoir's watershed area is 187 square miles, more than a quarter of the entire Chicopee River Basin. The Massachusetts Department of Conservation and Recreation manages this public water supply reservoir, which has a capacity of 412 billion gallons, and a surface area of 39.4 square miles. The mean and maximum depth in the reservoir is 45 and 151 feet, respectively. Due in part to Quabbin Reservoir's elongated shape and large size that results in long detention times, significant dilution and settling of tributary inflows, water quality in the reservoir is excellent. The reservoir has very crystalline water with low turbidity, bacterial counts, algal densities, and nutrients (MA DCR 2004, 2005, 2006b, 2007). The Massachusetts Water Resources Authority (MRWA) is allowed to withdraw (WMA Registration Number 10830901) 186.7 MGD from the reservoir. The majority of this water is transferred out of the Chicopee River Basin to supply potable water to 44 communities in the Metropolitan Boston area and three western Massachusetts communities. Water is delivered from Quabbin Reservoir via two tunnel systems.

The Quabbin Aqueduct is a 24.6-mile tunnel that travels from midway up the eastern arm of the reservoir in Hardwick to the Oakdale Power Station on the upper end of Wachusett Reservoir in West Boylston (Nashua River Basin). The Chicopee Valley Aqueduct (CVA) is a 14.77-mile tunnel that runs from the southern end of Quabbin Reservoir at Windsor Dam in Belchertown to the Nash Hill Reservoir in Chicopee. The Ware River may also be diverted via Shaft 8 in Barre into either the Quabbin or Wachusett Reservoirs. The diversions are allowed between 15 October and 15 June when flow in the Ware River exceeds 85 MGD. All other diversions require MassDEP approval (MDC 1997).

Manufacturing, wholesale and retail trades are the key industries of the region. Combined sewer overflow locations are present in the lower Chicopee River Basin, particularly in the Chicopee River, lower Ware River and the lower Quaboag River. There are a number of municipal and industrial National Pollution Discharge Elimination System (NPDES) permits as well as communities permitted for stormwater runoff (Appendix D). These permitted sources of pollution are also important determinants of water quality. Nonpoint source pollution that is associated with storm runoff, septic systems, landfills, and agriculture is also known to contribute to the watershed's water quality problems. In addition to providing drinking water, water in the Chicopee River Basin is managed by a number of dams in the Chicopee River Basin that are used for hydropower (listed below:)

Hydroelectric power plants:

- The Consolidated Edison Energy Massachusetts, Inc. plants on the Chicopee River (MA0035777 Dwight Station, MA0035815 Indian Orchard Station, MA0035823 Red Bridge Station and MA0035831 Putts Bridge Station in Chicopee and Ludlow) are all exempt from FERC licensing requirements.

Other hydroelectric projects exempt from FERC licensing requirements that do not have NPDES permits:

- Chicopee Municipal Light Plant (on Chicopee River), Chicopee
- Ware River Power (Ware Lower Project on Ware River)
- South Barre Hydroelectric Company (South Barre Mill Pond Dam Project and Powdermill Pond Project both on the Ware River)
- I Maxmat Corp. (Collins Project on Chicopee River)

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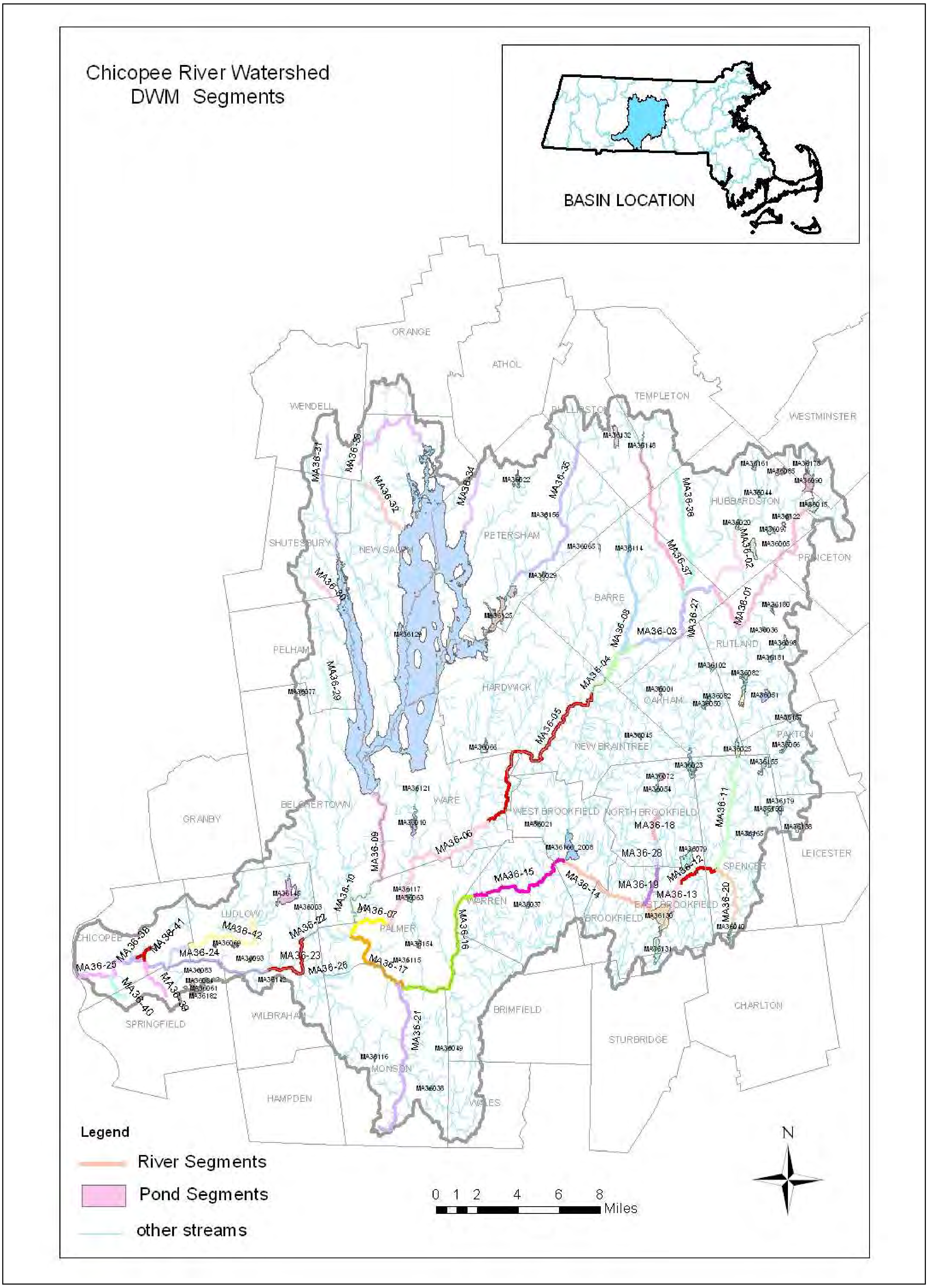

Figure 6: Chicopee River Basin - River Segments and Lake Segments

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The Swift River Subbasin

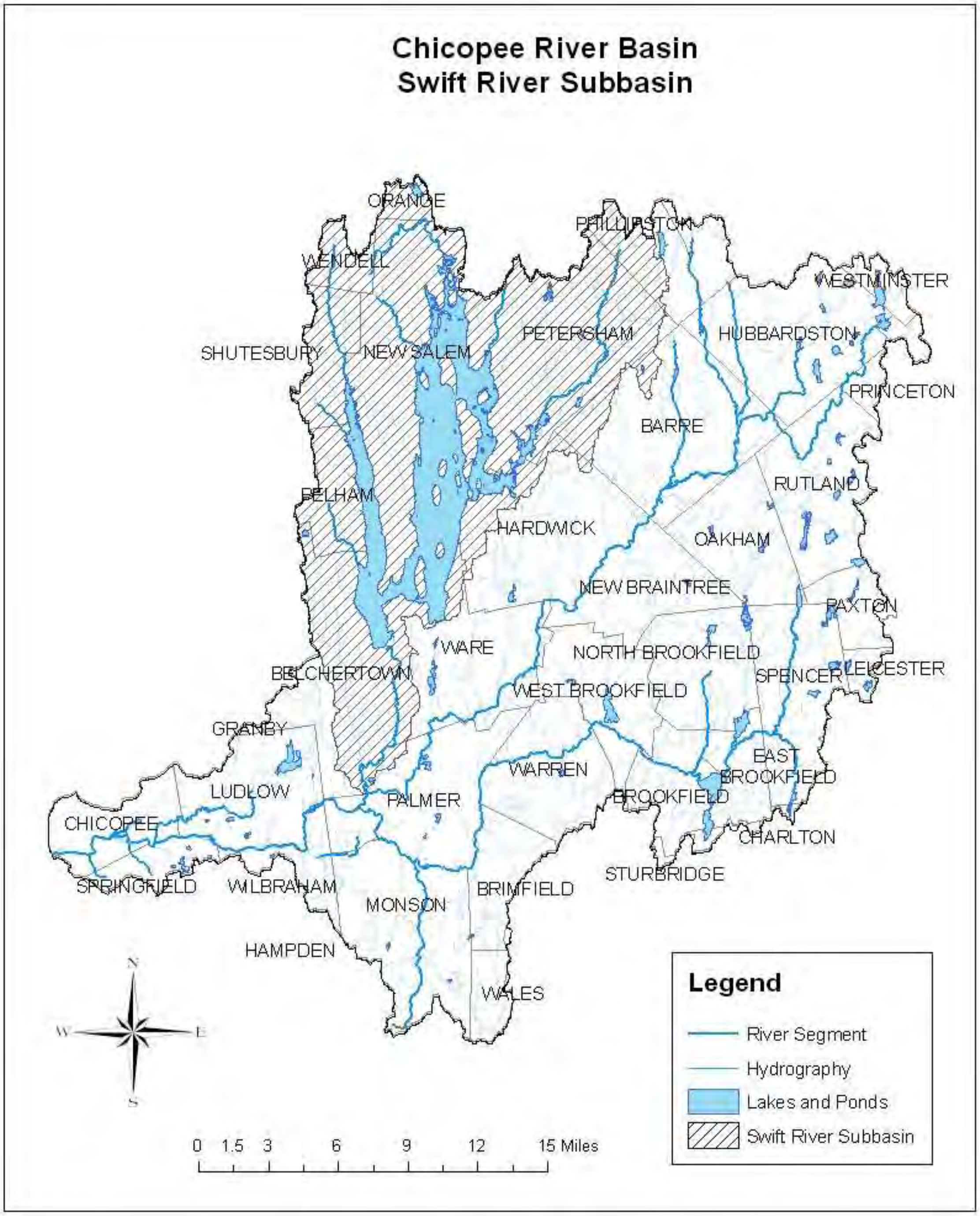


Figure 7: Swift River Subbasin

CADWELL CREEK (SEGMENT MA36-29)
Location: Headwaters east of Route 202 and northwest of Dodge Hill, Pelham, to mouth at Quabbin Reservoir, Belchertown
Segment Length: 3.2 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG conducted fish population sampling in Cadwell Creek at Gate 8, Quabbin Road crossing (Site 1211) in Pelham using a backpack electro-shocker (Richards 2006). Sixty-one brook trout were collected (61 fish total). This stream is considered a Coldwater Fishery Resource by MA DFG (Richards 2006).

The presence of multiple age classes of wild brook trout is indicative of excellent water and habitat quality as well as a stable flow regime. It is quite common to find only brook trout in small first order tributary streams (Maietta 2007).

Water Chemistry
Cadwell Creek has been identified as critically sensitive to acid rain deposition given the creek's limited acid neutralizing capacity and low pH (MA DCR 2004).

Given the presence of multiple age classes of brook trout *the Aquatic Life Use* is assessed as support. Due to its acid sensitivity Cadwell Creek is given "Alert Status".

Primary and Secondary Contact Recreation and Aesthetics Uses
No objectionable conditions have been reported in Cadwell Creek, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent quality-assured data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Cadwell Creek (Segment MA36-29) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT**
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.
** Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment.

Given the presence of brook trout, collect sufficient water temperature data to evaluate this waterbody for designation as a Cold Water Fishery in future Surface Water Quality Standards.

ATHERTON BROOK (SEGMENT MA36-30)

Location: Headwaters at confluence of Town Farm and Osgood Brooks, Shutesbury, to mouth at Quabbin Reservoir, Pelham
Segment Length: 1.9 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

<u>Biology</u>

MA DFG conducted fish population sampling in Atherton Brook at Route 202 – Gate 15, Quabbin Reservoir Road crossing (Site 1210) in Shutesbury on 12 September 2005 using a backpack electro-shocker (Richards 2006). Forty-eight brook trout were collected (48 fish total). This stream is considered a Coldwater Fishery Resource by MA DFG (Richards 2006).

The presence of multiple age classes of wild brook trout is indicative of excellent water and habitat quality as well as a stable flow regime. It is quite common to find only brook trout in small first order tributary streams (Maietta 2007).

<u>Water Chemistry</u>

No quality-assured data are available for Atherton Brook.

Atherton Brook has been identified as critically sensitive to acid rain deposition given the creek's limited acid neutralizing capacity and low pH (MA DCR 2004).

Given the presence of multiple age classes of brook trout the *Aquatic Life Use* is assessed as support. Due to its acid sensitivity Atherton Creek is given "Alert Status".

Primary and Secondary Contact Recreation and Aesthetics Uses

No objectionable conditions have been reported in Atherton Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent quality-assured data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Atherton Brook (Segment MA36-30) Use Summary Table

Designated Uses	Status
Aquatic Life	SUPPORT**
Fish Consumption	NOT ASSESSED
Drinking Water*	NOT ASSESSED
Primary Contact	NOT ASSESSED
Secondary Contact	NOT ASSESSED
Aesthetics	SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.
** Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment.

Given the presence of brook trout, collect sufficient water temperature data to evaluate this waterbody for designation as a Cold Water Fishery in future Surface Water Quality Standards.

WEST BRANCH SWIFT RIVER (SEGMENT MA36-31)

Location: Headwaters - Outlet of small unnamed impoundment east of Cooleyville Road in Wendell State Forest, Wendell, to mouth at Quabbin Reservoir, Shutesbury/New Salem.
Segment Length: 6.3 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

USGS maintains a gage near Shutesbury, MA, on the west branch of the Swift River (Gage 01174565) 800 feet downstream from State Highway 202. The average annual discharge at the gage is 22.0 cfs (period of record 2000 to 2005).

The drainage area to this gage is 12.6 mi^2. The period of record is Nov. 1983-Sept. 1985 and April 1995 to present. The average discharge for ten water years (1985, 1996-2004) is 22.1 cfs. The maximum discharge occurred on 17 September 1999 (1,490 cfs) and the minimum discharge occurred in mid-September of 1995 (about 0.35 cfs) (Socolow *et. al* 2005). Records are considered fair by USGS except estimated daily discharges and discharges greater than 100 cfs, which are considered poor (Socolow *et. al* 2005).

Biology

MA DFG stocks the West Branch Swift River with trout (MA DFG 2007).

Due to a lack of recent quality-assured data the *Aquatic Life Use* is not assessed.

Primary and Secondary Contact Recreation and Aesthetics Uses

No recent quality-assured data are available for the West Branch Swift River. No objectionable conditions have been reported in the West Branch Swift River, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

West Branch Swift River (Segment MA36-31) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring to assess *Aquatic Life Use*.

Given the presence of brook trout, collect sufficient water temperature data to evaluate this waterbody for designation as a Cold Water Fishery in future Surface Water Quality Standards.

HOP BROOK (SEGMENT MA36-32)
Location: Headwaters upstream from West Street, New Salem, to mouth at Quabbin Reservoir, New Salem.
Segment Length: 3.7 miles
Classification: Class A, Public Water Supply

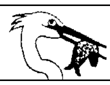
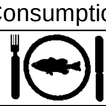
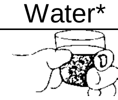
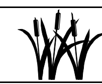
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Hop Brook. All designated uses with the exception of the *Aesthetics Use* are not assessed.

No objectionable conditions have been reported in the Hop Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Hop Brook (Segment MA36-32) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring to assess *Aquatic Life Use*.

Conduct fish population sampling to assess the *Aquatic Life Use*.

MIDDLE BRANCH SWIFT RIVER (SEGMENT MA36-33)
Location: Headwaters just north of Wendell and New Salem State Forests (South of the Swift River School), Wendell, to mouth at Quabbin Reservoir, New Salem.
Segment Length: 6.9 miles.
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

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WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
<u>Biology</u>
MA DFG stocks the Middle Branch Swift River with trout (MA DFG 2007).

No recent quality-assured data are available for Middle Branch Swift River. All designated uses with the exception of the *Aesthetics Use* are not assessed.

No objectionable conditions have been reported in the Middle Branch Swift River, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Middle Branch Swift River (Segment MA36-33) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring and conduct fish population sampling to assess *Aquatic Life Use*.

WEST BRANCH FEVER BROOK (SEGMENT MA36-34)

Location: Headwaters just north (upstream) of Route 122 in Petersham, to mouth at Quabbin Reservoir, Petersham
Segment Length: 3.4 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

MA DFG stocks West Branch Fever Brook with trout (MA DFG 2007).

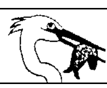
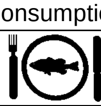
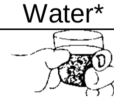
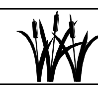
MA DFG conducted fish population sampling in West Branch Fever Brook at Route 122 – Women's Federal Forest (Site 887) in Petersham, MA, on 20 August 2003 using a backpack electro-shocker (Richards 2005). Twenty fallfish, sixteen blacknosed dace, two chain pickerel, and one channel catfish were collected (39 fish total). MA DFG fishery biologists noted that the stream was free-flowing at this location and located downstream from a large beaver pond. They also noted that few fish were collected given the area sampled.

Although total numbers of fish were low the sample was dominated by two fluvial specialists; a condition indicative of a stable flow regime. It is unclear why fish numbers were so low within this reach; but the presence of a large beaver dam just upstream may be affecting total fish numbers.

Other than the MA DFG fish population work, no other recent quality-assured data are available for West Branch Fever Brook. All designated uses with the exception of the *Aesthetics Use* are not assessed.

No objectionable conditions have been reported in the West Branch Fever Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

West Branch Fever Brook (Segment MA36-34) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring to assess *Aquatic Life Use*.

Consider fish population sampling in an area unaffected by beaver dams to determine fish population structure and numbers.

EAST BRANCH SWIFT RIVER (SEGMENT MA36-35)
Location: Headwaters at the confluence of Shattuck and Popple Camp Brooks, Phillipston, to mouth at Pottapaug Pond, Petersham.
Segment Length: 9.8 miles
Classification: Class A, Public Water Supply.

Connor Pond (MA36039) will no longer be reported on as an approximately 22-acre lake segment since the estimated retention time of this waterbody is approximately two days. It will be considered a run–of-the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01173000 and 01172500) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks the East Branch Swift River with trout (MA DFG 2007).

MA DFG conducted fish population sampling in the East Branch Swift River at East Street below Browning Pond (Site 877) in Petersham on 21 July 2003 using a backpack electro-shocker (Richards 2006). Fifteen pumpkinseed, fifteen common shiner, ten brown bullhead, seven eastern blacknose dace, four chain pickerel, three white sucker, three longnose dace, two brown trout and one tessellated darter were collected (67 fish total). MA DFG biologists noted the water level was low during sampling and that the two brown trout collected were stocked fish.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although the presence of six fluvial specialist/dependent species is generally indicative of a stable flow regime the low numbers of fish and low water levels noted by MA DFG suggests otherwise. All fish species present (with exception of stocked brown trout) are classified as being tolerant or moderately tolerant to pollution. The presence of macrohabitat generalists is most likely a result of this reach's proximity to Browning Pond. It should be noted that although native trout were not collected or observed, this stream is considered a Coldwater Fishery Resource by MA DFG (Richards 2006)

MA DFG also conducted fish population sampling in the East Branch Swift River at Quaker Road crossing (Site 874) in Petersham on 21 July 2003 using a backpack electro-shocker (Richards 2006). Seventy-three eastern blacknose dace, fifteen longnose dace, fourteen fallfish, five yellow bullhead, four common shiner, three white sucker and one tessellated darter were collected (115 fish total). MA DFG fishery biologists noted that the water level was low at this sampling site.

Despite low water levels noted on the date of sampling, all fish collected at this station, except yellow bullhead, are classified as fluvial specialist/dependents, which usually indicates a stable flow regime. Overall number of fluvial specialist/dependents was low (n= 38).

MA DFG conducted fish population sampling in the East Branch Swift River below Connors Pond Road (Site 870) in Petersham on 21 July 2003 using a backpack electro-shocker (Richards 2006). Ninety-eight golden shiner, twenty-three longnose dace, twenty-three eastern blacknose dace, eighteen common shiner, ten pumpkinseed, nine tessellated darter, four yellow perch, two white sucker and two yellow bullhead were collected (189 fish total). MA DFG fishery biologists noted that the water level was very low at this sampling site.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although the presence of five fluvial specialist/dependent species is generally indicative of a stable flow regime the golden shiner dominance (macrohabitat generalists) in the sample and the low flow levels suggest otherwise. All fish species present are classified as being tolerant or moderately tolerant to pollution. The presence of macrohabitat generalists may be a result of this reach's proximity to Connors Pond.

MA DFG conducted fish population sampling in the East Branch Swift River upstream the Glen Valley Road crossing (Site 895) in Petersham on 8 August 2003 using a backpack electro-shocker (Richards 2006). One hundred and eighteen eastern blacknose dace, twenty-three longnose dace, eighteen fallfish, fourteen bluegill, seven white sucker, five tessellated darter, four largemouth bass, three golden shiner, two yellow perch, two yellow bullhead, two pumpkinseed and one chain pickerel were collected (199 fish total). MA DFG fishery biologists noted that the water level was low at this sampling site and they covered 85 percent of the river in the sampling reach during sampling.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although the presence of seven macrohabitat generalist species is generally indicative of compromised flow regime the sample was heavily dominated by fluvial specialist/dependent species. All fish species present are classified as being tolerant or moderately tolerant to pollution. Eastern blacknose dace dominance in the sample (n= 118) suggests the possibility of nutrient enrichment at this site (Maietta 2007).

MA DFG conducted fish population sampling in the East Branch Swift River near the intersection of Glen Valley Road and the powerlines (Site 896) in Petersham on 8 August 2003 using a backpack electro-shocker (Richards 2006). Sixty-four eastern blacknose dace, fifty-five white sucker, twenty-nine fallfish, twenty-three longnose dace, thirteen common shiner, ten tessellated darter, ten golden shiner, ten largemouth bass, three bluegill, three brook trout, and one yellow perch were collected (221 fish total). MA DFG fishery biologists noted sampling started at end of long pond and estimated they caught 70% of the fish and covered 100% of river. MA DFG fishery biologists also noted that the brook trout caught were wild.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although four macrohabitat generalist species were present, the sample was heavily dominated by fluvial specialist/dependent species. With the exception of brook trout (wild), which are intolerant to pollution, all other fish species present are classified as being tolerant or moderately tolerant to pollution. Atlhough the numbers of wild brook trout were low (n=3) their presence suggests excellent water and habitat quality and corroborates MA DFG's classification of the East Branch Swift River as a Coldwater Fishery Resource.

MA DFG conducted fish population sampling in the East Branch Swift River near the Route 32A crossing (Site 878) in Petersham on 8 August 2003 using a backpack electro-shocker (Richards 2006). Thirty-nine fallfish, thirty-eight longnose dace, thirty-one eastern blacknose dace, seven yellow bullhead, five largemouth bass, four pumpkinseed, four bluegill, three yellow perch, three brook trout, three white sucker and one golden shiner were collected (139 fish total). MA DFG fishery biologists noted that they used two backpack electro-shockers and that the three brook trout collected were wild.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although six macrohabitat generalist species were present, the sample was dominated by fluvial specialist/dependent species. With the exception of brook trout (wild), which are intolerant to pollution, all other fish species present are classified as being tolerant or moderately tolerant to pollution. Although the numbers of wild brook trout were low (n=3) their presence suggests excellent water and habitat quality and corroborates MA DFG's designation of the East Branch Swift River as a Coldwater Fishery Resource.

Water Chemistry
Other than the MA DFG fish population work, no other recent quality-assured data are available for East Branch Swift River.

East Branch Swift River is classified by MassDEP as a Class A waterbody. It is not only stocked with trout by MA DFG but is also designated a Cold Water Fishery Resource by MA DFG(Richards 2006). Wild trout were only found at two of the six sites sampled and their numbers were low. MA DCR sampling data for temperature indicate that the East Branch of the Swift River often exceeds 20°C during summer month s (MA DCR 2006a). Fish assemblages varied between sites and although a compromised flow regime was suggested at a few sites while other sites appeared to be supporting a fluvial fish community. Macrohabitat generalists dominated at two sites that were located in close proximity to mainstem impoundments. The *Aquatic Life Use* is assessed as support given the presence of pollution intolerant wild trout. This segment is given an "Alert Status" due to the low numbers of trout observed despite it's designation as a Coldwater Fishery Resource.

Primary and Secondary Contact Recreation and Aesthetics Uses
No objectionable conditions have been reported in the West Branch Fever Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent quality-assured data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

East Branch Swift River (Segment MA36-35) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring and benthic macroinvertebrate monitoring to assess *Aquatic Life Use*.

Future fish population monitoring should concentrate sampling on areas further from mainstem impoundments and include extended deployment of temperature sensors during the summer to better document the extent of the wild trout population.

SWIFT RIVER (SEGMENT MA36-09)
Location: Windsor Dam, Belchertown, to Upper Bondsville Mill Dam, Belchertown/Palmer.
Segment Length: 5.6 miles.
Classification: Class B, Cold Water Fishery.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Massachusetts Division of Fisheries and Wildlife (McLaughlin& Palmer State Fish Hatchery) registration/permit (10802402/9P10802401)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D1, D4)
Massachusetts Division of Fisheries and Wildlife (McLaughlin& Palmer State Fish Hatchery) (MA0110043)
Belchertown (MAR0411002)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
USGS maintains a gage (Gage 01175500) on the Swift River in West Ware, MA, 1.4 mi downstream from the Quabbin Reservoir. The drainage area is 189 mi^2 including 1.6 mi^2 drained by Beaver Brook, flow that is diverted from the Ware River Basin (USGS 2007). The period of record is July 1910 to present (USGS 2007). The average discharge after completion of Quabbin Reservoir (1940-2005) is 94.4 cfs (USGS 2007). The maximum discharge occurred on 19 March 1936 (7,590 cfs). The maximum discharge since the construction of Quabbin Reservoir in 1939 occurred on 1 June 1984 (3,070 cfs). The minimum discharge occurred on 15 December 1968 (9.1 cfs) (USGS 2007).

The USGS remarks that flow has been regulated by Quabbin Reservoir since August 1939 (USGS 2007). The flow has been diverted from the Ware River to Quabbin Reservoir since 1940, from Quabbin Reservoir to Wachusett Reservoir since 1941, from Quabbin Reservoir to Chicopee Valley aqueduct since 1950, and from Quabbin Reservoir to the city of Worcester at times since 1966 (Socolow *et al.* 2004). Records with estimated daily discharge above 200 cfs are considered fair by USGS while all other records are considered good. During 2003 the Quabbin Reservoir released a total of 9236.4 million gallons or 25.3 MGD into the Swift River (MA DCR 2004). The Swift River's largely steady flow mimics this discharge (Appendix B).

The Swift River begins at the Windsor Dam with flow regulated by the MWRA via a control structure in the Quabbin power plant. From 1 December through 31 May, MA DCR is required to release 20 MGD out of Quabbin Reservoir to the Swift River. From 1 June through 30 November, the required releases (per order of the US War Department) are dependent on the streamflow of the Connecticut River at the USGS Montague gage. When the flow of the Connecticut River is <4900 cfs, the required release at Quabbin Reservoir is 45 MGD and when the flow is <4650 cfs, the required release at Quabbin Reservoir is 71 MGD. In practice, however, the MA DCR releases either 20 or 71 MGD from the reservoir or more depending on reservoir operating conditions (Austin 1993).

The wetlands and waterways in this segment of the Swift River are identified as habitat for rare and endangered species by the state's Natural Heritage and Endangered Species Program. The Swift River contains a variety of habitat types. The river's gradient, cold water coming from the depths of Quabbin Reservoir, and the impoundment and extensive wetlands formed by the Upper Bondsville Mill Dam in the village of Bondsville, Palmer, result in a mix of cold and warmwater fisheries habitat. The Upper Bondsville Mill Dam, however, has been classified by MA DCR's

Office of Dam Safety as a high hazard dam. There is currently no responsible party to implement dam safety improvements or removal.

The Swift River is heavily stocked with trout and is fished all year long by anglers, including icefishing. Special fishing regulations apply to two different portions of this river segment (see *MA DFG Abstracts of the Massachusetts Fish and Wildlife Laws* for details).

In July 2006 Mass Riverways conducted a habitat improvement project on this segment. The project entitled "Swift River Rock Structure Removal" improved habitat by eliminating flow constriction caused by rock piles left in the river by a former bridge (Graber 2004). The goal was to change pool habitat into new riffles. Mass Riverways staff conducted longitudinal and cross-sectional profiles off the stream before project implementation (Graber 2004). Since the river now carries approximately one quarter of the flow it experienced before the Quabbin Reservoir, they found a channel that was deeply incised, largely uniform in structure and disconnected from the floodplain (Graber 2004). A new channel has formed inside of the former channel, which was sized by historic flows. Riverways staff also found the bed structure to be comprised of a larger particle size distribution, typical of a stream that saw higher flows than currently found (Graber 2004).

Biology
MA DFG stocks this stream with trout (MA DFG 2007). Graber (2004) found significant number of rainbow trout and brook trout during their pre-project implementation habitat survey. The rainbow trout were found to be largely adults while multiple age classes of brook trout were found (Graber 2004).

Water Chemistry
DWM conducted water quality monitoring at Station SR03 (Cold Spring/Old Belchertown Road, Belchertown) along this segment of the Swift River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. There is also a MassDEP Central Environmental Regional Office (CERO) Strategic Monitoring and Assessment for River Basin Teams (SMART) station on this segment off River Road, at the USGS flow gage, west of River Road in Ware. DWM conducted water quality at this station (SRG) on the Swift River between May and August 2003 (Appendix B). CERO SMART crews also conduct water quality monitoring at this location each year in addition to DWM sampling. The DWM data collected in 2003 at both stations (SR03 and SRG) as part of DWM monitoring is summarized below.

Parameter	DWM 2003
DO (mg/L)	8.2 – 11.4 (n=13)
Percent Saturation (%)	82 – 108 (n=13)
pH (SU)	5.9-6.5 (n=13)
Temperature (°C)	8.9 – 14.6 (n=13)
Conductivity (µS/cm at 25°C)	43.5 – 67.0 (n=13)
Total phosphorus (mg/L)	0.008- 0.034 (n=7)
Ammonia- nitrogen (mg/L)	<0.02- 0.15 (n=6)
Total suspended solids (mg/L)	<1 -<2 (n=3)

All water quality data meets standards except pH, which was found to be slightly lower than the criterion on the majority of sampling events. Given the good water quality and the presence of multiple age classes of brook trout this segment supports the *Aquatic Life Use*. This use is identified with an "Alert Status" due to the low pH found.

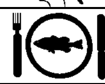
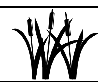
Primary and Secondary Contact Recreation Uses
DWM conducted water quality monitoring at one station (SR03-Cold Spring/Old BelchertownRoad, Belchertown) along this segment of the Swift River between April and October 2003 (Appendix B). The geometric mean of *E. coli* counts was 5.1 cfu/100 mL. The bacteria

samples collected are summarized below. None of the DWM or CERO field crews noted any objectionable conditions (objectionable deposits, scums, or odors) at this site during the sampling season with the exception of two occasions when the water had a manure odor (Appendix B).

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<0.9 - 100
Geometric mean	8.1
E. coli (cfu/100mL)	<0.9 - 80
Geometric mean	5.1

Both *Primary* and *Secondary Contact Recreational Uses* are supported given the low bacteria levels found at this site. The *Aesthetics Use* is supported for the Swift River.

Swift River (Segment MA36-09) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

* Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct benthic macroinvertebrate and fish population sampling to assess *Aquatic Life Use*.

SWIFT RIVER (SEGMENT 36-10)
Location: Upper Bondsville Mill Dam, Belchertown/Palmer, to confluence with Ware River, Palmer.
Segment Length: 3.9 miles.
Classification: Class B, Cold Water Fishery, CSO.

Although this segment is classified as a CSO in the 2006 Massachusetts Water Quality standards, all CSOs in this segment have been eliminated (see below) and this should not be classified with a CSO qualifier.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

The Old Bondsville Factory, a Tier 1A Hazardous Waste Site (#1-0000968), is located along the upper reach of this segment (Mass DEP 2001)

The Upper Bondsville Mill Dam has been classified as a high hazard dam (MA DCR 2002). The Belchertown Land Trust currently owns it.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Bondsville Fire and Water Department registration/permit (10822704/9P210822702)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Palmer WTTP (MA0101168)
Belchertown (MAR041002)
Palmer (MAR041017)

Palmer WWTP (MA0101168) is permitted to discharge via three wet weather CSOs (outfalls 024, 025, and 026) to this segment of the Swift River. Hydraulic modeling performed as part of Palmer's CSO Abatement Plan conducted in 1994-1996 estimated the following discharge quantities based on a three-month frequency storm.

Village of Bondsville (upstream to downstream)
- Outfall #026 – 1,380 gallons (intersection of Main Street with Spring Street)
- Outfall #025 – 8,650 gallons (intersection of Main Street with Depot Street)
- Outfall #024 – 7,230 gallons (intersection of Main Street with First Street)

The Town's permit was reissued on 29 September 2000. Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate CSO outfalls 024, 025, and 026 was proposed for the third phase of work at an estimated cost of $810,000. In 1999 Palmer submitted a request for MA SRF financing for the first three phases of work and in November 1999 was selected to receive financing for $7.1 million dollars. MassDEP approved sewer separation, including drainage areas to CSO outfalls #024, 025, and 026, in December 2000 as part of CW SRF-423. Sewer Separation has been completed and there are no known remaining CSO's on this Swift River segment (Boisjolie 2007a).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Water Chemistry</u>
DWM conducted water quality monitoring at one station (SR02- Rte 181/State St., Palmer) along this segment of the Swift River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, ammonia-nitrogen and total phosphorus (Appendix B).

A summary of measured water quality parameters at the DWM station on this segment is below.

Parameter	DWM 2003
DO (mg/L)	9.2 – 11.1 (n=9)
Percent Saturation (%)	98 – 105 (n=9)
pH (SU)	6.8 –7.0 (n=9)
Temperature (℃)	11.9 – 19.5 (n=9)
Conductivity (µS/cm at 25℃)	56.0 – 66.0 (n=9)
Total phosphorus (mg/L)	0.023- 0.033 (n=5)
Ammonia- nitrogen (mg/L)	<0.02-< 0.10 (n=6)
Total suspended solids (mg/L)	< 2 (n=6)

Dissolved oxygen, pH, and temperature all meet criteria at the DWM station on the Swift River. Ammonia-nitrogen concentrations were low while total phosphorus concentrations ranged from 0.020 mg/L and 0.033 mg/L. Given the good water quality conditions found the *Aquatic Life Use* is assessed as support.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted water quality monitoring at one station (SR02- Rte 181/State St., Palmer) along this segment of the Swift River between April and October 2003 (Appendix B). The geometric mean of *E. coli* counts was 34.4 cfu/100 mL and no count was greater than 235 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 140
Geometric mean	40.4
E. coli (cfu/100mL)	2 - 120
Geometric mean	34.4

DWM field crews found trash on four occasions (mainly cans and bait worm containers) although the extent of the trash was not extensive. White foam was noted on three occasions but generally no scums were noted. No water odor was noted with the exception of one occasion when the water had a rotting vegetable smell. No shoreline erosion was found at this station as the banks were armored.

Both *Primary* and *Secondary Contact Recreational Uses* are supported given the low bacteria counts found at this site. Due to the lack of objectionable conditions, the *Aesthetics Use* is assessed as support for this segment of the Swift River

Swift River (Segment MA36-10) Use Summary Table

<table>
<tr><th>Designated Uses</th><th>Status</th></tr>
<tr><td>Aquatic Life</td><td>SUPPORT</td></tr>
<tr><td>Fish Consumption</td><td>NOT ASSESSED</td></tr>
<tr><td>Primary Contact</td><td rowspan="3">SUPPORT</td></tr>
<tr><td>Secondary Contact</td></tr>
<tr><td>Aesthetics</td></tr>
</table>

RECOMMENDATIONS

Conduct water quality monitoring (water chemistry, multiprobe) to assess the *Aquatic Life Use.*

Conduct bacteria sampling to assess the *Primary* and *Secondary Contact Recreational Uses*.

The Ware River Subbasin

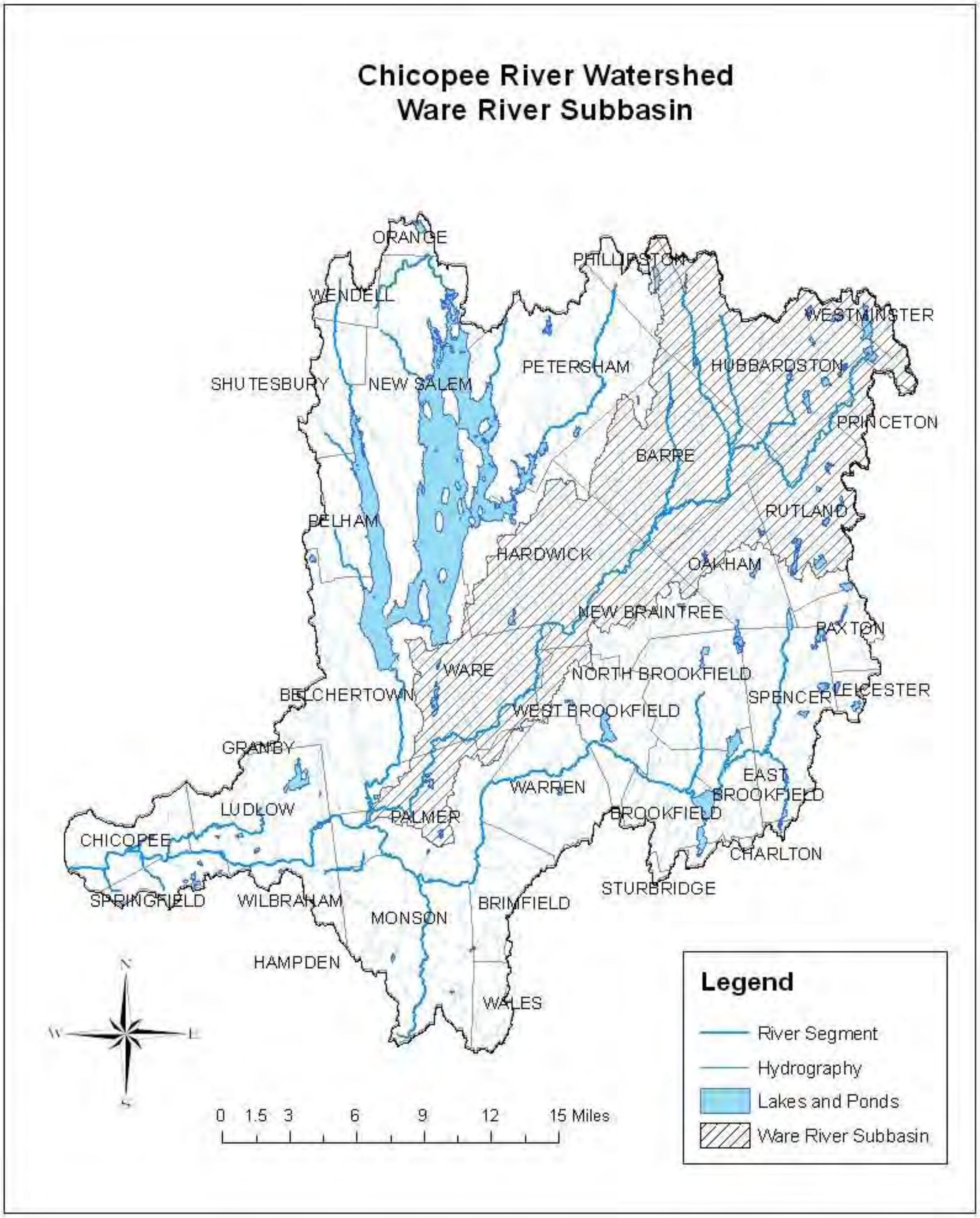


Figure 8: Ware River Subbasin

EAST BRANCH WARE RIVER (SEGMENT MA36-01)
Location: Outlet Bickford Pond, Hubbardston, to confluence with the West Branch Ware River, Barre.
Segment Length: 12.4 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Organic enrichment/low DO (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Fitchburg Water Department registration/permit (20809701/9P20809701)

The Fitchburg Water Department's use of water from the Bickford Reservoir and Mare Meadow Reservoir for drinking water purposes, have the potential to influence streamflows in the East Branch Ware River. This withdrawal also represents an out-of-basin transfer of water as the drinking water is consumed and the wastewater is disposed of in Fitchburg in the Nashua River Basin.

NPDES SURFACE WATER DISCHARGES (APPENDIX E, TABLE E4)
Town of Rutland (MAR041154)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG conducted fish population sampling on the East Branch Ware River near Intervale Road in Rutland (Site 889) and at the Prison Camp Road crossing in Rutland (Site 891) on 26 August 2003 using a backpack electro-shocker (Richards 2006). Fourteen longnose dace, five fallfish, three common shiner, one tessellated darter, one chain pickerel, one brown trout and one eastern blacknose dace were found at the Intervale Road site (Site 889, 26 fish total). Fluvial specialists/dependants dominated the sample. Although overall fish numbers were low at this site, it should be noted that fish sampling efficiency was rated as poor due to dark stained water. It is unclear what effect the presence of numerous beaver dams (upstream and downstream) may be having on the fish assemblage at this site.

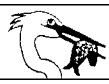
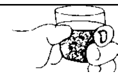
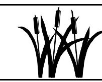
At the Prison Camp Road crossing site (Site 891) eighteen redbreasted sunfish, five longnose dace, five fallfish, five common shiner, four chain pickerel, three yellow bullhead, three tessellated darter, and one brown trout were collected (44 fish total). Although the sample was dominated by redbreast sunfish, a macrohabitat generalist, five fluvial specialists/dependants were also present. This sampling station was located just upstream from a wetland dominated reach, which likely contributed to the large number of redbreast sunfish.

Although the fish community was fairly diverse and fluvial specialist/dependant species were well represented, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
No recent quality-assured bacterial data are available for East Branch Ware River.
No objectionable conditions have been reported in the East Branch Ware River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

East Branch Ware River (Segment MA36-01) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Review USGS report (2006-5044) and forthcoming reports on reservoir operations and flow management practices.

Evaluate the flow management practices (e.g., outlet control operations) of the lakes in this subwatershed.

Conduct continuous temperature to determine the temperature dynamics during the summer months.

WEST BRANCH WARE RIVER (SEGMENT MA36-02)
Location: Outlet Brigham Pond, Hubbardston, to confluence with the East Branch Ware River, Barre
Segment Length: 4.5 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks the West Branch Ware River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the West Branch Ware River near Brigham Road crossing in Barre (Site 890) on 26 August 2003 using a backpack electro-shocker (Richards 2006). Sixteen fallfish, fifteen tessellated darter, eight longnose dace, six chain pickerel, six banded sunfish, one wild brook trout, one common shiner and one redbreast sunfish were collected (54 fish total). Fluvial specialists/dependants dominated the sample and the presence of a single native brook trout is noteworthy. Although only brook trout are classified as being intolerant to pollution, the additional presence of longnose dace and tessellated darter (moderately tolerant) suggests good water quality and quantity. Overall fish numbers were low given the length of the reach that was sampled.

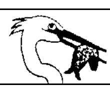
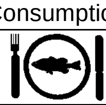
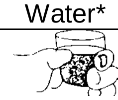
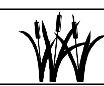
<u>Water Chemistry</u>
No recent quality-assured water quality data are available for West Branch Ware River.

Although the fish community was fairly diverse and fluvial specialist/dependant species were well represented, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
No recent quality-assured bacterial data are available for the West Branch Ware River. No objectionable conditions have been reported in the West Branch Ware River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

West Branch Ware River (Segment MA36-02) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct water quality and biological monitoring to evaluate designated uses.

Deploy multiple multiprobes along this segment to determine the effects if any of large wetland areas on oxygen dynamics in this segment.

CANESTO BROOK (SEGMENT MA36-36)
Location: Headwaters northwest of Hubbardston State Forest near the Hubbardston/Templeton town line to the confluence with Ware River, Barre
Segment Length: 7.3 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG conducted fish population sampling in the Canesto Brook near the Route 62 crossing in Barre (Site 883) on 14 August 2003 using a backpack electro-shocker (Richards 2006). Twelve eastern blacknose dace, five white sucker, four tessellated darter, one banded sunfish, and one chain pickerel were collected (23 fish total). Fluvial specialists/dependants dominated the sample. Overall fish numbers were low given the length of the reach sampled although sampling efficiency was noted as poor due to high and cloudy waters at the sampling site (Richards 2006).

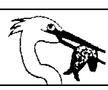
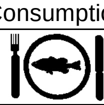
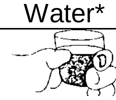
<u>Water Chemistry</u>
No recent quality-assured water quality data are available for Canesto Brook.

Although the fish community was largely composed of fluvial specialist/dependant species, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
No objectionable conditions have been reported in Canesto Brook, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The Primary and Secondary Contact Recreation Uses are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Canesto Brook (Segment MA36-36) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct water quality and biological monitoring to evaluate designated uses.

BURNSHIRT RIVER (SEGMENT MA36-37)
Location: Headwaters - Outlet Stone Bridge Pond, Templeton/Phillipston, to the confluence with Canesto Brook, Barre
Segment Length: 8.6 miles
Classification: Class A, Public Water Supply

Williamsville Pond (MA36167) will no longer be reported on as an approximately 57-acre lake segment since the estimated retention time of this waterbody is approximately five days. It will be considered a run-of-the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01173000 and 01172500) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks the Burnshirt River with trout (MA DFG 2007).

MA DFG conducted fish population sampling in the Burnshirt River downstream from Gilbert Road in Barre (Site 881) on 19 August 2003 using a backpack electro-shocker (Richards 2006). Forty-three common shiner, twenty-three eastern blacknose dace, sixteen fallfish, ten brown bullhead, seven longnose dace, six white sucker, two yellow bullhead, two bluegill, one brown trout, one tessellated darter, and one chain pickerel were collected (112 fish total). Fluvial specialists/dependent species dominated the sample.

The presence of longnose dace and tessellated darter (moderately tolerant) suggests good water quality and quantity. Although the presence of brown trout, an intolerant fluvial specialist is notable, only one specimen assumed to have been stocked was collected. Overall fish numbers were good.

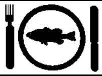
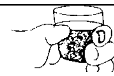
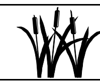
Water Chemistry
No recent quality-assured data are available for Burnshirt River.

Although the fish community was largely composed of fluvial specialist/dependant species, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
No recent quality-assured data are available for Burnshirt River. No objectionable conditions have been reported in Burnshirt River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Burnshirt River (Segment MA36-37) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Conduct water quality and biological monitoring to evaluate designated uses.

A review of flow management practices at Queen Lake, Stone Bridge and Williamsville ponds could be conducted to determine the effects if any of said practices on temperatures in the Burnshirt River.

WARE RIVER (SEGMENT MA36-27)
Location: Headwaters - Confluence of East Branch Ware and West Branch Ware rivers to MDC intake, Barre
Segment Length: 4.9 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Organic Enrichment/low DO and thermal modifications (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
MDC-MWRA Ware River diversion, registration (10830901)

The Massachusetts Water Resources Authority (MRWA) is allowed to divert the Ware River via Shaft 8 in Barre into either the Quabbin or Wachusett Reservoirs (WMA registration number 10830901). The diversions are allowed between 15 October and 15 June when flow in the Ware River exceeds 85 MGD. All other diversions require MassDEP approval (MDC 1997).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
The U.S. Army Corps of Engineers (ACOE) owns and maintains Barre Falls Dam, a dry bed reservoir built in 1958 for flood control purposes, along this segment of the Ware River Segment near the Barre/Hubbardston town boundary. The Barre Falls Dam does not maintain a conservation or recreation pool, so inflow equals outflow except during flood-control operations. According to the ACOE (US ACOE 2003), during daily operations and maintenance activities "the minimum outflow should be the less of inflow or 55 cfs from October through March, 220 cfs from April through May and 30 cfs from June to September". The ACOE operations procedure "stipulates a minimum release of 30 cfs at dam during periods of regulation to sustain downstream fish life" (US ACOE 2003). Active dam operations may influence the flow of water in this segment.

USGS maintains a gage near Barre, MA, on the Ware River (Gage 01172500) 700 feet downstream from the Barre Falls Reservoir. The average annual discharge at the gage is 95.3 cfs (period of record 1946 to 2005) (USGS 2007). The drainage area is 55.1 mi^2 and the maximum discharge occurred on 16 October 1955 (1,890 cfs) (USGS 2007). Since the construction of the Barre Falls Reservoir in 1958, the maximum discharge for this gage occurred on 13 April 1987 (1,630 cfs) (Socolow *et al*. 2004). The minimum daily discharge occurred on 8 September 1995 and 11 September 1995 (0.1cfs) (Socolow *et al*. 2004). During the period of 3-8 September and on 13 September 1996 this gage experienced no flow for at least part of the day (Socolow *et al*. 2004).

The USGS remarks that there was slight regulation at low flow at times by Long Pond before August 1955. The flow has been regulated by the Barre Falls Reservoir since 1958 and since 1955 has been diverted at times from 6.5 mi^2 upstream the station for municipal drinking water supply to Fitchburg (Socolow *et al*. 2004). Estimated daily discharge records are considered fair by the USGS (Socolow *et al*. 2004).

Biology
MA DFG stocks the Ware River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the Ware River upstream from Route 122 in Barre (Site 893) on 10 September 2002 using a backpack electro-shocker (Richards 2006). This sampling station is within the impounded portion of the Ware River formed by the MDC intake dam. One hundred and forty golden shiner, thirty-four chain pickerel, twenty-seven common shiner, sixteen white sucker, twelve pumpkinseed, ten yellow perch, nine bluegill, six creek chubsucker, two largemouth bass, two fallfish, one rainbow trout and one redbreast sunfish were collected (260 total fish). The fish

assemblage at this station was a mix of macrohabitat generalists and fluvial specialist/dependent species. Although macrohabitat generalists dominated the sample, this is not surprising given the lentic nature of this narrow impoundment.

Geosyntec Consultants as part of their 2006 Quabbin Reservoir/Ware River aquatic macrophytes assessment sampled in this segment of the Ware River. Aquatic macrophytes were sampled at 22 stations in a one mile stretch of river immediately upstream from the Quabbin Reservoir's Shaft #8 (Geosyntec Consultants, 2006). The majority of stations were characterized as having no plant growth or very sparse plant growth and the remaining stations had sparse plant growth. Yellow water lily (*Nuphar variegatum*), pickerelweed (*Pontederia cordata*) and common bladderwort (*Utricularia vulgaris*) were the three most dominant species found (Geosyntec Consultants, 2006). The Ware River has a wide shallow channel in portions of the reach sampled.

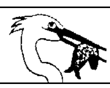
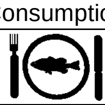
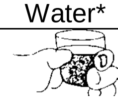
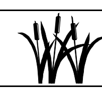
<u>Water Chemistry</u>
No recent quality-assured data are available for the Ware River. The *Aquatic Life Use* is not assessed due to a lack of sufficient information.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
There are two beaches along the shoreline of Ware River in this segment: Cozy Cabin Beach and Barre Dam. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH, as required by the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No objectionable conditions have been reported in this segment of the Ware River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Ware River (Segment MA36-27) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

WARE RIVER (SEGMENT MA36-03)
Location: MDC intake, Barre to dam in South Barre
Segment Length: 2.1 miles
Classification: Class B, Cold Water Fishery, High Quality Water

Powder Mill Pond (MA36126) and South Barre Reservoir (MA36141) will no longer be reported on as approximately 18-acre and 19-acre lake segments, respectively, since the retention time of these waterbodies was estimated at less than one day. They will be considered run of the river impoundments (McVoy 2006). The retention time estimates were based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01173000 and 01172500) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
MDC-MWRA Ware River diversion, registration (10830901)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
The USGS maintains a gage near Barre, MA, on the Ware River at the intake works above diversion dam on Ware River, 2.7 miles downstream from Burnshirt River (Gage 01173000). The drainage area is 96.3 mi^2 (Socolow *et al*. 2004). The period of record for this gage is 1928 to present and the average discharge from 1929-2004 is 168 cfs (Socolow *et al*. 2004). The maximum discharge occurred on 21 September 1938 (14,000 cfs) by computation of flow over dam. Since the construction of Barre Falls Reservoir in 1958, the maximum discharge occurred on 14 April 1987 (1,590 cfs) while the minimum discharge, which was caused by unusual regulation, occurred on 15 September 1987 (0.46 cfs) (Socolow *et al*. 2004).

The USGS remarks that each year discharge is diverted as needed for the Boston Metropolitan district (now MA DCR) from 15 October to 14 June and at other times for emergency flood-control purposes as authorized by U.S. Army Corps of Engineers. The flow has been regulated 4.3 mi upstream by Barre Falls Reservoir since 1958, and since 1955 it has been diverted at times from 6.5 mi^2 upstream from the station for municipal drinking water supply to Fitchburg *(Socolow et al. 2004)*.

<u>Biology</u>
One potential non-native aquatic macrophyte species, *Myriophyllum* sp., was identified in Powder Mill Pond during the 1998 synoptic lake survey (MassDEP 1998). Confirmation of the species is needed.

<u>Water Chemistry</u>
There is a MassDEP Central Regional Office Strategic Monitoring and Assessment for River Basin Team (SMART) station on this segment off River Road, at the USGS flow gage, west of River Road in Ware. The DWM conducted water quality at this station (CBG) on the Ware River between May and August 2003 (Appendix B). CERO crews have conducted water quality monitoring at this location yearly from 1998 to the present. DWM also conducted water quality monitoring at Station WAWV (New Braintree Rd. bridge, White Valley, S. Barre) along this segment of the Ware River between April and October 2003 (Appendix B). *In-situ* parameters

were measured in 2003 on nine occasions (three during pre-dawn hours) at Station WAWV and on four occasions (three during pre-dawn hours). Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus at both locations (Appendix B).

Water quality data met dissolved oxygen criteria at the stations on the Ware River. pH was below the criterion the majority of the time at both stations, but the low pH is considered to be naturally-occurring. Low alkalinity and hardness values, recorded at Station WAWV located below Powder Mill Pond (Appendix B), are indicative of poor buffering ability. Temperature exceeded the criterion in July and August at both stations. The duration and extent of high temperatures is currently unknown. All nutrient concentrations were generally low with the exception of one slightly elevated total phosphorus concentration measured in July at Station WAWV. The *Aquatic Life Use* is assessed as support for this segment but listed as “Alert Status” due to temperature issues and the possible presence of a non-native macrophytes species.

Fish Consumption
The MA DPH (MA DPH 2005) has issued a fish consumption advisory due to mercury contamination for Powder Mill Pond, Barre, as follows.

> “*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Powder Mill Pond in order to prevent exposure to developing fetuses, nursing infants and young children to mercury. The general public should limit consumption of all fish species from Powder Mill Pond to two meals per month*”.

Because of the site-specific fish consumption advisory due to mercury contamination, the *Fish Consumption Use* is assessed as impaired for the 0.3 mile reach of the Ware River through Powder Mill Pond. Although sources are unknown, atmospheric deposition is a suspected source. The close proximity of this pond to the Martone Landfill must also be noted however.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
The DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (WAWV and CBG) along this segment of the Ware River between April and October 2003 (Appendix B). Only one *E.coli* sample was collected at station CBG. The geometric mean of *E. coli* counts at station WAWV was 12.3 cfu/100 mL. Neither DWM nor CERO field crews noted any objectionable conditions (objectionable deposits, scums, or odors) at these sites during the sampling season with the exception of isolated trash at Station WAWV. White foam, believed to be naturally-occurring, was also noted at both stations.

Parameter	DWM Station WAWV 2003 (n=5)
Fecal coliform (cfu/100mL)	<2 - 100
Geometric mean	18.0
E. coli (cfu/100mL)	<2 - 70
Geometric mean	12.4

The *Primary* and *Secondary Contact Recreational Uses* and the *Aesthetics Use* are assessed as support given the low bacteria counts and the lack of objectionable conditions.

Ware River (Segment MA36-03) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		IMPAIRED (0.3 miles- Powder Mill Pond) Cause: Mercury in fish tissue Source: Unknown Suspected source: Atmospheric deposition NOT ASSESSED (1.8 miles-rest of segment)
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct water quality and biological monitoring to evaluate designated uses.

Conduct temperature monitoring along the Ware River especially above and below impoundments on this segment and determine conditions that result in exceedences of standards.

Conduct macrophyte mapping in Powder Mill Pond to ascertain whether any non-natives species are present.

WARE RIVER (SEGMENT MA36-04)
Location: Dam in South Barre to Wheelwright Dam, New Braintree
Segment Length: 5.36 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Barre Water Department Registration # (2021000)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Barre Wastewater Treatment Plant WWTP- (MA0103152)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks the Ware River with trout (MA DFG 2007). The MA DFG conducted fish population sampling in the Ware River well upstream from the Wheelwright Impoundment, approximately one half mile downstream from Barre Plains in Barre (Site 462) on 2 October 2001 using a boat shocker (Richards 2006). One hundred nineteen golden shiner, one hundred three common shiner, twenty-six white sucker, twenty-four chain pickerel, twelve pumpkinseed, ten yellow perch, five fallfish, five brown bullhead, four bluegill, three largemouth bass, two yellow bullhead, one creek chubsucker and one tessellated darter were collected (315 fish total).

MA DFG conducted fish population sampling in the Ware River near Airport Road approximately 1.6 miles downstream from Barre Plains near the Barre/Hardwick town line (Site 463) on 2 October 2001 using a boat shocker (Richards 2006). Seventy-one yellow perch, ten golden shiner, eight chain pickerel, five pumpkinseed, five common shiner, four white sucker, three creek chubsucker, two brown bullhead, one black crappie, one largemouth bass, one bluegill and one fallfish were collected (66 fish total).

MA DFG conducted fish population sampling in the Ware River upstream from the Wheelwright Impoundment near the Barre-Hiller Airport in Hardwick (Site 464) on 2 October 2001 using a boat shocking technique (Richards 2006). Thirty-eight golden shiner, twenty-one pumpkinseed, twenty-one chain pickerel, eighteen yellow perch, eighteen brown bullhead, thirteen white sucker, nine bluegill, five black crappie, four largemouth bass, and one creek chubsucker were collected (148 fish total)

The fish assemblage in this segment was dominated by macrohabitat generalists with limited numbers of fluvial specialist/dependent species. Although macrohabitat generalists dominated the samples, this is not surprising given the impounded nature of this reach.

<u>Toxicity</u>
Ambient
The Barre Wastewater Treatment Plant (WWTP) staff collected water from the Ware River at the Route 32 Bridge for use as dilution water in the facility's whole effluent toxicity tests. Between July 2000 and May 2007 survival of *C. dubia* exposed (48 hours) to the Ware River water ranged from 90 to 100% (n=28). For August 2002 survival of *P. promelas* exposed (48 hours) to the Chicopee River water was 100% (n=1). Hardness ranged from 12 mg/L to 28 mg/L (n=28).

Effluent
Whole effluent toxicity tests have been conducted on the Barre Wastewater Treatment Plant (WWTP) treated effluent. Between July 2000 and May 2007 thirteen valid chronic tests were conducted using *C. dubia*. Results of the *C. dubia* chronic whole effluent toxicity tests (CNOEC) ranged from <6.25 to 100% effluent. The LC_{50} using *C. dubia* ranged from 18.30% to >100% effluent (n=28). Of the 28 valid tests, ten did not meet the LC_{50} limit, which is $\geq$100%. Seven of the nine acutely toxic samples were during the January/February or April/May testing period. The LC_{50} using *P. promelas* was >100% (n=1).

Ammonia-nitrogen concentrations reported in the whole effluent toxicity reports between July 2000 and May 2007 ranged from 0.150 mg/L to 70.0 mg/L (n=28). Total residual chlorine (TRC) concentrations reported in the whole effluent toxicity reports between July 2000 and May 2007 ranged from 0.010 to 0.150 mg/L (n=28).

Water Chemistry
DWM conducted water quality monitoring at Station WAIR (between the confluence of Pine Hill Brook and Broadmeadow Brook, Hardwick) along this segment of the Ware River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three during pre-dawn hours occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). Both temperature and dissolved oxygen met criteria. pH was below the criterion the majority of the time but generally within 0.5 units of the criterion. Total phosphorus concentration was elevated in the July sample (Appendix B).

The *Aquatic Life Use* is assessed as support for this segment based on the good survival of test organisms exposed to river water and good water quality conditions, but listed as “Alert Status” due to acute whole effluent toxicity of the Barre Wastewater Treatment Plant discharge and low instream pH values.

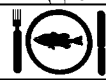
Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
DWM conducted fecal coliform and *E. coli* bacteria monitoring at Station WAIR (between the confluence of Pine Hill Brook and Broadmeadow Brook, Hardwick) along this segment of the Ware River between April and October 2003 (Appendix B). Bacteria counts were low at this station and the geometric mean of *E. Coli* counts was 47.5 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 400
Geometric mean	67.6
E. coli (cfu/100mL)	<2 - 200
Geometric mean	47.5

DWM field crews did not note objectionable deposits at this site with the exception of one occasion when trash was noted. A pollen sheen was noted on three occasions and an oily sheen was noted once although generally no scums were noted. DWM field crews did not note any water odor. Slight undercut banks were noted on the left bank at this station.

The *Primary* and *Secondary Contact Recreational Uses* and the *Aesthetics Use* are assessed as support given the low bacteria counts and the general lack of objectionable conditions.

Ware River (Segment MA36-04) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct water quality and biological monitoring to evaluate designated uses.

Macroinvertebrate sampling upstream and downstream of the Barre WWTP discharge should be conducted to ascertain if the discharge is having any adverse effects on aquatic life.

Barre WWTP should conduct a toxicity identification and reduction evaluation (TIE/TRE). If one is not conducted before their NPDES permit renewal, one should be required as part of their permit renewal.

PRINCE RIVER (SEGMENT MA36-08)
Location: Source, outlet Hemingway Pond to confluence with Ware River, Barre.
Segment Length: 7.1 miles.
Classification: Class B, Cold Water Fishery, High Quality Water.

Old Reservoir (MA36114) is a pond based on retention time, so the portion of the river that overlaps the reservoir will no longer be considered part of this segment.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Barre Water Department Registration # 2021000

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
No known NPDES discharges are present on this segment.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aesthetics* (MassDEP 2007b).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks the Prince River with trout (MA DFG 2007). MA DFG conducted fish population sampling in Prince River near the Williamsville Road crossing (Site 884) in Barre on 14 August 2003 using a backpack electro-shocker (Richards 2006). Fifteen eastern blacknose dace, nine white sucker, two tessellated darter, two brown bullhead, and one brook trout were collected (29 fish total).

Although fluvial specialist/dependent species dominated the sample at Williamsville Road and the presence of a single brook trout is noteworthy, blacknosed dace and white sucker (fluvial specialist/dependent species) are both classified as tolerant to pollution while the brook trout was most likely a stocked fish. In light of the classification of the Prince River as a coldwater fishery the absence of reproducing brook trout must be noted. Overall fish numbers were low given the length of the reach that was sampled.

MA DFG conducted fish population sampling in Prince River near the Valley Road crossing (Site 888) in Barre on 19 August 2003 using a backpack electro-shocker (Richards 2006). Ninety eastern blacknose dace, six longnose dace, five white sucker, three brook trout, one yellow bullhead, one pumpkinseed, one tessellated darter and one brown trout were collected (108 fish total). Fluvial specialist/dependent species dominated the sample collected at the Valley Road crossing. In addition, although multiple age classes of brook trout suggest a reproducing population, only three specimens were collected. A stocked brown trout and one tessellated darter (in addition to a couple of macrohabitat generalist species) complete the sample.

Too limited quality-assured data are available for Prince River. Although there was evidence of a reproducing population of brook trout the numbers were very low and don't allow a definitive assessment of *Aquatic Life Use*. All designated uses are not assessed.

Prince River (Segment MA36-08) Use Summary Table

<table>
<tr><th>Aquatic Life</th><th>Fish Consumption</th><th>Primary Contact</th><th>Secondary Contact</th><th>Aesthetics</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">NOT ASSESSED</td></tr>
</table>

RECOMMENDATIONS

Conduct water quality and biological monitoring (fish population and macroinvertebrate) to evaluate designated uses.

Conduct bacteria monitoring in this segment to assess the *Primary* and *Secondary Contact Recreation Uses*.

WARE RIVER (SEGMENT MA36-05)
Location: Wheelwright Dam, New Braintree, to Ware Dam, Ware
Segment Length: 11.5 miles
Classification: Class B, Warm Water Fishery. CSO**

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life and Aesthetics* (MassDEP 2007b).

** Although the river as defined in the 2006 standards inclusive of this segment has a CSO qualifier, there are no CSOs in this segment, so the CSO qualifier does not apply to this segment. All Class B standards apply.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Ware Water Department Registration/Permit (10806101/9P210830903)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Town of Hardwick (Hardwick Pollution Control Facility- Gilbertville) (MA01001021)
Town of Hardwick (Hardwick Pollution Control Facility- Wheelwright) (MA0102431)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks the Ware River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the Ware River off Route 32 in Hardwick (Site 879) on 7 July 2003 using barge shocking (Richards 2006). Fifteen fallfish, nine yellow perch, nine yellow bullhead, nine golden shiner, eight bluegill, seven redbreast sunfish, six longnose dace, five tessellated darter, three chain pickerel, three rock bass, two pumpkinseed, two common shiner, one eastern blacknose dace, and one largemouth bass were collected (80 fish total).

The fish assemblage in this segment consisted of a diverse mix of macrohabitat generalists and fluvial specialist/dependent species. Although detailed information regarding habitat type is not available it appears that a mix of habitat types was sampled. This accounts for the wide variety of species collected. Given the amount of flow and wide width in this reach of the Ware River, fish sampling efficiency was less than optimal.

MA DFG conducted fish population sampling in the Ware River near the Church Street crossing in Ware (Site 873) on 31 July 2003 using the barge shocking technique (Richards 2006). One hundred fifty-nine tessellated darter, one hundred four spot-tail shiner, fifty-nine redbreast sunfish, forty-six white sucker, fifteen rock bass, fifteen pumpkinseed, ten yellow bullhead, six fallfish, four bluegill, four largemouth bass, three longnose dace, two chain pickerel, one yellow perch, one eastern blacknose dace, and one brown trout were collected (430 fish total).

The majority of fish collected at both sites were macrohabitat generalists, although good numbers of fluvial specialists/dependent species were also present at both sites.

Toxicity
Ambient
The Hardwick Water Pollution Control Facility staff collected water from the Ware River, approximately 50 yards above the outfall at the Wheelwright facility, for use as dilution water in the Wheelwright facility's whole effluent toxicity tests. Between May 2000 and May 2007 survival of *C. dubia* exposed (48 hours) to the Ware River was all 100% (n=15). Between May 2000 and May 2003 survival of *P. promelas* exposed (48 hours) to the Ware River water ranged from 95 to 100% (n=7). Hardness ranged from 8.0 mg/L to 27.0 mg/L (n=14).

The Hardwick Pollution Control Facility staff collected water from the Ware River, approximately 50 yards above the outfall at the Gilbertville WWTP, for use as dilution water in the Gilbertville facility's whole effluent toxicity tests. Between May 2000 and November 2007 survival of *C. dubia* exposed (48 hours) to the Ware River water was all 100% (n=15). Between May 2000 and May 2003 survival of *P. promelas* exposed (48 hours) to the Ware River water was all 100% (n=7). Hardness ranged from 12.0 mg/L to 61.0 mg/L (n=14).

The Ware Treatment Plant (WWTP) staff collected water from the Ware River, off of Upper Church Street by the northern end of the landing strip, for use as dilution water in the facility's whole effluent toxicity tests. Between November 2005 and May 2006 survival of *C. dubia* exposed (approximately 7 days) to the Ware River water was 100% (n=3). Hardness ranged from 8.0 mg/L to 20.0 mg/L (n=3).

Effluent
Whole effluent toxicity tests have been conducted on the Hardwick Water Pollution Control Facility in Wheelwright treated effluent. Between May 2000 and November 2007 fifteen valid tests were conducted using *C. dubia* and seven using *P. promelas*. The LC_{50}'s using *C. dubia* ranged from 10.9% to >100% effluent (n=15). Overall of the 15 tests, six did not meet the limit of $\geq$100%. The LC_{50}'s using *P. promelas* were all >100% (n=7) with the exception of May 2002, which was 57.4% (Appendix D).

Whole effluent toxicity tests have been conducted on the Hardwick Water Pollution Control Facility in Gilbertville treated effluent. Between May 2000 and May 2007 fifteen valid tests were conducted using *C. dubia* and seven using *P. promelas*. The LC_{50} using *C. dubia* was all >100% effluent (n=15), except for May 2001 (93.90%), and November 2001 and 2002 (both results = 70.70%) and August 2006 (79.4% effluent). The LC_{50} using *P. promelas* were all >100% (n=7) (Appendix D).

Water Chemistry
DWM conducted water quality monitoring at two stations, WA06A (Upper Church St. Ware) and WAX (Creamery Road/Unitas Road, Hardwick/New Braintree), along this segment of the Ware River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). Total phosphorus concentrations at both locations were slightly elevated in June, July and August. All water quality data meets criteria, although pH was slightly low on occasion.

The *Aquatic Life Use* is assessed as support for this segment based on good survival of test organisms exposed to river water at all three locations, the presence of fluvial specialists/dependent fish species and good water quality conditions. The segment is given "Alert Status" due to acute whole effluent toxicity in both the Hardwick Water Pollution Control Facilities in Wheelwright and Gilbertville discharges and the slightly elevated total phosphorus concentrations.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations, WA06A (Upper Church St. Ware) and WAX (Creamery Road/Unitas Road, Hardwick/New Braintree), along this segment of the Ware River between April and October 2003 (Appendix B). DWM field crews did not note any objectionable conditions (trash, scums, odors, etc) at either station (Appendix B). White foam was generally noted at both stations, although it is believe to be natural (Appendix B).

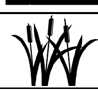
At Station WAX *E. coli* counts ranging from 2 – 880 cfu/100 and the geometric mean of 87.6 met criteria. Only one bacteria count exceeded 235 cfu/100ml at this station and this sample represented wet weather conditions.

At Station WA06A, *E. coli* counts ranging from 2 - 1100 cfu/100 and the geometric mean of 143.4 exceeded the primary contact recreation criterion. Three bacteria counts exceeded 235 cfu/100ml at this station. The highest counts represented both wet and dry weather conditions.

Parameter	Station WAX (n=6)	Station WA06A (n=6)
Fecal coliform (cfu/100mL)	8 - 1200	4 - 3700
Geometric mean	142.6	260.1
E. coli (cfu/100mL)	2 - 880	2 - 1100
Geometric mean	87.6	143.4

The *Primary Contact Recreational Use* is assessed as support in the upper 3.8 mile reach of this segment based on bacteria counts at Station WAX and the lower 7.7 miles of this segment is assessed as impaired for this use due to elevated *E. coli* counts at station WA06A. The *Secondary Contact Recreational Use* is supported as bacteria levels at both stations met the criterion. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Ware River (Segment MA36-05) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT (Upper 3.8 miles) IMPAIRED (Lower 7.7 miles) Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Given the high *E. coli* counts found at Station WA06A bacteria source tracking should be conducted in this area and the Gilbertville area.

Continued water quality sampling and macroinvertebrate sampling should be conducted along this segment to assess the *Aquatic Life Use*.

The Hardwick Water Pollution Control Facilities in Wheelwright and Gilbertville should reduce their whole effluent toxicity to achieve compliance with permit limits.

WARE RIVER (SEGMENT MA36-06)
Location: Ware Dam, Ware, to Thorndike Dam, Palmer
Segment Length: 10.1 miles
Classification: Class B, Warm Water Fishery, CSO**

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5- Waters requiring a TMDL. Pollutants needing TMDLs: Pathogens (MassDEP 2007b).

** Although this segment is classified as a CSO in the 2006 standards, there are currently no CSOs in this segment, so this should not be classified with a CSO qualifier. Future standards will reflect this fact.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Cascades Diamond Inc. Registration # 10822705
Ware Water Department Registration/Permit (10806101/9P210830903)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D1, D2, D4)
Town of Ware- Ware Wastewater Treatment Plant (MA0100889)
Palmer Water Pollution Control Facilities (MA0101168)
Town of Palmer (MAR041017)
Quabbin Wire & Cable Co. Inc (MA0030571, MAR00A028)

Palmer WWTP (MA0101168) was permitted to discharge through two CSO outfalls (# 019 and 020) in this segment of the Ware River. The permit was issued (29 September 2000). Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate CSO #019 (and to disconnect the 100 GPM stream from entering the sewer system) was proposed for the first phase of work at an estimated cost of $135,000. In 1999 the Town of Palmer submitted a request for Massachusetts SRF financing for the first three phases of work and was selected to receive financing for the $7.1 million dollars worth of sewer separation work to be performed in the first three phases. MassDEP approved sewer separation, including drainage areas to CSO #019, in December 2000 as part of CW SRF-423. CSO #020 was blocked and inactive by 2001, while CSO #019 was blocked in 2003 (Boisjolie 2005), so the combined sewer overflow has been eliminated.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
The USGS maintains a gage on the Ware River (Gage 01173500) 0.5 mi upstream from Gibbs Crossing. The drainage area for this gage is 197 mi^2 and the average annual discharge is 294 cfs (period of record 1931-2005 (USGS 2007). The maximum discharge occurred on 21 September 1938 (22,700 cfs) *(Socolow et al. 2004)*. The maximum discharge since the construction of Barre Falls Reservoir in 1958, occurred on 6 March 1979 (5,050 cfs) (Socolow 2004). The minimum discharge occurred on 24 August 1995 (4.2 cfs) *(Socolow et al. 2004)*. The USGS remarks that there have been diversions at times since March 1931 from 96.3 mi^2 to supply water to Boston Metropolitan district (now MA DCR) and since 1955 from 6.5 mi^2 for municipal water supply to Fitchburg *(Socolow et al. 2004)*. Since 1958 flow has been regulated by mills upstream and by Barre Falls Reservoir *(Socolow et al. 2004)*.

<u>Biology</u>
On April 16th 2003 the CERO crew noticed heavy sand deposits near the Gibbs Crossing (Route 32) bridge. These deposits were also noticed later during the 2003 field season (May 16) by DWM field crews. Beaudoin (2006) states that the "bottom at this site shows ever-increasing embeddedness but not yet covered in sand".

Toxicity

Effluent

Whole effluent toxicity tests have been conducted on the Ware Wastewater Treatment Plant (WWTP) treated effluent. Between July 2000 and May 2007 twenty-eight valid chronic tests were conducted using *C. dubia.* The chronic whole effluent toxicity tests using *C. dubia* ranged between <6.25% and 100% effluent (n=28). Of the 28 tests, twenty did not meet the required limit of >7%. The January 2001 test and the tests from November 2002 to May 2007 were all $\leq$6.25%. The LC_{50} ranged from 71% to 100% effluent. Five of the 24 tests did not meet the required limit (Appendix D).

Water Chemistry

DWM conducted water quality monitoring at one station (WA09A-Route 32 at Gibbs Crossing, Ware) along this segment of the Ware River between May and August 2003 (Appendix B). *In-situ* parameters were measured on four occasions with three measurements during pre-dawn hours. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

The DWM station is also a MassDEP Central Regional Office Strategic Monitoring and Assessment for River Basin Teams' station. CERO crews also conduct water quality monitoring at this location yearly in addition to DWM sampling (1998 to present).

Water quality parameters met state standards and nutrient concentrations were generally low at this station with the exception of one elevated total phosphorus concentration in June 2003. *In-situ* measurements from 2001 to 2003 as collected by DWM and CERO crews indicated good water quality conditions. *The Aquatic Life Use* is assessed as support given good water quality conditions. This use is given an "Alert Status" due to the acute and chronic whole effluent toxicity from the Ware Wastewater Treatment Plant discharge.

Primary and Secondary Contact Recreation and Aesthetics Uses

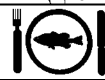
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (WA09A-Route 32 at Gibbs Crossing, Ware) along this segment of the Ware River on one occasion in May (Appendix B). CERO crews in coordination with the DWM sampling effort conducted fecal coliform and *E. coli* bacteria monitoring on three occasions. Bacteria samples collected on August 20th, 2003 did not meet data quality objectives in terms of reproducibility (Appendix B).

Parameter	DWM 2003 (n=4)
Fecal coliform (cfu/100mL)	<2 -190
Geometric mean	37.8
E. coli (cfu/100mL)	2 - 150
Geometric mean	26.6

Both DWM field crews and CERO crews found objectionable deposits in the form of garbage and trash on the stream banks and in the stream (including tire, metals, bottles etc.) throughout the sampling season. The extent of trash coverage in this segment is not known, but isn't considered to be widespread. Water odors were not noted by either field crew. DWM field crews did not notice any scums, although CERO crews noticed small quarter size patches of foam in June, July, August and October. Water clarity was generally clear. Field crews also noted undercut banks.

The samples collected by DWM and CERO crews had low fecal coliform and *E. coli* bacteria counts but only four samples were collected and more data are needed to assess the *Primary* and *Secondary Contact Recreation Uses*, so both uses are not assessed. Given the general lack of objectionable conditions the *Aesthetics Use* is assessed as support for this segment.

Ware River (Segment MA36-06) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

The Ware Wastewater Treatment Plant should reduce their whole effluent and chronic toxicity to achieve compliance with permit limits.

Continued water quality sampling and macroinvertebrate sampling should be conducted along this segment to assess *Aquatic Life Use*.

A habitat walk should be conducted at Station WA09A to determine the extent of sedimentation and embeddednessat this station. Best management practices should be instituted to prevent further degradation of in-stream habitat.

Conduct bacteria sampling to assess recreational uses.

WARE RIVER (SEGMENT MA36-07)
Location: Thorndike Dam, Palmer, to confluence with Quaboag River (forming headwaters Chicopee River), Palmer
Segment Length: 2.5 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2 D4)
Town of Palmer- Palmer Water Pollution Control Facilities (MA0101168)
Town of Palmer- (MAR041017)

Palmer WWTP (MA0101168) is permitted to discharge via six wet weather CSOs in this segment of the Ware River. The Town's permit was issued on 29 September 2000. Hydraulic modeling performed as part of Palmer's CSO Abatement Plan estimated the following discharge quantities based on a three-month frequency storm.

Village of Thorndike:	021A	no data avalaible
	021B	sealed, no longer discharges
	22	8,000 gallons
	023A	5,000 gallons
	023B	no data available
Village of Three Rivers:	18	23,000 gallons

Palmer's May 1999 final Long Term Control Plan for CSO abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate CSO #021A, 022, 023A, 023B and 018 is not scheduled until the fourth phase, which has an estimated cost of approximately 1.32 million dollars. However, the regulator structures to CSO # 018, 023A, 023B and 022 were scheduled to be adjusted (raised) in Phase I of the project, in order to maximize the flow to the WWTP and minimize CSO discharges from these regulators. The final adjustment of these weirs has not yet been completed. If successful, the fourth phase of sewer separation may not be required or considered to be cost effective (MassDEP 2001).

In 1999 Palmer submitted a request for MA SRF financing for the first 3 phases of work, and in November 1999 was selected to be eligible for $7.1 million in financing for the first 3 phases of sewer separation (including raising overflow weirs at CSO # 022, 023A, 023B and 018). The MassDEP in December 2000 approved this work as part of CW SRF-423. The contract was awarded in 2001 (Boisjolie 2001). Currently CSO #018, 23A, 023B and 022 are active and final adjustments of their weirs has not been completed (Boisjolie 2007a). The fourth phase of work is currently scheduled by the Town for 2012 (Boisjolie 2007a).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Toxicity</u>
Ambient
Palmer Water Pollution Control Facility staff collect water from the Ware River, about 500 feet from the railroad tracks and about a half mile from where the Ware River and the Quaboag River converge, for use as dilution water in the facility's whole effluent toxicity. Between July 2000 and

March 2007 survival of *C. dubia* exposed (approximately 7 days) to the Ware River water ranged from 80 to 100% (n=27). Hardness ranged from 12.0 mg/L to 52.0 mg/L (n=27).

Effluent
Whole effluent toxicity tests have been conducted on the Palmer Water Pollution Control Facility treated effluent. Between July 2000 and March 2007 twenty-six valid chronic tests were conducted using *C. dubia.* Results of the chronic whole effluent toxicity tests using *C. dubia* ranged from 6.25% to $\geq$100% effluent (n=26). June 2001 showed a significant difference in reproduction for 25% effluent. The LC_{50} results were all 100% effluent (n=28) with the exception of September 2004, which was 33.0% (Appendix D).

Water Chemistry
DWM conducted water quality monitoring at one station (WA12 – Route 181, Palmer) along this segment of the Ware River between May and August 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). All parameters met water quality criteria. All water samples collected at this station had low ammonia-nitrogen concentrations and total phosphorus was generally low although somewhat elevated in June and July (Appendix B).

Based on the good survival of test organisms exposed to river water and good water quality conditions, the *Aquatic Life Use* is assessed as support.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (WA12 – Route 181, Palmer) along this segment of the Ware River between April and October 2003 (Appendix B). The geometric mean for *E. coli* of samples collected at this station was 50.1 cfu/100mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	2 – 510
Geometric mean	101.5
E. coli (cfu/100mL)	2 – 180
Geometric mean	50.1

No objectionable deposits or water odors were noted by DWM field crews at this site. A white foam, believed to be naturally-occurring, was noted on the majority of occasions during the 2003 sampling season. Water clarity was generally either clear or slightly turbid. DWM field crews noted that the banks are slightly undercut at this location.

The *Primary* and *Secondary Contact Recreation Use* are assessed as support given the low geometric mean of *E. coli* counts but given the presence of CSOs are identified with an “Alert Status”. Given the lack of objectionable conditions at this location the *Aesthetics Use* is assessed as support.

Ware River (Segment MA36-07) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT *
Secondary Contact		SUPPORT *
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Continue water quality monitoring to evaluate designated uses. Water quality monitoring should include water chemistry and bacteria monitoring to assess the progress in CSO abatement. Particular attention should be given to a sampling below CSO# 018 and the cluster of CSOs near Summer Street in Thorndike.

Benthic macroinvertebrate sampling should be conducted along this segment to assess the *Aquatic Life Use.*

Quaboag River Subbasin

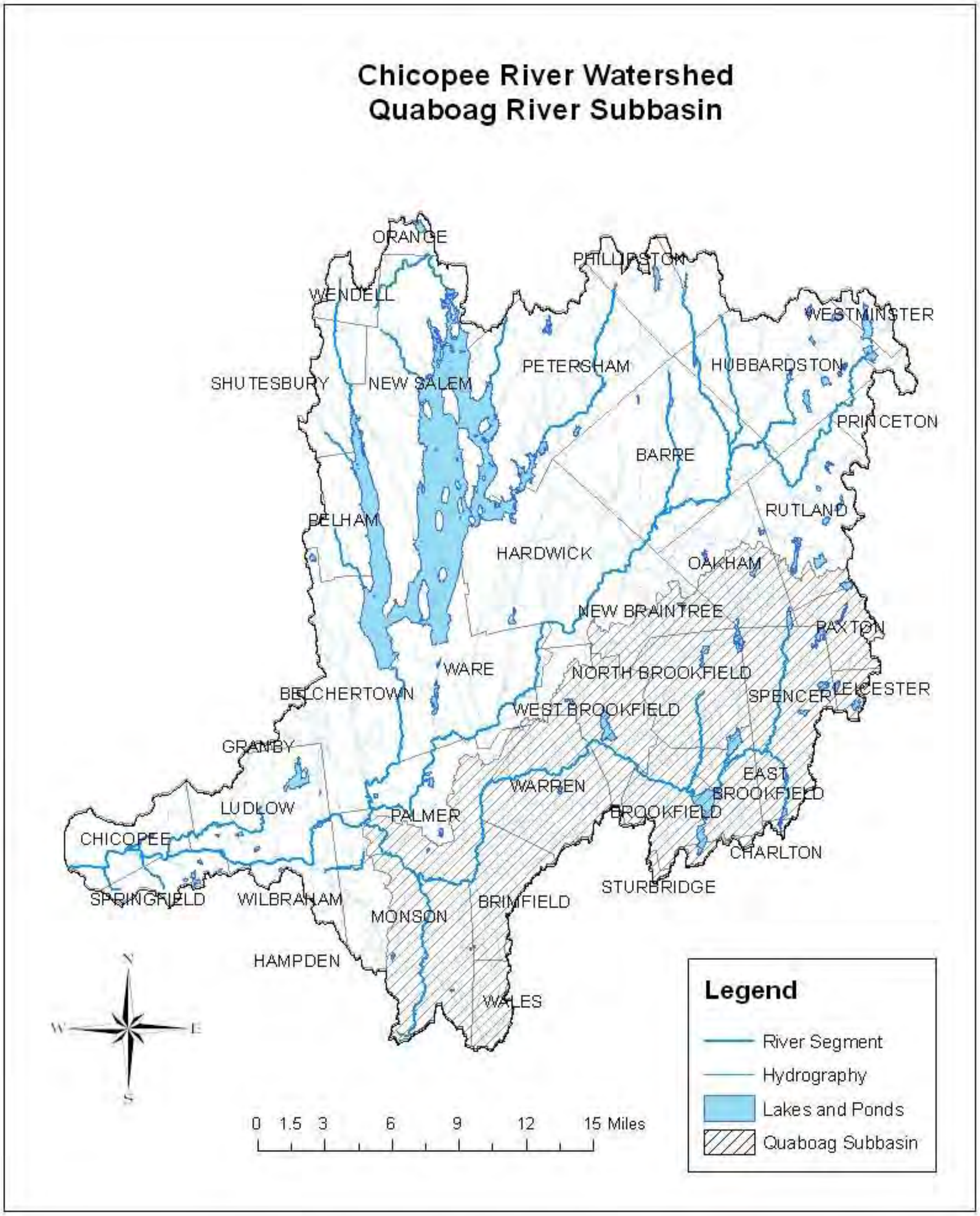


Figure 9: Quaboag River Subbasin

SEVENMILE RIVER (SEGMENT MA36-11)
Location: Source, outlet Browning Pond Spencer to confluence with Cranberry River, Spencer.
Segment Length: 7.3 miles.
Classification: Class B, Warm Water Fishery, High Quality Water.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Bond Construction Company Registration (20828002)
Spencer Water Department Registration/Permit (20828001/9P20828001)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
Town of Spencer (MAR041162)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
The USGS maintained a gage near Spencer, MA, on the Sevenmile River (Gage 01175670) 40 feet upstream from the bridge on Cooney Road and 1.5 miles north of Spencer. In August 2005 the UGSS gage was relocated to the downstream side of the Cooney Road bridge. The drainage area for this gage is 8.81 mi^2 and the period of record is October 1960 to present. The average discharge is 14.9 cfs (1961-2005) (USGS 2007). The maximum discharge occurred on 18 March 1968 (412 cfs) while the minimum discharge occurred on 6, 7, 9, and 18 September 2001 (0.03 cfs) *(Socolow et al. 2004)*. According to the USGS records are good except for estimated daily discharges, which are poor *(Socolow et al. 2004)*. The Sevenmile River has been subject to occasional regulation by upstream ponds since 1971 *(Socolow et al. 2004)*. Flow fluctuations in the Sevenmile River due to the Bond Construction Company's withdrawal have been reported (Conners, 2007).

Biology
MA DFG stocks the Sevenmile River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the Sevenmile River at numerous locations in Spencer.

MA DFG conducted fish population sampling near the Route 31-North Spencer Road crossing and Hasting Road in Spencer (Site 1151) on 29 July 2005 using a backpack electro-shocker (Richards 2006). Twenty-two common shiner, seven pumpkinseed, five tessellated darter, three yellow bullhead, two white sucker, two largemouth bass, two chain pickerel, one fallfish and one bluegill were collected (45 fish total). Although the majority of fish collected at this site are fluvial dependent/fluvial specialist species, a number of macrohabitat generalist species were also represented.

MA DFG conducted fish population sampling upstream from the Cooney Road crossing in Spencer (Site 789) on 18 July 2002 using a backpack electro-shocker (Richards 2006). Seventy-two common shiner, thirty longnose dace, thirty-six eastern blacknose dace, nineteen fallfish, thirteen yellow bullhead, eleven tessellated darter, five white sucker, three chain pickerel, and one brook trout were collected (197 fish total). The fish community was dominated by fluvial dependent/fluvial specialist species.

MA DFG conducted fish population sampling downstream from the Cooney Road crossing in Spencer (Site 791) on 18 July 2002 using a backpack electro-shocker (Richards 2006). Thirty-two fallfish, twenty-eight common shiner, twenty-three tessellated darter, nineteen longnose dace, eighteen yellow bullhead, seven eastern blacknose dace, four white sucker, three chain pickerel, two bluegill, two brown bullhead, one hybrid redfin/chain pickerel, and one golden shiner were collected (140 fish total). The majority of fish collected at this site are fluvial dependent/fluvial specialist species.

MA DFG conducted fish population sampling south of the Cooney Road crossing in Spencer (Site 1150) on 28 July 2005 using a backpack electro-shocker (Richards 2006). Fifty-six fallfish, eight yellow bullhead, four longnose dace, two yellow perch, two common shiner, two white sucker, and one brown trout were collected (75 fish total). The majority of fish collected at this site are fluvial dependent/fluvial specialist species.

The Sevenmile River is considered to be a Coldwater Fishery Resource (CFR) under criteria developed by the MA DFG. One brook trout was collected in 2002 and appeared to be a wild fish. It is unclear why the Sevenmile River is considered a CRF as historic MA DFG data seems to suggest otherwise. The four trout listed within their historic dataset were all greater than >140 millimeters. It seems possible that these were stocked fish. Although the MA DFG fish surveys did not firmly establish the presence of a reproducing salmonid population, fluvial specialist/dependent species dominated the fish samples at all four locations. The fish assemblages varied somewhat between stations and time, however the consistent fluvial specialist/dependent species suggest a stable flow regime. In addition, a number of the species present are considered only moderately tolerant to pollution. It should be noted that water temperatures as high as 24.3° C have been recently documented by MassDEP (MassDEP 2006a).

Water Chemistry

DWM conducted water quality monitoring at two stations (SMG – Cooney Road at the USGS flow gaging station and SM01- upstream from the Route 9 bridge, Spencer) along this segment of the Sevenmile River between May and October 2003 (Appendix B). Station SMG is also the MassDEP, Central Regional Office, Strategic Monitoring and Assessment for River Basin Teams station. CERO crews conduct water quality monitoring at this location yearly from 1998 to present. CERO data collected between 2001 and 2003 are summarized in this report. Between both crews *in-situ* parameters were measured on ten occasions at Station SMG in 2003 with three measurements during pre-dawn hours. *In-situ* parameters were measured on eight occasions at Station SM01 in 2003 with three measurements during pre-dawn hours. Grab samples were also collected and analyzed for TSS, turbidity and nutrients at both sites (Appendix B).

All water quality parameters at Station SMG met state criteria with the exception of a few low pH measurements in the winter during the CERO sampling. Generally nutrient concentrations at this station were low. The total phosphorus concentration was greater than 0.050 mg/L on only one occasion (MassDEP 2006a). For a summary of water quality data collected at Station SMG by both crews see table below.

Parameter	DWM 2003	CERO (2001-2003)
DO (mg/L)	7.3 – 10.6 (n=4)	7.2 – 13.6 (n=16)
pH (SU)	6.6 - 6.8 (n=4)	5.7 – 6.8 (n=17)
Temperature (℃)	12.7 – 22.3 (n=4)	-0.11 – 24.3 (n=17)
Conductivity (µS/cm at 25℃)	86.0 –102 (n=4)	64.1 – 108 (n=17)
Ammonia- nitrogen (mg/L)	<0.02 (n=1)	<0.02 –0.06 (n=17)
Nitrate – nitrite nitrogen (mg/L)	--	<0.02 – 0. 19 (n=17)
Total Kjeldahl nitrogen (mg/L)	--	0.14 – 0.43 (n=17)
Total phosphorus (mg/L)	0.009 – 0.014 (n=2)	0.009 – 0.069 (n=17)
Alkalinity (mg/L)	--	3 – 11 (n=17)
Total suspended solids (mg/L)	2 (n=1)	<1 – 16 (n=17)
Turbidity (NTU)	0.77 (n=1)	0.65 – 9.0 (n=17)

Low dissolved oxygen concentrations, which does not meet standards criteria, were documented on five of the eight sampling events at Station SM01, although on three occasions the DO measurements were taken during predawn, worst-case conditions (Appendix B). Site SM01 is downstream from the Great Meadow wetland area and the Sevenmile River is relatively low gradient along this stretch of the river, which may contribute to naturally low dissolved oxygen. There are also large areas of agriculture upstream from the Great Meadows wetland area. pH is also slightly below the criterion at Station SM01. TDS and conductivity are also higher at SM01 than Station SMG (Appendix B). Nutrients at this station were low (Appendix B).

The *Aquatic Life* use is assessed as support given the presence of fluvial specialists/dependent fish species and generally good water quality conditions. However, the segment is identified with an "Alert Status" due to the low dissolved oxygen and low pH found at SM01. There is uncertainty over whether low DO is due to natural conditions. Historic measurements in the 1980s met the criterion and were higher than found during 2003 sampling (Kimball 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (SMG – Cooney Road at the USGS flow gaging station and SM01- upstream from the Route 9 bridge, Spencer) along this segment of the Sevenmile River between May and October 2003 (Appendix B). DWM and CERO crews collected four bacteria samples in 2003. All of these samples had low bacteria counts and represent both wet and dry weather conditions (Appendix B, MassDEP 2006a). Six bacteria samples were collected by DWM at Station SM01 and, with the exception of the October 15th sample, all samples had low bacteria counts. The October 15th sample result was 1000 cfu/100 ml *E. coli* and represents wet weather conditions. The geometric mean of all bacteria samples collected by DWM crews at Station SM01 is 51.7 cfu/100mL. Not enough data was collected at station SMG to compute a geometric mean.

Parameter	DWM SM01 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 1000
Geometric mean	53.6
E. coli (cfu/100mL)	<2 - 1000
Geometric mean	40.9

CERO crews noted that sunken granite blocks from a partially dismantled dam were present at Station SMG. Neither DWM field crews nor CERO crews noted any objectionable deposits at Station SMG. No water odors were noted but white foam was commonly observed at this site. The river at Station SMG appears to be a depositional area for sand/gravel, possibly from extraction activities upstream. A large gravel bar has formed on the western bank and has blocked flow through the western culvert except on extreme high flows.

DWM field crews did not find any objectionable deposits at Station SM01 with the exception of minimal trash on one occasion. No scums were noted at Station SM01 and no water odor was noted with the exception of one occasion when a musty smell was noted. Slight bank erosion and undercut banks were noted at this station.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on low bacteria counts. One wet weather sample on October 15th had a high bacteria count, so the *Primary Contact Recreation Use* is identified with an "Alert" status". The *Aesthetics Use* is assessed as support given the general lack of objectionable conditions noted by both DWM and CERO field crews.

Sevenmile River (Segment MA36-11) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Continue water quality monitoring to evaluate designated uses.

Conduct bacteria sampling during wet weather events to determine whether bacterial source tracking is warranted with special attention paid to Station SM01.

Conduct macroinvertebrate sampling to fully assess the *Aquatic Life Use*.

CRANBERRY RIVER (SEGMENT MA36-20)
Location: Source, outlet Cranberry Meadow Pond in Spencer to confluence with Sevenmile River, Spencer
Segment Length: 3.6 miles
Classification: Class B, High Quality Water

Howe Pond (MA36073) will no longer be reported on as an approximately 12-acre lake segment since the estimated retention time of this waterbody is approximately 3 days. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01175670 and 01173000) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Spencer Water Department Registration/Permit (20828001/9P20828001)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Town of Spencer- Spencer Wastewater Treatment Plant (MA0100919)
Town of Spencer- MAR041162

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks the Cranberry River and Howe Pond with trout (MA DFG 2007). MA DFG conducted fish population sampling in Cranberry River near Howe Road, Spencer State Park, Spencer (Site 1147), on 2 August 2005 using a backpack electro-shocker (Richards 2006). Thirty yellow bullhead, twelve pumpkinseed, nine bluegill, eight white sucker, six chain pickerel, two brown trout, two largemouth bass, one black crappie, one tadpole madtom, and one fallfish were collected (72 fish total).

The Cranberry River is considered to be a Coldwater Fishery Resource under criteria developed by the MA DFG. At one station in 1983 multiple age classes of reproducing brook trout were collected (Richards 2006). Although the 2005 survey did not result in the collection of brook trout it is unclear as to the exact location of the 1983 sampling station. The fish assemblage documented as result of the 2005 survey consists of mostly macrohabitat generalist species. It is possible that the species composition is habitat related since the 2005 sampling station is just downstream from Howe Pond in and upstream from a forested wetland. Additional monitoring of the Cranberry River in an attempt to document the continued presence and extent of brook trout within this watershed is warranted.

Toxicity
Ambient
The Spencer Wastewater Treatment Plant (WWTP) staff collected water from the Cranberry River at the South Spencer Road Crossing for use as dilution water in the facility's whole effluent toxicity tests. Between May 2003 and May 2007 survival of *C. dubia* exposed (approximately 7 days) to the Cranberry River water ranged from 70 to 100% (n=17). Survival was <75% in only one test. Hardness ranged from 18.0 mg/L to 44.0 mg/L (n=17).

Effluent
Whole effluent toxicity tests have been conducted on the Spencer Wastewater Treatment Plant (WWTP) treated effluent. Between May 2000 and May 2007, twenty-two valid chronic tests were

conducted using *C. dubia.* The chronic whole effluent toxicity tests using *C. dubia* were all >100% effluent (n=27). Results of the LC_{50} were all 100% effluent (n=24) (Appendix D).

Water Chemistry
DWM conducted water quality monitoring at one station (CRN01-South Spencer Road, Spencer) along this segment of the Cranberry River between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). On two occasions dissolved oxygen did not meet the criterion and pH was generally below the criterion, but by less than 0.5 SU. There are large wetland areas upstream from the sampling station. A beaver dam was noted in May near this station and by November it was breached with the installation of a culvert. Beaver activity is common upstream from the sampling station. There is also a large impoundment upstream from the sampling station. Given these factors it is likely that low dissolved oxygen and pH values are due to natural conditions. Nutrients at this station were also low.

The *Aquatic Life Use* is assessed as support given the good survival of test organisms and good water quality conditions. However, this use is identified with an “Alert Status” due to occasional low dissolved oxygen concentrations and the absence of brook trout and other fluvial species. The low dissolved oxygen conditions are likely to be naturally-occurring.

Primary and Secondary Contact Recreation and Aesthetics Uses
Howe Pond Beach in Spencer State Forest is present on this segment. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, this information is not used to assess the contact recreational uses. The pond is currently marked with “No Swimming” signs.

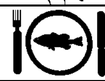
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CRN01-South Spencer Road, Spencer) along this segment of the Cranberry River between April and October 2003 (Appendix B). Bacteria counts during both wet and dry weather at this site were low with the exception of October 15th, which had a bacteria count of 480 cfu/100mL and represents a wet weather sampling event. The geometric mean of *E. coli* counts was 53.3 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	2 - 500
Geometric mean	72.4
E. coli (cfu/100mL)	2 - 480
Geometric mean	53.3

DWM field crews did not find any objectionable deposits with the exception of trash on one occasion and sand from the road on two occasions. No water odors or scums were noted by DWM field crews. Slight shoreline erosion was noted at this site.

The *Primary* and *Secondary Contact Recreational Uses* are assessed as support as the geometric mean of E. coli counts meets the criterion. *Primary Contact Recreation Use* is identified with an “Alert Status” given the one wet weather sample that exceeded 235 cfu/100mL. Given the lack of objectionable conditions at this location the *Aesthetics Use* is assessed as support.

Cranberry River (Segment MA36-20) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses. Water quality monitoring below the Spencer WWTP could test for total phosphorus and copper to document in stream conditions before any future Spencer WWTP upgrades.

SEVENMILE RIVER (SEGMENT MA36-12)
Location: Confluence with Cranberry River, Spencer, to confluence with East Brookfield River, East Brookfield
Segment Length: 2.5 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from this subwatershed.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
Town of Spencer (MAR041162)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
DWM field crews noted sand deposits coming from Route 49 at one water quality monitoring station (SM02, Route 49 Bridge, Spencer). Slight erosion was noted at this site in addition to sand deposits. On April 16th 2003 the sand deposits were characterized as "forming large delta from Route 49" and it was noted that the road lacks a catch basin (Appendix B).

Biology
MA DFG stocks the Sevenmile River with trout (MA DFG 2007).

Water Chemistry
DWM conducted water quality monitoring at one station (SM02, Route 49 Bridge, Spencer) along this segment of the Sevenmile River between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). Generally pH was slightly less than the criterion. On one occasion (during worst-case conditions) dissolved oxygen did not meet the criterion. Ammonia-nitrogen and total phosphorus concentrations at Station SM02 were generally low.

The *Aquatic Life Use* is assessed as support for this segment given generally good water quality conditions.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (SM02, Route 49 Bridge, Spencer) along this segment of the Sevenmile River between April and October 2003 (Appendix B). Bacteria counts during both wet and dry weather at this site were low with the exception of October 15th, which had a bacteria count of 440 cfu/100mL and represents a wet weather sampling event. The geometric mean of *E. coli* counts was 42.0 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	< 2-1100
Geometric mean	89.3
E. coli (cfu/100mL)	<2 - 440
Geometric mean	42.0

DWM field crews did not find any objectionable deposits with the exception of two occasions where sand deposits coming from Route 49 were observed. Slight erosion was noted at this site in addition to sand deposits. No water odors or scums were noted except on one occasion when a chlorine smell was noted and an oil sheen was found. Water clarity was generally recorded as slightly turbid.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on low bacteria counts. Elevated bacteria counts found during wet weather sampling by DWM are a cause of concern. Elevated bacteria counts at the Route 49 bridge found by ESS in 2002 during both dry and wet weather are also a cause of concern (ESS 2005). Given these facts this segment is given “Alert Status” for *Primary Contact Recreation Use*. Given the general lack of objectionable conditions at this location the *Aesthetics Use* is assessed as support.

Sevenmile River (Segment MA36-12) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
The recommendations of the Quaboag and Quacumquasit Ponds TMDL (MassDEP 2006b) affecting this tributary should be implemented.

Best management practices should be instituted to stop sand deposition in the Sevenmile River where it crosses under Route 49 in Spencer. A habitat walk should be conducted to determine the extent of sand deposition and quality of habitat along this reach.

Macroinvertebrate sampling should be conducted to determine water quality and assess *Aquatic Life Use* in this segment.

Effluent from the Spencer WWTP generally has greater copper concentrations than its permitted value and may have adverse affects on aquatic life in the upper part of this segment. Recently a copper removal optimization engineering report required by an Administrative Order from the EPA was written for the town of Spencer. The engineering report outlines steps to reduce copper in town drinking water and treatment techniques available at the Spencer WWTP to reduce copper concentrations in the plants effluent. Copper testing in the upper Sevenmile River to document conditions before any future Spencer WWTP upgrades may be conducted.

EAST BROOKFIELD RIVER (SEGMENT MA36-13)
Location: Outlet Lake Lashaway East Brookfield to Quaboag Pond, East Brookfield
Segment Length: 2.4 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
East Brookfield Water Department Registration # 20808401
Brookfield Water Department Registration # 20804501

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
Flow into the East Brookfield River is controlled by the outlet structure on Lake Lashaway. During the fall the outlet structure is adjusted to release water in order to draw down the lake. This management practice was instituted in 1984 to prevent excessive macrophyte growth and has been conducted annually since then.

Biology
In July and August the invasive species fanwort (*Cabomba carolinia)* was found at in the river near Shore Road (Station EB04A). The close proximity to Quaboag Pond explains the presence of many pond plant species found there.

Water Chemistry
DWM conducted water quality monitoring at two stations (EB04 – below Lake Lashaway outlet structures and EB04A – Shore Road, East Brookfield) along this segment of the East Brookfield River between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). These stations were also part of DWM 2003 TMDL monitoring for Quaboag Pond. For a complete analysis of nutrients loading in and from the East Brookfield River consult *Quaboag and Quacumquasit Ponds Total Phosphorus Total Maximum Daily Load* (Mass DEP 2006b). Station EB04 meets all criteria and its location below Lake Lashaway makes it very different from EB04A, which is located below a large wetland.

Station EB04A has lower temperature and generally lower pH than Station EB04. Station EB04A did not meet the dissolved oxygen criterion on four occasions. It's location below a large swamp may be the cause of the low dissolved oxygen levels found there. Nutrient concentrations (ammonia-nitrogen and total phosphorus) at both EB04 and EB04A were fairly low.

Although the first 0.6 miles of this segment, from Lake Lashaway to the confluence with the Sevenmile River exhibits good water quality conditions it is assessed as impaired for the entire length due to the presence of the non-native plant species, *Cabomba caroliniana* [see below] The lower 1.85 miles of the river, from the confluence with the Sevenmile River to Quaboag Pond, is assessed as impaired based on low dissolved oxygen concentrations and best professional judgement.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (EB04 – below Lake

Lashaway outlet structures and EB04A – Shore Road, East Brookfield) along this segment of the East Brookfield River between April and October 2003 (Appendix B). All samples collected at both stations had low bacteria counts. The geometric mean of *E. coli* counts was less than 15 cfu/100 mL at both stations.

Parameter	DWM 2003 EB04 (n=12)	DWM 2003 EB04A (n=12)
Fecal coliform (cfu/100mL)	<2-100	<2 - 152
Geometric mean	12.2	16.9
E. coli (cfu/100mL)	<2-90	<0.9 – 100
Geometric mean	9.4	10.6

On four occasions DWM field crews noted objectionable deposits at Station EB04. Limited trash was found on one occasion, sunken concrete debris on another occasion and two flocculent masses on two occasions (one rust colored). On the majority of occasions DWM field crews did not note any objectionable deposits. Water odor was not noted with the exception of a musty smell on one occasion and a fishy smell on two occasions. White foam was generally noted at this station, but was considered to be naturally-occurring. Water clarity was often slightly turbid, otherwise it was clear. The west bank (opposite lake discharge pipe) was observed to be eroding according to DWM field crews.

DWM field crews did not find any objectionable deposits at Station EB04A during the sampling season. No water odors or scums were noted. No shoreline erosion was found and water clarity was generally slightly turbid. Field crews found sparse to dense amounts of many different types of aquatic plants (submerged, emergent and floating) during the sampling season.

Both *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on low bacteria counts. Given the generally good aesthetic conditions found at both stations the *Aesthetics Use* is assessed as support.

East Brookfield River (Segment MA36-13) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants, low DO Source: Introduction of non-native organisms, Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

RECOMMENDATIONS

Implement recommendations of the Quaboag and Quacumquasit TMDL (MassDEP 2006b) with special attention to the recommended slow drawdown of Lake Lashaway in the fall.

Due to the presence of large wetlands in the lower section of this segment and Lake Lashaway's impact on the upper section of this segment it is difficult to find an ideal sampling location to assess this segment. Multiple multiprobes could be deployed along this segment especially at the beginning of the wetland-influenced section of this segment and also at the confluence with Sevenmile River to evaluate the dissolved oxygen regime.

On-going non-native plant control in Lake Lashaway should continue in order to keep source populations from spreading to the East Brookfield River at a minimum. A stream walk to determine the extent and amount of non-native plants in the East Brookfield River should also be conducted.

QUABOAG RIVER (SEGMENT MA36-14)
Location: Outlet of Quaboag Pond, Brookfield, to Route 67 bridge, West Brookfield.
Segment Length: 6.1miles.
Classification: Class B, Warm Water.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
For a two-mile section the channel bottom of the Quaboag River in West Brookfield is perched, or higher in elevation, than the channel bottom at the outlet of Quaboag Pond (MassDEP 2006b).

Biology
MA DFG conducted fish population sampling in the Quaboag River near the Route 148 bridge in Brookfield (Site 892) on 29 September 2003 using a boat shocker (Richards 2006). Thirty-seven bluegill, twenty-three yellow perch, twenty-one chain pickerel, fifteen golden shiner, eleven pumpkinseed, nine largemouth bass, three creek chubsucker, one black crappie, one brown bullhead, one American eel, one white sucker and one yellow bullhead were collected (124 fish total). The fish sample was heavily dominated by macrohabitat generalist species, which is to be expected given the nature of this reach. The reach is slow, meandering and wetland dominated. Sampling efficiency may have been affected by very poor visibility due to deep and silty water.

DWM conducted water quality monitoring at two stations (QA100 – Route 148, Brookfield and QAOBO –Long Hill Road bridge, West Brookfield) along this segment of the Quaboag River between April and October 2003 (Appendix B). DWM crews made notes of conditions at these sites throughout the sampling season. At Station QA100 phytoplankton was not found with the exception of May 14th when a moderate population was found. Early in the field season sparse coverage of emergent aquatic plants was found. Between June and October a moderate density of aquatic plants (emergent, submerged, and floating) was found at this site. Many pond species were found at this site consistent with its wide shallow nature with extensive wetlands and location below Quaboag Pond. During the first three survey dates moderate coverage of green algae was found on the river bottom, while during the remainder of the sampling season sparse to moderate coverage of thin brown films were noted (Appendix B).

At Station QAOBO sparse to moderate density of aquatic plants was found throughout the sampling season. Arrowhead (*Sagittaria* sp.), lily pads and grass and rush-like plants were found. A moderate phytoplankton was found on August 20th, although generally phytoplankton was not noted. No periphyton coverage was recorded early in the sampling season but by July a moderate coverage of green filamentous algae was found. A moderate coverage of green algae was also found in August, but in October periphyton coverage was not found (Appendix B).

Water Chemistry
DWM conducted water quality monitoring at two stations (QA100 – Route 148, Brookfield, and QAOBO –Long Hill Road bridge, West Brookfield) along this segment of the Quaboag River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. These stations were also part of DWM 2003 TMDL monitoring for Quaboag Pond. Grab samples were also collected and analyzed at both stations for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen was slightly low (4.4 mg/L) and did not meet the criterion at Station QA100 on two occasions (one occasion; pre-dawn worst-case conditions). There are large wetland areas along the Quaboag River near Station QA100.

Dissolved oxygen did not meet the criterion on three occasions (two occasions; pre-dawn worst-case measurements) at Station QAOBO. The extremely low dissolved oxygen concentration (1.9 mg/L) on August 21st, 2003 at Station QAOBO is a concern (Appendix B). A moderate phytoplankton bloom was also noted at this station on August 20th, 2003 during dry weather conditions (Appendix B). Large wetlands are also present just upstream from Station QAOBO. Given the presence of large area of wetlands directly upstream, dry weather conditions, and the fact that the Long Hill Road bridge and the nearby railroad bridge are flow constriction points for the Quaboag River, low dissolved oxygen at this station may be naturally-occurring. pH was below the criterion on occasion but generally met standards. More information on the frequency and duration of low dissolved oxygen at both sites is needed. Total phosphorus concentrations were slightly elevated throughout the summer at both sites. Ammonia-nitrogen concentrations were low at both sites (Appendix B).

The *Aquatic Life Use* is assessed as support for the upper 1.9 miles given the generally good water quality conditions while the lower 4.2 miles is not assessed given uncertainty over whether low dissolved oxygen is naturally-occurring because of the large wetland areas and meandering nature of this reach of the river. The segment is given an “Alert Status” due to the low dissolved oxygen values recorded at both locations.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (QAOBO – Long Hill Road bridge, West Brookfield, and QA100 – Route 148, Brookfield) along this segment of the Quaboag River between April and October 2003 (Appendix B). On 15 October 2003 the *E. coli* count was 460 cfu/100ml at Station QA100 and represents wet weather sampling. All other bacteria counts at the two stations were low. The geometric mean of *E. coli* counts was less than 20 cfu/100 mL at both stations.

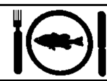
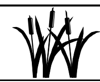
Parameter	DWM 2003 QAOBO 2003 (n=6)	DWM 2003 QA100 (n=6)
Fecal coliform (cfu/100mL)	<2 -410	<2-800
Geometric mean	45.5	15.9
E. coli (cfu/100mL)	<2-120	<2 - 460
Geometric mean	19.7	9.5

No objectionable deposits were found at Station QA100 with the exception of one occasion when limited amounts of plastic bags were noted. DWM field crews noted no scums or water odors. Some limited erosion around a boat launch area was noted early in the sampling season but generally erosion was not noted.

Objectionable deposits in the form of siltation on the left bank from a storm drain and sand deposits on the right bank coming from the road were noted on three occasions at Station QAOBO. Water odor was not noted by DWM field crews and scums were not found with the exception of two occasions when limited patches of scum were noted. Water clarity was clear on all sampling occasions and no erosion was noted.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on the low bacteria counts. Given the general lack of objectionable conditions noted by DWM field crews, the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-14) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT (Upper 1.9 miles)* NOT ASSESSED (Lower 4.2 miles)*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

Multiprobe sampling further downstream at the route 67 bridge in West Brookfield in addition to sampling at the Long Hill Bridge may be warranted to determine the extent and duration of low dissolved oxygen.

FORGET-ME-NOT-BROOK (SEGMENT MA36-18)
Location: Headwaters to North Brookfield WWTP, North Brookfield
Segment Length: 1.7 miles
Classification: Class B, Cold Water Fishery, High Quality Water

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life and Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Toxicity
Ambient
The North Brookfield Wastewater Treatment Facility (WWTF) staff collected water from Forget-Me-Not Brook approximately 10 feet north of East Brookfield Road for use as dilution water in the facility's whole effluent toxicity tests. Between July 2000 and February 2006 survival of *C. dubia* exposed (approximately 7 days) to the Forget-Me-Not Brook water ranged from 80 to 100% (n=23). Between July 2000 and February 2006 survival of *P. promelas* exposed (approximately 7 days) to the Forget –Me-Not Brook water ranged from 63 to 100% (n=23). Three tests were less than 75%. Hardness ranged from 20.0 mg/L to 64.0 mg/L (n=26).

Water Chemistry
DWM conducted water quality monitoring in Forget-Me-Not Brook upstream from the East Brookfield Road bridge in North Brookfield, MA (Station DB08) between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperatures were above 20 degrees C on four occasions while dissolved oxygen concentrations were less than 6 mg/L on three occasions. pH met the criteria on all occasions. Ammonia-nitrogen concentrations in the collected samples were generally low. Total phosphorus concentrations collected during the June, July and August sampling dates were elevated.

The *Aquatic Life Use* is assessed as support given the good survival of test organisms and generally good water quality conditions, however elevated temperatures and elevated total phosphorus concentrations are of concern so this use is identified with an "Alert Status".

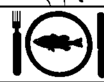
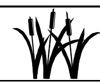
Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (DB08) along this segment of Forget-Me-Not Brook between April and October 2003 (Appendix B). The two highest *E. coli* counts were 1050 cfu/100mL and 4100 cfu/100mL during the June and October sampling dates, respectively. These high bacteria counts were collected during wet weather sampling while bacteria counts were low during dry weather conditions. The geometric mean of *E. coli* counts was 100.5 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 6000
Geometric mean	183.3
E. coli (cfu/100mL)	<2 - 4100
Geometric mean	100.5

No objectionable deposits were found at Station DB08 with the exception of one occasion when a heavy, rusty brown bottom floc was noted. No scums were found and no water odors were noted with the exception of one date when a musty water smell was noted. Water clarity was generally slightly turbid at this location and no streambank erosion was noted.

The *Primary* and *Secondary Contact Recreation Use* are assessed as support as the geometric mean of *E. coli* counts meets the criterion. Due to the two elevated bacteria counts these uses are identified with an “Alert Status”. The *Secondary Contact Recreation Use* is assessed as support given the low geometric mean of *E. coli* counts. The *Secondary Contact Recreation Use* is given an “Alert Status” due to the two elevated bacteria counts. Given the lack of objectionable conditions, the *Aesthetics Use* is assessed as support for this segment

Forget-Me-Not-Brook (Segment MA36-18) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct benthic invertebrate monitoring upstream from the North Brookfield Wastewater Treatment Facility in this segment and in the downstream segment to assess the impact of the treatment plant on Forget-Me-Not Brook and assess *Aquatic Life Use*.

Conduct temperature monitoring on Forget-Me-Not Brook to determine whether it is meeting temperature standards for a cold water fishery.

Conduct bacteria source tracking at Station DB08 to determine the source of high wet weather bacteria counts.

Conduct water chemistry monitoring above the North Brookfield Wastewater Treatment Plant to compare to values below the treatment plant

FORGET-ME-NOT-BROOK (SEGMENT MA36-28)
Location: North Brookfield WWTP, North Brookfield, to confluence with Dunn Brook, East Brookfield/Brookfield
Segment Length: 1.3 miles.
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, “Waters requiring a TMDL”. Pollutants needing TMDLs: Cause unknown, unknown toxicity, organic enrichment/low DO, taste, odor and color (MassDEP 2007b).

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Town of North Brookfield- North Brookfield Wastewater Treatment Facility (MA0101061)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
DWM conducted water quality monitoring at one station (DB07) along this segment of Forget-Me-Not Brook downstream from the North Brookfield Wastewater Treatment Plant’s discharge between May and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. Moderate densities of green algae and sparse to moderate densities of thin, brown film algae were found on substrates at this site during the sampling season. A brown floc on the stream bottom was also found on August 20th. Sparse and moderate amounts of phytoplankton were found on May 14th and June 18th, respectively, although none were found on the other survey dates. Sparse densities of grasses were found early in the sampling season but later in the sampling season no aquatic plants were noted.

MA DFG conducted fish population sampling in Forget-Me-Not-Brook at the West Main Street crossing in North Brookfield (Site 1391) on 4 August 2005 using a backpack electro-shocker (Richards 2006). Nine white sucker, seven blacknosed dace, three yellow bullhead, two chain pickerel, one pumpkinseed, and one bluegill were collected (23 fish total). MA DFG fish biologists noted that they sampled 90% of the sample reach and that the water was cloudy.

Toxicity
Effluent
Whole effluent toxicity tests have been conducted on the North Brookfield Wastewater Treatment Facility (WWTF) treated effluent. Between July 2000 and May 2007 twenty-eight valid chronic tests were conducted using *C. dubia* and 30 using *P. promelas.* The chronic whole effluent toxicity tests using *C. dubia* were all 100% effluent (n=28) with the exception of five occasions. Generally no distinct pattern relating effluent chemistry and the poor *C. dubia* CNOEC tests exists, although in February 2005 ammonia-nitrogen was elevated. The chronic whole effluent toxicity tests using *P. promelas* were all 100% (n=23) with the exception of July 2001 which was 25%. In the May 2007 CNOEC test, using *P. promelas,* significant effects were observed in 25% effluent, although the lab reported CNOEC = 100% effluent. Results of the LC_{50} were all $\geq$100% effluent. Ambient toxicity tests for the North Brookfield Wastewater Treatment plant were sampled upstream of the treatment plant in Forget-Me-Not-Brook (Segment MA36-18) and are detailed in that segment.

Water Chemistry
DWM conducted water quality monitoring in Forget-Me-Not Brook downstream from the East Brookfield Road bridge in North Brookfield, MA (Station DB07), between May and October 2003 (Appendix B). This station is downstream from the North Brookfield Wastewater Treatment Plant’s discharge. *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All dissolved oxygen, pH and temperature measurements met standards at the DWM monitoring station. Ammonia-nitrogen concentrations were low in the samples collected by DWM although total phosphorus concentrations were all elevated.

The *Aquatic Life Use* is assessed as support given the good water quality conditions. However, the segment is given an "Alert Status" due to the observed chronic effluent toxicity of the North Brookfield Wastewater Treatment Plant's discharge and the elevated total phosphorus concentrations.

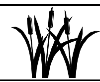
Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (DB07) along this segment of Forget-Me-Not Brook between April and October 2003 (Appendix B). *E. coli* bacteria counts were elevated on two wet weather sampling events. The highest *E. coli* count of 5100 cfu/100 mL was measured on 15 October 2003, a wet weather sampling event. Station DB08 is located downstream from the North Brookfield Wastewater Treatment Plant's discharge. During dry weather *E. coli* counts were low or at the treatment plant's permitted discharge (200 cfu/100mL). Although wet weather sampling events generally had high bacteria counts, the May sampling date low bacteria counts are the exception to this generalization. The geometric mean for *E. coli* at Station DB08 is 194.9 cfu/ 100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	96 - 5200
Geometric mean	255.3
E. coli (cfu/100mL)	60 – 5100
Geometric mean	194.9

No objectionable deposits or scums were noted although the water was often found to have either a septic or musty smell. The septic smell is not surprising given the station's close proximity to the treatment plant's discharge. On one occasion a slight chlorine smell was noted in addition to a septic smell. A brown floc on the stream bottom was also found on August 20th. The water clarity was clear, slightly turbid and highly turbid on two occasions each. No erosion was noted at this site. The MA DFG fish sampling crew also noted the water column was cloudy.

The *Primary Contact Recreation Use* is impaired for Forget-Me-Not Brook due to the elevated geometric mean of *E. Coli* counts. The *Secondary Contact Recreation Use* is assessed as support as the geometric mean of *E. coli* counts meets the criterion. The *Secondary Contact Recreation Use* is given an "Alert Status" due to the one elevated bacteria count. The *Aesthetics Use* is supported given the general lack of objectionable conditions, but is given an "Alert Status" due to the noted water odors and turbidity at Station DB08.

Forget-Me-Not-Brook (Segment MA36-28) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct benthic invertebrate monitoring downstream of the North Brookfield Wastewater Treatment Facility in this segment to assess the impact of the treatment plant on Forget-Me-Not Brook and assess *Aquatic Life Use*.

Conduct water chemistry monitoring below the North Brookfield Wastewater Treatment Plant. The presence of a beaver dam along this segment should be verified and investigated before any future sampling.

DUNN BROOK (SEGMENT MA36-19)
Location: From confluence with Forget-Me-Not Brook, East Brookfield/Brookfield, to confluence with Quaboag River, Brookfield
Segment Length: 2.4 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3- No Uses Assessed (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
Wetlands are present along much of this segment. A large wetland and beaver dam area is located in the upper part of this segment. Immediately upstream (<500 feet) from the DWM sampling station (DUN01 – Quaboag Street, Brookfield) there is a beaver dam along with sizeable wetland areas.

Biology
DWM conducted water quality monitoring at one station (DUN01) in Dunn Brook between May and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. Sparse to moderate amounts of aquatic plants were found during the sampling season and included mosses, duckweed, various emergents and pond plants. Dense green filamentous algae were found on substrates in April and July while green filamentous coverage was sparse in May. Moderate densities of a brown alga were found on substrates on the June, August and October survey dates. Sparse to moderate abundances of phytoplankton were noted throughout the sampling season.

Water Chemistry
DWM conducted water quality monitoring at one station (DUN01 – Quaboag Street, Brookfield) along Dunn Brook between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). DWM sampled at DUN01 at the Quaboag Street bridge.

pH was always within 0.5 standard units of the criterion. Dissolved oxygen at Station DUN01 was generally low (minimum 2.6 mg/L) and was below the criterion on four occasions (three worst case conditions). The minimum measured dissolved oxygen value was 2.6 mg/L during the morning of 30 July 2003. On 14 May 2003 dissolved oxygen was 7.5 mg/L, the maximum measured value at this station. Ammonia-nitrogen concentrations were low at this station. Total phosphorus concentrations were elevated (as high as 0.23 mg/L) (Appendix B).

It is unclear the exact cause of low dissolved oxygen concentrations and evidence of nutrient enrichment found in Dunn Brook. It should be noted that the station on this segment of Dunn Brook is located downstream from a beaver dam and a large wetland area as well as being below the North Brookfield Wastewater Treatment Plant (MA0101061). It should also be noted that the stretch of the brook above Route 9 and downstream from the sampling station is very low gradient. The North Brookfield WWTP has reduced their load of biological oxygen demand (BOD) and under their new permit will achieve more stringent total phosphorus limits (Appendix D). Low dissolved oxygen has been documented upstream from the route 9 crossing of Dunn Brook as far back as the 1970's (Firmin 1981). Discharge monitoring reports of the North Brookfield Wastewater Treatment Plant's effluent during the months of June, July and August 2004 indicated that BOD was less than 3.5 mg/L (monthly average) (MassDEP undated).

Therefore, at this time low dissolved oxygen readings are considered natural given the sampling stations immediate proximity to a beaver dam and a large wetland area.

The *Aquatic Life Use* for Dunn Brook is not assessed due to lack of sufficient data given the complexity of the system. The *Aquatic Life Use* is given an “Alert Status” due to the low dissolved oxygen and elevated total phosphorus concentrations.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (DUN01) along Dunn Brook on five occasions between April and October 2003 (Appendix B). *E. coli* bacteria counts were generally low during both dry and wet weather sampling with the exception of 15 October 2003. The highest *E. coli* count of 960 cfu/100 mL was measured on 15 October 2003, a wet weather sampling event. The geometric mean of the *E. coli* counts is 37.6 cfu/100 mL.

Parameter	DWM 2003 (n=5)
Fecal coliform (cfu/100mL)	<2 -1400
Geometric mean	47.5
E. coli (cfu/100mL)	4 - 960
Geometric mean	37.6

No objectionable deposits or scums were noted by DWM field crews at this location. No water odors were found with the exception of one occasion when the water had a musty odor. Water clarity was generally slightly turbid.

The *Primary Contact and Secondary Contact Recreation Uses* are assessed as support based on the low geometric mean of *E. coli* counts. The Primary Contact Recreation Use is identified with an “Alert Status” due to the one elevated bacteria count. Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Dunn Brook (Segment MA36-19) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESED*
Fish Consumption		NOT ASSESED
Primary Contact		SUPPORT*
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct biological monitoring to assess the *Aquatic Life Use*.

Conduct multiprobe monitoring with the intent of determining dissolved oxygen dynamics in this system.

QUABOAG RIVER (SEGMENT MA36-15)
Location: Route 67 bridge West Brookfield, to Warren WWTP, Warren
Segment Length: 6.3miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life and Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1)
William E. Wright Limited Partnership (MAG2500031) (MA0001074)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
DWM conducted water quality monitoring at one station (QA06A – Gilbert Road bridge- Warren) along this segment of the Quaboag River between May and October 2003. DWM crews made notes of conditions at this site throughout the sampling season. DWM field crews did not note phytoplankton and only once a sparse coverage of aquatic plants were found. In May a sparse coverage of green filamentous algae was found on substrates while in July a moderate coverage of brown thin films was noted. In August a sparse coverage of periphyton was found (Appendix B).

MA DFG conducted fish population sampling in the Quaboag River near River Street in Warren (Site 886) on 30 July 2003 using barge shocking (Richards 2006). Forty-five redbreast sunfish, twelve bluegill, eight yellow bullhead, five fallfish, four tessellated darter, three largemouth bass, two American eel, one chain pickerel and one pumpkinseed were collected (81 fish total). MA DFG fish biologists noted low sampling efficiency due to reach width and the lack of riffle to stop fish.

MA DFG conducted fish population sampling in the Quaboag River near the intersection of Route 67 and Gilbert Road (upstream from the Warren Wastewater Treatment Plant and downstream from a dam-Site 871) in Warren on 29 July 2003 using backpack electro-shocking (Richards 2006). Seventeen longnose dace, nine redbreast sunfish, eight bluegill, three smallmouth bass, three brown bullhead, two yellow bullhead, two white sucker, two fallfish, two eastern blacknose dace, one American eel, and one pumpkinseed were collected (50 fish total). MA DFG fish biologists used two backpacks to electroshock and estimated sampling efficiency at 25% due to the river's width.

Although macrohabitat generalist species dominated both fish samples MA DFG noted very low sampling efficiencies due the river's width and/or lack of riffle to stop fish. Despite the low abundance the presence of fallfish, tessellated darter, longnose dace, eastern blacknose dace, and white sucker (fluvial species) is indicative of a stable flow regime.

Toxicity
Ambient
The Warren Treatment Plant staff collected water from the Quaboag River (MA36-15) at Gilbert Street, approximately 500 feet upstream from the discharge site, for use as dilution water in the facility's whole effluent toxicity tests. Between September 2000 and November 2005 survival of *C. dubia* exposed (approximately 7 days) to the Quaboag River water ranged from 90 to 100% (n=21). Between September 2000 and November 2001 survival of *P. promelas* exposed (approximately 7 days) to the Quaboag River water was 100% (n=1). Hardness ranged from 12.0 mg/L to 30.0 mg/L (n=21).

Water Chemistry

DWM conducted water quality monitoring at one station (QA06A – Gilbert Road bridge- Warren) along this segment of the Quaboag River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All measured water quality parameters met criteria and guidelines. Dissolved oxygen was high at this station throughout the sampling season, which is logical given the station's location below a dam. Ammonia-nitrogen concentrations at Station QA06A were generally low, but total phosphorus concentrations were slightly elevated during the majority of the sampling season.

The *Aquatic Life Use* is assessed as support given the good survival of test organisms and good water quality conditions.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (QA06A – Gilbert Road bridge- Warren) along this segment of the Quaboag River between April and October 2003 (Appendix B*).* *E. coli* counts were generally low during both wet and dry weather sampling events with the exception of 15 October 2003. The highest *E. coli* count of 690 cfu/100 mL was measured on that date, a wet weather sampling event. Wet weather *E. coli* counts at this station were generally higher than when compared to dry weather counts. The geometric mean of *E. coli* counts was 47cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -800
Geometric mean	112
E. coli (cfu/100mL)	<2 - 690
Geometric mean	47.2

With the exception of May 14, 2003, when garbage and trash were noted on the banks, no objectionable deposits were found. No water odor was noted, but white foam was often found issuing from the upstream dam. No other scums were noted and the white foam is considered naturally-occurring. Water clarity was generally listed as clear or slightly turbid during the sampling season.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on the low geometric mean of *E. coli* counts. Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-15) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

RECOMMENDATIONS

Conduct macroinverterbrate sampling along this segment to assess the *Aquatic Life Use*. A station along Route 67 west of Warren center is recommended.

QUABOAG RIVER (SEGMENT MA36-16)
Location: Warren WWTP, Warren, to the Route 32 bridge, Palmer/Monson
Segment Length: 8.7miles
Classification: Class B, Warm Water Fishery, CSO**

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens, taste, odor and color (MassDEP 2007b).

** Although the river as defined in the 2006 standards inclusive of this segment has a CSO qualifier, there are no CSOs in this segment, so the CSO qualifier does not apply to this segment. All class B standards apply.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from this subwatershed.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Town of Warren-Warren Treatment Plant (MA0101567)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
The USGS maintain a gage in West Brimfield, MA, on the Quaboag River (Gage 01176000) 10 feet upstream from abandoned highway bridge site at West Brimfield, 0.9 mi upstream from Blodgett Mill Brook. The drainage area is 150 mi^2 and the period of record is from August 1909 to July 1912 (twice daily gage height) and August 1912 to present *(Socolow et al. 2004)*. The average discharge is 249 cfs (1912-2005) (USGS 2007). The maximum discharge occurred on 19 August 1955 (12,800 cfs) and the minimum discharge occurred on 28 and 29 September 1957 (6.6 cfs) *(Socolow et al. 2004)*. The USGS remarks that before 1956 slight diurnal fluctuation at low flow was caused by a mill upstream. Since 1965 high flow has been slightly affected by retarding reservoirs *(Socolow et al. 2004)*. The estimated daily discharge is considered to be poor by the USGS, but otherwise records at this gage are considered good.

Biology
MA DFG conducted fish population sampling in the Quaboag River near Route 67 and Warren Street above both a Route 67 rest area and an unnamed tributary on the Warren/Palmer border (Site 876) on 30 July 2003 using backpack shocking (Richards 2005). Eleven longnose dace, eight fallfish, seven white sucker, six smallmouth bass, three eastern blacknose dace, two golden shiner, one bluegill, one rock ass, one pumpkinseed, and one tessellated darter were collected (41 total fish). MA DFG fishery biologists noted that two backpacks were used on the Quaboag River's channel on both sides of the river while the middle of the river was not sampled. MA DFG fishery biologists also noted that some white suckers were not collected due to fast flow.

MA DFG conducted fish population sampling in the Quaboag River near a Route 67 rest area and the USGS gage in West Brimfield (Site 880) on 30 July 2003 using barge shocking (Richards 2006). Eleven white sucker, nine redbreast sunfish, seven bluegill, five yellow perch, five longnose dace, three American eel, three tessellated darter, two yellow bullhead, two blacknosed dace, two rock bass, two smallmouth bass, one common shiner, one largemouth bass, and one pumpkinseed were collected (54 fish total). MA DFG fishery biologists noted that they shocked two large pool areas with poor results.

Toxicity

Effluent

Whole effluent toxicity tests have been conducted on the Warren Treatment Plant treated effluent. Between September 2000 and November 2005, nineteen valid chronic tests were conducted using *C. dubia*. The chronic whole effluent toxicity tests using *C. dubia* ranged between 13.0 to 100% effluent (n=19), all of which meet the permit limit of >13.0, except for May 2001 which was exactly 13.0%. Results of the LC_{50} for *C. dubia* were all $\geq$100% effluent, with the exception of the LC_{50} of 38.0% in May 2003 and the LC_{50} of 66.0%.in May 2004.

Water Chemistry

DWM conducted water quality monitoring at one station (QRG- near USGS flow gauging station 01176000) along this segment of the Quaboag River between May and October 2003 (Appendix B). Station QRG is also the MassDEP, Central Regional Office's Strategic Monitoring and Assessment for River Basin Team (SMART) station. CERO crews conduct water quality monitoring at this location throughout each year. CERO data collected between 2001 and 2003 are summarized in this report. Between both crews *in-situ* parameters were measured on nine occasions at Site QRG in 2003 with three measurements during pre-dawn hours. Grab samples were also collected and analyzed for TSS, turbidity and nutrients at this site (Appendix B).

All water quality parameters at Station QRG met state standards with the exception of a single pH value on one occasion (Appendix B). Dissolved oxygen concentrations were generally close to saturation. Ammonia-nitrogen concentrations were generally low at this station. Most of the total phosphorus concentrations at Station QRG were greater than 0.05 mg/L (Appendix B, MassDEP 2006a). Nitrate-nitrite-nitrogen concentrations were generally low at this station while total Kjeldahl nitrogen concentrations were on average around 0.5 mg/L. For a summary of water quality data collected at Station QRG by both crews see table below.

Parameter	DWM 2003	CERO (2001-2003)
DO (mg/L)	7.4-10.7 (n =4)	8.1 – 14.6 (n =16)
pH (SU)	7.0 – 7.4 (n =4)	6.1 – 8.1 (n =16)
Temperature (℃)	15.3 – 23.5 (n =4)	-0.08 – 24.6 (n =16)
Conductivity (µS/cm at 25℃)	117 –173 (n =4)	102 – 377 (n =16)
Ammonia- nitrogen (mg/L)	<0.02 (n =1)	<0.02 – 0.17 (n =15)
Nitrate – nitrite nitrogen (mg/L)	--	<0.06 – 0.45 (n =15)
TKN (mg/L)	--	0.19 – 0.55 (n =15)
Total phosphorus (mg/L)	0.049 (n =1)	0.026 – 0.20 (n =16)
Alkalinity (mg/L)	--	4 – 22 (n =15)
Hardness (mg/L)	--	7 – 25 (n =15)
Total suspended solids (mg/L)	5 (n =1)	<1 – 7.3 (n =15)
Turbidity (NTU)	1.3 (n =1)	0.87 – 3.8 (n =15)

Given the good water quality conditions this segment of the Quaboag River is assessed as support for *Aquatic Life Use*. This segment is given an "Alert" Status though due to elevated total phosphorus concentrations measured at Station QRG.

Primary and Secondary Contact Recreation and Aesthetics Uses

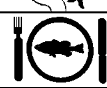
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (QRG, near USGS Gage 01176000) along this segment of the Quaboag River between May and October 2003 (Appendix B). Four bacteria samples were collected during the 2003 sampling season by either DWM or CERO crews. The samples collected represent both wet and dry weather conditions. Two of the samples had low *E. coli* counts (both wet and dry weather sampling) while the other two samples during dry weather sampling had slightly elevated *E. coli* counts. The geometric mean of *E. coli* counts was 47.7 cfu/ 100 mL.

Parameter	DWM 2003 (n=4)
Fecal coliform (cfu/100mL)	6 - 380
Geometric mean	78.4
E. coli (cfu/100mL)	<2 - 300
Geometric mean	47.7

Both DWM and CERO crews found garbage and trash throughout the 2003 survey season at this site (tires, old appliances, metals, floatables, assorted trash, etc) and on two occasions May 14th and October 22nd sand and silt deposits were noted. The trash and debris at this site are believed to be localized. Water odor was not noted by DWM or CERO crews during 2003. Scums were not noted with the exception of small isolated patches of foam found on three occasions by CERO crews. MassDEP field crews noted some minor erosion. Water clarity was generally clear although slightly turbid on two occasions. DWM and CERO crews noted that the water color was typically reddish at Station QRG. Hardwick Knitters and Wm. E. Wright both have industrial discharges that go to the Warren WWTP plant (Kimball 2007a). Both companies use dyes and Wm. E. Wright attempted to pre-treat their discharge before treatment at the Warren WWTP while Hardwick Knitters have reduced their effluent color through operational changes (Kimball 2007a). These dyes may explain the reddish color seen in the field by crews although natural conditions are also indicated. Recently in December 2006 Wm. E. Wright announced that they were closing their operations in Warren. Hardwick Knitters has also recently gone out of business.

Since only four bacteria samples were collected at this site and five samples are required to assess both contact uses, both the *Primary* and *Secondary Contact Recreation Uses* are not assessed. Given the localized nature of objectionable conditions the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-16) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS
Conduct macroinverterbrate sampling to assess the *Aquatic Life Use* along this segment.

Collect an adequate number of bacteria samples along this segment to assess *Contact Recreational Uses*.

QUABOAG RIVER (SEGMENT MA36-17)
Location: Route 32 bridge, Palmer/Monson, to the confluence with Ware River, forming headwaters of Chicopee River, Palmer
Segment Length: 5.3 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Palmer Water Department registration (10822702)
Three Rivers Fire District registration/permit (10822701/9P210822701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Town of Palmer (MAR041017)
Palmer WWTP (MA0101168)

Palmer WWTP (MA0101168) is permitted to discharge an estimated 21 MG per year of combined sewage via 14 wet weather CSOs along this segment of the Quaboag River. Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges (MassDEP 2001). Sewer separation work to eliminate 13 of the 14 CSO discharges into this segment of the Quaboag River is included in the first three phases of work. In 1999 the Town of Palmer submitted a request for MA SRF financing for the first three phases of work and in November 1999 was selected to receive financing for $7.1 million dollars. Sewer separation was approved by the MassDEP in December 2000 as part of CW SRF-423. The regulations in thirteen of the fourteen CSOs were plugged in 2003 (Boisjolie, 2005). CSO Outfall #008 (near Pump Station #2, on Route 181) is the one CSO in Palmer on the Quaboag River that was not scheduled to be eliminated in the first 3 phases of sewer separation work. Modeling of this CSO, however, indicates that it has little discharge (does not discharge during a three-month storm) (Boisjolie 2001). Currently CSO #008 is still active (Boisjolie, 2007).

An EPA superfund site is located at the PCS Resources site at 10 Water Street, Palmer, MA. This site has undergone significant remedial action and is the subject of continued monitoring. According to the EPA, groundwater contamination is mainly benzene and methylene chloride (volatile organic compounds). Polychlorinated biphenyls (PCBs), including Aroclor-1248 and Aroclor-1260, and lead have also been found in soils on this site in the past (EPA 2006). Contamination has been found in soils on site and groundwater in nearby wetlands. Cleanup of the contaminated soils and contaminated wetlands soils has been completed. In the 2005 five-year progress report on this site the EPA notes that groundwater contaminants have generally fallen and only benzene and vinyl chloride have exceeded their cleanup targets (EPA 2006). The EPA also notes that surface water cleanup levels in the Quaboag River have been met and the sediment contaminant cleanup levels have been met with the exception of lead, which will continue to be monitored (EPA 2006).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Water Chemistry</u>
DWM conducted water quality monitoring at one station (QA09A –Palmer Street bridge, Palmer) along this segment of the Quaboag River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All water quality parameters measured by DWM met criteria. Dissolved oxygen concentrations at Station QA09A were always greater than the criterion and often near saturation, while pH was generally neutral. Ammonia-nitrogen concentrations were low at the DWM station. Total phosphorus concentrations collected at Station QA09A were generally around 0.050 mg/L with the highest sample (0.078 mg/L) collected in June.

Given the good water quality conditions, the *Aquatic Life Use* is assessed as support.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (QA09A –Palmer Street bridge, Palmer) along this segment of the Quaboag River between April and October 2003 (Appendix B*).* The DWM station was downstream from numerous CSOs that were eliminated during the summer of 2003. Without the exact dates when the CSOs were eliminated it is impossible to determine what impacts these CSOs would have on bacteria levels during the 2003 sampling season. It is known, though, that CSO #008 was active during the period of DWM sampling.

E. coli bacteria counts were high on both wet and dry weather sampling dates. The highest *E. coli* count of 2160 cfu/100mL was collected on 15 October 2003 during wet weather sampling. The *E. coli* geometric mean was 156.8 cfu/100 mL and four samples were greater than 235 cfu/100 mL. Only the October sample had an *E. coli* count greater than 1260 cfu/100 mL. Given the high *E. coli* bacteria counts it appears that the CSOs in the Quaboag River were still having an effect on in-stream bacteria levels during DWM sampling, but it is impossible to estimate the extent of their impact.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -410
Geometric mean	277.5
E. coli (cfu/100mL)	<2 - 2160
Geometric mean	156.8

Garbage and trash were noted on the stream banks on two occasions and in-stream trash was noted on two occasions, while on four occasions no objectionable deposits were noted. No water odor was observed. On three occasions white foam was noted while on the majority of occasions no scums were found. Water clarity was generally clear or slightly turbid during the sampling season. A sparse coverage of irises (*Iris* sp*.*) was found throughout the sampling season but no periphyton or phytoplankton were observed. Erosion was found on the right bank, which was undercut at this site.

The *Primary Recreation Contact Use* is assessed as impaired due to elevated *E. coli* bacteria counts. *Secondary Contact Recreation Use* is assessed as support given an *E. coli* geometric mean less than criterion. The *Secondary Contact Recreation Use* is given an “Alert Status” due to the presence of an active CSO discharge and the one high *E. coli* count. Given the general lack of objectionable conditions along this segment, the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-17) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Combined sewer overflows Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Continue bacteria monitoring in this segment below Palmer WPCF CSO #008 to assess recreational contact uses. A bacteria monitoring station in the upper part of this segment (Bridge St., etc) is recommended.

Conduct fish toxics work downstream of the PCS Resources superfund site to assess *Fish Consumption Use*.

Conduct benthic macroinvertebrate and fish population sampling in this segment to assess *Aquatic Life Use*.

CHICOPEE BROOK (SEGMENT MA36-21)
Location: Headwaters, east of Peaked Mountain, Monson, to confluence with Quaboag River, Monson
Segment Length: 9.9 miles
Classification: Class B, Cold Water Fishery

Chicopee Brook Pond (MA36031) will no longer be reported on as an approximately 9-acre lake segment since the estimated retention time of this waterbody is less than one day. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from USGS two stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, “No Uses Assessed” (MassDEP 2007b).

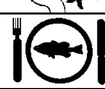
WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Monson Water and Sewer Department registration (10819101)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1)
Double A Plastics Co. Inc. (MAG250027)
Thermotech (MAG250376)
Polymer Injection Molding (MAG250376)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks Chicopee Brook with trout (MA DFG 2007).

<u>Water Chemistry</u>
All designated uses are not assessed due to the lack of quality-assured data available for Chicopee Brook.

Chicopee Brook (Segment MA36-21) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Conduct water quality monitoring (water chemistry, multiprobe, bacteria sampling) to evaluate designated uses.

Conduct fish population sampling and temperature monitoring along this segment to assess the *Aquatic Life Use*. Although listed as a coldwater fishery no recent fish population work has been done.

Chicopee River Subbasin

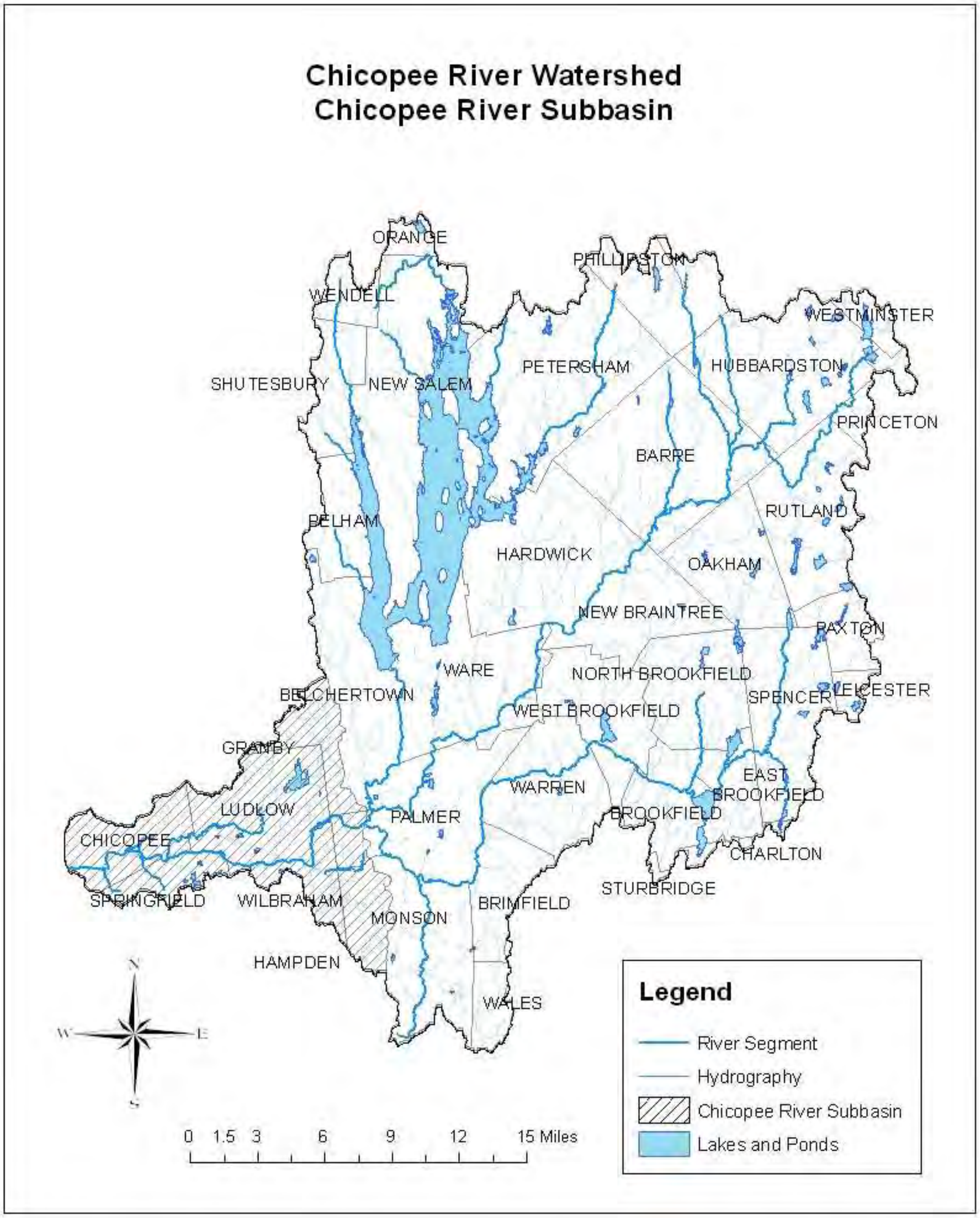


Figure 10: Chicopee River Subbasin

CHICOPEE RIVER (SEGMENT MA36-22)
Location: Source, confluence of Ware River and Quaboag River, Palmer, to Red Bridge Impoundment Dam, Wilbraham/Ludlow
Segment Length: 2.8 miles
Classification: Class B, Warm Water Fishery, CSO

Red Bridge Impoundment (MA36171) will no longer be reported as an approximately 73 acre lake segment since the estimated retention time of this waterbody is approximately one day. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from USGS two stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Palmer Waste Water Treatment Plant (WWTP) (MA0101168)
Town of Palmer (MAR041017)
Town of Wilbraham (MAR041025)

Palmer WWTP (MA0101168) is authorized to discharge 5.6 MGD of treated wastewater to the Chicopee River via Outfall 027. The Town's permit was reissued in September 2000. The Palmer WWTP is also permitted to discharge an estimated 4 MG per year of combined sewage via three wet weather CSOs in this segment of the Chicopee River. As of September 2000 CSO #015 (Springfield St., Three Rivers) was blocked. Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate two of these three CSO discharges to the Chicopee River is included in the first three phases of work (Appendix E). In 1999 Palmer submitted a request for MA SRF financing for the first three phases of work and in November 1999 was selected to receive financing for $7.1 million dollars. Sewer separation was approved by the MassDEP in December 2000 as part of CW SRF-423. As part of this work all three CSOs in this segment have been blocked in 2003 (Boisjolie, 2005) .The sewer separation work began in 2002 and was completed in spring 2004 (Boisjolie 2007b). In August 2004 an illicit connection to CSO Outfall #014 was removed (Boisjolie 2005). The Town continues to monitor for illicit connections.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Flow is influenced by the Red Bridge Dam hydropower project (see Segment MA36-23 for details).

<u>Toxicity</u>
Effluent
Whole effluent toxicity tests have been conducted on the Palmer Water Pollution Control Facility treated effluent. Between July 2000 and March 2006, twenty-two valid chronic tests were conducted using *C. dubia.* Results of the chronic whole effluent toxicity tests using *C. dubia* ranged from 6.25% to 100% effluent (n=22). Results in June 2001 showed a significant difference in reproduction for 25% effluent. The LC_{50} results were all >100% effluent (n=24) with the exception of September 2004, which was 33.0% effluent (Appendix D).

Water Chemistry

DWM conducted water quality monitoring at one station (CH01 – near the intersection of New Hampshire Avenue and Springfield Street, Palmer) along this segment of the Chicopee River between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen, temperature and pH all met criteria. Ammonia-nitrogen concentrations in samples collected at Station CH01 were low, while total phosphorus concentrations were slightly elevated during the summer (Appendix B).

Given generally good water quality conditions the *Aquatic Life Use* is assessed as support for this segment.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CH01 – near the intersection of New Hampshire Avenue and Springfield Street, Palmer) along this segment of the Chicopee River between April and October 2003 (Appendix B*).* The DWM station is downstream from numerous CSOs and the Palmer WWTP discharge.

DWM sampling dates included both wet weather and dry weather sampling. *E.coli* counts were generally elevated during wet weather sampling but no strong pattern was found relating *E. coli* counts and sampling conditions. Both high and low *E. coli* counts were measured on dry weather sampling dates. The highest *E. coli* count of 1520 cfu/100 mL was found on 15 October 2003, a wet weather sampling date. The geometric mean for *E. coli* was 194.5 cfu/100 mL.

Parameter	DWM 2003 (n=16)
Fecal coliform (cfu/100mL)	20 –1800
Geometric mean	304.7
E. coli (cfu/100mL)	30 - 1520
Geometric mean	194.5

Currently without the exact dates when CSOs were eliminated it is impossible to determine what impacts CSOs would have on bacteria levels during the 2003 sampling season. It is known, though, that CSO #014 had an illicit connection removed in 2004.

No objectionable deposits, scums or water odor were recorded by DWM field crews. Water clarity was generally noted to be clear although on two occasions it was noted to be slightly turbid. Erosion was noted on one occasion only. Aquatic vegetation, periphyton and phytoplankton were unobservable or not observed.

Given the elevated *E. coli* counts, the *Primary Contact Recreation Use* is assessed as impaired. Since the geometric mean for *E. coli* meets the *Secondary Recreation Contact Use* criterion the *Secondary Contact Recreation Use* is assessed as support. The *Secondary Contact Recreation Use* is given an “Alert Status” due to CSO discharges upstream and the one high *E. coli* count. Given the general lack of objectionable conditions along this segment the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-22) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Combined sewer overflows Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Continue to collect bacteria data during wet and dry weather to evaluate the effectiveness of CSO abatement work and assess the *Primary* and *Secondary Contact Recreational Uses*.

Conduct water quality sampling (chemistry and multiprobe) along this segment to assess *Aquatic Life Use.*

CHICOPEE RIVER (SEGMENT MA36-23)
Location: Red Bridge Impoundment Dam to Wilbraham Pumping Station (old WWTP), Wilbraham/Ludlow
Segment Length: 3.8 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

The MassDEP awarded money for the 604(b) grant entitled Chicopee River Watershed Basin Assessment. This project will address watershed assessment needs in the communities of Chicopee, Ludlow, Springfield, and Wilbraham that fall within the Chicopee River Basin. Stormwater infrastructure components will be identified, compiled into a database, and mapped; existing BMPs will be mapped and recommendations for future BMP implementation will be generated; existing water quality data will be compiled into a comprehensive database and analyzed to determine data gaps and to recommend future sampling efforts; and local water quality protection ordinances and bylaws will be reviewed and draft water protection bylaws prepared for communities within the study area.

FERC
Western Mass Electric Co. (Consolidated Edison Energy), Red Bridge Impoundment Station, is a FERC-exempt facility (FERC Exempt #10676) operating a 3,600-Kilowatt hydroelectric power station on the Chicopee River in Wilbraham (FERC 20 December 2000). Under its exempt status, the facility is required to release a continuous flow of 237 cfs from the Red Bridge Impoundment Dam. This facility is permitted to draw down the Red Bridge Impoundment to one-foot below crest from April to June and two-feet below crest during the remainder of the year. In 1997 MA DFW reached agreement with Consolidated Edison Energy, MA, on an interim measure, that their Red Bridge Impoundment Station could use between 140 – 300 cfs if a constant spillage is maintained over the spillway. The water levels at Red Bridge Impoundment are monitored and recorded and fluctuations are limited to three inches with a minimum flow released over the entire width of the spillway (Kleinschmidt Associates and CEEI 1999). In a 1998 letter to Consolidated Edison Energy, Inc. the USFWS described the minimum continuous flow release method at the Red Bridge Impoundment Station as inadequate (McCollum 2001). A slide gate has been installed at the Red Bridge Impoundment to ensure a more reliable minimum continuous flow release (Slater 2007).

I. Maxmat Co. (176 Cottage St., Wilbraham), Collins Dam Station, is a FERC-exempt facility (FERC Exempt #6544) operating a 1,500-Kilowatt hydroelectric power station on this segment of the Chicopee River (FERC 20 December 2000). The dam has a hydroelectric facility leased by Swift River Co., which, for the most part, maintains minimum flows of approximately 200 cfs. The Collins Dam was built in 1985 and is eight feet tall with four-foot flashboards.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1)
Consolidated Edison Energy Massachusetts Inc. (CEEMI) (MA0035823)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Flow is regulated by two hydropower projects (discussed above) on this segment.

Water Chemistry

DWM conducted water quality monitoring at one station (CH02B–Miller Street/Cottage Avenue bridge, Ludlow/Wilbraham) along this segment of the Chicopee River between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen, temperature and pH at Station CH02B all met criteria. Ammonia-nitrogen concentrations in samples collected at Station CH02B were low, while total phosphorus concentrations were slightly elevated during the summer (Appendix B).

Given the generally good water quality conditions, the *Aquatic Life Use* is assessed as support. Due to the potential impacts of hydropower operations this segment is identified with an "Alert Status."

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CH02B–Miller Street/Cottage Avenue bridge, Ludlow/Wilbraham) along this segment of the Chicopee River between April and October 2003 (Appendix B*).*

E. coli bacteria counts were low on both dry and wet weather sampling dates. The highest *E. coli* count was 160 cfu/100mL on 15 October 2003, a wet weather sampling date. The geometric mean of the *E. coli* counts was 20.8 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -120
Geometric mean	28.2
E. coli (cfu/100mL)	<2 - 160
Geometric mean	20.8

No objectionable deposits, odors or scums were noted by DWM field crews with the exception of one occasion when an oily sheen and rusty flow was noticed on the downstream left bank. Water clarity, although sometimes unobservable, was generally noted to be clear with one occasion of slight turbidity. Aquatic plant density, periphyton and plankton were generally noted as unobservable.

Given the low bacteria counts, both *Primary* and *Secondary Recreation Contact Uses* are assessed as support. Given the general lack of objectionable conditions along this segment, the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-23) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Fish population and benthic invertebrate monitoring in this segment to assess the *Aquatic Life Use* should be conducted.

Conduct multiprobe monitoring upstream from the Collins Dam to collect more representative data and determine *Aquatic Life Use.*

Monitor the effects of hydropower activities on the Chicopee River.

Fish passage plans should be considered at the hydropower dams along this segment.

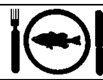
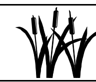
CALKINS BROOK (SEGMENT MA36-26)
Location: Headwaters, southeast of Baptist Hill, Palmer, to confluence with Twelvemile Brook, Wilbraham
Segment Length: 2.7 miles
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, “No Uses Assessed” (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Calkins Brook. All designated uses are not assessed.

Calkins Brook (Segment MA36-26) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Conduct water quality sampling (water chemistry, multiprobe and bacteria) to assess the *Aquatic Life Use* and the *Primary* and *Secondary Recreational Contact Uses*.

CHICOPEE RIVER (SEGMENT MA36-24)
Location: Wilbraham Pumping Station, Wilbraham/Ludlow, to Chicopee Falls, Chicopee
Segment Length: 9.1 miles
Classification: Class B, Warmwater Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1):
Dauphinais & Son Inc. registration (10833901)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D1,D2,D4)
Connecticut Valley Sanitary Waste Disposal Inc. (MA0033847)
Consolidated Edison Energy Massachusetts Inc. (CEEMI) (MA0035815) (MA0035831)
Solutia Inc. (MA0001147)
Town of Ludlow (MA0101338)
City of Chicopee, Chicopee Water Pollution Control (MA0101508)
Springfield Water and Sewer Commission (MA0103331)
Town of Ludlow (MAR041014)
City of Springfield (MAR041023)
City of Chicopee (MAR041003)
Town of Wilbraham (MAR041025)

Ludlow Sewage Collection System (MA0101338) permit was issued in August 1985. The permit authorized the discharge of combined sewer overflows via five outfalls to the Chicopee River. The sewage has been tied into Springfield's collection system and four of the five outfalls were blocked as of December 1998. The single outfall described as "south of the primary plant" (referred to as Outfall #005 in the compliance evaluation inspection report, which is likely Outfall #007 in the NPDES permit) still remains physically connected to the river (McCollum 2000). The inspection report indicated there was no evidence of dry weather overflows. Since the permit's expiration the Town of Ludlow has worked with the City of Springfield to craft a Long Term CSO Plan. CSO #005 is the only CSO now active and it is currently scheduled to be eliminated by May 2009 (Boisjolie, 2007b).

The City of Chicopee, Chicopee Water Pollution Control (MA0101508), is permitted to discharge via CSO #037 (East Main Street-House 227) to this segment. The estimated discharge from this CSO is 0.1 MG/year.

The Springfield Water and Sewer Commission (SWSC) NPDES permit (MA0103331) issued in 2003 allows the discharge from six CSOs into this segment (CS0#033-0037, CSO#043, CSO#044). The estimated discharge from these CSOs is 22.6 MG/year. The status of the remaining CSOs and their estimated CSO discharge is listed below. All discharge estimates listed below are from the SWSC Long Term Control Plan. Springfield is currently scheduled to begin its Chicopee River Abatement Project in 2007 and will reduce CSO discharges by May 2009. The goal of this 31 million dollar project will be to limit CSO discharges from Springfield's permitted CSOs to twice per year or less, with the cumulative volume of CSO discharge reduced from 22.6 MG/yr to less than 1.0 MG/yr (Boisjolie 2007b). A summary of Springfield CSOs is below.

NAME	ADDRESS	NO_	Estimated CSO Discharge Million Gallons/year (MG/yr)
SPRINGFIELD CSO	Front St.	033	*Eliminated*
SPRINGFIELD CSO	Main St.	034	9.8 MG/yr
SPRINGFIELD CSO	Front & Oak St.	035	0.2 MG/yr

NAME	ADDRESS	NO_	Estimated CSO Discharge Million Gallons/year (MG/yr)
SPRINGFIELD CSO	Pinevale & Water St.	036	0.7 MG/yr
SPRINGFIELD CSO	Cedar St.	037	10.8 MG/yr
SPRINGFIELD CSO	Banner St.	043	0.7 MG/yr
SPRINGFIELD CSO	Rogers Ave.	044	0.4 MG/yr

FERC

Western Mass Electric Co. (Consolidated Edison Energy, Inc.), Putts Bridge Dam Station, is a FERC-exempt facility (FERC Exempt #10677) operating a 3,200-Kilowatt hydroelectric power station on the Chicopee River in Ludlow/Springfield (FERC 20 December 2000). Under its exempt status, the dam is not subject to Part 12 FERC Inspections and is operating within the exemption conditions for one-foot drawdown of the pool. The dam has 1.7' high flashboards. There are no current provisions to allow fish passage (Kleinschmidt Associates and CEEI 1999).

Western Mass Electric Co. (Consolidated Edison Energy), Indian Orchard Station, is a FERC-exempt facility (FERC Exempt #10678) operating a 3,700-Kilowatt hydroelectric power station on the Chicopee River in Ludlow/Springfield (FERC 20 December 2000). Under its exempt status, the dam is subject to FERC Part 12 Inspection requirements. The license exemption requires a continuous minimum flow release of 247 cfs, or inflow, at the base of the dam. The order also limits pond drawdown to one foot below the top to the flashboards, or to permanent crest during flashboard outage. There are no current provisions to allow fish passage (Kleinschmidt Associates and CEEI 1999).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

<u>Habitat and Flow</u>

The USGS maintains a gage in Springfield, MA, on the Chicopee River (Gage 01177000) 1000 ft downstream from West Street Bridge at Indian Orchard and 1.1 mi upstream from Fuller Brook. The drainage area of this gage is 689 mi^2 and the period of record is August 1928 to present (pre-Nov. 1938 published as "at Bircham Bend") (Socolow 2005). The average discharge is 909 cfs (1928-2005) and the maximum discharge occurred on 21 September 1938 (45,200 cfs) while the minimal discharge of 16 cfs occurred several times in 1929-31 (USGS 2007 and Soclolow *et al.* 2005).

The USGS remarks that flow diversion has occurred since 1941 from 186 mi^2 in Swift River basin and at times since 1931 from 97 mi^2 in Ware River Basin for Boston Metropolitan District (now MA DCR) (Socolow *et al* 2005). Diversions have also occurred since 1950 for Chicopee, since 1952 for South Hadley, at times since 1966 for Worcester, and at times since 1955 from 6.5 mi^2 in Ware River Basin for Fitchburg. Diversion from Ludlow Reservoir for Springfield and, prior to 1952, for Chicopee has also occurred. Flow is regulated by powerplants upstream, by Quabbin Reservoir 21 mi upstream on the Swift River since 1939, by Barre Falls Reservoir on the Ware River since 1958, by Conant Brook Reservoir since 1966, and by smaller reservoirs (Socolow 2005). Discharge records are considered to be good except for estimated daily discharges, which are poor. (Socolow *et al* 2005).

There are two dams on this segment of the Chicopee River: Putts Bridge Dam at Route 21 between Ludlow and Indian Orchard (part of Springfield) and the Indian Orchard Dam north of Route 141 adjacent to an old mill on Front Street. The Putts Bridge Dam was constructed in 1918 as a concrete gravity structure. It rises 22' from the bed of the Chicopee River. The Indian Orchard Dam is a cut stone dam with 28' of height above the river. Both dams are owned and operated by CEEI as hydroelectric power plants. They generate and release minimum flows depending on the release from the Red Bridge Dam (located further upstream on the Chicopee River) (Kleinschmidt Associates and CEEI 1999). This segment of the Chicopee River ends at the Chicopee Falls Dam, which is a hydroelectric facility owned by the City of Chicopee.

Water Chemistry

DWM conducted water quality monitoring at one station (CH06– River Street/West Street bridge, Springfield/Ludlow) along this segment of the Chicopee River between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen, pH and temperature met criteria on all sampling dates. It should be noted though that the DWM station was below the Indian Orchard Impoundment. Total phosphorus concentrations during June and August 2003 sampling dates were slightly elevated. Ammonia-nitrogen concentrations were low on all sampling dates.

The *Aquatic Life Use* is assessed as support for this segment of the Chicopee River based on the good water quality conditions but is given an “Alert Status” due to the presence of CSOs and the potential impacts of hydromodification due to hydropower operations.

Primary and Secondary Contact Recreation and Aesthetics Uses

Metcalf and Eddy (2006), as part of CSO work for the Connecticut River Bacteria Monitoring Project, collected bacteria samples at the Route 21 bridge on the Springfield/Ludlow border. This station is upstream from the Indian Orchard Impoundment and upstream from the DWM sampling site. Metcalf and Eddy staff collected two samples along a transect. Samples were taken from the river bank east of the bridge on both sides of the river. Dry weather sampling was conducted on 8 August 2001 and wet weather sampling on three occasions: between 25 -27 September 2001; 15-16 September 2002 and 16-18 October 2002. This project had a MassDEP-approved Quality Assurance Project Plan. The sampling conducted between 25-27 September 2001 had quality control issues and the data for this sampling are not used for purposes of this assessment report nor detailed in this report. Six samples were collected during one sampling occasions in 2001 and the *E. coli* geometric mean was 22.8 cfu/100 mL. In 2002 sixteen samples were collected during two wet weather sampling events and the *E. coli* geometric mean was 61.8 cfu/100 mL. None of the *E. coli* counts reported by Metcalf and Eddy (2006) and used in this report were greater than 235 cfu/ 100 mL. High fecal coliform counts were found in numerous samples but the corresponding *E. coli* counts were not high.

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CH06– River Street/West Street bridge, Springfield/Ludlow) along this segment of the Chicopee River between April and October 2003 (Appendix B). This site is downstream from 13 CSOs and located just upstream from the USGS gage at Indian Orchard. There is a dam and a mill upstream from this station. The river channel is large and wide. Samples were collected by the bridge drop method at this station.

The *E. coli* bacteria counts in samples collected by DWM at Station CH06 were generally low. The highest *E. coli* bacteria count of 126 cfu/100 mL was found in the sample collected on 15 October 2003, a wet weather sampling date. It appears the elevated streamflow was largely due to rain in the upper Chicopee watershed as no significant rainfall was recorded at the NOAA rain gauge in Springfield. This wet weather sampling date may not have captured local CSO discharges. The *E. coli* geometric mean for Station CH06 was 35.4 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	2 - 248
Geometric mean	39.4
E. coli (cfu/100mL)	4 - 126
Geometric mean	35.4

No objectionable deposits, scums or water odor were recorded by DWM field crews although conditions were often unobservable. Water clarity was clear on all days when noted. When observable there were no phytoplankton noted and on the one occasion when periphyton was observable it was characterized as sparse. On three occasions (July 30th, July 31st and August 20th) dense submerged aquatic plants were noted (principally grasses) while on the rest of sampling days aquatic plants were unobservable.

Given the low *E. coli* bacteria counts the *Primary* and *Secondary Contact Recreation Uses* are assessed as support. Due to the presence of CSOs both *Primary* and *Secondary Contact Recreation Uses* are listed with an "Alert Status." Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-24) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct bacteria sampling at multiple stations along this segment to document the progress of Ludlow, Chicopee, and Springfield's CSO abatement activities.

Monitor the effects of hydropower activities on the Chicopee River. This may involve fish population sampling or benthic invertebrate sampling.

Fish passage plans should be considered at the hydropower dams along this segment.

HIGHER BROOK (SEGMENT MA36-42)
Location: Headwaters south of Route 21, Ludlow, thru Harris Pond (formerly reported as Segment MA36067) to the Ludlow/Chicopee corporate boundary where the stream name changes to Fuller Brook
Segment Length: 6.3 miles
Classification: Class B

Harris Pond (MA36067) will no longer be reported on as an approximately 14 acre lake segment since the estimated retention time of this waterbody is less than two days. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from USGS two stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals from this segment but the management of Springfield Reservoir would affect this waterbody. Currently the reservoir is not in use.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2, D4)
Springfield Water and Sewer Commission (MAG640022)
Town of Ludlow (MAR041014)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Water Chemistry
DWM conducted water quality monitoring at one station (FULL02–West Street bridge, south of Roy Street, Ludlow) along Higher Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All the temperature, dissolved oxygen and pH measurements at Station FULL02 met criteria. Ammonia-nitrogen concentrations were low in samples collected by the DWM. Total phosphorus concentrations were generally low but were elevated on one occasion (wet weather sampling event) at Station FULL02 (Appendix B).

The *Aquatic Life Use* is assessed as support based on the generally good water quality conditions.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (FULL02–West Street bridge, south of Roy Street, Ludlow) along Higher Brook between April and October 2003 (Appendix B). The *E. coli* bacteria counts showed no absolute correlation with rainfall, but the two highest counts were measured during wet weather sampling. The highest *E. coli* count of 800 cfu/100mL was recorded on 15 October 2003 and the next highest count of 370 cfu/100 mL was measured on 18 June 2003. The *E. coli* geometric mean was 83.3 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	10 - 1800
Geometric mean	168.6
E. coli (cfu/100mL)	4 - 800
Geometric mean	83.3

With the exception of one day on which small amounts of trash were found, no objectionable deposits were noted at this site. No water odors or scums were observed. Sparse coverage of moss was found in June while in August and October burreed (*Sparganium* sp.) was noted at this station. The presence of phytoplankton was not noted. Sparse coverage of green filamentous algae was found on substrates on the first two survey dates while in July and August respectively sparse and moderate algal coverage was found (Appendix B).

The geometric mean for *E. coli* meets the criteria for both the *Primary* and *Secondary Contact Recreation Use* criteria so these uses are assessed as support. The *Aesthetics Use* is assessed as support due to the lack of objectionable conditions.

Higher Brook (Segment MA36-42) Use Summary Table

<table>
<tr><th colspan="2">Designated Uses</th><th>Status</th></tr>
<tr><td>Aquatic Life</td><td></td><td>SUPPORT</td></tr>
<tr><td>Fish Consumption</td><td></td><td>NOT ASSESSED</td></tr>
<tr><td>Primary Contact</td><td></td><td rowspan="3">SUPPORT</td></tr>
<tr><td>Secondary Contact</td><td></td></tr>
<tr><td>Aesthetics</td><td></td></tr>
</table>

RECOMMENDATIONS

Conduct bacteria monitoring to assess the contact recreational uses.

Conduct water chemistry and multiprobe monitoring along this segment to assess *Aquatic Life Use*.

FULLER BROOK (SEGMENT MA36-41)
Location: From the Ludlow/Chicopee corporate boundary where the stream name changes from Higher Brook to the confluence with the Chicopee River, Chicopee
Segment Length: 1.9 miles
Classification: Class B

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1, D4)
Connecticut Valley Sanitary Waste Disposal, Inc. (MA0033847/ MAR05C657)
City of Chicopee (MAR041003)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks Fuller Brook with trout (MA DFG 2007). MA DFG conducted fish population sampling in Fuller Brook from the mouth of Fuller Brook to Shawinigan Drive (Site 96) on April 20' 2000 using a backpack electro-shocker (Richards 2006). Sixty-nine fallfish, forty-one common shiner, thirty-eight eastern blacknose dace, fourteen white sucker, fourteen tessellated darter, fourteen longnose dace, two yellow bullhead, two brook trout, one American eel, one rock bass, one pumpkinseed, and one brown trout were collected (198 total fish). Sampling was conducted in a sandy stretch between two beaver dams.

The sample was heavily dominated by fluvial specialist/dependent species (98%). While most species present are classified as tolerant or moderately tolerant to pollution, brook trout and brown trout (n=3) were also collected and the brook trout appear to be part of a reproducing population. MA DFG identifies Fuller Brook as a Coldwater Fishery Resource (Richards 2006). The aforementioned dominance by fluvial species and the presence of brook and brown trout are indicative of a stable flow regime and excellent water quality. It should be noted that brook trout numbers were very low and that beaver activity may be affecting habitat within the sampled reach.

DWM conducted water quality monitoring at one station (FULL01) in Fuller Brook (Station 96) between April and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. When observable no phytoplankton was found and only on June 18th was a sparse coverage of moss noted; otherwise no aquatic plants were found. Sparse coverage of thin green films on substrates was noted on April 16th and a sparse coverage of green filamentous algae was noted on June 18th. Later, on June 30th and August 20th, a dense coverage of green and brown algae was found attached to the rocks.

Toxicity
Ambient
The Connecticut Valley Sanitary Waste Disposal, Inc. staff collected water from the Fuller Brook just upstream from New Lombard Road for use as dilution water in the facility's whole effluent toxicity tests. Between May 2000 and September 2004 survival of *C. dubia* exposed (48 hours) to the Fuller Brook water was 100% (n=9). Between May 2000 and September 2004 survival of *P. promelas* exposed (48 hours) to the Fuller Brook water ranged from 95 to 100% (n=9).

Effluent
Whole effluent toxicity tests have been conducted on the Connecticut Valley Sanitary Waste Disposal, Inc. treated effluent. Between May 2000 and September 2004 nine valid tests were conducted using *C. dubia* and *P. promelas*. The LC_{50} resuts were all $\geq$100% effluent for both test species (n=9).

Water Chemistry
DWM conducted water quality monitoring at one station (FULL01–between Route 90 and Shawinigan Drive, Chicopee) along Fuller Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All the temperature, dissolved oxygen and pH measurements at Station FULL01 met criteria. Ammonia-nitrogen concentrations ranged from <0.10 to 0.20 mg/L in samples collected at this site. Total phosphorus concentrations in samples collected by DWM were slightly elevated to elevated at this site. The highest total phosphorus concentration (0.088 mg/L) was found on 18 June 2003, a wet weather sampling date.

Given the good ambient and effluent whole effluent toxicity results, the good water quality conditions, and fish population information Fuller Brook is assessed as support for *Aquatic Life Use*. This use is identified with an "Alert Status" due to elevated total phosphorus concentrations.

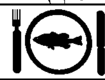
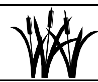
Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (FULL01–between Route 90 and Shawinigan Drive, Chicopee) along Fuller Brook between April and October 2003 (Appendix B*).* The *E. coli* bacteria counts were generally low during dry weather but elevated during wet weather. The highest *E. coli* bacteria count of 1120 cfu/100 mL was found in the sample collected 15 October 2003, a wet weather sampling date. The second highest E. coli count of 450 cfu/100 mL was found in the 18 June 2003 sample, a wet weather sampling date. The geometric mean of *E. coli* counts was 152.2 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	20 - 5500
Geometric mean	365.9
E. coli (cfu/100mL)	14 - 1120
Geometric mean	152.2

The Fuller Brook station (FULL01) is downstream from a large landfill and Interstate 90. On April 16th and August 20th trash and debris were noted at this station. Additionally, sedimentation likely due to adjacent roadwork was noticed on April 16th. Objectionable deposits were not noted on any other sampling dates. No scums or water odors were noted during the sampling season. Water clarity was generally described as slightly turbid at this station during the sampling season except on the first two sampling dates when the water was clear. Minimal erosion was noted on two occasions and the presence of riprap was recorded. DWM field crews noted sparse to moderate coverage of algae on substrates at this location during the summer of 2003.

The geometric mean of *E. coli* counts did not meet the *Primary Contact Recreation Use* criterion, so the *Primary Contact Recreation Use* is assessed as impaired. The *Secondary Contact Recreation Use* is assessed as support based on the geometric mean of *E. coli* counts meets the criterion. It is believed that the negative aesthetic conditions found at Station FULL01 are limited in extent so the *Aesthetics Use* is assessed as support.

Fuller Brook (MA36-41) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct bacteria monitoring to assess the *Contact Recreational Uses*.

Conduct water chemistry sampling and multiprobe monitoring along this segment to assess *Aquatic Life Use*.

Conduct field reconnaissance and a habitat walk along this segment to evaluate current conditions.

UNNAMED TRIBUTARY TO THE CHICOPEE RIVER (SEGMENT MA36-39)
Location: Unnamed tributary to the Chicopee River, locally known as “Poor Brook,” from headwaters near the Conrail tracks in Springfield to the confluence with the Chicopee River, Chicopee
Segment Length: 2.2 miles
Classification: Class B

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1, D4)
Doncasters Inc. MAG250947
City of Springfield (MAR041023)
City of Chicopee (MAR041003)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
Geosyntec Consultants (Geosyntec Consultants, undated), as part of the Chicopee River Watershed Degraded Stream Survey, made field observations downstream from Route 141 (East Main Street bridge) on 16 May 2003. They found bank erosion, sand deposits and point bar formations, undercut banks and exposed roots. Erosion was noted at the DWM sampling station (POOR01–Route 141 (East Main Street bridge, Chicopee) throughout the 2003 sampling survey.

Toxicity
Effluent
Downcasters Inc. conducted a whole effluent toxicity test using *C. dubia* on 14 May 2001 on their non-contact cooling water using soft reconstituted freshwater as diluent. The forty-eight hour LC_{50} test was >100% and A-NOEC was 100% effluent. The C-NOEC test was 50%. Ammonia-nitrogen was <0.20 mg/L while total residual chlorine (TRC) was 0.19 mg/L.

Water Chemistry
DWM conducted water quality monitoring at one station (POOR01–Route 141 (East Main Street bridge) in Chicopee) along Poor Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All the temperature, dissolved oxygen and pH measurements at Station POOR01 met criteria. The conductivity measured at this site was elevated throughout the sampling season. Ammonia-nitrogen concentrations were elevated in the April, May and June samples collected by DWM but not at toxic levels. Total phosphorus concentrations in the samples collected at this station were generally low but were elevated on one wet weather survey date (Appendix B).

Given generally good water quality conditions Poor Brook is assessed as support for *Aquatic Life Use*. The elevated ammonia-nitrogen concentrations measured at this site, elevated conductivity and habitat quality degradation associated with erosion and sedimentation at the sampling location are a cause for concern, so this segment is identified with an “Alert Status.” The concentration of TRC in the Doncasters Inc. discharge is also of concern.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (POOR01–Route 141 (East Main Street bridge), Chicopee, along Poor Brook between April and October 2003 (Appendix B*).*

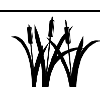
E. coli bacteria counts were generally low during dry weather sampling but were high during wet weather sampling. The highest *E. coli* count of 4200 cfu/100 mL was measured on 18 June 2003, a wet weather sampling date. The second highest *E. coli* count of 1880 cfu/100 mL was measured on 15 October, 2003, a wet weather sampling date. The geometric mean of *E. coli* counts was 246.2 cfu/ 100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	6 - 6100
Geometric mean	279.9
E. coli (cfu/100mL)	30 - 4200
Geometric mean	246.2

On April 16th and July 30th objectionable deposits of silt and sand were found covering bottom substrate, but no objectionable conditions were noted on other survey dates. No water odors were noted with the exception of a musty water smell on two occasions and no scums were found. Erosion, principally on the left bank, was noted throughout the survey. Generally, water clarity was high at this site, although on June 18th the water was highly turbid. Aquatic plants and phytoplankton were not noted at this site. Moderate and sparse green filamentous algae were noted on substrates on the first two survey dates, respectively, but periphyton cover, when observable, was not found on the remaining days.

Due to the elevated *E. coli* geometric mean, the *Primary Contact Recreation Use* is assessed as impaired. The *Secondary Contact Recreation Use* is assessed as support given a geometric mean of E. coli counts below the criterion. Given the two counts > 1260 cfu/100 mL this use is identified with an “Alert Status”. It is believed that objectionable conditions are localized, so the *Aesthetics Use* is assessed as support.

Poor Brook (MA36-39) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct bacteria sampling to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Conduct field reconnaissance and a habitat walk along this segment to determine current conditions and assess the extent of habitat degradation. Where appropriate develop and implement best management practices to reduce erosion and sedimentation.

Conduct benthic invertebrate monitoring along this segment to assess *Aquatic Life Use*. There is evidence of degraded habitat along this segment and indications that the benthic community may be impacted (Geosyntec Consultants, undated).

Doncasters Inc.'s NPDES permit should be reissued with appropriate limits for TRC.

COOLEY BROOK (SEGMENT MA36-38)
Location: From the outlet of the Chicopee Reservoir, Chicopee, to the confluence with the Chicopee River, Chicopee (segment includes "braid" that confluences with the Chicopee River upstream from the mouth of Cooley Brook)
Segment Length: 1.2 miles
Classification: Class B

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2,D4)
City of Chicopee (MA0101508)
Westover Airforce Base (MAR05B973)
City of Chicopee (MAR041003)

Westover Air Force Base's individual permit (MA0005444) has been terminated. Multi-sector general stormwater permits (MAR05A820 and MAR05A728) were issued to Westover Air Reserve Base and Westover Metro Airport in Chicopee for outfalls 003-008. An artificial wetland was constructed near Outfall 001 to treat stormwater discharge affected by aircraft deicing. Outfall 001 and Outfall 002 both have oil water separators in-line in the event of a fuel spill. These two outfalls are now covered by multi-sector general permit number MA05B973 issued in 2002.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks Chicopee Reservoir upstream from this segment of Cooley Brook with trout (MA DFG 2007). DWM conducted water quality monitoring at one station (COOL01) in Cooley Brook between April and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. No aquatic plants or phytoplankton were noted during the sampling season at this location and the water was clear with the exception of April 16th when water clarity was slightly turbid. Undercutting of both banks was noted throughout the sampling season. Periphyton cover was described as moderate on April 16th, August 20th and October 15th and sparse on May 14th and July 30th;none was observed on June 18th. The periphyton consisted of brown thin films attached on rocks and an orange floc on April 16th while green periphyton on rocks and green filamentous algae were found on May 14th. On other sampling dates the periphyton was described as brown algae attached on rocks.

Water Chemistry
DWM conducted water quality monitoring at one station (COOL01– apparent diversion of Cooley Brook at Fuller Road, approximately 1100 feet northwest of Haynes Circle, Chicopee) in this Cooley Brook segment between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperature, pH and dissolved oxygen measurements at Station COOL01 met criteria on all DWM sampling dates. Ammonia-nitrogen concentrations at this station were generally low while total phosphorus concentrations were slightly elevated during the May and June sampling dates and very high (0.23 mg/L) on the August sampling date (Appendix B).

The Aquatic Life Use is assessed as support given the generally good water quality conditions. The one sample with a high total phosphorus concentration is a cause for concern, so this segment is identified with an “Alert Status” for *Aquatic Life Use.*

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (COOL01– apparent diversion of Cooley Brook at Fuller Road, approximately 1100 feet northwest of Haynes Circle, Chicopee) between April and October 2003 (Appendix B*).*

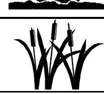
E. coli counts at Station COOL01 were generally low during dry weather sampling events. The highest *E. coli* count of 1100 cfu/100 mL was found on 15 October 2003 a wet weather sampling event. The second highest *E. coli* count of 300 cfu/100 mL was found on 20 August 2003, a dry weather sampling event. The geometric mean of *E. coli* counts was 61.9 cfu/ 100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 4700
Geometric mean	101.3
E. coli (cfu/100mL)	10 – 1100
Geometric mean	61.9

On April 16th the DWM field crews observed heavy siltation at Station COOL01 on the river bottom. No other objectionable deposits were noted at this station. With the exception of April 16th, when the water was noted to have both a septic and rotting vegetable odor, DWM field crews did not note water odors. No scums, aquatic plants or phytoplankton were noted during the sampling season at this location and the water was clear with the exception of April 16th when water clarity was slightly turbid.

Given the low geometric mean of *E. coli* counts, the *Primary Contact Recreation Use* is assessed as support. Two samples were greater than 235 cfu/100 mL, so this use is given an “Alert Status”. Given the low geometric mean of *E. coli* counts and the fact that none of the counts were greater than 1260 cfu/100 mL, the *Secondary Contact Recreation Use* is assessed as support. Given the general lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Cooley Brook (Segment MA36-38) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct bacteria monitoring to assess *Primary* and *Secondary Contact Recreational Uses*.

Conduct field reconnaissance and a habitat walk along this segment to determine current conditions.

Benthic invertebrate monitoring could be conducted along this segment to assess *Aquatic Life Use*.

CHICOPEE RIVER (SEGMENT MA36-25)
Location: Chicopee Falls to confluence with Connecticut River, Chicopee
Segment Length: 3.0 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals in this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1, D2, D4)
City of Chicopee (MA0101508)
City of Chicopee (MAR041003)
Consolidated Edison Energy Massachusetts Inc. (CEEMI) (MA0035777)
Eastern Etching & Manufacturing Company (MA0000647)

The City of Chicopee, under NPDES Permit MA0101508, is authorized to discharge via 12 CSOs (10 currently active) into this segment of the Chicopee River. Cumulatively the active CSOs discharge an estimated 76.0 MG/year. Two CSOs have been plugged. CSO #023 was plugged in early 2002, while CSO #025 was plugged on June 29, 2005. The following CSOs are considered active and the best current estimates of their discharge are also listed below. Updated estimates and an abatement schedule for the remaining CSOs will be completed in the Final Long Term Control Plan due to be completed in 2008 (Boisjolie 2007b).

Address	CSO ID Number	Estimated CSO Discharge Million Gallons/year (MG/yr)
Bell & Front St.	26	0.1 MGD
Topors & Front St	27.1	8.0 MG/yr
Chicopee Elec. Light -	29	0.1 MG/yr
Chicopee Elec. Light -	31.1	1.1 MG/yr
Easment N of Front St.	31.3	30.7 MG/yr
Under Deady Bridge	32	Cumulative = 6.1 MG/yr from CSO Regulators #32.2, 32.3, 32.4, and 32.5
Grove & Oak St.	32.1	2.5 MG/yr
Grattan & Hearthstone	34.1	7.7 MG/yr
Hearthstone Terrace	34.2	0.2 MG/yr
Old Fuller	34.3	19.5 MG/yr**
All CSOs		76.0 MG/yr

** This discharge is estimated from the 2002 Notice of Project Change, which reduced the estimated annual discharge from previously estimated 60.7 MG/yr in the 2001 Draft Long Term Control Plan (DLTCP). All other estimates are from the 2001 DLTCP.

This segment begins at the Chicopee Falls Dam at Route 33 in Chicopee Falls. This dam is a 10' high masonry stone dam that was constructed in the late 1800s. It is currently owned by the City of Chicopee and used as a hydroelectric facility. A second dam, the Dwight Station Dam, was constructed in 1920 and is a 15' high masonry dam that is owned and operated by CEEMI as a hydroelectric power plant. The dam generates and releases a minimum flow depending on the flows released at the upstream Red Bridge Impoundment Dam (Kleinschmidt Associates and CEEI 1999).

The former Uniroyal Complex is listed as a Tier 1A Hazardous Waste Site (#1-0000436). This site was listed for oil and hazardous material. This site is currently a Phase 4 site and cleanup work has been conducted and is ongoing.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The hydroelectric power plant at the Chicopee Falls Dam is a FERC exempt facility (FERC-exempt #6522). The facility operates a 2,500-Kilowatt hydroelectric power station on this segment of the Chicopee River (FERC 20 December 2000). Under its exempt status, the facility releases 127 cfs in the bypass reach and 230 cfs downstream. The dam has 18-inch flashboards and has all flow releases and power generation are automated. There are no current provisions to allow fish passage (Kleinschmidt Associates and CEEI 1999).

Consolidated Edison Energy Massachusetts Inc. (CEEMI) Dwight Station is a FERC-exempt facility (FERC-exempt #10675) operating a 3,700-Kilowatt hydroelectric power station on the Chicopee River in Chicopee (FERC 20 December 2000). Under its exempt status, the dam is not subject to FERC Part 12 Inspection requirements. The dam had 2.3' high flashboards that have been removed to assist in the passage of minimum flow. The canal system is currently in disrepair and the hydraulic capacity is limited because of unreliable canal head gates. During the spring the Station is shut down. Since the 1998 Chicopee WQAR report, an eelway has been built at the Dwight Dam through a USFWS grant and cooperation from the Chicopee River Watershed Council Silvio O. Conte Anadromous Fish Research Center and CEEMI (MA EOEA, 2007).

Biology

DWM conducted water quality monitoring at one station (CTO3 – Route 116 Bridge, Chicopee) in this Chicopee River segment between April and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. Although aquatic plant density was characterized as unobservable on the majority of sampling days, on August 20th aquatic plant density was noted to be moderate and composed of submerged plants, principally moss on rocks and milfoil (*Myriophyllum* sp.). Sparse periphyton coverage was noted on two occasions (April 16th and July 30th) while moderate coverage was noted on May 15th and August 20th. On the remaining sampling days periphyton coverage was unobservable or not recorded. On June 18th phytoplankton presence was described as sparse while the majority of occasions when observable or recorded no phytoplankton were noted.

Toxicity

Ambient

The Eastern Etching & Manufacturing Company staff collected water from the Chicopee River approximately 100 feet upstream from the Eastern Etching east parking lot, off of Riverview Terrace, for use as dilution water in the facility's whole effluent toxicity tests. Between May 2000 and May 2002 survival of *C. dubia* exposed (48 hours) to the Chicopee River water ranged from 90 to 100% (n=5). Between May 2000 and May 2002 survival of *P. promelas* exposed (48 hours) to the Chicopee River water was all 100% (n=5). Hardness ranged from 19.0 mg/L to 29.0 mg/L (n=5).

Effluent

Acute whole effluent toxicity tests have been conducted on the Eastern Etching & Manufacturing Company treated effluent. Between May 2000 and May 2002 five valid tests were conducted using *C. dubia* and *P. promelas*. The LC_{50} using *C. dubia* ranged from 56.10% to >100% effluent (n=5). The LC_{50} tests using *P. promelas* were all >100% (n=5). All of the tests met the limit of $\geq$50%.

Ammonia-nitrogen concentrations reported in the whole effluent toxicity reports between May 2000 and May 2002 ranged from 0.17 mg/L to 3.40 mg/L (n=5). Total residual chlorine (TRC) concentrations reported in the whole effluent toxicity reports between May 2000 and May 2002 ranged from <0.020 to 0.150 mg/L (n=5). Between May 2000 and May 2002 the total aluminum limit was exceeded once on May 10, 2000 when the effluent had an aluminum concentration of 5.3 mg/L (n=5).

Water Chemistry

DWM conducted water quality monitoring at one station (CTO3 – Route 116 Bridge, Chicopee) in this Chicopee River segment between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperature, pH and dissolved oxygen measurements at the DWM station all met criteria on DWM sampling dates (Appendix B). It should be noted, though, that this station is below the Dwight Dam and this may affect dissolved oxygen concentrations. Ammonia-nitrogen concentrations measured in DWM samples were low while total phosphorus concentrations ranged from 0.024 mg/L to 0.057 mg/L with the highest concentrations found on 18 June 2003, a wet weather sampling date (Appendix B).

Given the good survival of test organism and the generally good water quality conditions, the *Aquatic Life Use* is assessed as support. The *Aquatic Life Use* is identified with an "Alert Status" due to potential impacts of hydropower operations and CSOs.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CTO3 – Route 116 Bridge, Chicopee) between April and October 2003 (Appendix B). This station is approximately 900 feet below Chicopee CSO #025, which was active during the time of DWM sampling. This station was also below eleven other Chicopee CSOs (during time of sampling). *E. coli* counts were generally low with the exception of one sample collected on 15 October 2003, which had an *E. coli* count of 2980 cfu/ 100 mL. This high bacteria sample was collected on a wet weather sampling date.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	8 – 7700
Geometric mean	151.1
E. coli (cfu/100mL)	4 - 2980
Geometric mean	91.6

Metcalf and Eddy (2006), as part of CSO work for the Connecticut River Bacteria Monitoring Project, collected bacteria samples at the Route 116 bridge in Chicopee which was downstream from 12 Chicopee CSOs at the time of sampling. Metcalf and Eddy staff sampled three points (equidistant from one another) along a transect going from both banks of the river. They conducted dry weather sampling on 8 August 2001 and wet weather sampling on three occasions: 25 September 2001; 15 September 2002 and 16 October 2002. This project had a MassDEP-approved Quality Assurance Project Plan. Eighteen samples were collected in 2001 by Metcalf and Eddy (1 dry weather event, 1 wet weather event- two days total) and the *E. coli* geometric mean was 400 cfu/100 mL. Eight of the nine *E. coli* bacteria counts were greater than 235 cfu/100 mL on 8 August 2001 while none were greater than 1260 cfu/100 mL. Six of the nine *E. coli* counts collected on 25 September 2001 were greater than 235 cfu/100 mL while three of the nine *E. coli* counts were greater than 1260 cfu/100 mL. Eighteen samples were collected in 2002 by Metcalf and Eddy (2 wet weather events-2 days total) and the *E. coli* geometric mean was 412.8 cfu/100 mL. Seven of the *E. coli* bacteria counts collected on 15 September 2002 were greater than 235 cfu/100 ml and one sample was greater than 1260 cfu/100 mL. Eight of the nine *E. coli* counts collected on 16 October 2002 were greater than 235 cfu/100 mL and two *E. coli* counts were greater than 1260 cfu/100 mL.

No objectionable deposits, scums or water odor were recorded by DWM field crews. The water clarity was described as clear or slightly turbid when noted. Minimal erosion was observed on two occasions. Although aquatic plant density was characterized as unobservable on the majority of sampling days, on August 20th aquatic plant density was noted to be moderate and composed of submerged plants, principally moss on rocks and milfoil (*Myriophyllum sp*.). Sparse periphyton coverage was noted on two occasions (April 16th and July 30th) while moderate coverage was noted on May 15th and August 20th. On the remaining sampling days periphyton coverage was unobservable or not recorded. On June 18th phytoplankton presence was described as sparse while the majority of occasions when observable or recorded no phytoplankton were noted. On April 16th the water level was noted to be extremely high and the storm drains under the bridge were observed to be flowing. On June 18th a storm drain near the bridge on the right bank was flowing.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as impaired because of elevated *E. coli* counts. The highest bacteria counts were collected during wet weather events. Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-25) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Combined sewer overflows Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Track progress of the City of Chicopee's CSO abatement activities. Conduct bacteria sampling to evaluate the effectiveness of the CSO abatement and to assess *Primary* and *Secondary Contact Recreation Uses.* Wet weather sampling will give the best gage of CSO abatement activities, as *E. coli* counts in dry weather samples were low at this site.

Additional data are needed to evaluate the impact of hydropower activities on aquatic life conditions. This may include monitoring streamflow conditions and conducting fish population or benthic invertebrate monitoring.

Fish passage at the hydropower dams especially should be considered.

ABBEY BROOK (SEGMENT MA36-40)
Location: Headwaters west of Saint James Avenue, Springfield, thru Bemis Pond (formerly reported as segment MA36011) to the confluence with the Chicopee River, Chicopee
Segment Length: 1.5 miles
Classification: Class B

Bemis Pond (MA36011) will no longer be reported on as an approximately 4 acre lake segment since the estimated retention time of this waterbody is less than nine days. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

In 2000 MA DEM (MA DEM 2002a) awarded the City of Chicopee a $10,000 grant for Bemis Pond to repair the auxiliary spillway wall at the Bemis Pond dam, which stabilized the shoreline and prevent further erosion in the area. In 2002 DEM (DEM 2002b) awarded the City of Chicopee a $15, 000 grant to repair a wall of the auxiliary spillway on lower Bemis Pond to stabilize shoreline and control erosion. This work also removed fallen trees in the channel, which impeded flow between the two ponds.

Bemis Pond is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, “Waters requiring a TMDL”. Pollutants needing TMDLs: Suspended Solids (MassDEP 2007b).

Abbey Brook itself is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals from this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
City of Chicopee (MAR041003)
City of Springfield (MAR041023)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
Geosyntec Consultants (Geosyntec undated) as part of the Chicopee River Watershed Degraded Stream Survey, made field observations of Abbey Brook downstream from the Front Street bridge on 19 May 2003. They found bank erosion and substrate fouling. DWM field crews made observations throughout the 2003 field season at Station AB01 (Front Street Bridge, upstream side, Chicopee). They noted minimal erosion, especially on the right bank, on three occasions. Riprap was found along the banks.

Biology
DWM conducted water quality monitoring at one station (AB01, Front Street Bridge, Chicopee) in Abbey Brook between April and October 2003 (Appendix B). DWM crews made notes on conditions at this site throughout the sampling season. No aquatic plants or phytoplankton were found or recorded. Periphyton was noted on five occasions and described as dense on May 14, 2003. In April thin film algae and filamentous algae were noted, while in May a filamentous periphyton was noted. On the rest of the observable occasions a brown periphyton was noted. Water clarity was noted to be slightly turbid on five occasions and clear on three other occasions.

Water Chemistry
DWM conducted water quality monitoring at one station (AB01, Front Street Bridge, Chicopee) in Abbey Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperature, pH and dissolved oxygen measurements at the DWM station all met criteria on DWM sampling dates (Appendix B). Conductivity was slightly elevated at this station. Ammonia-nitrogen concentrations were low. Total phosphorus concentrations ranged from 0.035 to 0.079 mg/L with the two highest concentrations found on the sampling dates in July and August 2003 (Appendix B).

The *Aquatic Life Use* is assessed as support based primarily on the limited water quality data, which indicates generally good water quality conditions. This use is identified with an “Alert Status” due erosion and sedimentation (Geosyntec undated) particularly in the lower reach near the confluence with the Chicopee River.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* monitoring at one station (AB01, Front Street Bridge, Chicopee) between April and October 2003 (Appendix B*).* *E. coli* counts were generally low with the exception of 15 October 2003, a wet weather sampling date, when the *E. coli* count was 10,000 cfu/100 mL. The geometric mean of *E. coli* counts was 90 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -13500
Geometric mean	168.6
E. coli (cfu/100mL)	2 - 10000
Geometric mean	90

Objectionable deposits consisting of trash were noted on April 14th, July 30th and August 20th by DWM field crews. It is believed that the garbage and trash were localized. In addition to the trash noted on April 14th sand and silt were noted at this station. No scums were noted and, with the exception of one occasion on which a musty water odor was recorded, no odors were noted.

The *Primary and Secondary Recreation Contact Uses* area assessed as support based on the geometric mean of E. coli counts. Due to the one very high *E. coli* count both *Primary* and *Secondary Contact Recreation Uses* are identified with an “Alert Status.” Given the general lack of extensive objectionable conditions the *Aesthetics Use* is assessed as support.

Abbey Brook (Segment MA36-40) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct bacteria sampling to evaluate to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Conduct field reconnaissance and a habitat walk along this segment to determine current conditions and assess the extent of habitat degradation. Where appropriate develop and implement best management practices to reduce erosion and sedimentation.

Conduct water quality sampling in Bemis Pond to address a TMDL for TSS.

Chicopee River Watershed - Lake Assessments

A number of Chicopee River Watershed Lakes have no updated or pertinent information to report (TMDL completion, WMA withdrawals, NPDES permit, etc.) and lack new information with which to make an assessment of designated uses. Information on these waterbodies is summarized below. All these waterbodies are not assessed for all uses.

Lake	Location	WBID	Size (Arces)	Class	2006 Integrated List Category
Brooks Pond	Petersham	MA36022	86	A	3
Carter Pond	Petersham	MA36029	44	A	3
Crystal Lake	Palmer	MA36043	16	B	2
Knights Pond	Belchertown	MA36077	36	A	2
Town Barn Beaver Pond	Petersham	MA36156	20	B	3
Alden Pond	Ludlow	MA36003	4	B	5
Haviland Pond	Ludlow	MA36069	25	B	2
Murphy Pond	Ludlow	MA36103	6	B	3
Adams Pond	Oakham	MA36001	30	B	3
Asnacomet Pond	Hubbardston	MA36005	126	A	2
Bemis Road Pond	Hubbardston	MA36012	17	B	3
Bennett Street Pond	Palmer	MA36014	6	B	3
Cloverdale Street Pond	Rutland	MA36036	19	A, Public Water Supply	3
Cunningham Pond	Hubbardston	MA36044	27	A	3
Edson Pond	Rutland	MA36180	36	A	3
Lovewell Pond	Hubbardston	MA36085	82	A	3
Muddy Pond	Oakham/Rutland	MA36102	23	A	3
Old Reservoir	Barre	MA36114	37	B	4c
Pattaquattic Pond	Palmer	MA36117	18	B	2
Peppers Mill Pond	Ware	MA36121	11	B	3
Queen Lake	Phillipston	MA36132	139	A	2
Stone Bridge Pond	Templeton	MA36148	32	A	3
Thayer Pond	Rutland	MA36181	45	A	3
Waite Pond	Hubbardston	MA36161	34	A	2

Lake	Location	WBID	Size (Arces)	Class	2006 Integrated List Category
Brookhaven Lake	West Brookfield	MA36021	34	B	5
Cranberry Meadow Pond	Spencer/Charlton	MA36040	69	B	3
Cusky Pond	New Braintree	MA36045	28	B	3
Eames Pond	Paxton	MA36056	58	B	5
Lake Whittemore	Spencer	MA36165	52	B	5
Moose Hill Reservoir	Spencer/Leicester	MA36179	52	B	3
Paradise Lake	Monson	MA36116	18	B	2
Shaw Pond	Leicester	MA36138	64	B	2

Swift River Subbasin Lakes

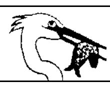
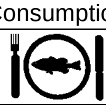
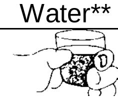
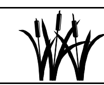
GASTON POND (SEGMENT MA36065)
Location: Barre
Segment Size: 15 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3- No Uses Assessed (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
One aquatic macrophyte species, *Myriophyllum sp.*, was identified in Gaston Pond in 1997 (MassDEP 1997). No recent quality-assured data are available for Gaston Pond. All designated uses are not assessed. Due to the possible presence of a non-native form of *Myriophyllum* Gaston Pond is given an "Alert Status" for *Aquatic Life Use*.

Gaston Pond (Segment MA36065) Use Summary Table

Aquatic Life*	Fish Consumption	Drinking Water**	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED*					

*Alert Status issues identified, see details in use assessment section
** The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence, if any, of non-native species.

POTTAPAUG POND (SEGMENT MA36125)
Location: Petersham
Segment Size: 568 acres
Classification: Class A.

This segment is on the Massachusetts Year 2006 Integrated List of Waters- Category 5- "Pollutants Needing a TMDL" – Metals (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
The Quabbin Reservoir Dam influences the level of water in this segment.

<u>Biology</u>
Geosyntec Consultants (undated) conducted an aquatic macrophytes survey in Pottapaug Pond on July 18, 2006. They found the highest plant densities in the northeastern and eastern parts of the north basin and in the shallow littoral areas along the western and northern parts of the main pond. Biovolume was found to be highest in shallow littoral zones. At 21% of the stations surveyed plant density was found to be dense (51-75%) while at another 21% of the stations surveyed it was found to be very dense (76-100%). Plant biomass was found to be high at 22% of stations and very high at 19% of stations.

Geosyntec Consultants (undated) surveyed 58 stations in the pond and found that a non-native species, variable milfoil (*Myriophyllum heterophyllum*), was the most dominant and spatially distributed plant in the pond. They found variable milfoil at 74% of the stations sampled and the plant was dominant at 24% of all sampling stations. The plant was especially dominant in stations located in the north basin. Floating-leaf vegetation, including White Water Lily (*Nymphaea odorata*), Yelllow Water Lilly (*Nuphar* sp.), Little Floating Heart (*Nymphoides cordata*), Watershield (*Brasenia schreberi*), was also abundant in the pond with White Water Lily being dominant at 21% of all stations. Other commonly observed species included: Common Bladderwort (*Utricularia vulgaris*), Purple Bladderwort (*Utricularia purpurea*) and a number of pondweed species (*Potamogeton* spp.).

Due to the presence of a non-native macrophyte, Pottapaug Pond is assessed as impaired for the *Aquatic Life Use*. The high plant density and biomass at this pond is a cause of concern, but it's shallow nature and probable role as a filter for the Quabbin Reservoir, a major drinking water supply must be noted.

Fish Consumption Use
It has been determined that the fish consumption advisory for the Quabbin Reservoir also applies to Pottapuag Pond (Celona 2007). The fish consumption advisory for the Quabbin Reservoir is detailed below.

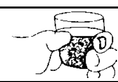
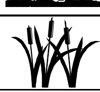
> "*Children younger than 12, pregnant women, and nursing women should refrain from consuming all fish in Quabbin Reservoir except Lake Trout less than 24 inches long and Salmon.*
> *The general population should refrain from consuming Smallmouth Bass, Largemouth Bass, and Lake Trout greater than 24 inches long. The general public may consume unlimited Salmon and lake trout less than 24 inches long. The general public should limit consumption of all other fish species to one five-ounce meal per week."*

Because MA DPH recommends that the site-specific fish consumption advisory for Quabbin Reservoir due to mercury should also apply to Pottapuag Pond (Celona 2007) this pond is assessed as impaired for the *Fish Consumption Use*.

A TMDL, a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards, was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Pottapuag Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Pottapaug Pond (Segment MA36125) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-Native Aquatic Plants Source: Introduction of non-native organisms
Fish Consumption		IMPAIRED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition-toxics
Drinking Water*		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Conduct fish toxics monitoring in Pottapaug Pond to more fully assess the *Fish Consumption Use.*

QUABBIN RESERVOIR (SEGMENT MA36129)
Location: Petersham/Pelham/Ware/Hardwick/Shutesbury/Belchertown/New Salem
Segment Size: 24012 acres
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5- Pollutants Needing a TMDL – Metals (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
MWRA (registration #10830901)
The Massachusetts Water Resources Authority (MRWA) is allowed to withdraw (WMA Registration Number 10830901) 186.7 MGD from the reservoir. The majority of this water is transferred out of the Chicopee River Basin to supply potable water to 44 communities in the Metropolitan Boston area and three Western Massachusetts communities.

NPDES SURFACE WATER DISCHARGES
There are no permitted discharges to this drinking water supply reservoir.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
Geosyntec Consultants (2006) conducted aquatic macrophytes surveys in the Quabbin Reservoir between July 17, 2006 and August 16, 2006. They conducted surveys in a number of littoral areas in the reservoir including: northern settling pond, Fishing Area 3 & Shaft 11A, Fishing Area 2, Fishing Area 1, Quabbin-North Dana, Quabbin-Millington and Quabbin-Mt. Russ.

The northern settling pond, a small 47 acre area directly north of Fishing Area 2, was surveyed on July 24, 2006. Fifty-one stations were sampled. Forty-three percent of the stations in the northern settling pond were found to have moderate to very dense plant densities, although only 5% of that total was very dense. Moderate plant biomass was found at 43% of stations and high plant biomass was found at 19% of stations, while the remaining stations had low or zero biomass. Plant species in order of dominance (number of stations at which they were the most abundant) include: White Water Lily (*Nymphaea odorata)*, Pickerelweed (*Pontederia cordata*),Variable Milfoil (*Myriophyllum heterophyllum*), Purple Bladderwort (*Utricularia purpurea*), various pondweeds (*Potamogeton* spp.), Low Watermilfoil (*Myriophylum humile*) and Watershield (*Brasenia schreberi*).

In addition to the northern settling pond, Geosyntec sampled for aquatic macrophytes at 327 stations in the Quabbin Reservoir. Aquatic plant growth was found to be sparse and when found, it was mainly located in shallow areas in coves and along the shores of the Quabbin (Geosyntec Consultants 2006). Eighty-three percent of all stations sampled had low plant densities (0-25%) and dense and very dense plant growth was located at only 17% of stations (Geosyntec Consultants 2006). High plant densities were found in “coves along the northern and eastern portions of North Dana, the area north of Mount L in Millington and the southeast cove near Shaft 11A of Fishing Area 3” (Geosyntec Consultants 2006). It is important to note that 60% of the stations sampled were characterized as having virtually no plants or very sparse densities (1-5%) (Geosyntec Consultants 2006). Plant biomass was also found to be low in the littoral areas surveyed in the Quabbin Reservoir. Seventy-nine percent of the stations surveyed were characterized as having low or zero plant biomass (Geosyntec Consultants 2006). Moderate biomass was present at 12% of sampled stations, while 9% of the stations had high to very high biomass (Geosyntec Consultants 2006). Fifty-two plant species were observed with golden hedge hyssop (*Gratiola aurea*) dominant at 31% of stations. Other plant species commonly found include: Bur-reed (*Sparganium* sp.), Robbin’s Spike Rush (*Eleocharis robbinsii*), Variable Milfoil (*Myriophyllum heterophyllum*), numerous bladderwort species (*Utricularia sp*.), and Mermaid Weed (*Proserpinaca palustris*).

The non-native species Variable Milfoil (*Myriophyllum heterophyllum*) was dominant at 7% of all stations sampled and largely found in coves (Geosyntec Consultants 2006). Geosyntec staff found Variable Milfoil in coves near Shaft 11, Albertine's Cove, a cove directly west of Albertine's Cove, in coves near Leveau Island, a cove near Pittman Hill, and in a shallow area near Bassett and Fairview Hills (Geosyntec Consultants 2006). Generally the densities and biovolume of aquatic macrophytes in the Quabbin Reservoir is low.

<u>Water Chemistry</u>
MA DCR collects water quality data at numerous locations in the Quabbin Reservoir and its tributaries, although a QAPP and field duplicates were not available for their reservoir sampling.

<u>2003</u>

MA DCR (2004) collected water chemistry data and water column profiles at three stations in 2003. MA DCR documented low turbidity, low color and low specific conductance; the pH ranged from 5.6 –7.2 SU in their samples (MA DCR 2004). Secchi disk depth ranged from 3.8 to 13 m. Dissolved oxygen levels were near saturation or over-saturated in the metalimion and epilimion. At the Shaft #12 sampling site the minimum dissolved oxygen reading was 49.2 % saturation, while the minimum found at Site 202 was 75.9% saturation in the hypoliminion. The average pH of all 54 reservoir samples was 6.64 SU while the average alkalinity of samples from the three MA DCR sampling sites was 4.0 mg/L as CaC03 (MA DCR 2004). Quarterly nutrient sampling was also conducted by MA DCR scientists. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2004).

<u>2004</u>

MA DCR (2005) collected water chemistry data and water column profiles at three stations in 2004. MA DCR documented low turbidity and low specific conductance. The pH ranged from 5.5 –7.0 SU in their samples. Secchi disk depth ranged from 5.8 to 13.1 m. At the Shaft #12 sampling site, the minimum dissolved oxygen reading was 48% saturation while the minimum found at Site 202 was 73% saturation in the hypoliminion. The average pH of all 46 reservoir samples was 6.54 SU while the average alkalinity of samples from the three MA DCR sampling sites was 4.4 mg/l as CaC03. MA DCR scientists also conducted quarterly nutrient sampling. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2005).

<u>2005</u>

MA DCR collected water chemistry data and water column profiles at three stations in 2005. MA DCR documented low turbidity, and the pH ranged from 5.5 –7.0 SU in their samples (MA DCR 2006a). Secchi disk depth ranged from 3.7 to 11.8 m. At the Den Hill sampling site the minimum dissolved oxygen reading was 31% saturation while the minimum found at Site 202 was 55% saturation in the hypoliminion (MA DCR 2006b). The average pH across the three reservoir stations was 6.61 SU while the average alkalinity of samples was 4.85 mg/l as CaC03. MA DCR scientists also conducted quarterly nutrient sampling. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2006b).

<u>2006</u>

MA DCR collected water chemistry data and water column profiles at three stations in 2006. MA DCR documented low turbidity, and the pH ranged from 5.5 –7.7 SU in their samples (MA DCR 2007). Secchi disk depth ranged from 4.0 to 12.6 m. At the Den Hill sampling site the minimum dissolved oxygen reading was 20% saturation while the minimum found at Site 202 was 58% saturation in the hypoliminion (MA DCR 2007). The average pH across the three reservoir stations was 6.34 SU while the average alkalinity of samples was 5.31 mg as CaC03 (MA DCR 2007). Quarterly nutrient sampling was also conducted by MA DCR scientists in 2006. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2007).

The *Aquatic Life Use* is assessed as impaired based on the presence of the non-native macrophyte (*Myriophyllum heterophyllum*). The Quabbin Reservoir and its tributaries, including flow diversion from the Ware River, are subject to acid deposition. Acid deposition effects on the reservoir and its tributaries is a cause of concern. MA DCR (2007) notes that productivity within the reservoir is limited by phosphorus, which is found in low concentrations in the reservoir.

Fish Consumption Use

MDPH has issued a fish consumption advisory due to mercury contamination for Quabbin Reservoir as follows.

> "*Children younger than 12, pregnant women, and nursing women should refrain from consuming all fish in Quabbin Reservoir except Lake Trout less than 24 inches long and Salmon.*
> *The general population should refrain from consuming Smallmouth Bass, Largemouth Bass, and Lake Trout greater than 24 inches long. The general public may consume unlimited Salmon and lake trout less than 24 inches long. The general public should limit consumption of all other fish species to one five-ounce meal per week."*

Fish were collected from the Quabbin Reservoir by MassDEP for mercury analysis on April 20th, 2005 as part of an Office of Research and Standards long term trend study (MassDEP 2005). The largemouth bass samples had an average mercury concentration around the 0.5 μg/g Hg trigger level that MA DPH uses to issue no consumption advisories for sensitive population groups and limited consumption general population advisories. The data are summarized below.

Fish Species	Number Collected	Average Length (mm)	Range Length (mm)	Average Wet Weight Whole Specimen(g)	Range Wet Weight Whole Weight (g)	Average Hg of individual fillets(µg/g)	Range Hg-individual fillets (µg/g)
Largemouth Bass	12	385	250-470	927.7	227-1765	0.51	0.17-0.88
Lake Trout	7	550	480-590	1434.3	1029-1770	0.38	0.2-0.51
Yellow Perch	6	218	140-330	146.2	28-347	0.31	0.11-0.63

A TMDL, a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards, was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Pottapuag Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

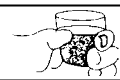
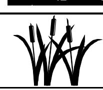
Primary and Secondary Contact Recreation Uses

In 2003 MA DCR sampled at three sites for fecal coliform bacteria and found very low fecal bacteria counts. Only 14 of the 60 samples taken tested positive for fecal coliform bacteria and the greatest count was 3 cfu/100 mL (MA DCR 2004). In 2004 fecal coliform counts were very low with a range from 0 to 1 cfu/100 mL (n=90) (MA DCR 2005). In 2005 MA DCR monitored bacteria levels between May 25 and December 13 (MA DCR 2006b). Fecal coliform counts in 2005 were very low with a range from 0 to 5 cfu/100 mL (n=73) (MA DCR 2006). In 2006 MA DCR monitored bacteria levels between April 20 and December 14 (MA DCR 2007). Fecal coliform counts in 2006 were very low with a range from 0 to 19 cfu/100 mL (n=129, 9 sampling days) (MA DCR 2007). Of the 129 total samples taken, fifty one samples were taken at the three stations on five sampling days during the primary contact season. The majority of the samples did not show the presence of fecal coliform bacteria. Of the 129 samples taken, *E. coli* was only detected in two samples. These samples, taken on October 19 and November 15, had *E. coli* counts at the minimum detection limit of 10 MPN/100 mL (MA DCR 2007). MA DCR (2007) notes that a “season gull population that roosts on the reservoir overnight has been identified as the primary contributor of fecal coliform bacteria contamination to the reservoir”.

Given the very low fecal coliform counts in 2006 and reported historically at the Quabbin Reservoir the *Primary* and *Secondary Contact Recreational Uses* are assessed as support.

Aesthetics Use
No objectionable conditions have been reported in the Quabbin Reservoir, which is a protected public water supply and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). Given the lack of objectionable conditions, the *Aesthetics Use* is assessed as support.

Quabbin Reservoir (Segment MA36129) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native
Fish Consumption		IMPARIED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Drinking Water*		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Coordinate future MassDEP sampling with the existing MA DCR sampling program.

Conduct additional fish toxics monitoring in the Quabbin Reservoir to evaluate Hg in response to TMDL implementation.

Conduct efforts to minimize and contain the spread of non-native plants.

Ware River Subbasin Lakes

BEAVER LAKE (SEGMENT MA36010)
Location: Ware
Segment Size: 150 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
Two non-native species (*Myriophyllum heterophyllum* and *Myriophyllum spicatum*) were observed in Beaver Lake during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of non-native species. With the exception of *Aquatic Life Use* no other quality-assured data are available, the remaining designated uses are not assessed.

Beaver Lake (Segment MA36010) Use Summary Table

Designated Uses	Status
Aquatic Life	IMPAIRED Cause: Non-Native aquatic plants *Myriophyllum spicatum* Source: Introduction of non-native organism
Fish Consumption	NOT ASSESSED
Primary Contact	
Secondary Contact	
Aesthetics	

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current macrophyte conditions.

Management to control and prevent the spread of non-native macrophytes should be conducted.

BICKFORD POND (SEGMENT MA36015)
Location: Hubbardston/Princeton
Segment Size: 163 acres
Classification: Class A

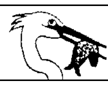
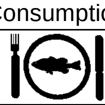
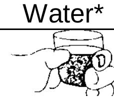
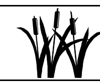
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Fitchburg Water Department registration/permit (20809701/9P20809701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Bickford Pond. All designated uses are not assessed

Bickford Pond (Segment MA36015) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

BRIGHAM POND (SEGMENT MA36020)
Location: Hubbardston
Segment Size: 47 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One potential non-native aquatic macrophyte species, *Myriophyllum sp.*, was identified in Brigham Pond (MassDEP 1998). The *Aquatic Life Use* is not assessed for Brigham Pond. However, this use is identified with an "Alert" Status because of the potential infestation of non-native form of *Myriophyllum*.

No recent quality-assured data are available for Brigham Pond. All designated uses are not assessed.

Brigham Pond (Segment MA36020) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

DEMOND POND (SEGMENT MA36051)
Location: Rutland
Segment Size: 120 acres
Classification: Class A

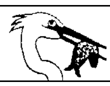
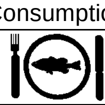
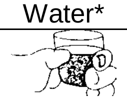
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One potential non-native aquatic macrophyte species, *Myriophyllum sp*., was identified in Demond Pond (MassDEP 1998). The *Aquatic Life Use* is not assessed for Demond Pond. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*.

No recent quality-assured data are available for Demond Pond. All designated uses are not assessed.

Demond Pond (Segment MA36051) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

FOREST LAKE (SEGMENT MA36063)
Location: Palmer
Segment Size: 45 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Myriophyllum spicatum*) was observed in Forest Lake during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. No recent quality-assured data are available for Forest Lake. All designated uses with the exception of the *Aquatic Life Use* are not assessed.

Forest Lake (Segment MA36063) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: *Myriophyllum spicatum* Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

HARDWICK POND (SEGMENT MA36066)
Location: Hardwick
Segment Size: 67 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

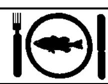
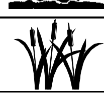
WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Hardwick Pond. All designated uses with the exception of *Aquatic Life Use* are not assessed.

Aquatic Life Use
<u>Biology</u>
Two non-native species (*Cabomba caroliniana*, *Myriophyllum heterophyllum*) were observed in Hardwick Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of two non-native species. No recent quality-assured data are available for Forest Lake. All designated uses with the exception of *Aquatic Life Use* are not assessed.

Hardwick Pond (Segment MA36066) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
An aquatic macrophyte survey should be considered to determine the extent of impairment.

Actions to control non-natives should be taken to minimize their impact in this pond.

LONG POND (SEGMENT MA36082)
Location: Rutland
Segment Size: 167 acres
Classification: Class A

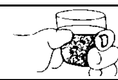
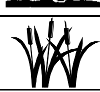
This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
A non-native species (*Myriophyllum heterophyllum*) was observed in Long Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. No recent quality-assured data are available for Long Pond. All designated uses with the exception of *Aquatic Life Use* are not assessed.

Long Pond (Segment MA36082) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Drinking Water*		NOT ASSESSED
Fish Consumption		
Primary Contact		
Secondary Contact		
Aesthetics		

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
An aquatic macrophyte survey should be considered to determine the extent of non-native plant species.

Actions to control non-natives should be taken to minimize their impact in this pond.

MARE MEADOW RESERVOIR (SEGMENT MA36090)
Location: Westminster/Hubbardston
Segment Size: 240 acres
Classification: Class A

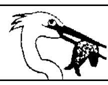
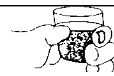
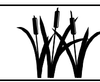
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Fitchburg Water Department registration/permit (20809701/9P20809701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Mare Meadow Reservoir. All designated uses are not assessed.

Mare Meadow Reservoir (Segment MA36090) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Monitor water withdrawals by the Fitchburg Water Department.

MARE MEADOW RESERVOIR NORTH (SEGMENT MA36178)
Location: Westminster
Segment Size: 38 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Fitchburg Water Department registration/permit (20809701/9P20809701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Mare Meadow Reservoir North. All designated uses are not assessed.

Mare Meadow Reservoir North (Segment MA36178) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Monitor water withdrawals by the Fitchburg Water Department.

MOOSEHORN POND (SEGMENT MA36097)
Location: Hubbardston
Segment Size: 67 acres
Classification: Class A

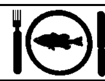
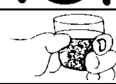
This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Biology
A non-native species (*Myriophyllum heterophyllum*) was observed in Moosehorn Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. No recent quality-assured data are available for Moosehorn Pond. All designated uses with the exception of the *Aquatic Life Use* are not assessed.

Moosehorn Pond (Segment MA36097) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Fish Consumption		NOT ASSESSED
Drinking Water*		
Primary Contact		
Secondary Contact		
Aesthetics		

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
An aquatic macrophyte survey should be considered to determine the extent of non-native plant species.

Actions to control non-natives should be taken to minimize their impact in this pond.

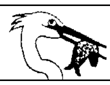
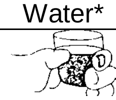
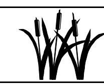
MOULTON POND (SEGMENT MA36098)
Location: Rutland
Segment Size: 65 acres
Classification: Class A

This segment is on the 2006 Integrated List of Waters in Category 3 - *No Uses Assessed* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One potential non-native aquatic macrophyte species, *Myriophyllum sp.*, was identified in Moulton Pond (MassDEP 1998). The *Aquatic Life Use* is not assessed. However this use is identified with an “Alert” Status because of the potential infestation of non-native form of *Myriophyllum*.
No recent quality-assured data are available for Moulton Pond. All designated uses are not assessed.

Moulton Pond (Segment MA36098) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine the presence if any of non-native species.

PERRY HILL POND (SEGMENT MA36122)
Location: Hubbardston
Segment Size: 23 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 3 - *No Uses Assessed* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
One potential non-native aquatic macrophyte species, *Myriophyllum sp.*, was identified in Perry Hill Pond during the 1998 synoptic lake survey (MassDEP 1998). This macrophyte may be a non-native and confirmation of the species is needed. The *Aquatic Life Use* is not assessed. However this use is identified with an "Alert" Status because of the potential infestation of non-native form of *Myriophyllum*. No recent quality-assured data are available for Perry Hill Pond. All designated uses are not assessed.

Perry Hill Pond (Segment MA36122) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

THOMPSON LAKE (SEGMENT MA36154)
Location: Palmer
Segment Size: 35 acres
Classification: Class A

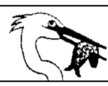
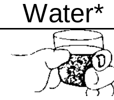
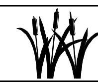
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
The presence of *Myriophyllum heterophyllum* was listed in the herbicide permit files and the lake has been treated with herbicides.

Confirmation of the presence of non-natives macrophytes by DWM personnel is needed. The *Aquatic Life Use* is not assessed for Thompson Lake. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. No recent quality-assured data are available for Thompson Lake. All designated uses are not assessed.

Thompson Lake (Segment MA36154) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED**					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

Quaboag River Subbasin Lakes

BROOKS POND (SEGMENT MA36023)
Location: N. Brookfield/New Braintree/Spencer/Oakham
Segment Size: 86 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5- *Waters Requiring a TMDL* because of pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A milfoil species (*Myriophyllum sp.*) was observed in Brooks Pond during the 1998 synoptic surveys (MassDEP 1998). A private company, Aquatic Control Technologies has reported *Myriophyllum heterophyllum* in Brooks Pond (ACT 2000) and the pond has been treated with herbicides in the past.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Brooks Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Brooks Pond with the exception of macrophytes information. All designated uses are not assessed with the exception of *Aquatic Life Use*.

Brooks Pond (Segment MA36023) Use Summary Table

Designated Uses	Status
Aquatic Life	IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Fish Consumption	NOT ASSESSED
Primary Contact	
Secondary Contact	
Aesthetics	

RECOMMENDATIONS

Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

Conduct water quality monitoring to evaluate designated uses.

BROWNING POND (SEGMENT MA36025)
Location: Oakham/Spencer
Segment Size: 106 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of pathogens (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.015 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Browning Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The current estimated phosphorous loading of 200 kg/ha/year does not have to be reduced to meet the target estimated loading (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Myriophyllum heterophyllum*) was observed in Browning Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Browning Pond (Segment MA36025) Use Summary Table

Designated Uses	Status
Aquatic Life	IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption	NOT ASSESSED
Primary Contact	
Secondary Contact	
Aesthetics	

RECOMMENDATIONS
Consult Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

COMINS POND (SEGMENT MA36037)
Location: Warren
Segment Size: 26 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 3 - *No Uses Assessed* (MassDEP 2007b).

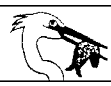
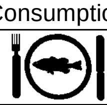
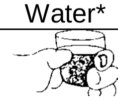
WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Warren Water Department registration/permit (20831102/9P220831102)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Comins Pond (no postings). Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Comins Pond. All designated uses are not assessed.

Comins Pond (Segment MA36037) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

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CONANT BROOK RESERVOIR (SEGMENT MA36038)
Location: Monson
Segment Length: 4.4 acres
Classification: B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2 - Attaining Some Uses; Other Uses Not Attained. Uses attained are *Secondary Contact Recreation* and *Aesthetics* (Mass DEP 2005a).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
The Town of Monson municipal water supply, which included a large dug well (72 feet wide by 23 feet deep, one of the largest in the country)(US ACOE 2007a) and this 115-acre surface water reservoir, was located here historically. When the U.S. Army Corps of Engineers (ACOE) built the Conant Brook Dam in 1966, this system was replaced by a well field in northern Monson in the Chicopee Brook watershed. The Conant Brook system was officially abandoned as a public drinking water supply and all infrastructure connections were severed in 1996 (Mass DEP 2007c).

Based on the available information, there are no WMA regulated groundwater or surface water withdrawals from or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Historically this water body was approximately 115 acres (Ackerman 1989). The current Conant Brook Reservoir is impounded by the ACOE Conant Brook Dam. This project was built to reduce flooding in the Conant Brook, Chicopee and Connecticut rivers. The earth and rockfill dam is 85 feet high and 1,050 feet long, with a 36-inch reinforced concrete pipe outlet with no gate. It controls a drainage area of 7.8 square miles. The Conant Brook Dam Project is a dry bed reservoir and does not maintain a permanent recreational pool. During flood control activities the 2.25-acre reservoir can increase to a maximum 158 acres, with a storage capacity of 3,740 acre-feet. Water level at Conant Brook Dam is controlled by thirty-six inch diameter conduit without gates (US ACOE 2006). When the dam is not in use for flood control it is operated in a run-of-river mode.

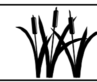
No other water quality data are available for Conant Brook Reservoir so the *Aquatic Life Use* is not assessed.

Primary and Secondary Contact Recreation and Aesthetics Uses
As at all Army Corps projects, primary and secondary contact recreation uses are allowed unless specifically prohibited; swimming, boating, and similar uses are not prohibited at the Conant Brook Dam Project. However, there is no public beach or boat launch located here. Given the lack of recent quality-assured data the *Primary* and *Secondary Contact Recreation Uses* are not assessed for Conant Brook Reservoir.

The Conant Brook Dam Project encompasses 471 acres and is managed by the ACOE for flood control, recreation, and habitat. Recreational opportunities include hunting, fishing, mountain biking, hiking, cross-country skiing, snowshoeing, sightseeing, and photography. Off road vehicles are prohibited, as are dumping and littering, loud noises, and any form of vandalism. These rules are enforced by Army Corps staff (US ACOE 2007b). The Monson-Brimfield-Wales Trail traverses the property; a total of 24 trail miles traverse the project. The ACOE web site for the dam states, “The natural environment of Conant Brook Dam reflects the diverse nature and beauty of New England. Forested, rolling hills frame the river valley in which numerous wildlife species find a home” (US ACOEc).

Based on this and the largely undeveloped watershed surrounding the Conant Brook Reservoir, noted scenic views and active management of the property, the *Aesthetics Use* is assessed as support.

Conant Brook Reservoir (Segment MA36050) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				SUPPORT

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

DEAN POND (SEGMENT MA36049)
Location: Brimfield/Monson
Segment Size: 10 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

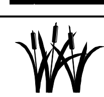
WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One potential non-native aquatic macrophyte, *Myriophyllum sp.*, was identified in Dean Pond during the 1998 synoptic lake surveys (MassDEP 1998). In 2003 the MA DCR Lakes and Ponds Program confirmed the presence of the non-native *Myriophyllum heterophyllum* in Dean Pond.

The *Aquatic Life Use* for this waterbody is assessed as impaired based on the presence of a non-native species. No quality-assured data are available for Dean Pond with the exception of macrophytes information. All designated uses are not assessed with the exception of *Aquatic Life Use.*

Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Dean Pond: Dean Pond Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Dean Pond (Segment MA36049) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic plant Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
An aquatic macrophyte survey should be considered to determine the extent of non-native plant species.

DEAN POND (SEGMENT MA36050)
Location: Oakham
Segment Size: 64 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of noxious aquatic plants and turbidity (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

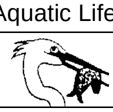
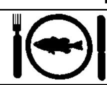
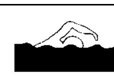
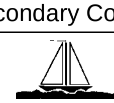
DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
Myriophyllum heterophyllum and *Myriophyllum sp*. were listed as found in Dean Pond in herbicide permit applications between 2003 to 2006 and the pond has been treated with herbicides.

The *Aquatic Life Use* is not assessed for Dean Pond. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. Confirmation of the presence of non-natives macrophytes by DWM personnel is needed.

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Dean Pond: Dean Campground and Pine Acres Campground. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Dean Pond with the exception of macrophyte information. All designated uses are not assessed.

Dean Pond (Segment MA36050) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

DOANE POND (SEGMENT MA36054)
Location: North Brookfield
Segment Size: 28 acres
Classification: Class A

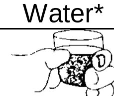
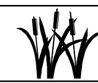
This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of noxious aquatic plants (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
North Brookfield Water Department registration (20821201)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Doane Pond. All designated uses are not assessed.

Doane Pond (Segment MA36054) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

HORSE POND (SEGMENT MA36072)
Location: North Brookfield
Segment Size: 63 acres
Classification: Class A

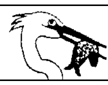
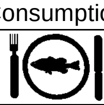
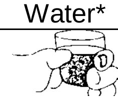
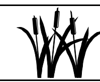
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
North Brookfield Water Department registration (20821201)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Horse Pond. All designated uses are not assessed.

Horse Pond (Segment MA36072) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

LAKE LASHAWAY (SEGMENT MA36079)
Location: North Brookfield/East Brookfield
Segment Size: 274 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters- Category 5 - Pollutants Needing a TMDL – Metals and exotic (non-native) species* (MassDEP 2007b).
*It should be noted that exotic species are not considered a pollutant.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Carbomba caroliniana*) was observed in Lake Lashaway during the 1998 synoptic survey (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native plant species.

Fish Consumption Use
MDPH has issued a fish consumption advisory due to Mercury contamination for Lake Lashaway, East Brookfield/North Brookfield as follows:

> *"Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Lake Lashaway in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury.*
> *The general public should limit consumption of Largemouth Bass fish from Lake Lashaway to two meals per month."*

The *Fish Consumption Use* is assessed as impaired for this waterbody due to a site specific fish consumption advisory.

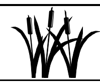
A TMDL was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Lake Lashaway that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Lake Lashaway. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary or Secondary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody. The *Aesthetics Use* is also not assessed.

No recent quality-assured data are available for Lake Lashaway with the exception of macrophyte information and a fish consumption advisory. All designated uses are not assessed with the exception of *Aquatic Life Use* and *Fish Consumption*.

Lake Lashaway (Segment MA36079) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		IMPAIRED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

PALMER RESERVOIR (SEGMENT MA36115)
Location: Palmer
Segment Size: 8 acres
Classification: Class A

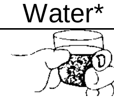
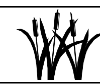
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2 - Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Palmer Water Department registration (10822702)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Palmer Reservoir. All designated uses are not assessed.

Palmer Reservoir (Segment MA36115) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

QUABOAG POND (SEGMENT MA36130)
Location: Brookfield/East Brookfield
Segment Size: 544 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of noxious aquatic plants, nutrients, metals and exotic species* (MassDEP 2007b).
*It should be noted that exotic species are not considered a pollutant. EPA approved a total phosphorus TMDL for Quaboag and Quacumquasit Ponds on 6 December 2007 (Perkins 2007).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Brookfield Water Department registration (20804501)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

A 319 grant entitled "Phosphorus and Sediment Load Reduction at Quaboag and Quacumquasit Ponds" has been awarded. The goal of this project is to support the TMDL development and implementation by prioritizing and addressing pollutant sources within the shared watershed of the two lakes. Target pollutants are nutrients and TSS. Some implementation work that has been previously recommended will be undertaken, and plans will be developed for future implementation that will further reduce the NPS coming into the lakes.
Project tasks include:

1. development and implementation of a Quality Assurance Project Plan (QAPP);
2. prioritization of pollutant sources;
3. development of conceptual plans for two or more high-priority BMPs;
4. evaluation of additional control measures, including the backflow between the two lakes; and
5. aquatic vegetation management.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
According to field notes there was a fish kill after a July 21st, 2004 herbicide treatment. A blue-green bloom that may have been exacerbated by the herbicide treatment was later noted in July 2004. After the herbicide treatment the blue-green bloom was extensive, although high nutrient loading also likely contributed to the bloom.

In August 2003, during baseline TMDL sampling, three non-native species (*Myriophyllum heterophyllum, Cabomba caroliniana,* and *Myriophyllum spicatum*) were observed in Quaboag Pond (MassDEP 2006b). The macrophytes density and biovolume was very dense for the majority of the pond in August 2003 (MassDEP 2006b). The density and biovolume of macrophytes was much larger than found in the 1980's and macrophytes also occurred deeper in the water column (3 m versus <2 m) (MassDEP 2006b). These same non-native species were also observed in Quaboag Pond during the 1998 synoptic surveys (MassDEP 1998).

MA DFG conducted fish population sampling in Quaboag Pond (Site 1018) in Brookfield using a boat shocker on 30 June 2004. One hundred and twenty-nine chain pickerel and one alewife were collected (130 fish total) (Richards 2006). MA DFG fish biologists noted the targeted fish, *Escocidae* (chain pickerel and pike), only during their collection. Given the target nature of this sampling no conclusions on the fish population dynamics in Quaboag Pond can be made.

Water Chemistry
The selected target phosphorus concentration and loads necessary to achieve surface water

quality standards for Quaboag Pond are 30 ppb (June through September) and 2588 kg/year, respectively (MassDEP 2006b). For the complete detailing of estimated nutrient loading to Quaboag Pond see the Total Maximum Daily Loads of Total Phosphorus for Quaboag Pond & Quacumquasit Pond (MassDEP 2006b). For the most recent water quality data see Appendix C.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of non-native plant species and excessive algal growth resulting from high total phosphorus. The TMDL estimates nutrient loading from the municipal point source discharge (Spencer WWTP), multiple nonpoint sources, and internal nutrient recycling.

Fish Consumption Use
MA DPH (2005) has issued a fish consumption advisory due to Mercury contamination for Quaboag Pond, Brookfield/East Brookfield as follows:

> "*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Powder Mill Pond in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury.*
> *The general public should refrain from consumption of Largemouth Bass fish from Quaboag Pond. The general public should limit consumption of non-affected fish from Quaboag Pond to two meals per month*".

Due to the site specific fish consumption advisory this waterbody is assessed as impaired for the *Fish Consumption Use*.

Primary and Secondary Contact Recreation Uses
Large populations of the non-native Eurasian milfoil (M*yriophyllum spicatum*) and fanwort (*Cabomba carolinina)* were found in August 2003 (MassDEP 2006b). Macrophyte density in the range of 75-100% was found over the majority of the pond. Macrophytes also occupied 50 to 75% of the biovolume in the majority of the pond and around the edges macrophytes often occupied 75-100% of the biovolume, especially along the northeastern and northwestern shores of the pond. In July 2003 the macrophyte density and biovolume were so great that frequent cleaning of the outboard motor was needed to traverse the pond although conditions improved in August. In July of 2004 an herbicide treatment occurred on Quaboag Pond.

According to MassDEP (2006b), "A bloom of algae was reported to be in the water at the time, but this bloom expanded to become a large, persistent surface bloom of blue-green algae (cyanobacteria) that raised concerns about health impacts." It was estimated that the herbicide treatment likely released a sufficient amount of nutrients to significantly contribute to a large bloom, although it was also noted that phosphorus concentrations in East Brookfield River (an upstream tributary to Quaboag Pond) were also high (50 *u*g/L) in July (MassDEP 2006b).

The *Recreational Uses* are impaired due to high density and biovolume of aquatic macrophytes, including non-natives and excessive algal growth.

Aesthetics Use
MassDEP DWM field crews noted objectionable deposits on two occasions during field visits conducted in 2003 and 2004. Noxious weeds were noted on the two occasions and a bloom of blue-greens (cyanobacteria) was noted in July 2003. On three occasions surface scums were noted, consisting of pollen sheen on one occasion, streaks of foam on one occasion and a blue-green bloom on another occasion. Water odors or other objectionable deposits were not noted during field sampling. The *Aesthetic Use* is impaired due to high density and biovolume of aquatic macrophytes including non-natives and excessive algal growth.

Quaboag Pond (Segment MA36130) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants, excessive algal growth, high total phosphorus Source: Introduction of non-native organism, municipal point source discharge, non-point sources, internal nutrient recycling
Fish Consumption		IMPARIED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Primary Contact		IMPAIRED Cause: Non-native aquatic plants, excessive algal growth Source: Introduction of non-native organism, municipal point source discharges, internal nutrient recycling Suspected Sources: Pesticide application
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Follow aquatic macrophytes management plan outlined in TMDL (MassDEP 2006b).

Follow TMDL recommendations in terms of nutrient loading with specif ic emphasis on non-point source loading reductions (MassDEP 2006b).

Conduct monitoring to assess the progress of TMDL implementation.

QUACUMQUASIT POND (SEGMENT MA36131)
Location: Brookfield/East Brookfield/Sturbridge
Segment Size: 223 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of metals and exotic species* (MassDEP 2007b).

*It should be noted that exotic species are not considered a pollutant. EPA approved a total phosphorus TMDL for Quaboag and Quacumquasit Ponds on 6 December 2007 (Perkins 2007). The target load listed for Quacumquasit Pond is considered a preventative TMDL.

A 319 grant entitled "Phosphorus and Sediment Load Reduction at Quaboag and Quacumquasit Ponds" has been awarded. The goal of this project is to support the TMDL development and implementation by prioritizing and addressing pollutant sources within the shared watershed of the two lakes. Target pollutants are nutrients and TSS. Some implementation work that has been previously recommended will be undertaken, and plans will be developed for future implementation that will further reduce the NPS coming into the lakes.
Project tasks include:

1. development and implementation of a Quality Assurance Project Plan (QAPP);
2. prioritization of pollutant sources;
3. development of conceptual plans for two or more high-priority BMPs;
4. evaluation of additional control measures, including the backflow between the two lakes; and
5. aquatic vegetation management.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Flow of water out of Quacumquasit Pond is controlled by means of a gate structure and the backflow of water from Quaboag Pond to Quacumquasit Pond has been noted (MassDEP 2006b). This backflow of water from Quaboag has been identified as a source of nutrient loading to Quacumquasit Pond (MassDEP 2006b).

<u>Biology</u>
Three non-native species (*Myriophyllum heterophyllum, Myriophyllum spicatum,* and *Cabomba caroliniana*) were observed in Quacumquasit Pond during the 1998 synoptic surveys (MassDEP 1998). Macrophyte mapping was not conducted at this pond in 2003.

<u>Water Chemistry</u>
For a complete detailing of estimated nutrient loading to Quacumquasit Pond please see the Draft Total Maximum Daily Loads of Total Phosphorus for Quaboag Pond & Quacumquasit Pond (MassDEP 2006b). For the most recent water quality data for this pond see Appendix C.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Fish Consumption Use
MA DPH (2005) has issued a fish consumption advisory due to Mercury contamination for Quacumquasit Pond, Brookfield/East Brookfield as follows:

> "*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Quacumquasit*

Pond in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury. The general public should limit consumption of all fish species from Quacumquasit Pond to two meals per month".

Due to the site-specific fish consumption advisory this waterbody is assessed as impaired for the *Fish Consumption Use*.

A TMDL was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont.

The TMDL covers waterbodies including Quacumquasit Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses

There are two beaches along the shoreline of Quacumquasit Pond: South Pond Beach and Camp Frank A Day. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No objectionable deposits, scum or odors were noted by DWM field crews during baseline TMDL sampling in 2003. Macrophyte mapping was not conducted at this pond.

Due to the lack of recent quality-assured bacteria information the *Recreation Uses* are not assessed. Due to the lack of objectionable conditions noted at Quacumquasit Pond by DWM field crews, the *Aesthetics Use* is supported for Quacumquasit Pond.

Quacumquasit Pond (Segment MA36131) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		IMPAIRED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS

Follow aquatic macrophytes management plan outlined in TMDL (MassDEP 2006b).

Efforts should be taken through appropriate gate management and/or raising the gate height to prevent unnecessary nutrient fluxes into the pond (MassDEP 2006b).

SUGDEN RESERVOIR (SEGMENT MA36150)
Location: Spencer
Segment Size: 85 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* for organic enrichment/low DO and nutrients (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.015 mg/L for this water body (MassDEP 2006c).

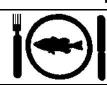
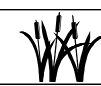
For a complete detailing of estimated nutrient loading to Sugden Reservoir see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 372 kg/ha/year to a target load of 230 kg/ha/year (38% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Sugden Reservoir. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Sugden Reservoir. All designated uses are not assessed.

Sugden Reservoir (Segment MA36150) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

Consult Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

THOMPSONS POND (SEGMENT MA36155)
Location: Spencer
Segment Size: 116 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c - *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

In 2000 the Town of Spencer and Concern Citizens Association of Thompsons Pond received a $2,250 grant. The Thompson Pond project goal was to control the spread of Eurasian milfoil, a non-native nuisance aquatic plant, with the use of herbicides. The aquatic plant was affecting recreational pursuits and the ecosystem of the lake. In 2002 an additional $3,750 was awarded to control Eurasian milfoil with the use of herbicides and conduct public education.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
No non-natives aquatic macrophytes were observed by DWM field crews during the 1998 synoptic survey, although abutters claimed Eurasian milfoil (*Myriophyllum spicatum*) was present. The presence of *Myriophyllum* sp. and *Myriophyllum heterophyllum* was listed in the herbicide permit files and the pond has been treated with herbicides.

The *Aquatic Life Use* is not assessed for Thompsons Pond. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. Confirmation of the presence of non-natives macrophytes by DWM personnel is needed.

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Thompsons Pond: Camp Marshall and Thompsons Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Thompsons Pond. All designated uses are not assessed.

Thompsons Pond (Segment MA36155) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence, if any, of non-native species.

TURKEY HILL POND (SEGMENT MA36157)
Location: Rutland/Paxton
Segment Size: 90 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c - *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Myriophyllum heterophyllum*) was observed in Turkey Hill Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. With the exception of macrophytes information, no quality-assured data are available for Turkey Hill Pond. All designated uses are not assessed with the exception of aquatic life use.

Turkey Hill Pond (Segment MA36157) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

WICKABOAG POND (SEGMENT MA36166)
Location: West Brookfield
Segment Size: 315 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of metals, noxious aquatic plants (CN118.0) and turbidity (CN118.0) (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.015 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Wickaboag Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 1049 kg/ha/year to a target load of 729 kg/ha/year (31% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
The presence of *Myriophyllum* sp. and *Myriophyllum heterophyllum* were listed in herbicide permit files. Aquatic macrophytes are managed with yearly herbicide applications.

The *Aquatic Life Use* is not assessed for Wickaboag Pond. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. Confirmation of the presence of non-natives macrophytes by DWM personnel is needed.

Fish Consumption Use
MDPH has issued a fish consumption advisory due to Mercury contamination for Wickaboag Pond, West Brookfield as follows:

> "*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Wickaboag Pond in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury. The general public should limit consumption of Largemouth Bass fish from Wickaboag Pond to two meals per month*".

Due to the site-specific fish consumption advisory this waterbody is assessed as impaired for the *Fish Consumption Use*."

A TMDL was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Wickaboag Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Wickaboag Pond: Main Beach and Small Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure

information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody. The *Aesthetics Use* is also not assessed.

With the exception of a fish consumption advisory, no recent quality-assured data are available for Wickaboag Pond. All designated uses are not assessed except fish consumption.

Wickaboag Pond (Segment MA36166) Use Summary Table

<table>
<tr><th colspan="2">Designated Uses</th><th>Status</th></tr>
<tr><td>Aquatic Life</td><td></td><td>NOT ASSESSED*</td></tr>
<tr><td>Fish Consumption</td><td></td><td>IMPAIRED
Cause: Mercury in fish tissue
Source: Unknown
Suspected Source: Atmospheric deposition toxics</td></tr>
<tr><td>Primary Contact</td><td></td><td rowspan="3">NOT ASSESSED</td></tr>
<tr><td>Secondary Contact</td><td></td></tr>
<tr><td>Aesthetics</td><td></td></tr>
</table>

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Consult Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

Implement the Northeast Regional Mercury Total Maximum Daily Load (TMDL).

Chicopee River Subbasin Lakes

CHICOPEE RESERVOIR (SEGMENT MA36033)
Location: Chicopee
Segment Size: 22 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact and Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
Westover Air Force Base (MAR05B973)
City of Chicopee (MAR041003)

DESIGNATED USE ASSESSMENT

Primary and Secondary Contact Recreation Uses
There is one beach along the shoreline of Chicopee Reservoir, Chicopee Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Chicopee Reservoir. All designated uses are not assessed.

Chicopee Reservoir (Segment MA36033) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED				

RECOMMENDATIONS
Attention should be paid to bacteria monitoring in Cooley Brook above Chicopee Reservoir as this is upstream from the bathing beach at the reservoir.

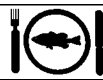
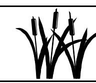
DIMMOCK POND (SEGMENT MA36053)
Location: Springfield
Segment Size: 9 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3 -No Uses Assessed (MassDEP 2007b).

DESIGNATED USE ASSESSMENT
The *Aquatic Life Use* for this segment is not assessed, however, it is identified with an “Alert Status” because of the possible presence of a non-native species (*Myriophyllum sp.)*, that requires further confirmation when flowering heads are evident.

No quality-assured data are available for Dimmock Pond. All designated uses are not assessed.

Dimmock Pond (Segment MA36053) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to assess *Aquatic Life Use* and determine the presence, if any, of a non-native plant species.

FIVEMILE POND (SEGMENT MA36061)
Location: Springfield
Segment Size: 36 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact and Aesthetics* (MassDEP 2007b).

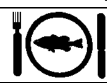
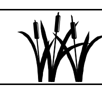
WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
1998 DWM field sheets state that *Myriophyllum heterophyllum* was found although a note made on the field sheets by Richard McVoy, dated 01/03/01, indicates the species found could also be *M. verticillatum* (MassDEP 1998). Due to the lack of confidence in the identification at this site, the *Aquatic Life Use* is not assessed for Fivemile Pond. However, this use is identified with an "Alert Status" because of the potential infestation of a non-native form of *Myriophyllum*.

Primary and Secondary Contact Recreation Uses
There is one beach along the shoreline of Fivemile Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Fivemile Pond. All designated uses are not assessed.

Fivemile Pond (Segment MA36061) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to assess *Aquatic Life Use* and determine the presence if any, of non-native species.

FIVEMILE POND SOUTH (SEGMENT MA36182)
Location: Springfield
Segment Size: 4 acres
Classification: Class B

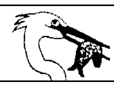
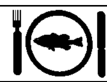
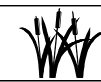
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3 - No Uses Assessed (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
1998 DWM field sheets state that *Myriophyllum heterophyllum* was found, although a note made on the field sheets by Richard McVoy, dated 01/03/01, indicates the species found could also be *M. verticillatum* (MassDEP 1998). Due to the lack of confidence in the identification at this site, the *Aquatic Life Use* is not assessed for Fivemile Pond. However, this use is identified with an "Alert" Status because of the potential infestation of a non-native form of *Myriophyllum*.

No quality-assured data are available for Fivemile Pond. All designated uses are not assessed.

Fivemile Pond South (Segment MA36182) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to assess *Aquatic Life Use* and determine the presence if any of non-native species.

LONG POND (SEGMENT MA36083)
Location: Springfield
Segment Size: 14 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.030 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Long Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 163 kg/ha/year to a target load of 68 kg/ha/year (58% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
One aquatic macrophyte species, *Myriophyllum* sp., was identified in Long Pond during 1998 synoptic surveys (MassDEP 1998). This macrophyte may be a non-native and therefore will require further identification when flowering heads are present. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*.

No quality-assured data are available for Long Pond. All designated uses are not assessed

Long Pond (Segment MA36083) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED *				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

Confirm species of *Myriophyllum* when flowering heads are present.

LAKE LORRAINE (SEGMENT MA36084)
Location: Springfield
Segment Size: 28 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 4c- Impairment caused by something other than a pollutant – exotic species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
A non-native species (*Myriophyllum heterophyllum*) was noted on 1998 synoptic surveys field sheets (MassDEP 1998). It wasn't exactly found during 1998 survey, it was noted on 1998 field sheet that it was found during a 1978 field survey (DWPC undated). Confirmation of the current presence of this species is needed.

Water Chemistry
Lake Lorraine was sampled by DWM as part of the nutrient criteria development project in July 2003 and again in September 2005. In July 2003 oxygen depletion was recorded only at a depth of 10m (Appendix C). The profile data collected in September 2005 indicate oxygen depletion at approximately 8m and below which represents approximately 20% of the lake area. However the data collected in 2005 have not yet been reviewed for quality.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Primary and Secondary Contact Recreation Uses
There are two beaches along the shoreline of Lake Lorraine: Lake Lorraine and Knights of Columbus beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Lake Lorraine. All designated uses with the exception of the *Aquatic Life Use* are not assessed.

Lake Lorraine (Segment MA36084) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS

Conduct macrophyte mapping in Lake Lorraine to determine the presence of any non-native aquatic macrophytes.

Review the data collected for Lake Lorraine as part of the nutrient criteria development project in 2005 to better evaluate the status of the *Aquatic Life Use* and the need for additional monitoring.

MINECHOAG POND (SEGMENT MA36093)
Location: Ludlow
Segment Size: 21 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* for noxious aquatic plants (MassDEP 2007b).

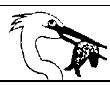
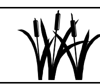
There is a proposed site-specific total phosphorous criterion of 0.030 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Minechoag Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 110 kg/ha/year to a target load of 53 kg/ha/year (52% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Minechoag Pond. All designated uses are not assessed.

Minechoag Pond (Segment MA36093) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

MONA LAKE (SEGMENT MA36094)
Location: Springfield
Segment Size: 11 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* (MassDEP 2007b).

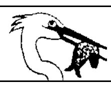
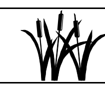
There is a proposed site-specific total phosphorous criterion of 0.030 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Mona Lake please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 47 kg/ha/year to a target load of 19 kg/ha/year (60% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Mona Lake. All designated uses are not assessed.

Mona Lake (Segment MA36094) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

SPECTACLE POND (SEGMENT MA36142)
Location: Wilbraham
Segment Size: 9 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.020 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Spectacle Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 16.8 kg/ha/year to a target load of 8.7 kg/ha/year (48% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
An unconfirmed species of *Myriophyllum* is present in Spectacle Pond. Whether or not it is non-native needs to be determined.

The *Aquatic Life Use* is not assessed for Spectacle Pond. However, this use is identified with an "Alert Status" because of the potential infestation of a non-native form of *Myriophyllum*.

Primary and Secondary Contact Recreation Uses
There are two beaches along the shoreline of Spectacle Pond: Spectacle Pond Camp and Spectacle Pond Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No recent quality-assured data are available for Spectacle Pond. All designated uses are not assessed.

Spectacle Pond (Segment MA36142) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

Confirm species of *Myriophyllum* when flowering heads are present.

SPRINGFIELD RESERVOIR (SEGMENT MA36145)
Location: Ludlow
Segment Size: 393 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

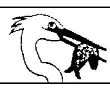
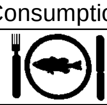
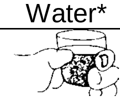
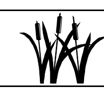
WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Springfield Water Department Registration #10828101

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG conducted fish population sampling in Springfield Reservoir (Station 494) on 13 July 2001. Forty-four bluegill, forty-two largemouth bass, forty-one yellow perch, thirty white perch, eight pumpkinseed, four black crappie, two smallmouth bass, one rock bass and one redbreast sunfish were collected (173 fish total) (Richards 2006). All of these species are macrohabitat generalists and would be expected in a lentic environment. The fish population data is not sufficient to assess the *Aquatic Life Use*.

No quality-assured data with the exception of fish population data are available for Springfield Reservoir. All designated uses are not assessed.

Springfield Reservoir (Segment MA36145) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

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APPENIDX B

Red Bridge Project

Water Quality

The Facility is in compliance with the quantitative water quality standards established by the state that support designated uses pursuant to the federal Clean Water Act in the Facility area and in the downstream reach.

Under Section 401(a)(1) of the Clean Water Act ("CWA"),[1] an applicant for a federal license or permit to conduct any activity that may result in any discharge into navigable waters must obtain from the state in which the discharge originates certification that any such discharge will comply with applicable water quality standards. The Commission may, therefore, not issue a license for a hydropower project unless the relevant state agency either has issued a water quality certification for the project or has waived certification by failing to act on a request for certification within a reasonable period of time, not to exceed one year.[2] At the time of the issuance of the Exemption from License, the MDEP did not complete a water quality study for the Project and, consequently, did not issue a water quality certificate for the Project.

The existing water quality at the Red Bridge project is classified by the MDEP as a Class B, warmwater fishery. In Massachusetts, general standards govern levels of oil and grease, radioactive substances, color, odor, form, turbidity, floating or suspended solids, nutrients, and aesthetics (314 CMR 4.03 (1988)) for all waters. In addition, the Class B warmwater fishery classification requires the water to have a minimum of 5.0 mg/l of dissolved oxygen ("DO"); temperature must be less than 83^{o}F; pH must be between 6.5 and 8.0 standard units, and fecal coliform bacteria counts must not be more than 200 per 100 ml sample.

At the commencement of the license process for the Red Bridge Project, WMECO filed results of a water quality study, including a dissolved oxygen ("DO") study[3] for the Project. A graph of DO may be found at Appendix B-1 while the entire report[4] may be found at Appendix B-3. It is certain that this study of the Red Bridge Project was submitted to DOI, FWS and MDFW on or about late November 1989 for review and analysis and that none of these agencies raised any objection to its data or conclusions.[5] Furthermore, there is no record than any agency conducted its own analysis prior to the issuance of the Exemption from License or subsequently found fault with the WMECO analysis or conclusions. Finally, the DOI letter of July 31, 1992 did not state any reason to deny the Exemption from License due to water quality.

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[1] 33 U.S.C. 1341(a)(1).
[2] Id.
[3] See Appendix B-3, WMECO Exhibit E -- Environmental Report, Appendix D – Water Quality Report, dated November 1989.
[4] Id.
[5] For example, see the bottom of page two and the top of page three of the DOI letter (dated July 31, 1992) setting forth its mandatory terms and conditions to WMECO for its Exemption from License.

Regarding the Chicopee River from the confluence of the Ware River and Quaboag River, Palmer, to Red Bridge Impoundment Dam, Wilbraham/Ludlow, MDWM ("Massachusetts Division of Water Management") found that the flow is influenced by the Red Bridge Dam hydropower project.[6]

Whole effluent toxicity tests have been conducted on the Palmer Water Pollution Control Facility treated effluent. Between July 2000 and March 2006, twenty-two valid chronic tests were conducted using *C. dubia*. Results of the chronic whole effluent toxicity tests using *C. dubia* ranged from 6.25% to 100% effluent (n=22). Results in June 2001 showed a significant difference in reproduction for 25% effluent. The LC50 results were all >100% effluent (n=24) with the exception of September 2004, which was 33.0% effluent.

DWM conducted water quality monitoring at one station (CH01 – near the intersection of New Hampshire Avenue and Springfield Street, Palmer) along this segment of the Chicopee River between April and October 2003. In-situ parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus.

Dissolved oxygen, temperature and pH all met criteria. Ammonia-nitrogen concentrations in samples collected at Station CH01 were low, while total phosphorus concentrations were slightly elevated during the summer.

Given generally good water quality conditions the Aquatic Life Use is assessed as support for this segment.

DWM conducted fecal coliform and *E. coli* bacteria monitoring at Station CH01 this segment of the Chicopee River between April and October 2003. The DWM station is downstream from numerous combined sewer outflows ("CSOs") and the Palmer wastewater treatment plant ("WWTP") discharge.

DWM sampling dates included both wet weather and dry weather sampling. *E. coli* counts were generally elevated during wet weather sampling but no strong pattern was found relating *E. coli* counts and sampling conditions. Both high and low E. coli counts were measured on dry weather sampling dates. The highest *E. coli* count of 1520 cfu/100 mL was found on October 15, 2003, a wet weather sampling date. The geometric mean for *E. coli* was 194.5 cfu/100 mL.

Parameter	DWM 2003 (n=16)
Fecal coliform (cfu/100mL)	20 –1800
Geometric mean	304.7
E. coli (cfu/100mL)	30 – 1520
Geometric mean	194.5

[6] See Appendix B-4, pages 84-87 and Appendices B and D of Chicopee River Watershed 2003 Water Quality Assessment Report. The entire report can be obtained at www.mass.gov/dep/water/resources/36wqar03.pdf.

Currently without the exact dates when CSOs were eliminated, it is impossible to determine what impacts CSOs would have on bacteria levels during the 2003 sampling season. It is known, though, that CSO #014 had an illicit connection removed in 2004.

No objectionable deposits, scums or water odor were recorded by DWM field crews. Water clarity was generally noted to be clear although on two occasions it was noted to be slightly turbid. Erosion was noted on one occasion only. Aquatic vegetation, periphyton and phytoplankton were unobservable or not observed.

Given the elevated *E. coli* counts, the Primary Contact Recreation Use is assessed as impaired. Since the geometric mean for *E. coli* meets the Secondary Recreation Contact Use criterion the Secondary Contact Recreation Use is assessed as support. The Secondary Contact Recreation Use is given an "Alert Status" due to CSO discharges upstream and the one high *E. coli* count. Given the general lack of objectionable conditions along this segment the Aesthetics Use is assessed as support.

Regarding the Chicopee River from Red Bridge Impoundment Dam to Wilbraham Pumping Station (old WWTP), Wilbraham/Ludlow, MDWM found that flow is regulated by two hydropower projects on this segment, Red Bridge and Collins Hydro Projects.[7]

Between April and October 2003, MDWM conducted water quality monitoring at one station (CH02B–Miller Street/Cottage Avenue bridge, Ludlow/Wilbraham) along this segment of the Chicopee River. In-situ parameters were measured on seven occasions, including two predawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen and total phosphorus.

Dissolved oxygen, temperature and pH at Station CH02B all met criteria. Ammonia-nitrogen concentrations in samples collected at Station CH02B were low, while total phosphorus concentrations were slightly elevated during the summer.

Given the generally good water quality conditions, the Aquatic Life Use is assessed as support. Due to the potential impacts of hydropower operations, this segment is identified with an "Alert Status."

Between April and October 2003, DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CH02B–Miller Street/Cottage Avenue bridge, Ludlow/Wilbraham) along this segment of the Chicopee River.

E. coli bacteria counts were low on both dry and wet weather sampling dates. The highest *E. coli* count was 160 cfu/100mL on October 15, 2003, a wet weather sampling date. The geometric mean of the *E. coli* counts was 20.8 cfu/100 mL.

Parameter	DWM 2003 (n=6)

[7] See Appendix B-4, pages 87-89 and Appendix B of Chicopee River Watershed 2003 Water Quality Assessment Report. The entire report can be obtained at www.mass.gov/dep/water/resources/36wqar03.pdf.

Fecal coliform (cfu/100mL)	<2 -120
Geometric mean	28.2
E. coli (cfu/100mL)	<2 - 160
Geometric mean	20.8

No objectionable deposits, odors or scums were noted by DWM field crews with the exception of one occasion when an oily sheen and rusty flow was noticed on the downstream left bank. Water clarity, although sometimes unobservable, was generally noted to be clear with one occasion of slight turbidity. Aquatic plant density, periphyton and plankton were generally noted as unobservable.

Given the low bacteria counts, both Primary and Secondary Recreation Contact Uses are assessed as support. Given the general lack of objectionable conditions along this segment, the Aesthetics Use is assessed as support.

The facility area and the downstream reach are currently identified by the US EPA as meeting the water quality standards pursuant to Section 303(d) of the CWA.[8] While the US EPA noted that pathogens are present in the Chicopee River downstream or in its upstream tributaries,[9] none, however, appear to be found in the Chicopee River just immediately above or below the Red Bridge Project.[10] Thus, it can be deduced that the Project does not contribute to any degradation of the water quality of the Chicopee River.

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[8] At http://iaspub.epa.gov/tmdl_waters10/attains_impaired_waters.impaired_waters_list?p_state=MA&p_cycle=2006, information on this US EPA determination may be found.

[9] Ware, Quaboag and Swift Rivers.

[10] A similar conclusion was reached by the MDEP in its letter dated October 19, 2011. A copy of which may be found at Appendix A-7.

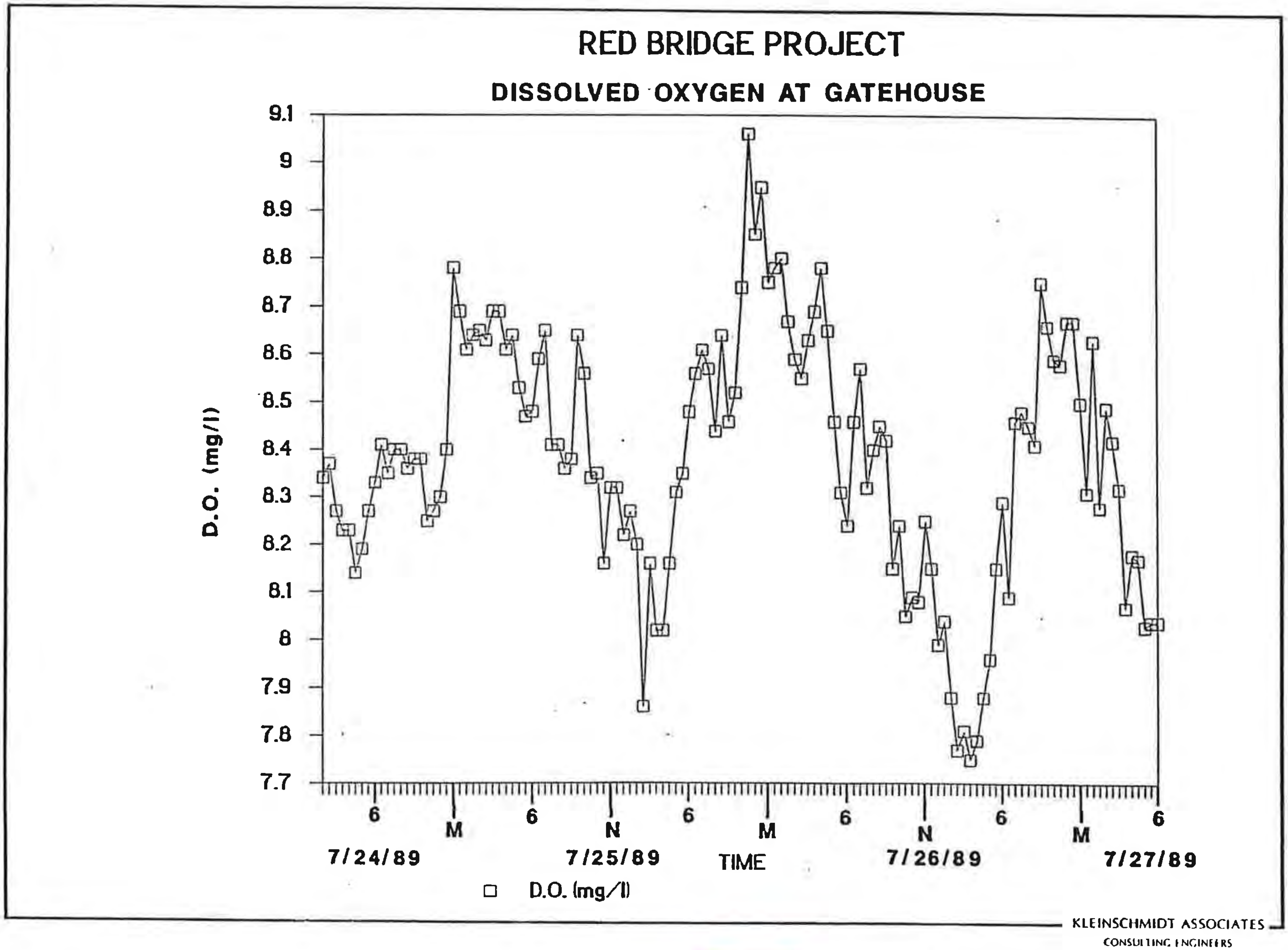

RED BRIDGE PROJECT
DISSOLVED OXYGEN AT GATEHOUSE
D.O. (mg/l)
9.1
9
8.9
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
8
7.9
7.8
7.7
6
M
6
N
6
M
6
N
6
M
6
7/24/89
7/25/89
TIME
7/26/89
7/27/89
D.O. (mg/l)
KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS

EXHIBIT E

ENVIRONMENTAL REPORT

File: 241-72-90

RED BRIDGE PROJECT
DOCKET UL88-33-000

WESTERN MASSACHUSETTS ELECTRIC COMPANY

EXHIBIT E

ENVIRONMENTAL REPORT

INTRODUCTION

The Red Bridge Project consists of a dam with two flood control dikes, a canal headgate house, a power canal, a penstock intake structure, two operating penstocks, a powerhouse with two generating units, and a tailrace channel (see Exhibit A). The project is located at river mile 15.2 on the Chicopee River. The dam is approximately 2.6 miles upstream of the Collins dam, and 1.8 miles downstream of the confluence of the Ware and Quaboag Rivers.

The Chicopee River basin is the largest contributing basin of the Connecticut River, with a total drainage area of 727 square miles. The 17-mile-long Chicopee River is formed by the confluence of the Quaboag and Ware Rivers. The Swift River flows into the Ware River approximately 1 mile upstream of the Chicopee River. Approximately 186 square miles of the Swift River's drainage area are contained in the Quabbin Reservoir, which is a major municipal water supply source in Massachusetts.

Topography of the Chicopee River basin varies from the upland plains of western Massachusetts to low rolling hills near the river's confluence with the Connecticut River. The upstream portions of the Chicopee River basin are rural, while the lower portions of the basin are highly developed by residences, commerce, and industry. Six hydroelectric power facilities harness the river's resources in its 17-mile course.

Terrain adjacent to the project impoundment is composed of forested hills in a rather rural setting. The area upstream of the impoundment is dominated by small communities. Downstream of the project, the river meanders through an urban environment to its confluence with the Connecticut River.

The project operates in a pond-and-release mode to supply peak power needs. During daily peak demand periods, the pond may fluctuate by as much as two ft below crest of dam. This fluctuation may occasionally be exceeded by as much as one ft during annual energy audits or during system emergencies.

As a result of consultation with resource agencies in the course of preparing this application, WMECO proposes to discharge a continuous and reliable minimum flow of 237 cfs or inflow, if less, into the bypassed reach upon completion of the proposed minimum flow facility. WMECO also proposes to limit impoundment fluctuation to 1 ft during critical fish spawning seasons.

A detailed feasibility study was performed to determine the location of the minimum flow facility. Two alternative layouts were evaluated. The alternative not selected would have required construction of an intake and a penstock along the existing ice sluice to a powerhouse located in the same area as the proposed alternative. The proposed alternative consists of a penstock, a powerhouse with one generating unit, and a tailrace (see Exhibit A, Section 1.2). The proposed alternative includes a bypass valve to release the minimum flow when the turbine is out of service. This alternative was selected for economic and operational factors, and for aesthetic considerations.

WMECO has identified and reviewed four relevant comprehensive state and regional water resource development plans regarding the Connecticut River Basin. The plans are as follows:

1) Connecticut River Basin Water Quality Management Plan. Massachusetts Department of Environmental Quality Engineering, Westborough Massachusetts, June 1983. 95pp

2) The Outdoor Heritage of Massachusetts: Strategies for its Protection, Promotion, and Enjoyment, SCORP 1988-1992. Massachusetts Department of Environmental Management, December 1988. Two volumes.

3) A Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River Basin, Policy Committee for Fish Management of the Connecticut River Basin, September, 1982.

4) Connecticut River Basin Fish Passage, Flow, and Habitat Alteration Considerations in Relation to Anadromous Fish Restoration. Technical Committee for Fisheries Management of the Connecticut River Basin, 1981.

WMECO, in reviewing these comprehensive plans has determined that their projects, as proposed, will comply with all these plans by maintaining river water quality as flow passes the projects, by increasing recreational access to the river, and by providing increased minimum flow releases to enhance fisheries resources. WMECO also plans to consult with fish and wildlife agencies regarding fish passage facilities at the project when specific management data and schedules are developed that directly affect the project.

1.0 ENVIRONMENTAL SETTING OF THE PROJECT

1.1 Vegetative Cover

In order to assess the vegetative cover in the Chicopee River region and the Red Bridge Project area, literature searches of pertinent documents were performed, aerial photographs and topographic maps were examined, resource agencies were contacted regarding rare and endangered species, and a field survey was conducted. The field survey covered a study area greater than the project area. A Vegetation Cover Map of the project was then prepared (see Figure E-1). A detailed report of the botanical resources in the project area is contained in Appendix B.

The Chicopee River Valley is located within the Appalachian oak forest of the Laurentian mixed forest province. Vegetative cover in this area is generally composed of tall broadleaf deciduous forest with the dominant species being white oak and northern red oak. Other components are red maple, sugar maple, yellow birch, bitternut hickory, pignut hickory, beech, tulip tree, white pine, scarlet oak, scrub oak, chinquapin oak, chestnut oak, black oak, and hemlock.

The Red Bridge Project contains eleven discrete cover types as follows: Developed, Shrub Upland, Deciduous Forest, Mixed Forest, Evergreen Forest, Open Water, Unconsolidated Shore, Emergent Wetland, Open Field, and Shrub Wetland.

Developed land covers 9.2% of the study area, and consists of residential, industrial, and commercial development. The vegetation types found in these areas vary from patches of open field to shrub upland species with some horticultural species around several of the buildings.

Open Field covers less than 1% of the study area. The vegetation types found include grasses, sheep sorrell, sweet fern, goldenrod, king devil, and cinnamon fern.

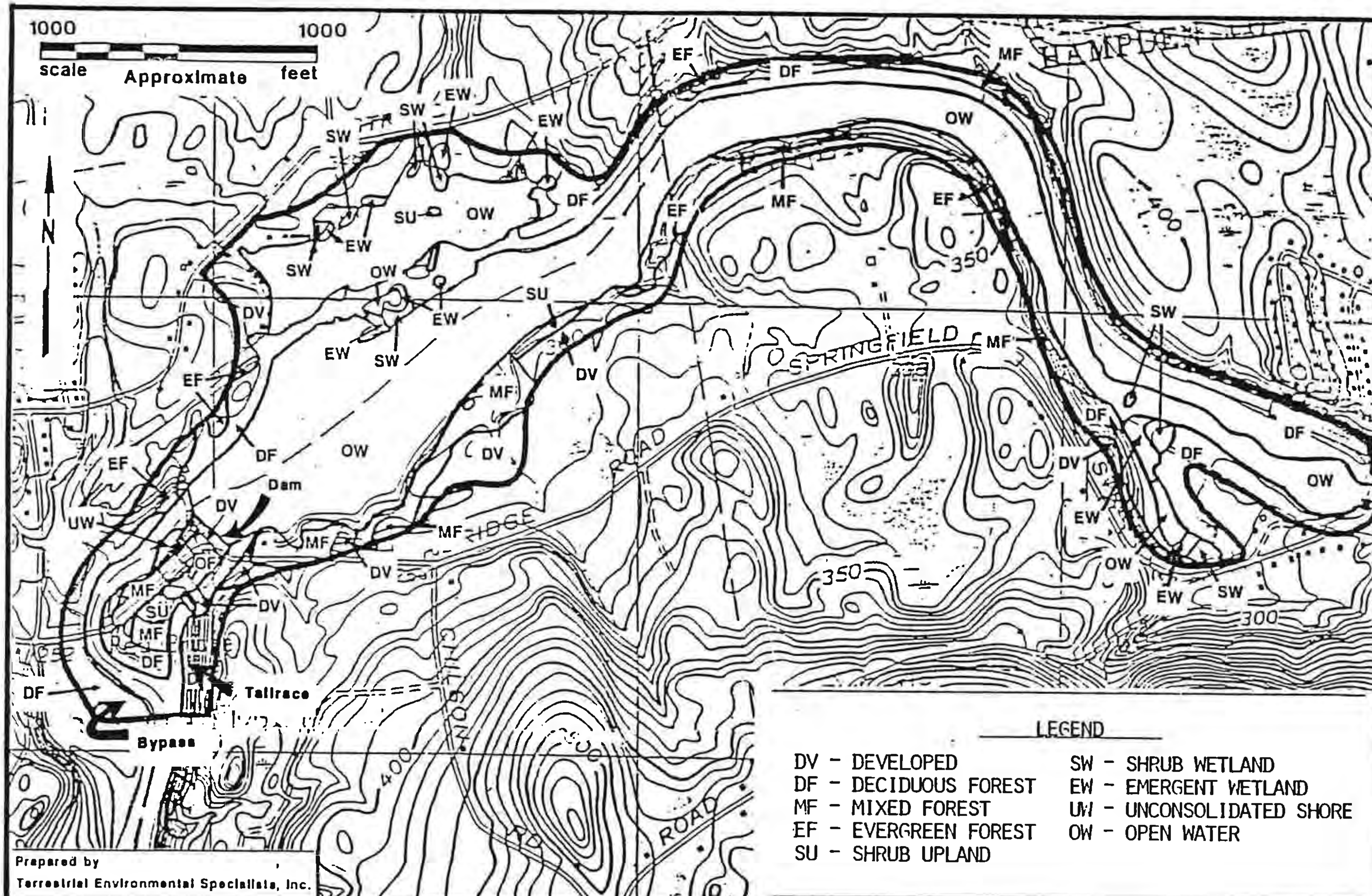


FIGURE E-1. Vegetation Cover, Red Bridge Hydroelectric Project.

Shrub Upland also covers less than 1% of the study area. Included in this cover type are speckled alder, staghorn sumac, brambles, and silky dogwood, which form the understory and shrub layers. Common herbaceous species include hayscented fern, tall meadowrue, sweet fern, goldenrod, and sensitive fern.

Deciduous Forest covers approximately 24.7% of the study area. This cover type is dominated by red maple, slippery elm, red oak, white oak, American elm, and green ash. White pine and hemlock occur as co-dominants and understory species. Other understory species include sassafras, hemlock, gray birch, and American chestnut. The most common shrub is witchhazel. Common ground layer species are ferns, wintergreen, star flower, and wild sarsparilla. A narrow fringe of this cover type along the shoreline of the Red Bridge impoundment is dominated by speckled alder, maleberry, swamp azalea, pepperbush, swamp sweetbells, smooth buckthorn, and highbush blueberry.

Mixed Forest covers about 7.2% of the study area. This cover type is dominated by hemlock, white pine, red oak, and red maple, with pagoda dogwood, and gray birch in the understory. Common shrubs in this area are witchhazel and mapleleaf viburnum, while wild lily-of-the-valley, rock polypody, wild sarsparilla, Christmas fern, Indian pipe, and poison ivy occur in the ground layer.

Several small areas of Evergreen Forest occur along the south bank of the impoundment, along the north side of the "bay" area, and below the dam. White pine is the dominant species. Red maple, red oak, and hemlock occur as co-dominants. The understory includes gray birch, red oak, sugar maple, and hemlock, with some witchhazel occurring in the sparse shrub layer. The ground layer includes wild lily-of-the-valley, wintergreen, starflower, striped pipsisewa, ground pine, northern running pine, false Solomon's seal, and lady fern.

Open Water covers 48.8% of the study area, and includes the project impoundment, tailrace, and bypass. Aquatic vegetation in both the impoundment and below the project is sparse. A small area of Unconsolidated Shore composed of large rocks and gravel with little scattered vegetation occurs below the dam.

Emergent Wetland occurs near the "bay" area and east end of the impoundment. Non-persistent emergent wetland areas contain duckweed, pickerel-weed, spikerush, and white water lily. Persistent Emergent Wetland areas contain arrow arum, arrowhead, cattail, pickerel-weed, sedges, rushes, and purple loosestrife.

Small areas of Shrub Wetland also occur around the "bay" area. This cover type includes dense stands of speckled alder, southern arrowwood, and willow. These areas are subject to frequent flooding and contain common herbaceous species such as sensitive fern, tall meadowrue, and swamp milkweed.

1.1.1 Endangered, Threatened, and Rare Species

By letters dated June 13, 1989 and June 21, 1989 respectively, the Massachusetts Natural Heritage Program and the USFWS reported that no known populations of endangered, threatened, or rare species occurred in the study area, and no evidence of any such species was found during the field survey.

1.2 Fish Resources

Fish resources of the Red Bridge Project occur in the impoundment and the tailrace/bypass channel areas of the project. A report on fish resources is contained in Appendix C. A 1982 report by the Massachusetts Division of Fisheries and Wildlife (MDFW) indicates that the impoundment "for all practical purposes is warmwater (fish) habitat." This observation is also supported by water quality sampling conducted by the applicant during July, 1989, when a vertical profile of temperature and dissolved oxygen was sampled (see Section 1.4.1).

According to a June 23, 1981 survey conducted by the MDFW, the impoundment contained the following fish species, in declining order of abundance: yellow perch, white perch, pumpkinseed, white sucker, bluegill, golden shiner, fallfish, largemouth bass, yellow bullhead, chain pickerel, black crappie and brown bullhead.

Since the 1981 survey, the MDFW has also introduced tiger muskie (a hybrid gamefish) and northern pike to the impoundment fishery. The original purpose of this stocking was to introduce predatory game species which would also crop the overpopulation of yellow perch and white perch, in order to rebalance the gamefish community (MDFW, 1982). The northern pike are now believed to have established a self-reproducing population; the tiger muskie are a sterile hybrid species. Reports from anglers indicate that some of the pike and muskies have escaped the impoundment and have been harvested elsewhere in the watershed.

Fish habitat in the impoundment generally includes a wooded shoreline with downed trees and tree stumps near shore, patches of submergent and emergent vegetation, and a sediment/gravel substrate. Small fringe wetlands occur in patches along the westerly shoreline of the impoundment. Maximum depth of the impoundment is approximately 45 ft. A bathymetric map of the project impoundment is presented in Appendix C.

Although no specific survey data exist for the tailrace/bypass channel area of the project, the Chicopee River including this area is reported by MDFW (personal communication) to contain fish species similar to those of the impoundment. Consultants for the applicant have additionally observed small-mouth bass in this portion of the Chicopee River; a 1989 publication of the MDFW entitled "Best Bets for Bass" lists the Chicopee River as a largemouth bass fishery. The 1973 MDFW Performance Report characterized this reach of the Chicopee as a good warmwater fishery, containing silt, rubble and gravel substrate and brown water color.

Although headwater streams located upstream of the project, such as the Swift, Quaboag, and Ware rivers, are stocked seasonally with trout, there is no evidence of a coldwater fishery in the project area, and summer water temperatures (see Section 1.4.1) appear to exceed the upper thermal limits for coldwater fish.

The riverine bypassed channel of the Red Bridge Project consists of two types of habitat: a series of split channels, pools and riffles in the upper half of the approximately 1,600 ft reach, and a wider, shallow run in the lower half of the reach. This run appears to at times become backwatered by the project tailrace discharge. Pools in each of the split channels of the upper reach are approximately 50-80 ft wide, dominated by rock and boulder substrate, and shaded by a deciduous and coniferous tree canopy. Riffles form hydraulic controls for each of these pools; the riffles are composed of well washed cobbles and rock. Banks are composed of relatively steep sides, with rock, boulder and root wads for stabilization and cover.

The split channels converge into a single channel which then enters the wide, shallow run in the vicinity of a highway bridge. This run extends downstream to the confluence with the Red Bridge tailrace, has a substrate of silt, sand and gravel, gradually widens to a bank width of approximately 250 ft, and has shallow, sandy embankments. Instream cover is provided by scattered rocks boulders and mats of rooted aquatic vegetation.

There are no existing anadromous fish runs involving the project waters. American shad presently ascend the Chicopee River only to the base of the Dwight dam, which is approximately 14 river miles downstream. The Chicopee River is not a component of the Connecticut River Anadromous Fish Restoration Program because of limited habitat for Atlantic salmon and American shad (USFWS, correspondence, April 20, 1989).

1.2.1 Endangered, Threatened, and Rare Species

The shortnose sturgeon, the only federally listed endangered fish species in New England, is not known to exist in or near the project waters. There are no state-listed rare or endangered fish species or species of special consideration that are known to occur in or near the project waters (MDFW, personal communication).

1.3 Wildlife Resources

Wildlife resources in the Red Bridge Project area were determined from literature searches of pertinent documents, consultation with resource agencies, and from a field survey conducted to locate indications of wildlife. The field survey included an area (study area) larger than the project area. Wildlife resources within the study area include amphibians, birds, and mammals. No reptiles were observed in the project area. For a detailed description of the wildlife resources in the project area see Appendix B.

The only amphibians observed in the study area were bullfrogs and green frogs. However, virtually any reptile species whose range includes central Massachusetts would be expected to occur in the project.

The major habitats for birds in the study area were mixed and deciduous forest, and shrub upland, which were a part of larger contiguous forest tracts. A total of 55 bird species were observed during the field survey, including the broad-winged hawk. Other bird species observed in the project area include the downy woodpecker, great crested flycatcher, American crow, black-capped chickadee, wood thrush, red-eyed vireo, and rose-breasted grosbeak.

Mammal species inhabiting the study area include Eastern chipmunks, red squirrels, and muskrats. Although no white-tailed deer, striped skunks, and raccoons were observed, they undoubtedly occur in the project area.

1.3.1 Endangered, Threatened, and Rare Species

By letters dated June 13, 1989 and June 21, 1989 respectively, the Massachusetts Natural Heritage Program and the USFWS reported that no known populations of endangered, threatened, or rare species occurred in the study area, and no evidence of any such species was found during the field survey.

1.4 Water Quality and Quantity

1.4.1 Existing Water Quality

Existing water quality at the Red Bridge Project is classified by the Massachusetts Department of Environmental Quality Engineering (MDEQE) as Class B, warmwater fishery. To meet this classification, the water must have a dissolved oxygen (D.O.) minimum of 5.0 mg/l. Temperature must be less than 83°F, pH must be between 6.5 and 8.0 standard units, and fecal coliform bacteria counts must not be more than 200 per 100 ml sample. Other general regulations govern levels of oil and grease, radioactive substances, color, odor, foam, turbidity, floating or suspended solids, nutrients, and aesthetics (314 CMR 4.03 (1988)).

According to the State of Massachusetts' 1988 Section 305(b) report, the river is generally meeting these water quality standards. The only impediment to full support of the standards is from fecal coliform bacteria caused by surface runoff after storm events.

Water quality has improved since 1980, apparently as a result of completion of a secondary wastewater treatment plant in Palmer, and the elimination of individual discharges in both Palmer and Monson. High-strength industrial wastes, previously discharged into the Chicopee River, are now discharged to the Connecticut River via the Springfield Regional Wastewater Treatment Facility at Bondi Island (West Springfield, Massachusetts).

The existing water quality data have been studied, and current data have been collected. A water quality report detailing the data is contained in Appendix D.

Existing data consist of several water quality data reports published by MDEQE. The most recent were published in 1980 and 1985. Only these two recent reports were considered to have current data. Earlier reports contained data before some wastewater treatment plants were operational.

The two remaining reports contain data from several sample locations in the Chicopee River basin. Sampling stations were located above the Red Bridge impoundment, and above and below the Red Bridge dam.

In 1985, data from all stations were collected for dissolved oxygen (D.O.), temperature, BOD_5, nitrogen and phosphorus, suspended and total solids, pH, alkalinity, chloride, hardness, and heavy metals. Individual data were collected for three periods: April 30, July 15-16, and August 21-22.

In 1980, the same locations and many of the same sample types had been measured. BOD was assessed for longer than five days, and D.O. was sampled every few hours to determine the diurnal fluctuation. Algae (as Chlorophyll (Chl "a")) and bacteria were also sampled in 1980. Two periods of data were collected: July 14-17, and August 18-21.

The results of MDEQE investigations indicated water quality to be generally acceptable and meeting the Class B standards. The average daily D.O. measured in the two years was generally in the upper 80% to low 90% saturation range; actual D.O. measurements varied with temperature. A slight diurnal fluctuation in D.O. was noted at all three sampling stations near Red Bridge.

Since most of these data were collected during the critical summer warm weather period, river water temperatures were in the low to mid 70° F range. No changes in BOD occurred as the water passed between the three sampling stations.

Total and suspended solids tended to be slightly higher above the impoundment than in and below the impoundment. Turbidity (measured in 1980) was also slightly lower in and below the impoundment. Bacteria data also tended to be much higher at the station above the impoundment than at the lower sampling stations.

Nitrogen (total Kjeldahl, Ammonia, and Nitrate) all showed no distinct pattern of change when passing from above the impoundment to below the dam. Hardness and pH data displayed this same lack of pattern. In 1980, Chl "a" was measured at all three MDEQE stations on July 15 and August 19. On both days, an increase from about 2 mg/m^3 to 11 mg/m^3 was noted between the station above the impoundment and the station just above the Red Bridge dam. The measured Chl "a" decreases slightly below the dam.

From July 24 to 27, 1989, D.O. and temperature at the Red Bridge Project were sampled. These were measured at the gatehouse, from the bridge over the power canal, and in the tailrace below the project. During the sampling period, the pools in the bypassed reach were isolated from flow other than leakage and were not sampled.

Two methods were used to sample the impoundment. The first was a hypolimnetic D.O. profile to determine if any stratification exists. Sampling was done in one-meter increments on the morning of July 25, 1989 at the deepest point in the impoundment. The D.O. and temperature both decreased with depth; stratification was documented at a depth of approximately 9 meters. Results are shown in the water quality report in Appendix D.

The second method of monitoring the impoundment's condition was by use of a Hydrolab to record D.O., temperature, and conductivity. This sonde unit was installed about 1.5 to 2m below the water's surface at the Red Bridge gatehouse. Flow was maintained past the unit by a partially open gate several feet downstream. The sonde was calibrated and programmed to record water temperature, D.O., and conductivity every 30 minutes.

Data recorded by the Hydrolab unit are shown graphically in Figure E-2. The D.O. ranged from 7.7 mg/l to 9.1 mg/l. During the sampling period, the temperatures measured by the probe ranged from 21.2°C to 24.5°C, and averaged 23.0°C. Conductivity was almost constant at 0.10 to 0.12 mmhos/cm.

Sampling downstream of the impoundment consisted of manually collected samples taken with a portable D.O./temperature meter. Sampling was done from a road bridge over the power canal between the gatehouse and powerhouse, and at a location approximately 735 feet downstream of the powerhouse. Data from this manual sampling are also included in Appendix D beside corresponding Hydrolab data.

All data collected during the July, 1989 sampling far exceed the requirements of the Class B water quality standards.

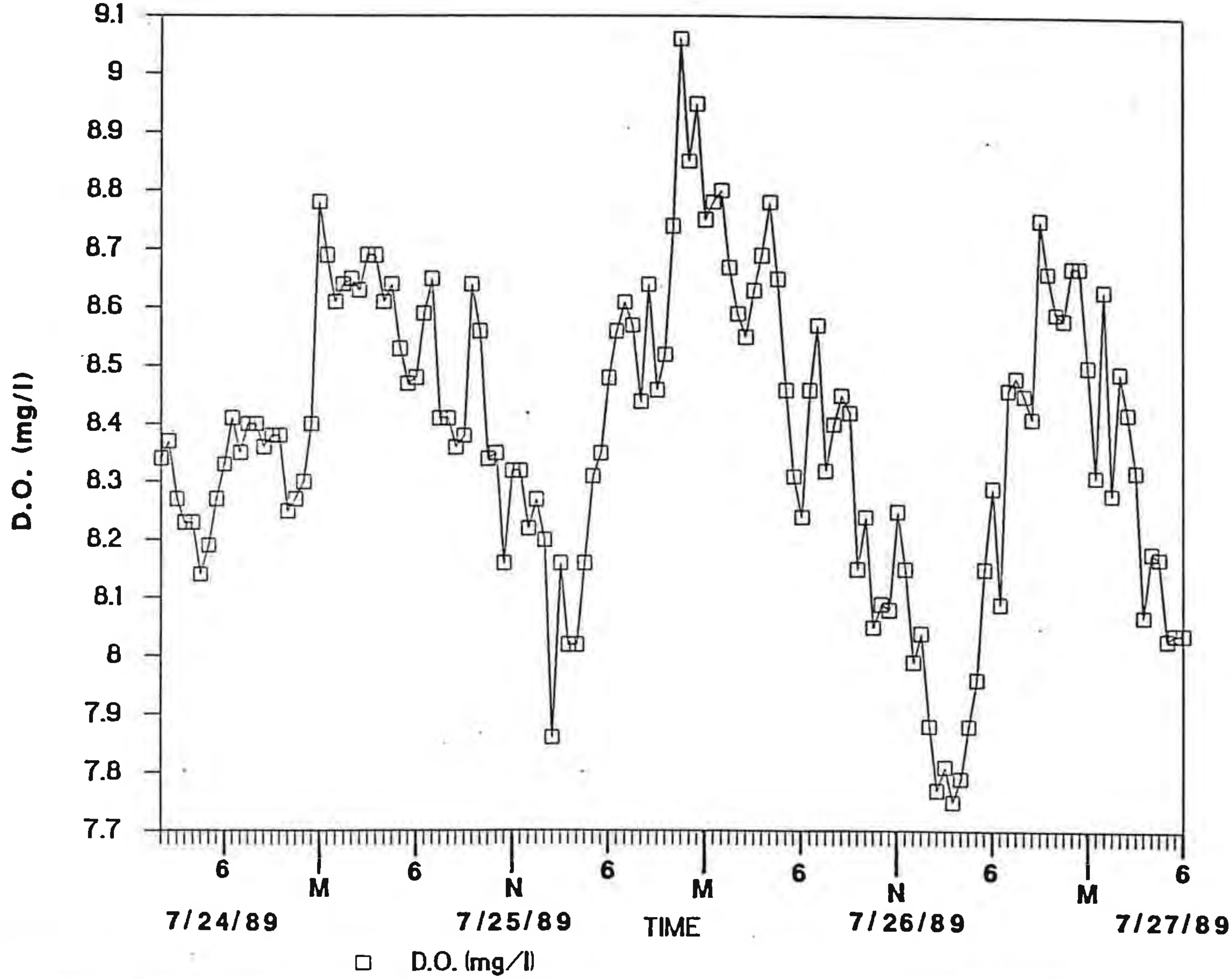
1.4.2 Existing Water Quantity

Average annual flow at the Red Bridge Project is approximately 877 cfs. At USGS Gage No. 01177000, located about 8 miles downstream at Indian Orchard, the maximum recorded flow was 45,200 cfs on September 21, 1938; the minimum flow was 16 cfs, recorded on several dates in 1929-31; and the average flow is 914 cfs.

Further description of the flow regime is presented in Exhibit A, Section 5.0.

RED BRIDGE PROJECT

DISSOLVED OXYGEN AT GATEHOUSE



KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS

1.5 Land and Water Uses

1.5.1 Land Uses

The area surrounding the Red Bridge Project is predominantly rural, with some suburban residences in the vicinity. Photographs of the project area can be found in Appendix G.

The dominant land use immediately around the impoundment is agricultural, although there is a forested buffer strip encircling the impoundment.

1.5.2 Water Uses

The primary uses of the waters of the Chicopee River are for hydroelectric generation, receiving waters for industrial and municipal discharges, and limited recreation. In the 17 miles between the river's confluence with the Connecticut River and its headwaters at the confluence of the Ware and Quaboag Rivers, there are six hydroelectric generating facilities. Numerous intake and discharge points exist below the Red Bridge Project as the river flows through the populated areas of Chicopee and Springfield, Massachusetts. Recreational use of the project area is described in Section 1.6.

1.6 Recreational Uses

The Red Bridge Project is located in a suburban/rural section of western Massachusetts. The major types of recreation at the project are boating, fishing, and hiking.

During the 1970's WMECO developed various recreational facilities in the Red Bridge Project area and then deeded land around the impoundment and below the powerhouse (with these recreation facilities) to the Commonwealth of Massachusetts. The facilities consist of a small boat access to the impoundment near the Red Bridge gatehouse, picnic facilities along the impoundment, a hiking trail following an abandoned railroad right-of-way generally paralleling the northern shore of the impoundment and a small boat/canoe put-in below the Red Bridge powerhouse tailrace (see Figure E-3).

These facilities were developed as a result of perceived demand at that time. The impoundment was (and still is) very scenic and supported a warmwater fishery. Walking for pleasure, and jogging, etc. for exercise were coming into vogue. Waterfowl hunting was popular in the fall, as was ice fishing during the winter. A large population could easily reach this area within a very few minutes of driving time.

Thus, WMECO elected to develop a car-top boat access to allow fishermen, hunters, and canoeists, etc. to gain access to the water. A formal boat launch was decided against, based on the small size of the impoundment periphery available for development. Picnic areas were developed along the impoundment where they would serve a dual usage, i.e., from walkers using the trail system, and boaters using the impoundment. Walk-in fishermen, hunters, etc. also used the picnic facilities.

Below the power station, WMECO developed an access road leading to the tailrace area, where another small boat access (not a full-size boat launch) and picnic area were developed. All of these facilities (with the land) were turned over to the Commonwealth of Massachusetts, allowing the state to then inaugurate a "park" to serve the people in this area.

From the 1970's to date, the lands and facilities that WMECO gave to the Commonwealth have been increasingly heavily used as people "discovered" the area, and as the general usage of outdoor facilities and resources has dramatically increased.

The President's Commission On Americans Outdoors report summarizes the problem by noting that recreational demand far exceeds the supply, and Americans need to find and develop facilities close to home to serve a high percentage of their needs. Both the demand and use have dramatically increased in the Red Bridge Project area over the last 20 or more years, and will continue to increase. Obviously, the resources are finite, and can only serve a certain demand before user conflicts occur and the resources of the area suffer from overuse. Additionally, as use increases, the need for maintenance increases, as does the need for better or more creative land management.

The various state departments are currently under severe budgetary constraints, including those departments and organizations concerned with managing and developing outdoor recreational facilities. The initial facilities developed at Red Bridge by WMECO are now very worn and/or overused. The car-top boat access on the impoundment, for example, is being used by large trailered boats, which causes a number of problems, including traffic congestion and lack of parking. Similarly, the car-top boat access into the tailrace has not been controlled, with the result that vehicles have torn up the picnic area and adjacent grounds. Consequently, the state has recently chained off the entrance to this area in an attempt to prevent vehicular access.

It is clear that the existing facilities have to be rehabilitated and expanded, and new facilities developed to meet growing usage.

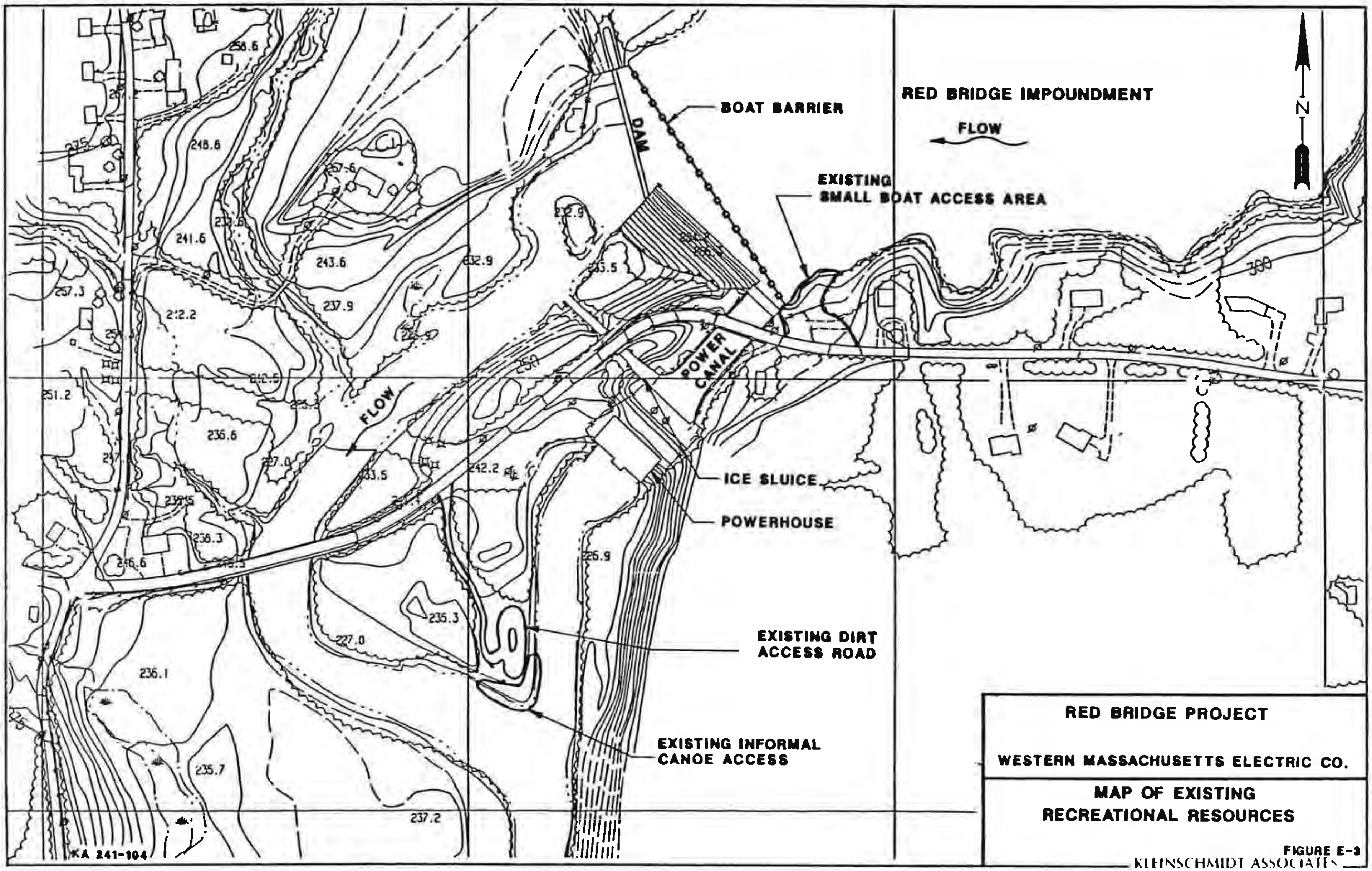
1.6.1 Map of Existing Recreational Resources

Attached as Figure E-3 is a map showing the existing recreational sites at the Red Bridge Project.

1.6.2 National Wild and Scenic Rivers and Wilderness Designations

No portions of the project area or areas affected by the project have been identified or included in the National Wild and Scenic Rivers in the Nationwide Rivers Inventory.

There are no areas along the project that have been identified under provisions of the Wilderness Act.



RED BRIDGE PROJECT

WESTERN MASSACHUSETTS ELECTRIC CO.

MAP OF EXISTING
RECREATIONAL RESOURCES

FIGURE E-3

KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS

1.7 Historical and Archaeological Resources

The Red Bridge Project was constructed *ca*. 1901 by the Ludlow Manufacturing Company, a major textile manufacturer located some 6 miles downstream. The major structures include the masonry dam and connected earthen embankments, frame-construction gatehouse, power canal, penstock intake structure, two penstocks, the powerhouse, and a tailrace channel. In *ca*. 1939, the embankments were raised to their present height, and the Alden Street flood control dike (another earthen embankment) were constructed. The brick powerhouse rises two stories to a near-flat roof, although inside the space is undivided to provide one high, open space. A three-story tower, with a Romanesque-inspired corbel table marking its attic story, is appended to the downstream side of the powerhouse. The only alterations are that the transoms of the high, segmental-arched first-story windows, and the entire openings of the flat-arched (stone lintel) second-story windows, have been filled with plywood. Wooden sash remains in the first-story windows.

Alterations to the equipment generally amount to normal replacement of parts such as switchgear. Other changes include a motor-drive added to the originally hand-cranked gate lifters, and complete replacement of the original turbines. The two present units were installed in 1926 and 1934.

Western Massachusetts Electric Company (WMECO) acquired the project from the Ludlow Manufacturing Company on December 26, 1957. The station was converted to semi-automatic control in 1962.

An archaeological survey of the site area consisted of a brief background survey, to determine if any previously reported prehistoric sites are known in the area, and a walkover survey and visual examination of the impact area. While no prehistoric sites are reported within or immediately adjacent to the project area, several have been recorded along the Chicopee River, including the Bircham Bend Site near Interchange 6 of I-90, and the Indian Crossing Site at the confluence of the Chicopee and Connecticut Rivers.

A visual examination of the project area indicated that it had been extensively disturbed by activities associated with the prior construction of and operation of the Red Bridge facility. Although the impact area has no potential for yielding intact prehistoric sites, the surrounding area is considered to have a high potential for yielding intact prehistoric archaeological sites, based on the topography of the area and its proximity to the Chicopee River.

1.7.1 National Register Sites

There are no structures or sites in the immediate project vicinity that are currently listed in or known to be eligible for listing in the National Register of Historic Places. There are presently a number of registered sites in Hampden and Hampshire Counties. None of these sites is in the vicinity of the Red Bridge Project, nor will any sites be affected by the project.

The Red Bridge Project may be eligible for listing in the National Register. Appendix F contains the appropriate historical sites survey forms of the Massachusetts Historical Commission. These forms more fully describe the features and potential significance of the Red Bridge Project.

1.8 Scenic and Aesthetic Resources

The Chicopee River Valley is located in western Massachusetts. The headwaters to the Chicopee River are located in the rural upland plains to the east, while the downstream portion of the river flows into the highly developed and densely populated Connecticut River Valley. The downstream portion of the river was heavily industrialized during the late 19th and early 20th centuries, as shown by the predominance of power canals that are directed through industrial complexes. As such, the natural scenic and aesthetic resources of the river basin are concentrated toward the east. The Chicopee River in the vicinity of the City of Chicopee (near the confluence with the Connecticut River) provides diverse urban and industrial scenic resources.

The Red Bridge Project is located just upstream of the cities of Springfield and Chicopee, Massachusetts. The project area itself is relatively rural, with farmland dominating the area around the impoundment. There is a lightly forested strip of land around much of the project, including the tailrace canal and bypass that is contiguous to larger forested tracts that encompass much of the central Massachusetts region near Quabbin Reservoir.

The hilly, lightly-forested character of the land surrounding the project provides the dominant scenic and aesthetic resource. The forest also provides favorable habitat for wildlife resources, creating a prevalence and diversity of wildlife that is difficult to find nearby. The wildlife resources provide a scenic attraction, and include such species as owls, hawks, herons, and beavers. This diversity of wildlife has encouraged hikers and nature watchers from the densely populated surrounding areas to visit the project area frequently.

Photographs showing the scenic and aesthetic resources of the project are contained in Appendix G.

2.0 PROJECT IMPACTS, AGENCY RECOMMENDATIONS, AND MEASURES PROPOSED BY THE APPLICANT

In compliance with §4.38(b)(1) of the Federal Energy Regulatory Commission's regulations, WMECO provided agencies with a document entitled Combined Initial Consultation Document on February 21, 1989. A copy of this document and all agency responses to it are included in Appendix A. On September 21, 1989, draft copies of this application were distributed to agencies, in compliance with §4.38(b)(2) of the Commission's regulations. Copies of agency comments to the draft application are contained in Appendix A.

The following section discusses (for each resource category discussed in the sub-sections of Section 1.0 of this Exhibit) the anticipated impacts associated with the operation of the Red Bridge Project, the specific agency recommendations for studies or other measures, and WMECO's proposals in response to agency recommendations.

2.1 Vegetative Cover

2.1.1 Continuing and Incremental Impacts

No adverse impacts to the botanical resources of the Red Bridge Project are expected to occur as a result of the continued operation of the project or as a result of the proposed modifications to the project (see Appendix B).

2.1.2 Recommendations by Agencies

No recommendations by resource agencies were made regarding the botanical resources of the project during Initial Stage Consultation or Second Stage Consultation.

2.1.3 Measures Proposed by Applicant

Since no adverse impacts to botanical resources are expected to result from the project, no measures regarding these resources are proposed.

2.2 Fish Resources

Based on recommendations by resource agencies concerning the Red Bridge Project (see Section 2.2.2), WMECO evaluated the continuing and incremental impacts of instream flows, peak flow releases, and impoundment fluctuations on fish resources, and the impact of project operation on water quality as it relates to fishery management. WMECO submitted study plans for evaluating these potential impacts to USFWS, MDFW, on June 5, 1989 (see Appendix A). The USFWS and MDFW approved the study plans in letters dated June 16 and June 14, 1989, respectively (see Appendix A). Whenever possible, resource agency personnel involved with review responsibilities participated in site visits and study activities.

2.2.1 Continuing and Incremental Impacts

At the recommendation of USFWS and MDFW, continuous minimum flow releases into the bypassed reach and below the project were considered by WMECO for the protection of aquatic habitat; both agencies deemed the historic practice of diverting all river flow (up to maximum turbine capacity) through the powerhouse, and stopping all flows during ponding, as having a negative effect on fishery potential. The potential impact of differing instream flows on fish resources in the bypass and below the project was evaluated using methods that were consistent with methods established by the USFWS Aquatic Base Flow (ABF) policy. WMECO estimated an ABF flow at the Red Bridge Project, based on historic flow records, that would be sufficient to protect aquatic habitat and prevent adverse impacts (see Appendix C). The ABF flow at the Red Bridge Project is 237 cfs.

The potential impact of upramping on fish resources was evaluated by determining whether riverine reaches downstream of the project would be adversely affected by changes in flow as the turbines are cycled on and off. Details concerning the methods and results of the ramping studies are contained in Appendix C. The potential upramping impacts at the Red Bridge Project are limited by the backwater influence of the impoundment of the Collins Project. The Collins Project dam is located approximately 2.6 miles downstream. Additionally, as shown in Appendix E, upramping effects associated with proposed project operation are not significant. Increases in water stage provides additional shoreline cover such as rootwads, trees, and shrubs that are submerged, and aquatic vegetation located midstream which will continue to provide velocity refuge, even at higher flows. This cover more than adequately offsets any velocity increases in the riverine reach downstream of the project.

The potential impacts of impoundment fluctuations were evaluated by first performing a survey of the project to locate potential fish spawning habitat in the littoral zone. The level of impact was evaluated based on the amount of potential spawning habitat that might be exposed during normal operation of the project. The impact at the Red Bridge Project is moderate, because of the small proportion of suitable spawning habitat affected by the fluctuations.

The potential effects of project operation on water quality as it relates to fishery management were evaluated in conjunction with other water quality studies at the project. Water quality parameters upstream and downstream of the project were measured to determine the impact of the project on water quality. Operation of the project in its current pond-and-release mode did not have an adverse impact on water quality (see Appendix D). In fact, the proposed modification of the project is expected to enhance water quality in the bypass by providing additional flow, increasing dissolved oxygen (D.O.), and decreasing temperature fluctuations in the bypassed reach (see Section 2.4.1 and Appendix D).

2.2.2 Recommendations by Agencies

The USFWS and MDFW both responded to WMECO's Initial Stage Consultation document with letters dated April 20, 1989 (see Appendix A). Both agencies recommended that WMECO evaluate the potential impacts of instream flows, peak flow releases, and impoundment fluctuations on fish resources, and the impact of project operation on water quality as it relates to fishery management. Additionally, they recommended that WMECO should plan to provide fish passage facilities when such facilities are needed. MDFW also requested information concerning flow velocities at the trashracks. A number of other federal, state, and local resource agencies also recommended increasing minimum flows below the Red Bridge dam, to enhance fishery resources, and evaluating the need for constructing fish passage facilities at the project.

During the Second Stage of Consultation, USFWS, MDFW, and many other agencies supported the minimum flow release proposed by WMECO to support fisheries resources. Additional comments requested variation of the flow releases, and documentation of those releases. The Connecticut River Watershed Council further recommended WMECO to examine operations "to determine if fish are entrapped or killed." As described below, trashrack intake velocities were estimated for the project, and it was determined that fish were not likely to become entrapped. Also, the minimum flow release should improve fisheries resources below the project dam.

2.2.3 Measures Proposed by the Applicant

Based on the ABF that is sufficient to protect aquatic habitat at the project (237 cfs), WMECO proposes to continuously provide the lesser of the ABF or inflow to the project at the base of the dam and downstream of the project. The flow will be discharged through a minimum flow turbine upon completion of the proposed facility (see Exhibit G, Sheet 6).

WMECO proposes no measures concerning peak flows, because no significant impacts regarding upramping are expected.

In order to protect potential fish spawning habitat at the project, WMECO proposes to limit the fluctuation of the project impoundment during the critical spawning periods from April 1 to June 30 annually. To enhance fish resources at the project, WMECO proposes to maintain the impoundment level within at least one foot of the permanent crest of the dam during the critical period.

The 2-ft impoundment fluctuation may expose as much as 17.8 acres of shoreline around the edge of the impoundment. Additionally, a small sand bar in the impoundment (less than one acre) is exposed. The methodology used to determine the acreage of the exposed shoreline provides conservative estimates. The acreage was estimated from the profiles selected for the impoundment fluctuation study. These profiles were specifically selected at high-impact locations (see Appendix F). As described above, WMECO has proposed to protect fish spawning habitat by reducing the amount of exposed shoreline during critical fish spawning periods.

WMECO proposes no additional measures regarding water quality, because no significant adverse impacts are expected to result from project operation.

The Chicopee River is not currently scheduled for the restoration of Atlantic salmon, American shad, or other anadromous fish species because of limited available habitat for these species (see USFWS and MDFW letters dated April 20, 1989, in Appendix A). WMECO proposes to consult with appropriate resource agencies regarding fish passage facilities at such time as specific management data and schedules are developed which directly affect the project. No further measures regarding fish passage facilities are proposed at this time.

The trashracks at the project are located at the penstock intake structure. The flow velocity at the trashracks is estimated to be a maximum of 1.17 fps when all units are operating. WMECO proposes no specific measures regarding this information, because the flow estimates indicate moderate velocities that would frequently be encountered under normal river conditions.

Minimum flow releases are expected to vary during high and low seasonal flows when the combined hydraulic capacity of the minimum flow turbine and the powerplant are exceeded or when inflows are less than the 237 cfs proposed minimum flow. WMECO will file a plan for monitoring the minimum flow releases with the USFWS within six months of receiving an exemption for the project. Additionally, records of the minimum flow releases will be filed with the USFWS and MDFW in a manner specified during further consultation with these agencies. WMECO will also notify MDFW within 30 days of the startup of the proposed minimum flow facility.

2.3 Wildlife Resources

2.3.1 Continuing and Incremental Impacts

No adverse impacts to the wildlife resources of the Red Bridge Project are expected to occur as a result of the continued operation of the project, or as a result of the proposed modifications to the project. The potential impacts of impoundment fluctuations on wildlife resources were evaluated in response to agency recommendations. Impoundment fluctuations were found to have no significant adverse impact on wildlife, because water level fluctuations at the project expose no critical wildlife habitat (see Appendix E).

2.3.2 Recommendations by Agencies

In response to WMECO's Initial Stage Consultation document, the USFWS and MDFW, by letters dated April 20, 1989, recommended that WMECO evaluate the impacts of impoundment fluctuations on the fish and wildlife resources of the project. Both agencies reviewed study plans that were developed to address the potential impacts and that were submitted on June 5, 1989. The study plans were approved by USFWS on June 16, 1989, and by MDFW on June 14, 1989. A discussion of impacts to fish resources is contained in Section 2.2.

No additional comments regarding wildlife resources were received during the Second Stage of Consultation.

2.3.3 Measures Proposed by the Applicant

WMECO proposes no measures regarding wildlife resources, because no significant adverse impacts are expected to result from the project.

2.4 Water Quality and Quantity

2.4.1 Continuing and Incremental Impacts

2.4.1.1 Impact of Continued Operation

Operational records were correlated with the D.O. measurements obtained by continuously recording D.O./temperature/ conductivity units (see Appendix D). During non-operating (ponding) periods, D.O. measured at the gatehouse averaged 8.30 mg/l, and average D.O. during project operation was 8.40 mg/l. Average temperature differed less than 0.1°C. The slight difference in D.O. levels, and the insignificant change in temperatures due to project operation, indicate that continued operation of the project in the current operating mode will have no significant impact on water quality.

No change in water quantity is expected as a result of continued project operation.

2.4.1.2 Incremental Impacts

The only new development proposed at the Red Bridge Project is installation of a minimum flow turbine to provide a continuous flow into the bypassed section of the river. The flow proposed for this turbine is 237 cfs, based on fisheries concerns discussed in Section 2.2. Flow through the turbine will be drawn from the top of the impoundment, where the water meets water quality requirements. Therefore, the water quality of the minimum flow release will be more than sufficient to maintain water quality standards in the bypass.

The bypassed reach is currently a series of split channels, pools, and riffles that receive only leakage from the spillway. The proposed minimum flow turbine will increase inflow to the pools, decreasing impoundment detention time and increasing natural aeration in that section of river.

Water passing through a turbine is not significantly re-aerated. Once through the proposed minimum flow turbine and into the bypass, however, shallow flow over rock and boulders as the water flows downstream will change oxygen levels. Supersaturated water from the impoundment would lose oxygen, and oxygen-deficient waters would gain oxygen, bringing D.O. levels closer to their natural saturation level. This will slightly reduce the magnitude of any diurnal fluctuations in the bypass and downstream reaches. At Red Bridge, this change will not, however, significantly change D.O., which was measured within 10% of saturation at most times (see Section 1.4.1).

Temperature fluctuations will probably increase slightly in the bypassed reach due to increased contact with ambient air temperature, and resulting water temperatures will be closer to ambient air temperature than it is now. In the power canal there is less opportunity for this contact with the atmosphere. This will not significantly affect overall river temperatures, however.

There should be no significant changes in other water quality constituents as a result of maintaining a minimum flow in the bypass.

Based on monitoring and study of water quality concerns, it is not expected that the Class B, warmwater fishery water quality standards will be violated by continued project operation. The bacteria levels, cited by MDEQE as being the cause for only partial support of the standards, are not affected by the project. No significant adverse impacts to water quality will result from the proposed development.

The only change in water quantity would be the addition of 237 cfs flow in the bypassed reach and removal of this flow from the power canal and existing turbines. No change to total water quantity will occur.

2.4.2 Agency Recommendations

Federal, state, and local resource agencies have recommended a minimum flow in the bypass that will maintain water quality sufficiently to protect fish and other aquatic biota. For the Red Bridge Project, this was calculated to be 237 cfs. This flow was viewed by agencies at a site visit on August 2, 1989, when this amount of water passed over the dam into the bypassed reach. The 237 cfs flow was approved in letters from USFWS and MDFW dated August 8 and August 10, 1989, respectively.

Nutrient sampling was requested in an April 20, 1989 letter from the USFWS. However, preliminary review of the 1980 MDEQE data showed that ample data already exist. Therefore, USFWS agreed that nutrient sampling would not be necessary, because there had been no significant change in nutrient loading to the river that would cause a significant change from the existing 1980 and 1985 data (see Appendix A). Nutrient levels showed no consistent change from above to below the project.

During the Second Stage of Consultation, the Connecticut River Watershed Council (October 25, 1989) recommended an "analysis of erosion due to the unloading of sediment in the impoundments behind the series of dams coupled with pulses of water released to the river." The project does not have a large hydraulic capacity, and flows released from the project are normally confined to the well-defined river channel. The natural high seasonal flows that would exceed the well-defined river channel and cause significant erosion cannot be controlled by WMECO. River flows exceed the hydraulic capacity of the proposed project approximately 12% of the time.

The Water Supply Citizens Advisory Committee on October 25, 1989, commented that "it may be that the ponding of polluted runoff or CSO's contributes to the coliform problem, and that larger minimum releases would help the situation." Actually, the ponding of polluted runoff does not exacerbate the coliform problem, and larger minimum releases would not help the situation. Coliform bacteria originate from point and non-point pollutant sources, and are not caused by the project. Once the bacteria enter the water column, they live out their life cycle. Changing operation of the project, or increasing minimum flow releases, would have no effect on the concentrations of these bacteria.

2.4.3 Measures Proposed by the Applicant

WMECO proposes no water quality measures beyond discharging a minimum flow release into the bypassed reach (upon completion of the proposed minimum flow facility), since operation of the existing project and the proposed modification of the project are expected to have no adverse impact on water quality.

2.5 Land and Water Uses

2.5.1 Continuing and Incremental Impacts

The existing land and water uses described in Section 1.5 will not be adversely affected by the project.

2.5.2 Recommendations by Agencies

With the exception of recreational uses (see Section 2.6), no recommendations regarding land or water uses were made by any consulting agencies during the Initial Stage of Consultation.

During the Second Stage of Consultation many agencies requested that WMECO participate in the purchase of additional land in the vicinity of their projects to provide a buffer strip to protect the river corridor.

2.5.3 Measures Proposed by the Applicant

Since no adverse impacts to land and water uses are expected to result from the project, WMECO proposes no measures concerning these uses at this time.

As noted in Exhibit G, WMECO owns flowage rights to all lands necessary to operate their projects, and, where possible, is utilizing their additional lands to enhance recreational facilities (see Section 2.6). In response to second stage recommendations that WMECO protect the river corridor, WMECO proposes to include all new facilities, as well as all lands that WMECO owns in fee, or for which WMECO owns flowage rights, within the project boundary. As shown by the correspondence contained in Appendix A, WMECO is also consulting further to assist governmental agencies in obtaining conservation easements for land parcels that are not part of the project.

2.6 Recreational Uses

2.6.1 Continuing and Incremental Impacts

The continued operation of the Red Bridge Project will have no adverse effect on recreation. The proposed operation of the project is expected to enhance recreation at the project, because a 237 cfs minimum flow release will be discharged into the bypassed reach, which will increase fish habitat below the dam, and should improve the existing recreational fishery and aesthetics of that area. Additionally, the measures proposed below will significantly enhance recreational opportunities at the project.

2.6.2 Recommendations by Agencies

The USFWS on April 20, 1989, and the MDFW on April 20, 1989, suggested that WMECO evaluate the adequacy of existing recreational access given the project's proximity to urban areas. Additionally, the USFWS suggested that additional recreational opportunities may be required, based on the outcome of instream flow and impoundment studies. The Massachusetts Riverways Program (MRP) responded on May 12, 1989 with general comments regarding resource protection, recreational access, and aesthetics. MRP also commented that they support more specific recommendations made by other resource agencies. A number of resource agencies requested boat portages around the Chicopee River dams.

During the Second Stage Consultation many commenters supported WMECO's proposals to ehnance recreation. Massachusetts Department of Environmental Management (DEM) on October 23, 1989, stated that "DEM is very interested in working with WMECO to improve the maintenance of existing facilities at Red Bridge." WMECO's proposals to enhance recreation (see Section 2.6.2) are predicated upon cooperation between WMECO and the state. Existing facilities accessing the river in the project area were constructed by WMECO during the 1970's and deeded to the state. Because WMECO does not own these lands that are necessary to enhance recreation, a cooperative venture provides the maximum potential for recreational enhancement of the project.

The Connecticut River Watershed Council recommended that a "canoe trail should be added between the Collins Project and Red Bridge, and another between Red Bridge and Putts Bridge with appropriate access and take out points and portage trails." This recommendation is consistent with the existing canoe put-in and the signing proposed by WMECO within the draft exemption application for the Red Bridge Project. The downstream Collins project is not owned or operated by WMECO. WMECO is, however, currently working cooperatively with the operators of the Collins Project to have portage facilities installed there.

2.6.3 <u>Measures Proposed by Applicant</u>

WMECO proposes to improve or construct recreational facilities at the Red Bridge Project, based on recommendations received during the consultation process, and on public recreational needs as perceived by WMECO. WMECO proposes to furnish, place and maintain these proposed facilities. However, because many of the facilities are on land deeded to the State by WMECO, a cooperative effort is required to enhance the facilities. In order to perform WMECO's planned improvements, former properties of WMECO could be deeded back from the State, or easement rights could be granted to perform the proposed improvements. If Massachusetts is unable to participate in this cooperative effort, WMECO will be limited to providing only the proposed facilities and recreational improvements that are located on WMECO land. However, as noted earlier, MDEM has indicated a strong interest in pursuing such a cooperative venture.

The capacity of the existing recreational facilities at the project is frequently exceeded. This overuse has created a severe maintenance problem, which will require a commitment of resources to correct. WMECO's proposals include improvement and maintenance of these faciities, and construction of new facilities to alleviate some of the pressures that are currently put on the overused facilities.

The four enhancement activities proposed by WMECO consist of: improving the existing impoundment boat access area near the gatehouse; improving the existing river access area at the confluence of the project tailrace with the bypass; construction of a trailhead/parking area adjacent to the tailrace boat launching area; and, construction of a picnic area between the highway and the bypass (see Figures E-4 and E-5). In conjunction with these proposals, WMECO plans to install all the necessary safety information and signs at the project. Details of the proposals for each area follow.

Gatehouse - Small Boat Access Area

This existing area was deeded to the state by WMECO. It serves as the access point to the Red Bridge impoundment. At this recreation area WMECO proposes the following activities:

- Improve the parking area and control access by placing post and guide rail facilities around and a good gravel surface over the final parking area.
- Place signs to inform the public of the available recreational opportunities at and adjacent to the project.
- Secure the intake gate area with proper fencing and provide for floating debris to be periodically removed. Provide appropriate safety signs.
- Refurbish the general area, including the gatehouse structure, fencing, drives, signs, walkways, etc., but without increasing the boat access area or the general parking area (see trailhead proposal).

Tailrace - Small Boat Access Area

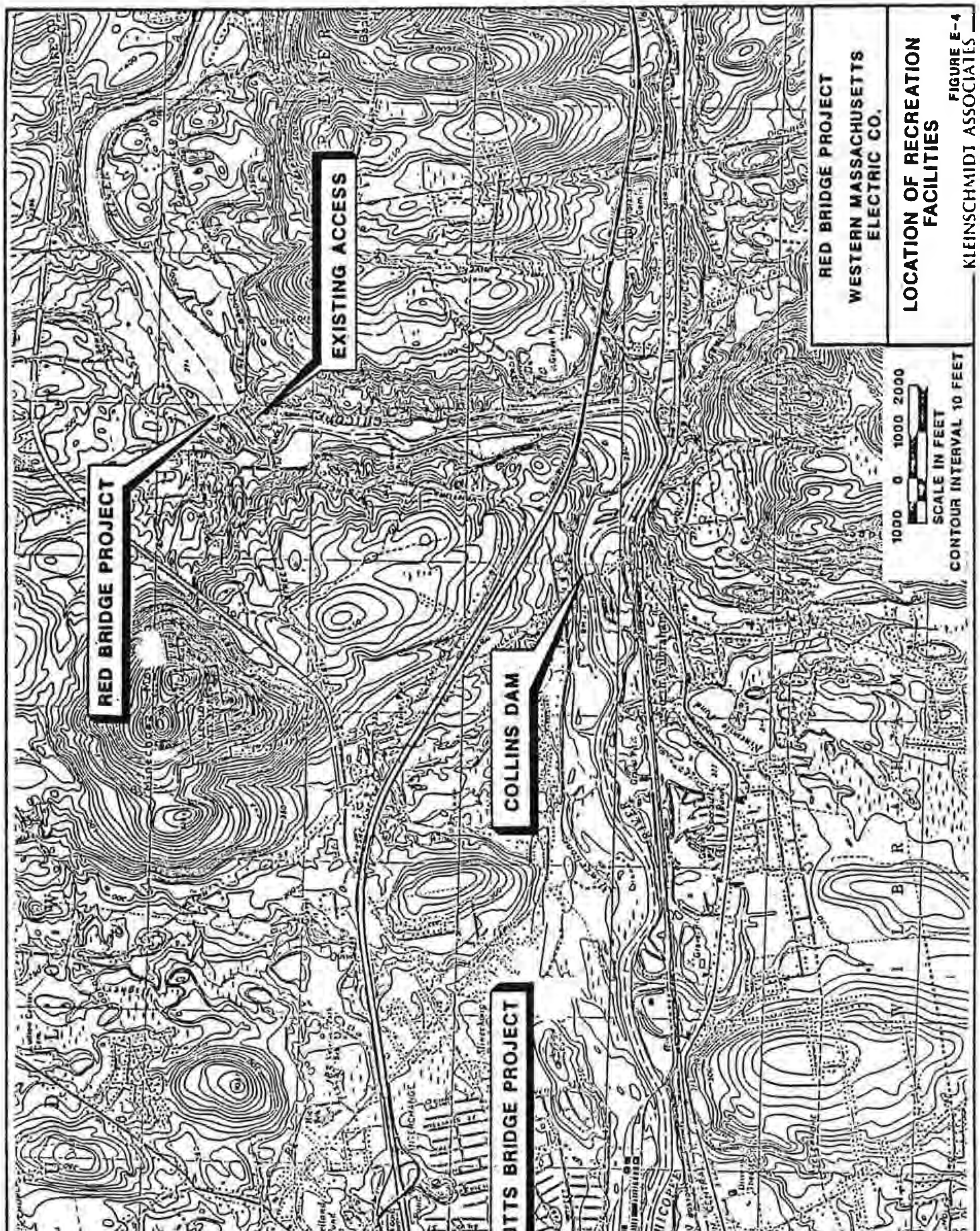
This area is also located on land owned by Massachusetts. The area could be used in conjunction with a possible canoe portage at the Collins Project and a downstream canoe take-out point that WMECO proposes to construct at the Putts Bridge Project (see Figure E-4). The proposed activities to improve this site are as follows:

- Install a post and rail fence or flex beam steel rail along the entrance road and around the boat unloading area to confine vehicles to the roadway and turn-around. A gate system would also be installed to close off the area seasonally, or as needed for control during nighttime hours.
- Install a handicapped fishing access adjacent to the tailrace, and provide an opening in the rail described above.
- Regravel the small boat access apron leading into the water, and provide timber cribbing, as necessary, for erosion control.
- Install informational and safety signs as necessary. Install an appropriate entrance sign at the parking/trailhead area.

Trailhead - Parking Area

This proposed parking area would be located on land owned by WMECO and Massachusetts. It would consist of an improvement to the existing cleared area adjacent to the tailrace access area (see Figure E-5). This area would provide parking for the tailrace access, trailhead, picnic area and also provide overflow parking for the gatehouse access area. WMECO proposes the following activities at this location:

- Design and install a parking area adjacent to the existing substation. The area would consolidate driveways to the tailrace small boat access and the power station.
- Provide and maintain a pit toilet type sanitary facility.
- Install a major entrance sign with minor signs for information and safety.
- Provide a marked crosswalk area to lead pedestrians across Red Bridge Road and on to the gatehouse small boat access area, the proposed picnic area, or to the footpath leading across the river and toward the main dam.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RED BRIDGE PROJECT
EXISTING ACCESS
COLLINS DAM
PUTTS BRIDGE PROJECT
PROPOSED ACCESS
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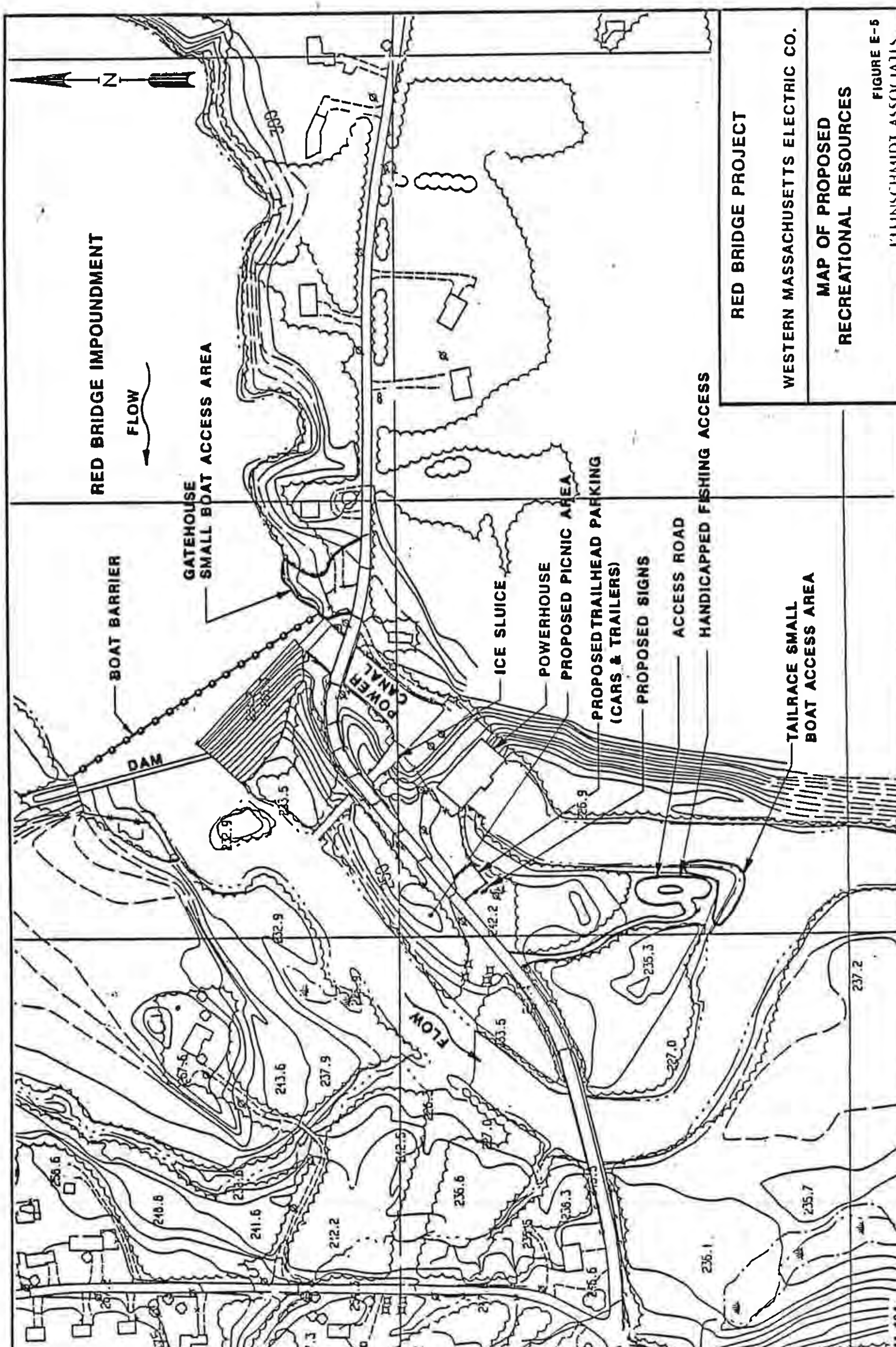
RED BRIDGE PROJECT
WESTERN MASSACHUSETTS ELECTRIC CO.
LOCATION OF RECREATION FACILITIES
FIGURE E-4
KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS


RED BRIDGE IMPOUNDMENT
FLOW
N
GATEHOUSE
SMALL BOAT ACCESS AREA
BOAT BARRIER
DAM
POWER CANAL
ICE SLUICE
POWERHOUSE
PROPOSED PICNIC AREA
PROPOSED TRAILHEAD PARKING (CARS & TRAILERS)
PROPOSED SIGNS
ACCESS ROAD
HANDICAPPED FISHING ACCESS
TAILRACE SMALL BOAT ACCESS AREA
FLOW
RED BRIDGE PROJECT
WESTERN MASSACHUSETTS ELECTRIC CO.
MAP OF PROPOSED RECREATIONAL RESOURCES
FIGURE E-5
KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS
KA 241-104

- Work cooperatively with state agencies and with local and regional organizations to establish trailhead access for the state-owned (abandoned) trolley line right-of-way that parallels the Chicopee River between the Red Bridge Project and the upstream town of Three Rivers.

- Cooperate with the Massachusetts Department of Environmental Management relative to operational and land management issues in the Red Bridge area. WMECO proposes to operate and manage facilities that it provides, but would urge the state to operate and manage other facilities. Encourage the state to provide a new boat launch into the Red Bridge impoundment at an alternative location, so that the gatehouse small boat access area could eventually be returned to a car-top boat access area.

Roadside Picnic Area

This presently undeveloped area on state-owned land would serve as a picnic area along the Chicopee River, to be enhanced by the release of a continuous minimum flow. The following activities are proposed at this location:

- Furnish and install a small picnic area adjacent to the proposed entrance to the minimum flow facility, and also adjacent to the footpath leading to the existing trail system. This small picnic area would provide users with a view of the bypass reach of river (with a minimum flow), and would also provide fishermen access to that reach of river. WMECO will seek land rights from the state for work in this area.

2.7 Historical and Archaeological Resources

2.7.1 Continuing and Incremental Impacts

The addition of a minimum flow turbine facility consisting of an intake, siphon penstock, and small powerhouse at the base of the dam, will have an insignificant structural impact on the dam embankment. The selection of a siphon facility was, in part, to minimize structural impacts to the dam. A limited and unavoidable visual impact will occur; however, this impact is not expected to have an adverse effect on the characteristics that may make the Red Bridge Project eligible for listing in the National Register of Historic Places, since the minimum flow facility is consistent with the original waterpower purpose of the project. Mitigative measures described below will reduce the visual impacts.

Based on a site survey conducted by an archaeologist, there are no indications that the construction activities associated with the proposed new facility will have any impact on archaeological resources that may be in the project area (see Appendix F). The immediate area is highly disturbed by prior construction activity.

2.7.2 Recommendations by Agencies

During the Initial Stage of Consultation, WMECO provided the Massachusetts Historical Commission (MHC) (acting as the Massachusetts State Historic Preservation Officer) with a description of the project, noting its operation and history. At the time, WMECO did not propose any new construction or operational changes. The MHC responded that WMECO's proposal to license the project without any changes would not affect significant cultural, historical, or archaeological resources.

During Phase II studies, and in response to recommendations of fishery agencies, WMECO gave consideration to the installation of a small turbine at the dam to discharge a continuous minimum flow into the bypassed segment of the river. WMECO immediately contacted the MHC by telephone to discuss the need for studies to address potential impacts resulting from installation of a new turbine. MHC staff requested that WMECO conduct a survey of the project sufficient to permit an assessment of its eligibility for inclusion in the National Register; based on the project's eligibility, an assessment of the impacts of the proposed turbine on historical and archaeological resources would be needed, together with mitigative proposals, if necessary, to minimize or eliminate impacts.

During the Second Stage of Consultation the MHC (October 24, 1989) requested the opportunity to review and comment on preliminary plans for the facilities to determine what effects the proposed undertakings may have on significant historical and architectural characteristics of the generating stations. The MHC also indicated that a site visit would assist their review and determination of effect.

2.7.3 Survey and Salvage Measures Proposed by the Applicant

A survey of the project sufficient to permit assessment of its eligibility for inclusion in the National Register of Historic Places was conducted. The results of the survey are contained in Exhibit F. In order to mitigate the visual impacts of the proposed minimum flow facility, WMECO proposes to design the architectural features of the new powerhouse, in consultation with the MHC, to be compatible in scale and materials with existing project structures. Additionally, WMECO will consult with the MHC to institute measures to be used during construction activities so that previously unidentified resources are adequately protected.

The contributing structures that make the project meet the criteria for National Register eligibility (i.e., the hydroelectric station, dam, canal, and associated structures) will not be adversely impacted by the proposed construction as a result of WMECO's proposal to consult with the SHPO on final design details. Therefore, as discussed in WMECO's response letter to the SHPO, WMECO has encouraged a site visit by the SHPO, and has requested the SHPO to find that the proposed activities have no adverse effect on the eligibility of the structures (see Appendix A).

2.8 Scenic and Aesthetic Resources

2.8.1 Continuing and Incremental Impacts

Since no major development of the project is proposed, no adverse impacts to scenic and aesthetic resources are expected to occur. The addition of a continuous minimum flow in the bypass, which is visible from the highway bridge crossing it, will have a positive effect on the scenic resources of the project area.

2.8.2 Recommendations by Agencies

During the Initial Stage of Consultation, Federal, state, and local resource agencies recommended that WMECO provide increased flow discharges into the bypassed reach to enhance the aesthetic resources of the project.

No further recommendations were made during the Second Stage of Consultation regarding scenic and aesthetic resources.

2.8.3 Measures Proposed by the Applicant

WMECO proposes to discharge an instantaneous minimum flow release of 237 cfs, or inflow if less, into the bypassed reach upon completion of the proposed minimum flow facility. Since no major changes to project structures are being proposed, WMECO proposes no additional specific measures to further enhance the scenic and aesthetic resources of the proposed project.

3.0 AGENCY CONSULTATION

3.1 Initial Stage of Consultation

On February 21, 1989, WMECO provided 37 agencies with the Combined Initial Consultation Document. A copy of this document is attached in Appendix A (Agency Consultation). Comments and recommendations from reviewing agencies were requested within 30 days. Eleven agencies responded (see Appendix A), some with specific recommendations regarding studies, surveys, and materials to be included in the draft application. Those recommendations have been addressed in Section 2.0 of this Exhibit.

The following agencies received the Initial Stage Consultation Document:

National Marine Fisheries Service
National Park Service, Division of Environmental Compliance
National Park Service, Mid-Atlantic Region
National Park Service, North Atlantic Region
U.S. Army Corps of Engineers
U.S. Department of Interior (DOI)
U.S. DOI, Environmental Project Review
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service (FWS)
U.S. FWS Connecticut River Atlantic Salmon Commission
U.S. FWS Endangered Species Specialist
U.S. FWS New England Region
U.S. FWS Regional Director
MA Cooperative Fisheries Research Unit
MA Environmental Protection Agency Unit
MA Department of Community Affairs
MA Department of Environmental Management
MA Department of Environmental Quality Engineering (DEQE)
MA DEQE Regional Environmental Engineer
MA Department of Public Utilities
MA Division of Fisheries and Wildlife (DFW)
MA DFW Natural Heritage Program

MA DFW Program Coordinator
MA Division of Marine Fisheries
MA Energy Facilities Siting Council
MA Executive Office of Environmental Affairs
MA Historical Commission
City of Chicopee, MA, Mayor
City of Chicopee, MA, Conservation Commission
City of Chicopee, MA, Office of Community Development
City of Chicopee, MA, Watershed Council
City of Springfield, MA, Mayor
Connecticut River Watershed Council
Pioneer Valley Planning Commission
Town of Belchertown, MA, Board of Selectmen
Town of Ludlow, MA, Board of Selectmen
Town of Palmer, MA, Board of Selectmen
Town of Wilbraham, MA, Board of Selectmen

3.1.1 Agency Meetings

Date	Agencies	Location	Topic
March 29, 1989	USFWS, MDFW	At Project	Preliminary site visit
May 12, 1989	USFWS, MDFW	Westboro, MA	Discuss study plans
June 20, 1989	City of Chicopee Office of Community Development	Chicopee	River Flows and Wildlife Protection
August 2, 1989	USFWS, MDFW	At Project	View ABF
August 23, 1989	MA Dept. of Fisheries, Wildlife and Law Enforcement, and interested citizens	Ludlow	Maintenance of Public Facilities
August 30, 1989	USFWS, MDFW	Concord, NH	Review study results

3.2 Second Stage of Consultation

On September 21, 1989, WMECO circulated a draft Application for Exemption from Licensing to 40 resource agencies. The draft application provided descriptions of resources and results of studies performed by WMECO to address resource issues raised during the Initial Stage of Consultation, as well as WMECO proposals for addressing resource issues. Comments from agencies were requested within 30 days. Seven agencies responded (see Appendix A). WMECO responded to all commenters to specifically address resource and other issues raised (see Appendix A), and resource issues have been addressed in this application.

The following agencies received the draft Application for Exemption from Licensing:

National Marine Fisheries Service
National Park Service, Division of Environmental Compliance
National Park Service, Mid-Atlantic Region
National Park Service, North Atlantic Region
U.S. Army Corps of Engineers
U.S. Department of Interior (DOI)
U.S. DOI, Environmental Project Review
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service (FWS)
U.S. FWS Connecticut River Coordinator
U.S. FWS Endangered Species Specialist
U.S. FWS New England Region
U.S. FWS Regional Director
MA Cooperative Fisheries Research Unit
MA Environmental Protection Agency Unit
MA Department of Community Affairs
MA Department of Environmental Management (DEM)
MA Department of Public Utilities
MA Division of Fisheries and Wildlife (DFW)
MA Metropolitan District Commission
MA DEM Division of Forests and Parks

MA Waterways Regulation Program
MA Division of Water Pollution Control
MA Dept. of Fisheries, Wildlife, and Environmental Law Enforcement
MA DFW Natural Heritage Program
MA Division of Marine Fisheries
MA Energy Facilities Siting Council
MA Executive Office of Environmental Affairs
MA Historical Commission
Connecticut River Watershed Council
Pioneer Valley Planning Commission
Town of Belchertown, MA, Board of Selectmen
Town of Belchertown, MA, Conservation Commission
Town of Ludlow, MA, Board of Selectmen
Town of Ludlow, MA, Conservation Commission
Town of Palmer, MA, Board of Selectmen
Town of Palmer, MA, Conservation Commission
Town of Wilbraham, MA, Board of Selectmen
Town of Wilbraham, MA, Conservation Commission
Chicopee River Watershed Council

APPENDIX D
WATER QUALITY REPORT

WESTERN MASSACHUSETTS ELECTRIC COMPANY
RED BRIDGE PROJECT

WATER QUALITY REPORT

1.0 Introduction

This report summarizes work performed in the summer of 1989 to evaluate water quality in the Chicopee River in the area of the Red Bridge Project.

The project is owned and operated by Western Massachusetts Electric Company (WMECO) of Berlin, Connecticut. It has been in operation since it was built ca. 1901. The 300-ft-long dam and the 362 and 165-ft-long embankments form the 185-acre Red Bridge impoundment. This impoundment is heavily used for recreational fishing and several water contact sports. A state-maintained public boat launch is located adjacent to the gatehouse.

Below the dam and headworks, a 340-ft-long power canal conveys water to the powerhouse. The powerhouse contains two equally sized turbines capable of generating 3,600 KW of power at full plant flow of 1,230 cfs. River flows exceeding this amount are currently passed over the dam and through the bypass.

The bypass is a series of pools that usually receives only leakage from the dam structure. The bypass is approximately 2,000 ft long and rejoins the tailrace several hundred feet below the powerhouse. Through most of the summer, little flow passes over the dam to the bypass.

The project is operated in a peaking mode, with headpond level fluctuations of 2 ft daily. When river flows are greater than 615 cfs, one turbine is operated full time, and the second is operated according to available flows. During daily peak periods, both turbines operate, and may draw the impoundment down as much as 2 ft. If river flows are less than 615 cfs, a single turbine is cycled on and off.

WMECO proposes to install a minimal flow turbine at the dam to provide a constant flow of 237 cfs, or inflow if less, to the bypassed reach. Flow for this turbine will be from a siphon system set up to draw water over the dam. The intake will be fixed 5 to 6 ft below the normal maximum impoundment surface.

As part of the studies recommended by the U.S. Fish and Wildlife Service (USFWS) and the Massachusetts Division of Fisheries and Wildlife (MDFW), WMECO studied the existing water quality. The study was divided into two phases: research of existing data, and collection of current data. The purpose of the study was to correlate water quality data with operational data to determine the impacts, if any, of project operation on water quality, and to determine if existing water quality meets or exceeds the Class B water quality standards.

2.0 Massachusetts Water Quality Standards

The Chicopee River at the Red Bridge Project is classified by the Massachusetts Department of Environmental Quality Engineering (MDEQE) as a Class B, warmwater fishery. This classification requires that the water have a minimum of 5.0 mg/l dissolved oxygen (D.O.). Temperature must be less than 83°F; pH must be between 6.5 and 8.0 standard units; and fecal coliform bacteria counts must not be more than 200 per 100 ml sample. Other general regulations govern levels of oil and grease, radioactive substances, color, odor, foam, turbidity, floating or suspended solids, nutrients, and aesthetics (314 CMR 4.03 (1988)). Pertinent excerpts of Massachusetts Water Quality Standards are presented in Tables 1 and 2.

According to the State of Massachusetts 1988 Section 305(b) report to the USEPA, the river is generally meeting these water quality standards. The only impediment to full support of the standards is from fecal coliform bacteria caused by surface runoff after storm events. It is likely that some combined sewer overflows and untreated individual discharges add to the bacteria problem.

Water quality has improved dramatically since 1980 as a result of completion of a secondary wastewater treatment plant in Palmer, and elimination of individual discharges in both Palmer and Monson, both upstream of the Red Bridge Project. High-strength industrial wastes previously discharged to the Chicopee are now discharged to the Connecticut River via the Springfield Regional Wastewater Treatment Facility at Bondi Island.

TABLE 1 MASSACHUSETTS WATER QUALITY CRITERIA-STANDARDS FOR ALL WATERS

Parameter	Criteria
1. Aesthetics	All waters shall be free from pollutants in concentrations or combinations that: (a) Settle to form objectionable deposits; (b) Float as debris, scum or other matter for form nuisances; (c) Produce objectionable odor, color, taste or turbidity; or (d) Result in the dominance of nuisance species.
2. Radioactive Substances	Shall not exceed the recommended limits of the United States Environmental Protection Agency's National Drinking Water Regulations.
3. Tainting Substances	Shall not be concentrations or combinations that produce undesirable flavors in the edible portions of aquatic organisms.
4. Color, Turbidity, Total Suspended Solids	Shall not be in concentrations or combinations that would exceed the recommended limits on the most sensitive receiving water use.
5. Oil and Grease	The water surface shall be free from floating oils, grease and petrochemicals and any concentrations or combinations in the water column or sediments that are aesthetically objectionable or deleterious to the biota are prohibited. For oil and grease of petroleum origin the maximum allowable discharge concentrations is 15 mg/l.
6. Nutrients	Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.

TABLE 1 (Continued)
MASSACHUSETTS WATER QUALITY CRITERIA-STANDARDS
FOR ALL WATERS

Parameter	Criteria
7. Other Constituents	Waters shall be free from pollutants in concentrations or combinations that: (a) Exceed the recommended limits on the most sensitive receiving water use: (b) Injure, are toxic to, or produce adverse physiological or behavioral responses in humans or aquatic life; or (c) Exceed site-specific safe exposure levels determined by bioassay using sensitive species.

Source: Massachusetts State Regulation 314 CMR 4.03 (1988).

TABLE 2. MASSACHUSETTS WATER QUALITY CRITERIA-STANDARDS
FOR CLASS B WATERS

Parameter	Criteria
1. Dissolved Oxygen	Shall be a minimum of 5.0 mg/l in warm water fisheries and a minimum of 6.0 mg/l in cold water fisheries.
2. Temperature	Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water fisheries nor shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).
3. pH	Shall be in the range of 6.5-8.0 standard units and not more than 0.2 units outside of the naturally occurring range.
4. Fecal Coliform Bacteria	Shall not exceed a log mean for a set of samples of 200 per 100 ml, nor shall more than 10% of the total samples exceed 400 per 100 ml during any monthly sampling period, except as provided in 314 CMR 4.02(1).

Source: Massachusetts State Regulation 314 CMR 4.03 (1988).

3.0 Existing MDEQE Data, Analysis, and Results

Existing water quality data consist of several water quality data reports published by MDEQE. The most recent were published in 1980 and 1985. Only these two recent reports were considered to have current data. Earlier reports contained data collected before some wastewater treatment plants were operational. The two remaining reports contained data from several sample locations in the Chicopee basin. Stations CH01A, GH02, and CH02A are, respectively, above the Red Bridge impoundment, above the Red Bridge dam, and below the Red Bridge dam.

In 1985, data from all stations were collected for D.O., temperature, five-day biochemical oxygen demand (BOD_5), nitrogen and phosphorus, suspended and total solids, pH, alkalinity, chloride, hardness, and heavy metals. Individual data were collected for three periods: April 30, July 15-16, and August 21-22, 1985.

In 1980, the same locations and many of the same sample types had been measured. BOD was assessed for 2, 5, 7, 14 and 21 days, and D.O. was sampled every few hours to determine a diurnal fluctuation. Algae (as Chlorophyll "a"), and fecal coliform bacteria were also sampled in 1980. Two periods of data were collected: July 14-17, and August 18-21, 1980.

The results of MDEQE are reported in two reports, "Chicopee River Basin - 1980 Water Quality Data & Wastewater Discharge Data," and "Chicopee River Basin - 1985 Water Quality Survey Data & Wastewater Discharge Survey Data." These investigations indicated water quality to be generally acceptable. The lowest D.O. measured at any of the three stations in the vicinity of the Red Bridge dam was 7.1 mg/l (81% saturation) on July 16, 1985, and 5.3 mg/l (57% saturation) on August 18, 1980. The average daily D.O. measured in the two years, however, was generally in the upper 80% to low 90% saturation range; actual D.O. measurements varied with temperature. A slight diurnal fluctuation in D.O. was noted at all three stations near the Red Bridge Project.

Since most of these data were collected during the critical summer warm weather period, river water temperatures were in the low to mid-70°F (low-20°C) range. Temperatures during the April 30, 1985 data set, however, ranged from 57°F (13.9°C) to 62°F (16.7°C) at the three stations. At the stations near Red Bridge, BOD_5 values measured in 1985 ranged from 1.5 to 2.4 mg/l. In 1980, corresponding values were 1.5 to 4.5 mg/l. This reduction in maximum recorded BOD is probably indicative of additional wastewater treatment plants being operational, and the elimination of some individual discharges. No significant changes in BOD were noted as the water passed the three stations.

Total and suspended solids tended to be slightly higher at station CH01A, above the impoundment, than at stations CH02 and CH02A, indicating that the impoundment is a sink for these solids during this time of year. In the spring with higher flow rates and velocities, these accumulated solids may be scoured out of the impoundment and passed along downstream. Turbidity, measured only in 1980, was also slightly lower in and below the impoundment. Turbidity and solids data usually correlate very well, as was seen here.

Nitrogen (total Kjeldahl, ammonia, and nitrate) and phosphorus data all showed no distinct pattern of change when passing from above the impoundment to below the dam. Hardness and pH data displayed this same lack of pattern.

Bacteria also tended to be much higher at station CH01A than at the lower stations. This may be a result of an unlicensed discharge or combined sewer overflow, but was not explained by MDEQE in their data reports. No significant changes were noted at the Red Bridge dam.

In 1980, grab samples for the algae indicative Chlorophyll "a" were measured at all three MDEQE stations on July 15 and again on August 19. On both days, an increase from about 2 mg/m^3 to 11 mg/m^3 was noted between station CH01A, above the impoundment, and station CH02, just above the Red Bridge dam. The measured Chlorophyll "a" decreased slightly below the dam. This is normal in impoundments, where the longer detention time gives the algae more opportunity to develop.

4.0 July 1989 Data

At the Red Bridge Project, there are extensive existing water quality data as described above. Additional sampling was performed, however, to provide current data to update and verify any changes since the 1985 data were collected.

From July 24 to 27, 1989, D.O. and temperature were sampled at four sites at the Red Bridge Project. These were measured in the impoundment, at the headworks, from the bridge over the canal, and below the project in the tailrace from a state-maintained park. During the sampling period there was no flow passing over the dam. The pools in the bypassed reach were isolated from flow other than leakage and, consequently, were not sampled.

4.1 Impoundment Sampling

The impoundment was sampled in two ways. The first was a hypolimnetic D.O. profile. One-meter (m) increments were measured on the morning of July 25, 1989. The deepest point in the impoundment was first located from a canoe equipped with a fathometer. As expected in a lacustrine type system, the D.O. and temperature both decreased with depth. Water in the top 4m had D.O. levels greater than 8.2 mg/l and temperatures ranging from 22°C (72°F) to 24°C (75.2°F). A distinct break was noted between 9 and 10m depth. D.O. decreased from 5.7 mg/l at 8m and 4.4 mg/l at 9m to 0.5 mg/l at 10m. Below 10m depth, the water was generally anaerobic, with D.O. readings less than 0.4 mg/l. Data from this sampling are shown in Table 3.

The second method of monitoring water quality in the impoundment was the use of a Hydrolab monitor recording D.O., temperature, and conductivity. This battery-powered sonde unit was installed 1.5 to 2m below the water surface at the impoundment side of the Red Bridge gatehouse. Flow was maintained past the unit by a partially open gate to the power canal several feet downstream. The sonde was calibrated and programmed to record water temperature, D.O., and conductivity every 30 minutes.

TABLE 3

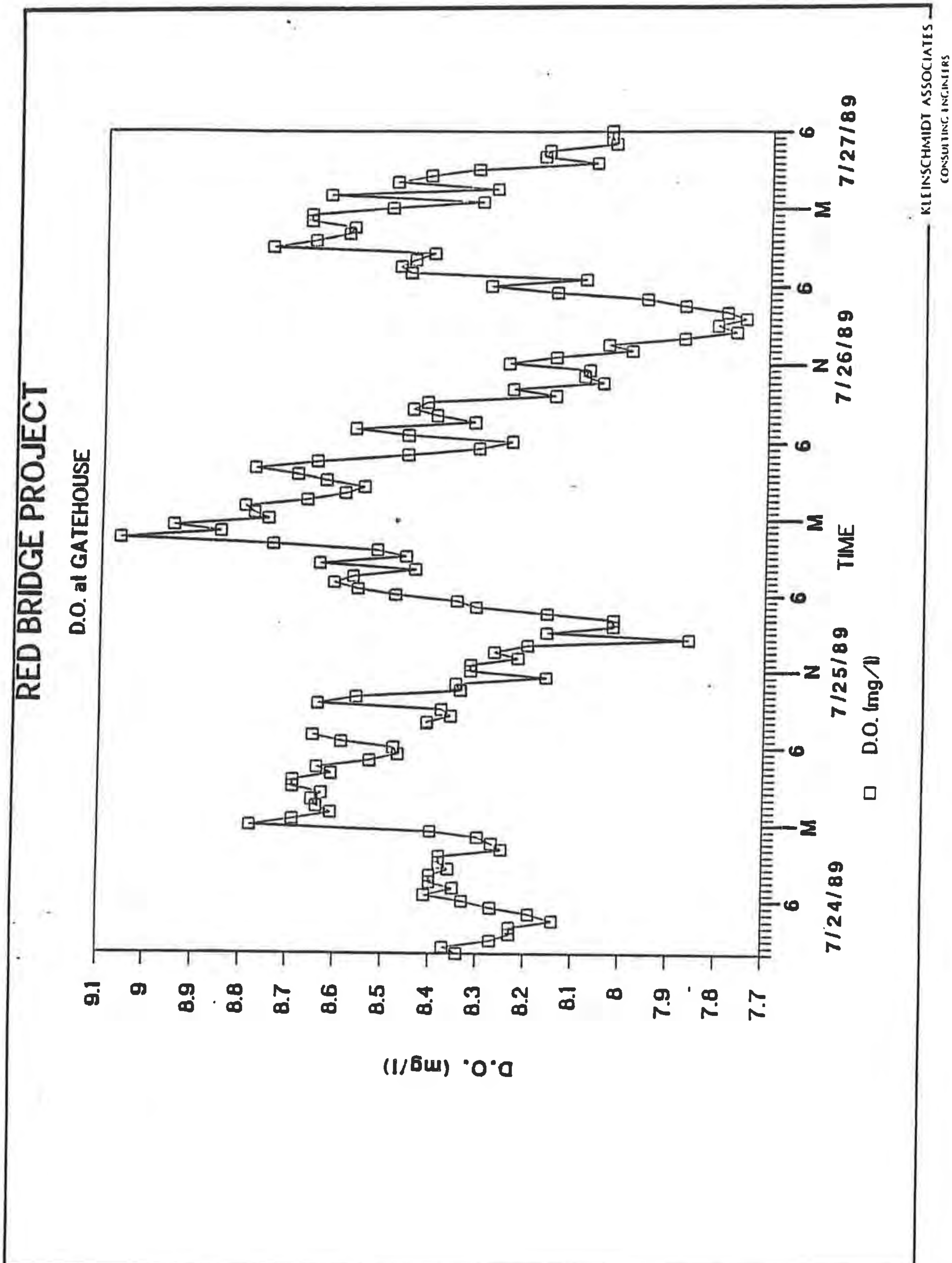
Red Bridge Hypolimnetic Sampling

DEPTH (m)	TEMP (°C)	D.O. (mg/l)
1	24.0	9.6
2	24.0	9.2
3	23.0	8.8
4	21.6	8.3
5	20.1	7.7
6	19.5	7.2
7	18.9	6.4
8	18.4	5.7
9	17.9	4.4
10	16.8	0.5
11	15.0	0.3
12	14.2	0.1
13	14.0	0.0

The sonde was installed at the gatehouse at 1430 hrs on July 24, 1989. The next morning at 0713 hrs, the unit was retrieved. The data it had collected over the night were downloaded to verify that the unit was operating correctly and that data were able to be transferred. Once this had been verified, the unit was reinstalled at about 0800 hrs. This quality control check accounts for the single gap in the collected data. The unit was left in place until 0730 hrs on Thursday, July 27, when it was retrieved, and all data were downloaded.

Data recorded by the Hydrolab unit are shown graphically in Figure 1. The actual data are attached in Appendix A. The minimum D.O. measured was 7.8 mg/l at 1638 hrs on July 26. The water temperature then was 23.3°C (73.9°F), yielding a saturation of 91.4%. The highest recorded D.O. was 9.1 mg/l, measured at 2338 hrs on July 25. The temperature at that time was 23.3°C (73.9°F), yielding a saturation of 106.7%. Average D.O. was 8.4 mg/l at an average temperature of 22.98°C (73.4°F). Based on this, average saturation at the gatehouse would be 97.6%.

During the sampling period, the temperatures measured by the probe ranged from 21.2°C (70.2°F) to 24.5°C (76.9°F) and averaged 23.0°C (73.4F). Conductivity was almost constant at 0.10 to 0.12 mmhos/cm, indicating that no concentrated pollutant plumes passed the probe during the sampling.



RED BRIDGE PROJECT
D.O. at GATEHOUSE
D.O. (mg/l)
9.1
9
8.9
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
8
7.9
7.8
7.7
6
M
6
N
6
M
6
N
6
M
6
7/24/89
7/25/89
TIME
7/26/89
7/27/89
D.O. (mg/l)
KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS

FIGURE 1

4.2 Downstream Sampling

Sampling downstream of the impoundment consisted of discrete samples taken manually with a YSI model 51B, portable D.O./temperature meter. Sampling was done on the afternoon of July 25 and several times between 0725 hrs and 1600 hrs on July 26. The first sampling location was from a road bridge over the power canal between the gatehouse and powerhouse.

In the power canal, the four surface samples taken between 0915 hrs and 1600 hrs on July 26 ranged from 7.9 to 8.6 mg/l D.O. and 24.0°C (75.2°F) to 24.8°C (76.6°F). These were all within 0.2 mg/l of the D.O. measured by the Hydrolab units just upstream. This close correlation indicates that there is little reaeration of water passing through the gates and the beginning of the canal. The similarity of measurements also verifies those of the Hydrolab sonde.

From the park at the tailrace, six surface samples were taken. The results ranged from 7.8 to 9.3 mg/l D.O. and 24°C (75°f) to 26°C (79°f). On the average the D.O. measurements averaged 0.2 mg/l higher than those measured at the headworks. Three of the readings, however, were within 0.1 mg/l of the headworks samples, indicating no significant change. Data from this manual sampling are also included in the data table in Appendix A, next to readings obtained by the Hydrolab monitor at approximately the same time.

4.3 Project Operations During Sampling

Records were obtained for project operations during the July 1989 sampling. These data show the project was operating one of its two turbines almost continuously at approximately 580 cfs during the time of the sampling (see Figure 2 and Appendix B). The second unit was not operated, due to relatively low river flows. On July 26, when many of the manual downstream samples were collected, operating flows ranged from 291 cfs to 580 cfs. This allowed data to be collected for both conditions.

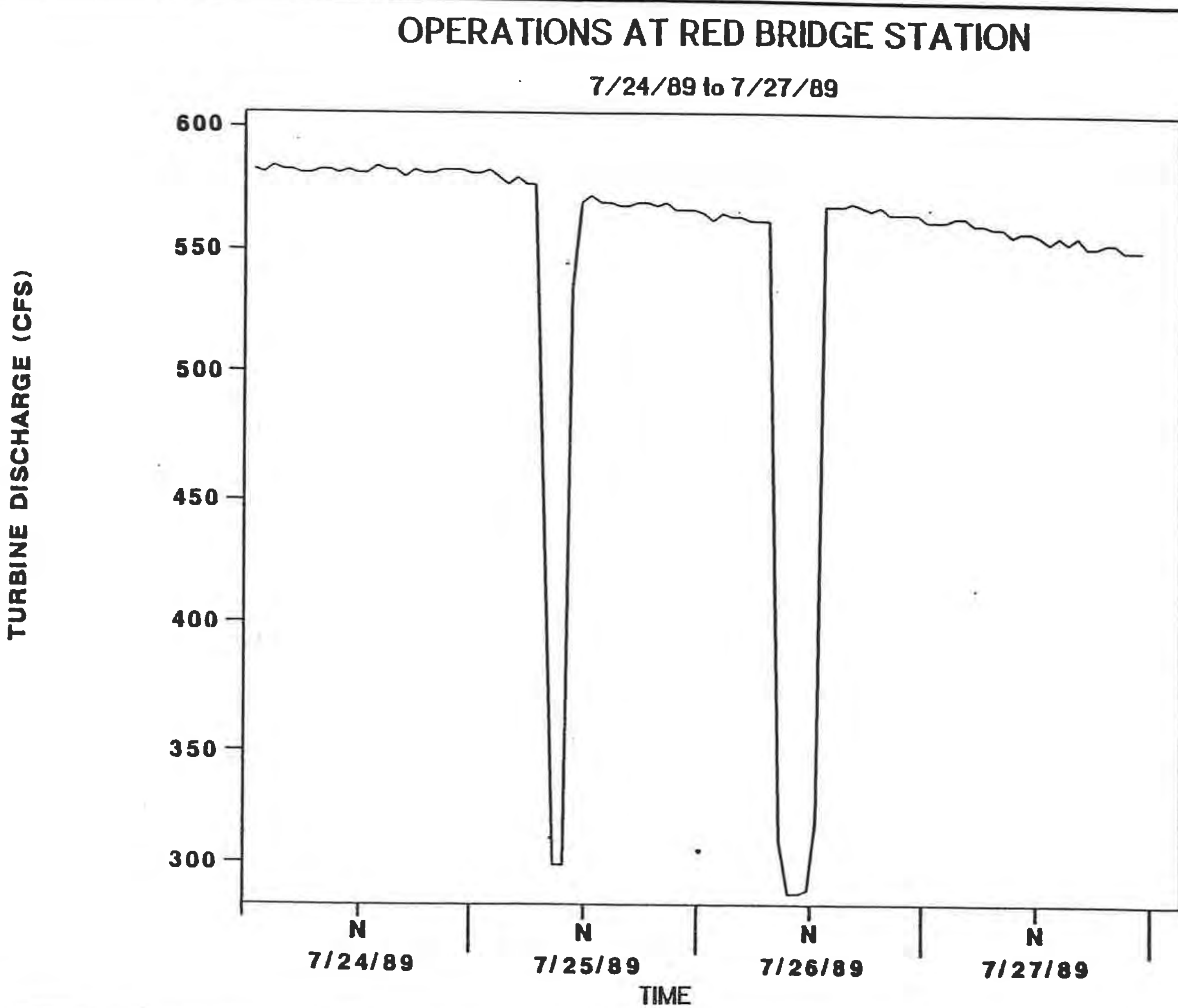


FIGURE 2

KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS

4.4 Impacts of Project Operation

The data collected during automatic sampling were correlated with the project operation, comparing the average D.O. and temperature between the generating and non-generating modes. With the increased flow required for generation, there would be additional mixing, drawing water from different depths. Water from deeper depths may not contain as much oxygen as shallower waters. The comparison, as shown in Table 4 below, results in only an insignificant change in both parameters.

TABLE 4

Comparison of D.O. and Temperature and Generating Mode

Mode	D.O. (mg/l)	Temperature (°C)
Generating	8.40	22.96
Non-generating	8.30	22.98
All data	8.38	22.98

Data from downstream manual sampling tended to be about the same or only slightly higher in D.O than that measured at the headworks. The slight increase is from reaeration received in the tailrace. Temperatures in the tailrace were about 2°C (3.6°F) higher than those measured in the impoundment. This is also a function of the water in the tailrace having increased contact with the atmosphere. Air temperatures during the week of sampling were in the 90+°F (324°C) range.

5.0 Impacts of Proposed Minimum Flow Turbine

WMECO proposes to install a minimum flow turbine passing 237 cfs continuously at the Red Bridge dam. Flow will be drawn over the dam through a siphon system with an intake approximately 5 to 6 ft below the impoundment surface, at about the same depth as the Hydrolab D.O./ temperature probe was installed. The increase in flow through the pools and riffles in the bypass will cause more water to contact the atmosphere. The results of atmospheric contact will be that water from the impoundment that is below saturation will be aerated, and supersaturated water will lose excess oxygen.

The minimum flow turbine provides more opportunity for atmospheric contact and aeration than the present power canal and turbine system. It can be assumed that installation of a minimum flow turbine at the dam will have a net positive effect on water quality in the Chicopee River.

6.0 Summary and Conclusions

All data collected in July 1989, and data from previous sampling by MDEQE in 1980 and 1985, indicate that water quality at the Red Bridge Project is consistent with the state's classification goals for Class B, warmwater fisheries. These data also show that the operation of the project has no significant adverse impact on the water quality of the Chicopee River. Installation of the proposed minimum flow turbine to provide flow in the bypass can only further enhance the river's condition.

APPENDIX A

1989 WATER QUALITY SAMPLING DATA

RED BRIDGE PROJECT

	TEMP.	COND.	D.O.	BATTERY	DATE	TIME	OTHER MANUAL SAMPLING PARK-D.O.	TEMP.	CANAL-DO	TEMP.
1438	21.96	0.10	8.34	11.82	72489					
1508	21.17	0.10	8.37	11.77						
1538	21.80	0.10	8.27	11.74						
1608	21.88	0.10	8.23	11.72						
1638	21.75	0.10	8.23	11.69						
1708	21.84	0.10	8.14	11.66						
1738	21.78	0.10	8.19	11.64						
1808	21.87	0.10	8.27	11.62						
1838	22.18	0.10	8.33	11.60						
1908	22.12	0.10	8.41	11.59						
1938	22.32	0.10	8.35	11.57						
2008	22.41	0.10	8.40	11.56						
2038	22.41	0.10	8.40	11.55						
2108	22.38	0.10	8.36	11.51						
2138	22.57	0.10	8.38	11.50						
2208	22.38	0.10	8.38	11.48						
2238	22.18	0.10	8.25	11.47						
2308	22.12	0.10	8.27	11.46						
2338	22.25	0.10	8.30	11.44						
8	22.16	0.10	8.40	11.43	72589					
38	22.85	0.10	8.78	11.42						
108	22.88	0.10	8.69	11.41						
138	22.68	0.10	8.61	11.40						
208	22.49	0.10	8.64	11.39						
238	22.72	0.10	8.65	11.38						
308	22.59	0.10	8.63	11.37						
338	22.56	0.10	8.69	11.36						
408	22.75	0.10	8.69	11.35						
438	22.69	0.10	8.61	11.33						
508	22.62	0.10	8.64	11.32						
538	22.75	0.10	8.53	11.32						
608	22.37	0.10	8.47	11.30						
638	22.47	0.10	8.48	11.30						
708	22.85	0.10	8.59	11.28						
738				11.27						
808	22.53	0.10	8.65	11.25	72589	722				
838	22.82	0.10	8.41	11.23	72589	739				
908	22.76	0.10	8.41	11.22						
938	22.69	0.10	8.36	11.21						
1008	22.71	0.10	8.38	11.20						
1038	22.43	0.10	8.64	11.28						
1108	22.81	0.10	8.56	11.29						
1138	22.28	0.10	8.34	11.30						
1208	22.13	0.10	8.35	11.30						
1238	21.99	0.10	8.16	11.26						
1308	22.02	0.10	8.32	11.25						
1338	21.81	0.10	8.32	11.25		1340	7.8	24		
1408	22.24	0.10	8.22	11.22						
1438	22.19	0.10	8.27	11.25						
1508	22.10	0.10	8.20	11.24						
1538	21.88	0.10	7.86	11.24						
1608	22.13	0.11	8.16	11.24						
1638	21.65	0.10	8.02	11.23						

1708	21.97	0.10	8.02	11.22						
1738	22.27	0.11	8.16	11.21						
1808	22.35	0.11	8.31	11.21						
1838	22.40	0.11	8.35	11.20						
1908	22.68	0.11	8.48	11.20						
1938	22.85	0.11	8.56	11.19						
2008	22.88	0.11	8.61	11.19						
2038	22.90	0.11	8.57	11.18						
2108	22.69	0.11	8.44	11.17						
2138	23.04	0.11	8.64	11.16						
2208	22.84	0.11	8.46	11.16						
2238	22.88	0.11	8.52	11.15						
2308	23.29	0.11	8.74	11.15						
2338	23.31	0.11	9.06	11.14						
8	23.29	0.11	8.85	11.14	72689					
38	23.48	0.11	8.95	11.13						
108	22.92	0.11	8.75	11.13						
138	23.32	0.11	8.78	11.12						
208	23.28	0.11	8.80	11.10						
238	22.98	0.11	8.67	11.10						
308	23.10	0.11	8.59	11.09						
338	23.01	0.11	8.55	11.09						
408	23.60	0.11	8.63	11.08						
438	23.35	0.11	8.69	11.08						
508	23.38	0.11	8.78	11.07						
538	23.45	0.11	8.65	11.07						
608	23.20	0.11	8.46	11.06						
638	22.43	0.11	8.31	11.05						
708	22.51	0.11	8.24	11.05						
738	22.90	0.11	8.46	10.99		725	8.4	24		
808	22.40	0.11	8.57	10.98						
838	23.54	0.11	8.32	10.98						
908	23.54	0.11	8.40	10.97		915	9.2	25	8.6	24.2
938	23.48	0.11	8.45	10.97						
1008	23.31	0.11	8.42	10.97						
1038	23.06	0.10	8.15	10.96						
1108	23.04	0.10	8.24	10.96		1105	9.3	26	8.1	24.8
1138	23.61	0.11	8.05	10.95						
1208	23.64	0.11	8.09	10.94						
1238	23.61	0.11	8.08	10.94						
1308	23.22	0.11	8.25	10.94						
1338	23.06	0.11	8.15	10.93		1354	8	25	8	24
1408	22.87	0.11	7.99	10.93						
1438	23.32	0.11	8.04	10.93						
1508	23.07	0.11	7.82	10.94						
1538	23.09	0.11	7.77	10.94		1545	7.8	24.5	7.9	24.8
1608	23.25	0.12	7.81	10.94						
1638	23.33	0.12	7.75	10.94						
1708	23.50	0.12	7.79	10.93						
1738	23.45	0.12	7.88	10.92						
1808	23.47	0.12	7.96	10.91						
1838	23.69	0.12	8.15	10.91						
1908	23.98	0.12	8.29	10.91						
1938	23.83	0.11	8.09	10.91						
2008	24.01	0.11	8.46	10.90						
2038	24.14	0.12	8.48	10.89						

2108	24.14	0.11	8.45	10.88					
2138	23.88	0.11	8.41	10.88					
2208	24.39	0.11	8.75	10.88					
2238	24.40	0.11	8.66	10.88					
2308	24.11	0.11	8.59	10.88					
2338	24.37	0.11	8.58	10.87					
8	24.33	0.11	8.67	10.86	72789				
38	24.55	0.12	8.67	10.87					
108	24.33	0.11	8.50	10.86					
138	24.42	0.11	8.31	10.86					
208	24.55	0.12	8.63	10.84					
238	24.07	0.11	8.28	10.84					
308	24.35	0.11	8.49	10.84					
338	24.02	0.11	8.42	10.84					
408	23.61	0.11	8.32	10.83					
438	24.20	0.11	8.07	10.83					
508	24.11	0.11	8.18	10.82					
538	23.85	0.11	8.17	10.82					
608	23.86	0.11	8.03	10.82					
638	23.66	0.11	8.04	10.81					
708	23.96	0.11	8.04	10.81					
72789	1005								
MAXIMUM	24.55	0.12	9.06			9.30	26.0	8.60	24.8
MINIMUM	21.17	0.10	7.75			7.80	24.0	7.90	24.0
RANGE	3.38	0.02	1.31			1.50	2.0	0.70	0.8
AVERAGE	22.98	0.11	8.38			8.42	24.8	8.15	24.5

CHICOPEE RIVER WATERSHED
2003 WATER QUALITY ASSESSMENT REPORT

Ware River, Ware, Massachusetts

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
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MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
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CHICOPEE RIVER WATERSHED

2003 WATER QUALITY ASSESSMENT REPORT

Prepared by
Matthew Reardon

Massachusetts Department of Environmental Protection
Division of Watershed Management

Report Number:

36-AC-3

DWM Control Number:

CN 106.5

Massachusetts Department of Environmental Protection
Division of Watershed Management
Worcester, Massachusetts

OCTOBER 2008

ACKNOWLEDGEMENTS

Coordination of local, state and federal agencies and private organizations is fundamental to the success of the Massachusetts watershed management approach.

Data and information used in this report was provided in part by the following agencies and organizations.

State
- Massachusetts Department of Environmental Protection (MassDEP)
  - –Bureau of Strategic Policy and Technology, Wall Experiment Station (WES)
  - –Bureau of Resource Protection (BRP)
  - –Bureau of Waste Prevention (BWP)
  - –Bureau of Waste Site Cleanup (BWSC)
- Massachusetts Department of Public Health (MDPH)
- Massachusetts Department of Fish and Game (MassWildlife)
  Division of Fisheries and Wildlife (MDFW)
- Massachusetts Department of Conservation and Recreation (MA DCR)

Federal
- United States Environmental Protection Agency (EPA)
- United States Geological Survey (USGS)
  - –Water Resources Division

Much appreciation is extended to the many MassDEP employees for their contributions: Therese Beaudoin, Warren Kimball, Alice Rojko, Kenneth Dominick, Jane Ryder, Laurie Kennedy, Susan Connors and Rick McVoy and Arthur Screpetis.

It is impossible to thanks all those who helped in the assessment process and all their contributions are appreciated.

Cover Photo Credit: Ware River – Therese Beaudoin, MassDEP

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List of Acronyms and Abbreviations

7Q10'………..Lowest mean flow for seven consecutive days to be expected once in ten years
ACOE Army Corps of Engineers
ADB ....Assessment Database
BRP………….Bureau of Resource Protection
BMP ....Best Management Practices
BOD ....Biological Oxygen DemandF
BWSC……….Bureau of Waste Site Cleanup
CERO .... Central Environmental Regional Office
C-NOEC ....Chronic No Observe Effect Concentration
CSO .... Combined Sewer Overflow
DO ....Dissolved Oxygen
EOEA ....Executive Office of Environmental Affairs
EPA................United States Environmental Protection Agency
FERC ....Federal Energy Regulatory Commission
LC_{50}................Lethal concentration to 50% of the test organisms
MA DCR Massachusetts Department of Conservation and Recreation.
MassDEP.......Massachusetts Department of Environmental Protection
MA DFG.........Department of Fish and Game (formerly the Department of Fisheries, Wildlife and Environmental Law Enforcement)
MA DPH.........Massachusetts Department of Public Health
MDC Metropolitan District Commission
MDL............... Method Detection Limit
MWRA........... Massachusetts Water Resources Authority
NOAA………..National Oceanic and Atmospheric Adminsitration
NPDES.......... National Pollutant Discharge Elimination System
PALIS .... Pond and Lake Information System
PCB............... Polychlorinated Biphenyl
QAPP .... Quality Assurance Project Plan
RBP............... Rapid Bioassessment Protocol
SARIS .... Stream and River Inventory System
SMART .... Strategic Monitoring and Assessment for River Basin ....Teams
SRF............... State Revolving Fund
SWQS .... Surface Water Quality Standards
TMDL .... Total Maximum Daily Load
TOXTD.......... MassDEP DWM Toxicity Testing Database
TRC ....Total Residual Chlorine
TSS .... Total Suspended Solids
USFWS.........United States Fish and Wildlife Service
USGS............ United States Geological Survey
WBID............. Waterbody Identification Code
WBS.............. Waterbody System Database
WMA .... Water Management Act
WWTP........... Wastewater treatment plant

List of Units

cfs	cubic feet per second
cfu	colony forming unit
MGD	million gallons per day
mg/L	milligram per liter
NTU	nephelometric turbidity units
ppm	parts per million
SU	standard units
µS/cm	microsiemens per centimeter
µg/g	microgram per gram
kg/ha/year	kilogram per hectacre per year

Table of Fish Scientific Names

Common name	*Scientific name*	Common name	*Scientific name*
Alewife	*Alosa pseudoharengus*	Largemouth bass	*Micropterus salmoides*
American Eel	*Anguilla rostrata*	Longnose dace	*Rhinichthys cataractae*
Black crappie	*Pomoxis nigromaculatus*	Northern pike	*Esox lucius*
Eastern blacknose dace	*Rhinichthys atratulus*	Pumpkinseed	*Lepomis gibbosus*
Banded Sunfish	*Enneacanthus obesus*	Rainbow trout	*Oncorhynchus mykiss*
Bluegill	*Lepomis macrochirus*	Redbreasted Sunfish	*Lepomis auritus*
Brook trout	*Salvelinus fontinalis*	Redfin x Chain Pickerel	*Esox americanus x niger*
Brown bullhead	*Ameiurus nebulosus*	Rock bass	*Ambloplites rupestris*
Brown trout	*Salmo trutta*	Smallmouth Bass	*Micropterus dolomieu*
Chain pickerel	*Esox niger*	Tesselated Darter	*Etheostoma olmstedi*
Common Shiner	*Luxilus cornutus*	Tadtpole Madtom	*Noturus gyrinus*
Creek Chubsucker	*Erimyzon oblongus*	Yellow Bullhead	*Ameiurus natalis*
Fallfish	*Semotilus corporalis*	Yellow Perch	*Perca flavens*
Golden shiner	*Notemigonus crysoleucas*	White sucker	*Catostomus commersonii*

Executive Summary

This assessment report presents a summary of current water quality data and information used to assess the status of the designated uses as defined in the Massachusetts Surface Water Quality Standards (SWQS) for the Chicopee River Watershed for reporting to EPA in the Integrated List of Waters, updates the assessments from the 1998 Water Quality Assessment Report (Mass DEP 2001), and provides basic information that can be used to focus resource protection and remediation activities later in the watershed management planning process.

The SWQS designate the most sensitive uses for which surface waters in the Commonwealth shall be protected. The designated uses, where applicable, include: *Aquatic Life, Fish Consumption, Drinking Water, Shellfish Harvesting, Primary* and *Secondary Contact Recreation* and *Aesthetics*. The assessment of current water quality conditions provides a determination of whether or not each designated use of a particular water body is ***supported*** or ***impaired***. When too little current data/information exist or quality-assured data are unavailable, the use is ***not assessed***. However, if there is some indication of water quality impairment, which is not considered to be naturally occurring, the use is identified with an “Alert Status”. It is important to note that many lakes and river miles do not have an assigned assessment segment and the status of the designated uses of these unassessed waters has never been reported to the EPA in the Commonwealth’s Summary of Water Quality Report (305(b) Report) nor is information on these waters maintained by the Massachusetts Department of Environmental Protection in the Water Body System (WBS) or Assessment Database (ADB).

In 2003 the Massachusetts Department of Environmental Protection (MassDEP), Division of Watershed Management (DWM), conducted water quality sampling and baseline lakes sampling, in the Chicopee River Watershed under Environmental Protection Agency (EPA) approved Quality Assurance Project Plans (QAPPs). The water quality monitoring data are available in a technical memorandum (DeCesare 2006, Appendix B). The lakes data are available in the technical memorandum entitled *Baseline Lakes 2003 Technical Memo* (MassDEP 2007a, Appendix C).

The data generated by DWM, together with other sources of information, were utilized to assess the status of water quality conditions of rivers and lakes in the Chicopee River Watershed in accordance with EPA’s and MassDEP’s use assessment methods. It is important to note that assessment methodologies have changed over time and a direct comparison between current and previous assessments of this watershed is not possible.

This report includes information on 29 freshwater rivers, stream or brooks (the term “rivers will hereafter be used to include all). The assessed rivers represent approximately 46% of the named rivers in the Chicopee River Basin that have been assigned SARIS (Stream and River Information System) code numbers (Halliwell *et al*. 1982). Numerous rivers have never been assessed, and are not included in this report. This report also includes information on seventy-four lakes, ponds, or impoundments that have been assigned a Pond and Lake Identification System (PALIS) number in the Chicopee River Watershed, representing 93% of the total lake acreage

A summary of the use assessments for the rivers and lakes in the Chicopee River Watershed is provided in Table 1. See also Figures 1-5 for a summary of the designated use assessments detailed in this report.

Table 1. River miles and lake acreage in the ChicopeeRiver Basin assessed as support, impaired, or not assessed for each use (with percentage of total river miles or acreage in report).

	River (Total Length included in report - 212.6 miles		
Use	**Support**	**Impaired**	**Not Assessed**
Aquatic Life	116.1 (55%)	2.4 (1%)	94.1 (44%)
Fish Consumption	0 (0%)	0.3 (0. 1%)	212.3 (99.9%)
Drinking Water	Not Assessed in this Report[1]		
Primary Contact	77.0 (36%)	24.2 (11%)	111.4 (52%)
Secondary Contact	98.2 (46%)	3.0 (1%)	111.4 (52%)
Aesthetics	192.9 (91%)	0 (0%)	19.7 (9%)
	Lakes (Total Acreage included in report--29798[2]		
Use	**Support**	**Impaired**	**Not Assessed**
Aquatic Life	0 (0%)	25630 (89%)	3268 (11%)
Fish Consumption	0 (0%)	25936 (87%)	3862 (13%)
Drinking Water	Not Assessed in this Report[1]		
Primary Contact	24012 (80.6%)	544 (1.8%)	5242 (17.6%)
Secondary Contact	24012 (80.6%)	544 (1.8%)	5242 (17.6%)
Aesthetics	24239 (81%)	544 (2%)	5015 (17%)

1- While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at http://www.mass.gov/dep/water/drinking.htm and from local public water suppliers
2 – Quabbin Reservoir (20412 acres) constitutes 81 percent of the lake acreage in the Chicopee River basin.
.

Fish Consumption Use

The following waterbodies in the Chicopee River Basin are impaired for the *Fish Consumption Use*: Ware River (MA36-03), Pottapaug Pond Basin (MA36125), Quabbin Reservoir (MA36129), Lake Lashaway (MA36079), Quaboag Pond (MA36130), Quacumquasit Pond (MA36131), Wickaboag Pond (MA36166). There is also currently a statewide fish consumption advisory (see Figure 2, MA DPH 2001). A TMDL, a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for certain regional waterbodies to meet and maintain compliance with state and federal water quality standards, was recently approved for mercury by the U.S. EPA.

The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). All of the waterbodies impaired for *Fish Consumption Use* and listed above with the exception of Ware River (MA36-03) and Quaboag Pond (MA361630) are covered by this TMDL. The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new on-going monitoring and air deposition data. Final targets will be determined at that time. It should be noted that not all river segments or lakes will have specific recommendations. Numerous general recommendations detailed below apply to these river segments or lakes.

GENERAL RECOMMENDATIONS
Bacteria source tracking studies should be conducted as appropriate in the seven river segments that are impaired for *Primary Contact Recreation Use*.

Continue to conduct biological and water quality monitoring to evaluate the effect(s), if any of National Pollution Discharge Elimination (NPDES) discharges, water withdrawals, and non-point sources of pollution and to document any changes in water quality as a result of infrastructure improvements/pollution abatement controls. Specific attention should be given towards gauging *Primary* and *Secondary Contact Recreation Uses* in segments impaired for these uses and those segments affected by CSO discharges.

Baseline sampling and aquatic macrophyte mapping should be conducted to evaluate the status of designated uses of lakes in the basin with special attention to sampling lakes with suspected infestations of non-native aquatic macrophytes.

Fish passage should be encouraged at both hydropower plants and other dams in the watershed. In addition, dam removal should be encouraged to promote ecological continuity as feasible.

The Northeast Regional Mercury Total Maximum Daily Load (TMDL) should be successfully implemented, with a minimum of a 90 percent control on out-of region coal-fired power plants emissions and successful control of in-state/regional reductions in mercury sources (NEIWPCC 2007). Fish toxics monitoring should be conducted in waterbodies impaired for the *Fish Consumption Use*

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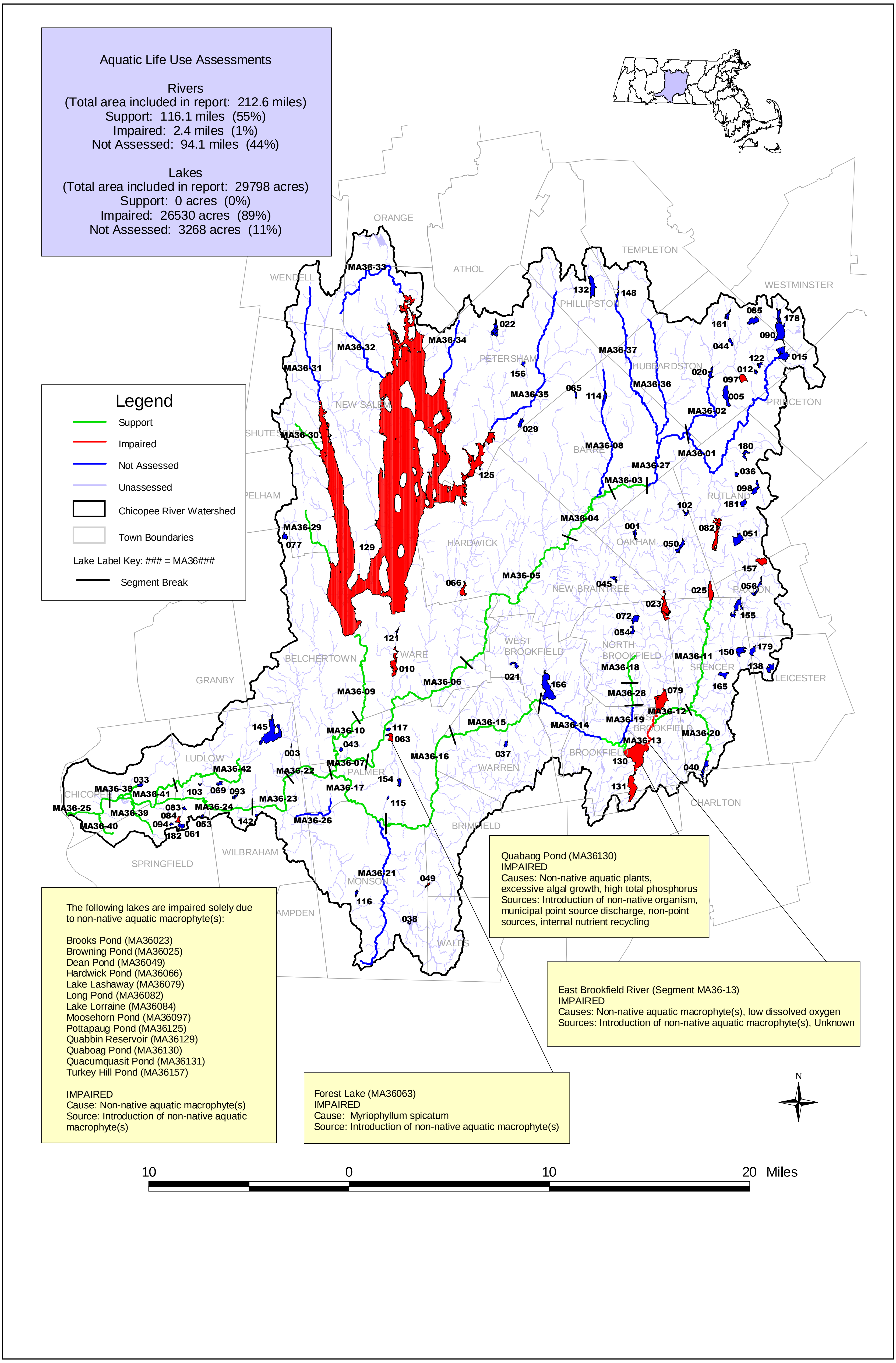

Figure 1: Chicopee River Basin *Aquatic Life Use* Summary

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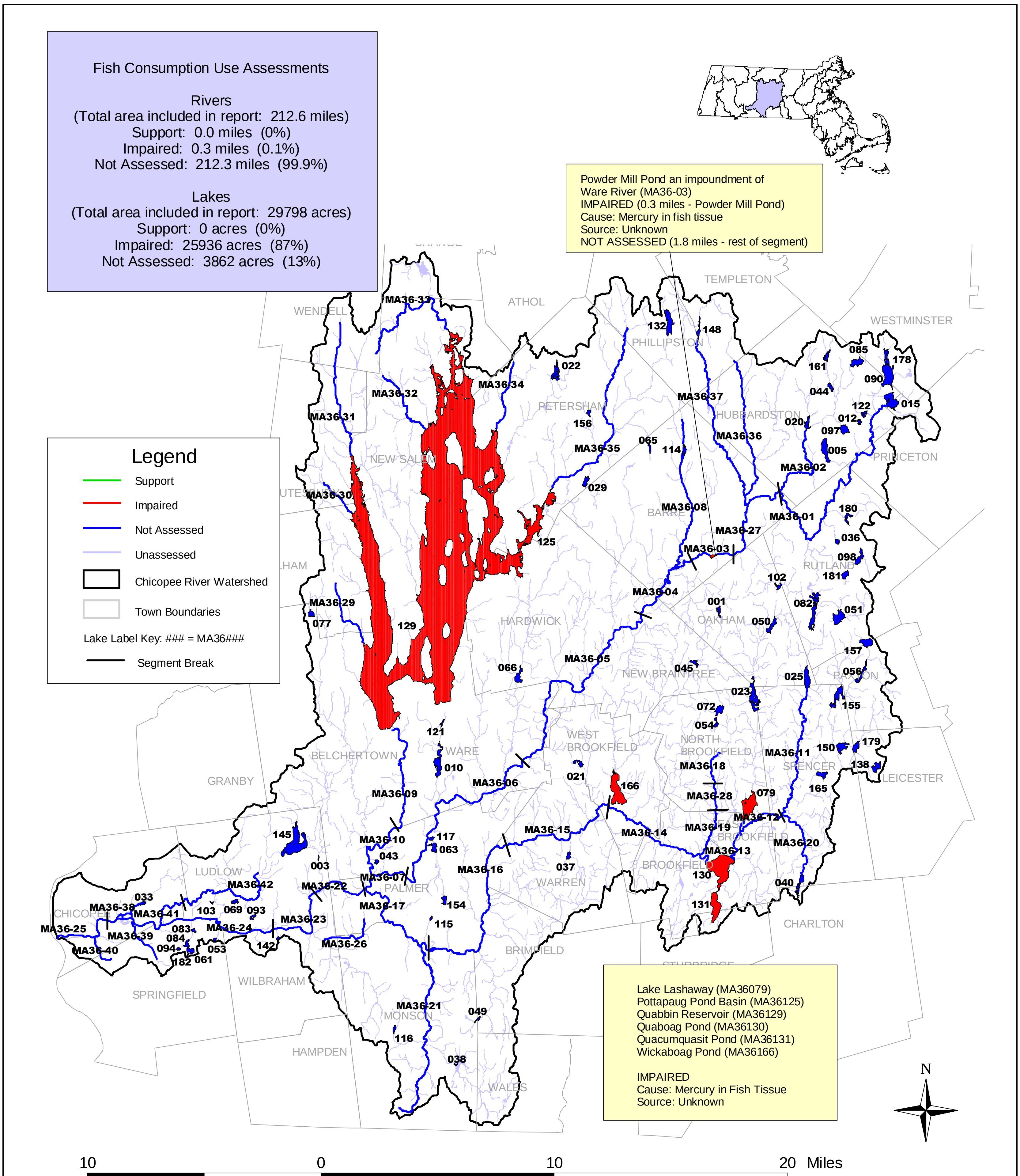

The current MA DPH statewide advisory (MA DPH 2001):

In July 2001 MA DPH issued new consumer advisories on fish consumption and mercury contamination. The MA DPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers, and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MA DPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age. Finally, MA DPH is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers, and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to two (2) cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury."

MA DPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

Since the statewide advisory encompasses all freshwaters in Massachusetts, the Fish Consumption Use for waterbodies cannot be assessed as support.

Northeast Regional Mercury TMDL: On 20 December 2007 the U.S. EPA approved the Northeast Regional Mercury Total Maximum Daily Load (TMDL). This TMDL is a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards. It was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers inland waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new on-going monitoring and air deposition data.
Final targets will be determined at that time.

Figure 2: Chicopee River Basin *Fish Consumption Use* Assessment Summary

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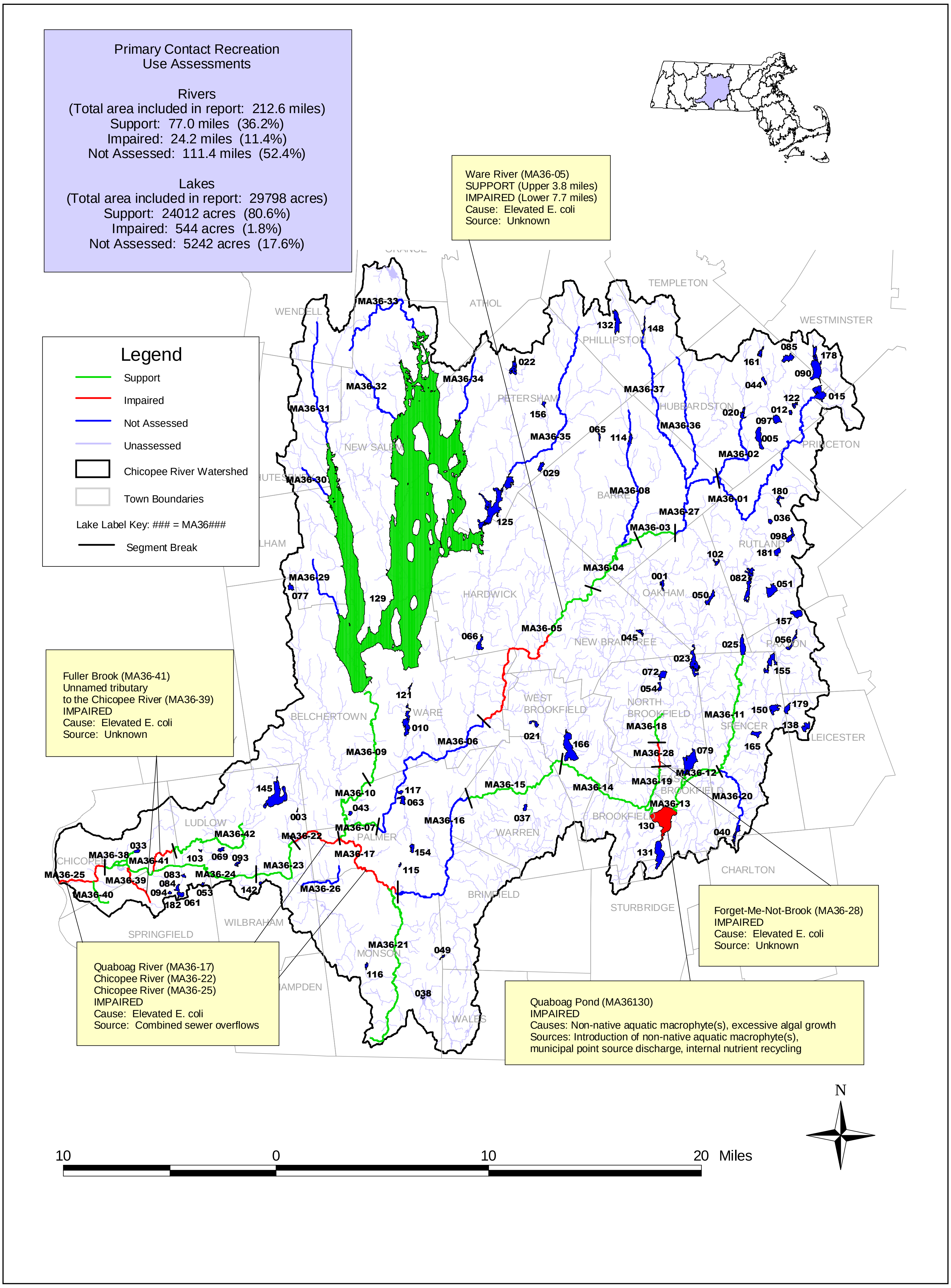

Figure 3: Chicopee River Basin *Primary Contact Recreational Use* Assessment Summary

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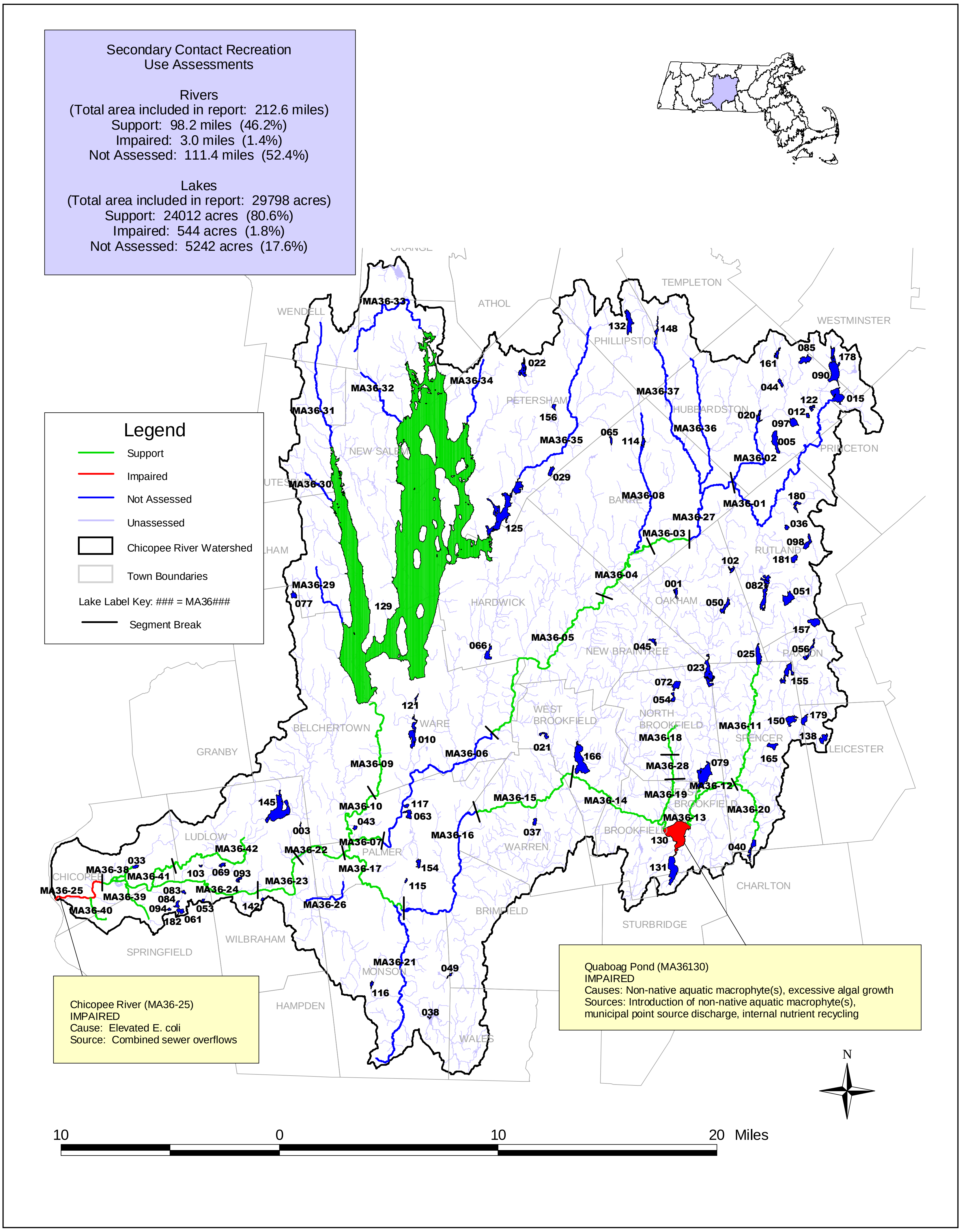

Figure 4: Chicopee River Basin *Secondary Contact Recreation Use* Assessment Summary

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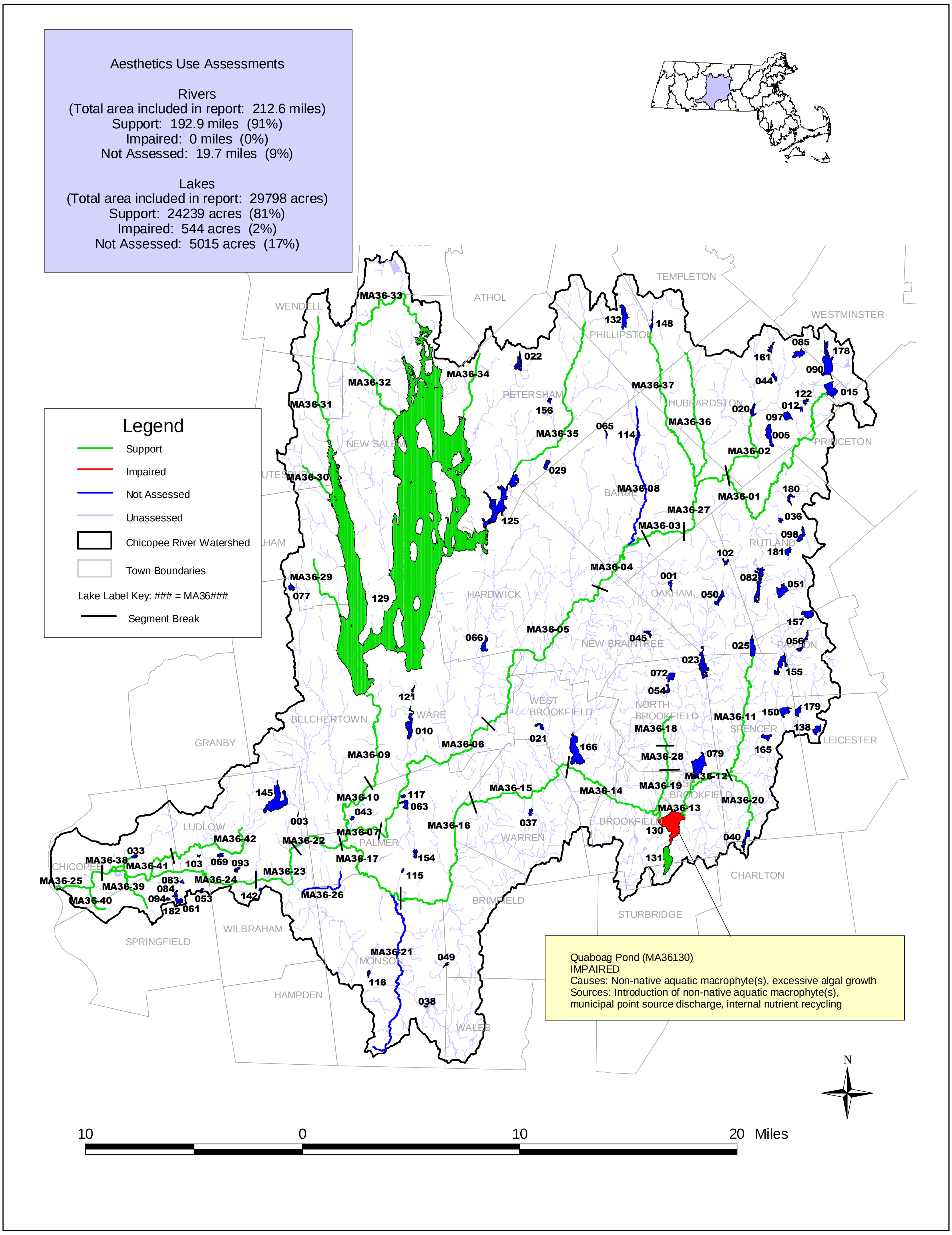

Figure 5: Chicopee River Basin *Aesthetics Use* Assessment Summary

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Chicopee River Basin Description

The Chicopee River Basin covers an area of 723 square miles in Franklin, Hampshire, Hampden, and Worcester counties in central Massachusetts (Wandle 1984). It encompasses all or parts of 39 communities: Athol, Barre, Belchertown, Brimfield, Brookfield, Charlton, Chicopee, East Brookfield, Granby, Hampden, Hardwick, Hubbardston, Leicester, Ludlow, Monson, New Braintree, New Salem, North Brookfield, Oakham, Orange, Palmer, Paxton, Pelham, Petersham, Phillipston, Princeton, Rutland, Shutesbury, Spencer, Springfield, Sturbridge, Templeton, Wales, Ware, Warren, Wendell, West Brookfield, Westminster, and Wilbraham. It is bordered by the Connecticut River Basin on the west and the Millers River Basin on the north, the Nashua River Basin on the northeast, a small portion of the Blackstone River Basin on the east, and the French and Quinebaug river basins to the southeast.

The Chicopee River Basin includes three major subbasins (the Swift, Ware, and Quaboag river systems) that merge to form the mainstem Chicopee River. The Swift River has three upper branches that flow into the Quabbin Reservoir, a manmade reservoir that serves as one of the major water supplies for metropolitan Boston. From the outlet of Quabbin Reservoir, the Swift River flows in a southerly direction to its confluence with the Ware River. The Ware River is formed by the confluence of east and west branches in Barre, and it flows in a generally southwest direction until joining the Quaboag River. The Quaboag River originates at the outlet of Quaboag Pond in Brookfield and flows southwest until it joins the Ware River. The Chicopee River is formed at the confluence of the Ware and Quaboag rivers in the village of Three Rivers in Palmer. It flows generally west to its confluence with the Connecticut River in Chicopee, MA. The Chicopee River contributes an average annual flow of 909 cubic feet per sec (cfs) to the Connecticut River (USGS 2007).

The topography of the Chicopee River Basin is characterized by rolling hills and alluvial plains with numerous natural and artificial lakes. The topography rises to heights of over 1,500 feet above mean sea level in the northern portion of the basin and drops to only 40 feet in the Connecticut Valley lowlands in the southwest. Granite and metamorphic rocks underlie most of the basin, while red sandstones, dark shales, and other sedimentary rocks are found near the Connecticut River (Kimball 1975).

There are 136 named rivers in the Chicopee River Basin that have been assigned SARIS (Stream and River Information System) code numbers (Halliwell *et al*. 1982). These streams and rivers flow an estimated 464.2 miles. There are approximately 1,200 river miles in the Chicopee River Basin according to the 1:24,000 National Hydrography Data coverage (Meek 2007). A total of 174 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned Pond and Lake Information System (PALIS) code numbers in the Chicopee River Basin (Ackerman 1989 and MassDEP 2000). The total surface area of the catalogued Chicopee River Basin lakes is 32,099 acres. For a map of river segments and lakes detailed in this report see Figure 6.

In the Swift River Subbasin the Swift River and Old Beaver Brook were impounded by Windsor Dam and Goodnough Dike in 1946 to form the Quabbin Reservoir. The Quabbin Reservoir's watershed area is 187 square miles, more than a quarter of the entire Chicopee River Basin. The Massachusetts Department of Conservation and Recreation manages this public water supply reservoir, which has a capacity of 412 billion gallons, and a surface area of 39.4 square miles. The mean and maximum depth in the reservoir is 45 and 151 feet, respectively. Due in part to Quabbin Reservoir's elongated shape and large size that results in long detention times, significant dilution and settling of tributary inflows, water quality in the reservoir is excellent. The reservoir has very crystalline water with low turbidity, bacterial counts, algal densities, and nutrients (MA DCR 2004, 2005, 2006b, 2007). The Massachusetts Water Resources Authority (MRWA) is allowed to withdraw (WMA Registration Number 10830901) 186.7 MGD from the reservoir. The majority of this water is transferred out of the Chicopee River Basin to supply potable water to 44 communities in the Metropolitan Boston area and three western Massachusetts communities. Water is delivered from Quabbin Reservoir via two tunnel systems.

The Quabbin Aqueduct is a 24.6-mile tunnel that travels from midway up the eastern arm of the reservoir in Hardwick to the Oakdale Power Station on the upper end of Wachusett Reservoir in West Boylston (Nashua River Basin). The Chicopee Valley Aqueduct (CVA) is a 14.77-mile tunnel that runs from the southern end of Quabbin Reservoir at Windsor Dam in Belchertown to the Nash Hill Reservoir in Chicopee. The Ware River may also be diverted via Shaft 8 in Barre into either the Quabbin or Wachusett Reservoirs. The diversions are allowed between 15 October and 15 June when flow in the Ware River exceeds 85 MGD. All other diversions require MassDEP approval (MDC 1997).

Manufacturing, wholesale and retail trades are the key industries of the region. Combined sewer overflow locations are present in the lower Chicopee River Basin, particularly in the Chicopee River, lower Ware River and the lower Quaboag River. There are a number of municipal and industrial National Pollution Discharge Elimination System (NPDES) permits as well as communities permitted for stormwater runoff (Appendix D). These permitted sources of pollution are also important determinants of water quality. Nonpoint source pollution that is associated with storm runoff, septic systems, landfills, and agriculture is also known to contribute to the watershed's water quality problems. In addition to providing drinking water, water in the Chicopee River Basin is managed by a number of dams in the Chicopee River Basin that are used for hydropower (listed below:)

Hydroelectric power plants:

- The Consolidated Edison Energy Massachusetts, Inc. plants on the Chicopee River (MA0035777 Dwight Station, MA0035815 Indian Orchard Station, MA0035823 Red Bridge Station and MA0035831 Putts Bridge Station in Chicopee and Ludlow) are all exempt from FERC licensing requirements.

Other hydroelectric projects exempt from FERC licensing requirements that do not have NPDES permits:

- Chicopee Municipal Light Plant (on Chicopee River), Chicopee
- Ware River Power (Ware Lower Project on Ware River)
- South Barre Hydroelectric Company (South Barre Mill Pond Dam Project and Powdermill Pond Project both on the Ware River)
- I Maxmat Corp. (Collins Project on Chicopee River)

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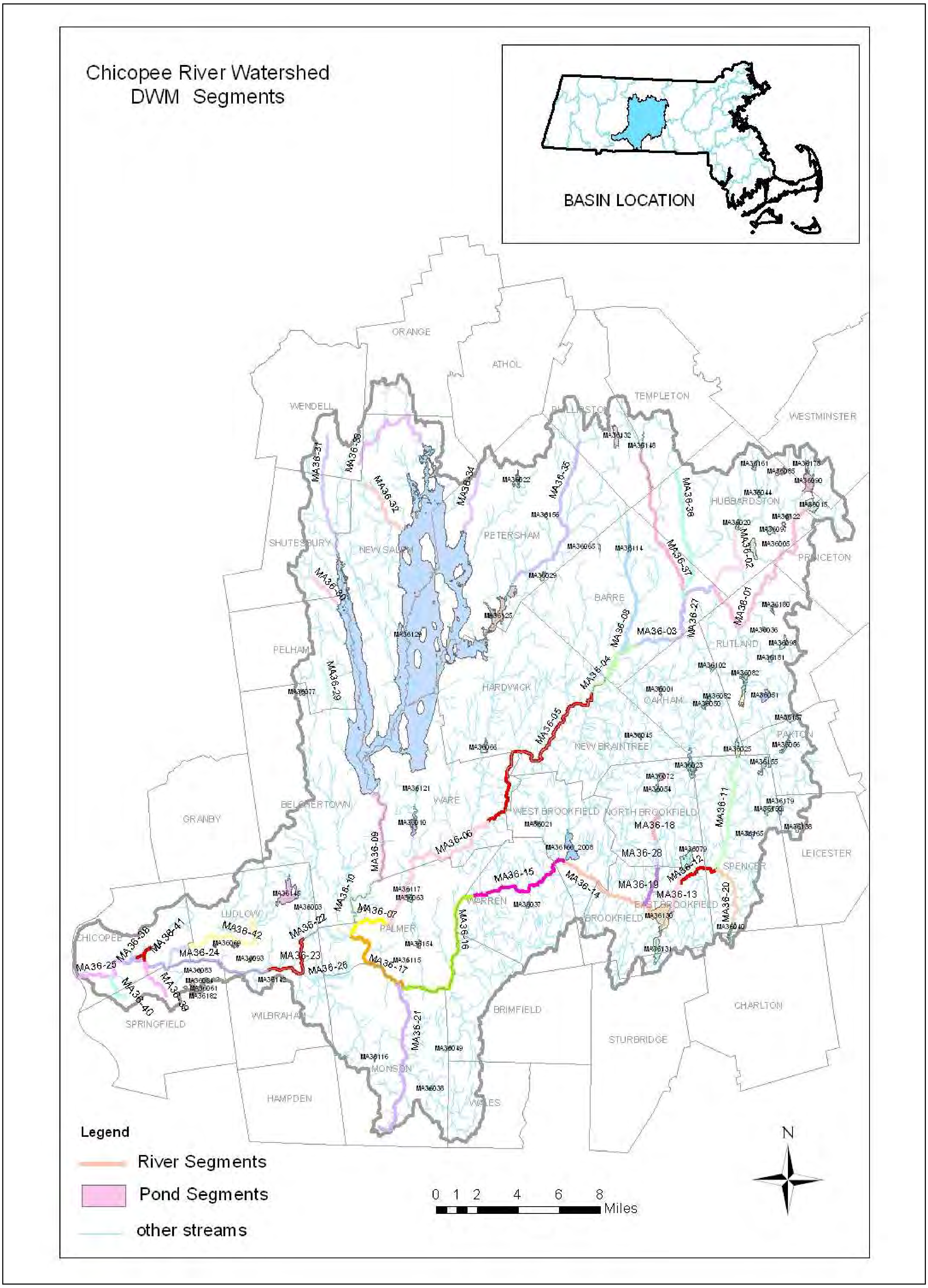

Figure 6: Chicopee River Basin - River Segments and Lake Segments

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The Swift River Subbasin

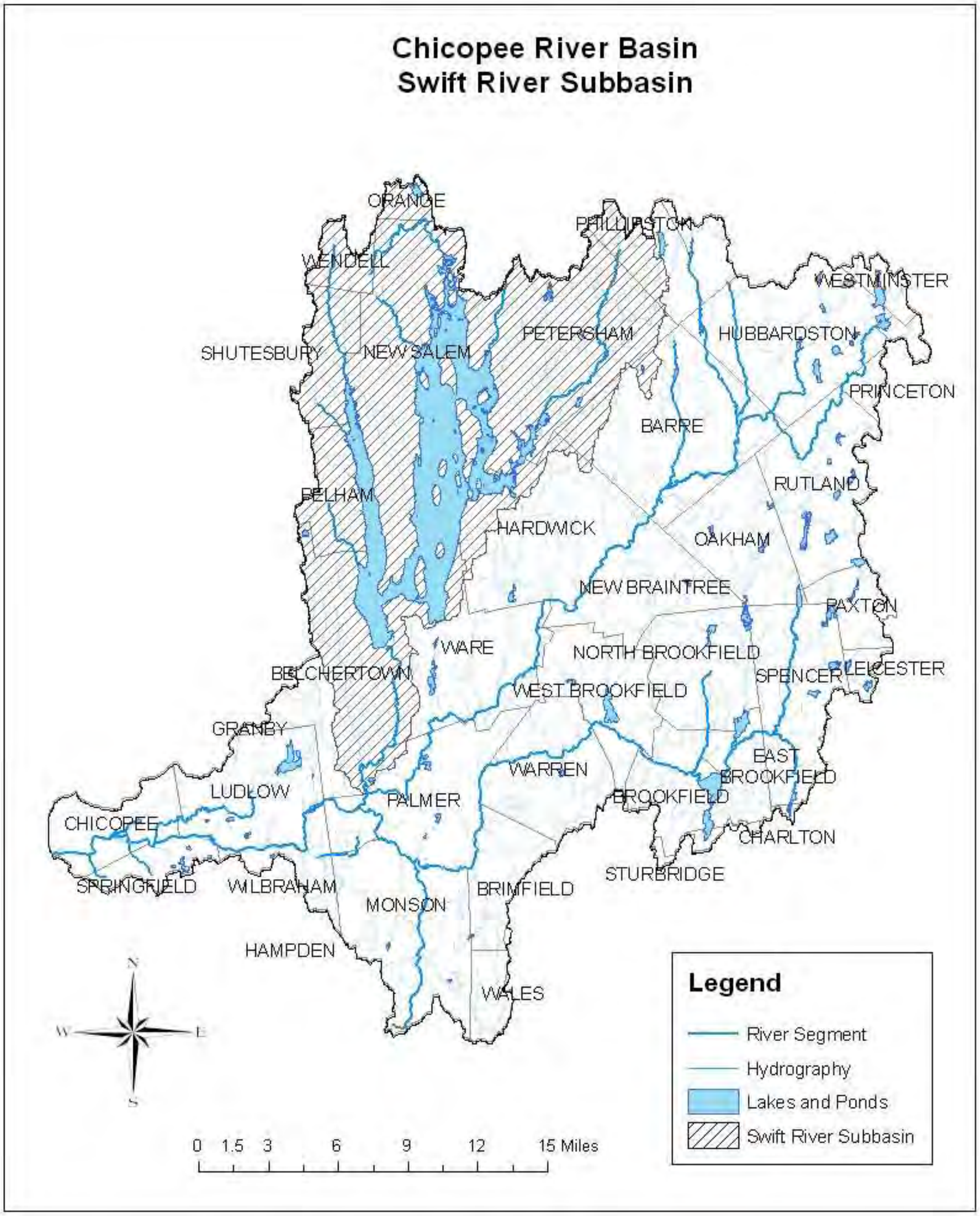


Figure 7: Swift River Subbasin

CADWELL CREEK (SEGMENT MA36-29)
Location: Headwaters east of Route 202 and northwest of Dodge Hill, Pelham, to mouth at Quabbin Reservoir, Belchertown
Segment Length: 3.2 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG conducted fish population sampling in Cadwell Creek at Gate 8, Quabbin Road crossing (Site 1211) in Pelham using a backpack electro-shocker (Richards 2006). Sixty-one brook trout were collected (61 fish total). This stream is considered a Coldwater Fishery Resource by MA DFG (Richards 2006).

The presence of multiple age classes of wild brook trout is indicative of excellent water and habitat quality as well as a stable flow regime. It is quite common to find only brook trout in small first order tributary streams (Maietta 2007).

<u>Water Chemistry</u>
Cadwell Creek has been identified as critically sensitive to acid rain deposition given the creek's limited acid neutralizing capacity and low pH (MA DCR 2004).

Given the presence of multiple age classes of brook trout *the Aquatic Life Use* is assessed as support. Due to its acid sensitivity Cadwell Creek is given "Alert Status".

Primary and Secondary Contact Recreation and Aesthetics Uses
No objectionable conditions have been reported in Cadwell Creek, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent quality-assured data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Cadwell Creek (Segment MA36-29) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT**
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.
** Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment.

Given the presence of brook trout, collect sufficient water temperature data to evaluate this waterbody for designation as a Cold Water Fishery in future Surface Water Quality Standards.

ATHERTON BROOK (SEGMENT MA36-30)
Location: Headwaters at confluence of Town Farm and Osgood Brooks, Shutesbury, to mouth at Quabbin Reservoir, Pelham
Segment Length: 1.9 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG conducted fish population sampling in Atherton Brook at Route 202 – Gate 15, Quabbin Reservoir Road crossing (Site 1210) in Shutesbury on 12 September 2005 using a backpack electro-shocker (Richards 2006). Forty-eight brook trout were collected (48 fish total). This stream is considered a Coldwater Fishery Resource by MA DFG (Richards 2006).

The presence of multiple age classes of wild brook trout is indicative of excellent water and habitat quality as well as a stable flow regime. It is quite common to find only brook trout in small first order tributary streams (Maietta 2007).

<u>Water Chemistry</u>
No quality-assured data are available for Atherton Brook.

Atherton Brook has been identified as critically sensitive to acid rain deposition given the creek's limited acid neutralizing capacity and low pH (MA DCR 2004).

Given the presence of multiple age classes of brook trout the *Aquatic Life Use* is assessed as support. Due to its acid sensitivity Atherton Creek is given "Alert Status".

Primary and Secondary Contact Recreation and Aesthetics Uses
No objectionable conditions have been reported in Atherton Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent quality-assured data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Atherton Brook (Segment MA36-30) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT**
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.
** Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment.

Given the presence of brook trout, collect sufficient water temperature data to evaluate this waterbody for designation as a Cold Water Fishery in future Surface Water Quality Standards.

WEST BRANCH SWIFT RIVER (SEGMENT MA36-31)

Location: Headwaters - Outlet of small unnamed impoundment east of Cooleyville Road in Wendell State Forest, Wendell, to mouth at Quabbin Reservoir, Shutesbury/New Salem.
Segment Length: 6.3 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

<u>Habitat and Flow</u>
USGS maintains a gage near Shutesbury, MA, on the west branch of the Swift River (Gage 01174565) 800 feet downstream from State Highway 202. The average annual discharge at the gage is 22.0 cfs (period of record 2000 to 2005).

The drainage area to this gage is 12.6 mi^2. The period of record is Nov. 1983-Sept. 1985 and April 1995 to present. The average discharge for ten water years (1985, 1996-2004) is 22.1 cfs. The maximum discharge occurred on 17 September 1999 (1,490 cfs) and the minimum discharge occurred in mid-September of 1995 (about 0.35 cfs) (Socolow *et. al* 2005). Records are considered fair by USGS except estimated daily discharges and discharges greater than 100 cfs, which are considered poor (Socolow *et. al* 2005).

<u>Biology</u>
MA DFG stocks the West Branch Swift River with trout (MA DFG 2007).

Due to a lack of recent quality-assured data the *Aquatic Life Use* is not assessed.

Primary and Secondary Contact Recreation and Aesthetics Uses

No recent quality-assured data are available for the West Branch Swift River. No objectionable conditions have been reported in the West Branch Swift River, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

West Branch Swift River (Segment MA36-31) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring to assess *Aquatic Life Use*.

Given the presence of brook trout, collect sufficient water temperature data to evaluate this waterbody for designation as a Cold Water Fishery in future Surface Water Quality Standards.

HOP BROOK (SEGMENT MA36-32)
Location: Headwaters upstream from West Street, New Salem, to mouth at Quabbin Reservoir, New Salem.
Segment Length: 3.7 miles
Classification: Class A, Public Water Supply

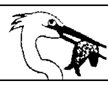
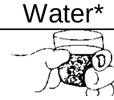
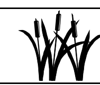
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Hop Brook. All designated uses with the exception of the *Aesthetics Use* are not assessed.

No objectionable conditions have been reported in the Hop Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Hop Brook (Segment MA36-32) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring to assess *Aquatic Life Use*.

Conduct fish population sampling to assess the *Aquatic Life Use*.

MIDDLE BRANCH SWIFT RIVER (SEGMENT MA36-33)
Location: Headwaters just north of Wendell and New Salem State Forests (South of the Swift River School), Wendell, to mouth at Quabbin Reservoir, New Salem.
Segment Length: 6.9 miles.
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

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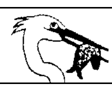
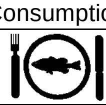
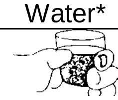
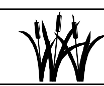
WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
<u>Biology</u>
MA DFG stocks the Middle Branch Swift River with trout (MA DFG 2007).

No recent quality-assured data are available for Middle Branch Swift River. All designated uses with the exception of the *Aesthetics Use* are not assessed.

No objectionable conditions have been reported in the Middle Branch Swift River, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Middle Branch Swift River (Segment MA36-33) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring and conduct fish population sampling to assess *Aquatic Life Use*.

WEST BRANCH FEVER BROOK (SEGMENT MA36-34)
Location: Headwaters just north (upstream) of Route 122 in Petersham, to mouth at Quabbin Reservoir, Petersham
Segment Length: 3.4 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks West Branch Fever Brook with trout (MA DFG 2007).

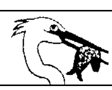
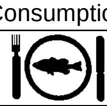
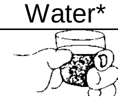
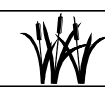
MA DFG conducted fish population sampling in West Branch Fever Brook at Route 122 – Women's Federal Forest (Site 887) in Petersham, MA, on 20 August 2003 using a backpack electro-shocker (Richards 2005). Twenty fallfish, sixteen blacknosed dace, two chain pickerel, and one channel catfish were collected (39 fish total). MA DFG fishery biologists noted that the stream was free-flowing at this location and located downstream from a large beaver pond. They also noted that few fish were collected given the area sampled.

Although total numbers of fish were low the sample was dominated by two fluvial specialists; a condition indicative of a stable flow regime. It is unclear why fish numbers were so low within this reach; but the presence of a large beaver dam just upstream may be affecting total fish numbers.

Other than the MA DFG fish population work, no other recent quality-assured data are available for West Branch Fever Brook. All designated uses with the exception of the *Aesthetics Use* are not assessed.

No objectionable conditions have been reported in the West Branch Fever Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

West Branch Fever Brook (Segment MA36-34) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring to assess *Aquatic Life Use*.

Consider fish population sampling in an area unaffected by beaver dams to determine fish population structure and numbers.

EAST BRANCH SWIFT RIVER (SEGMENT MA36-35)

Location: Headwaters at the confluence of Shattuck and Popple Camp Brooks, Phillipston, to mouth at Pottapaug Pond, Petersham.
Segment Length: 9.8 miles
Classification: Class A, Public Water Supply.

Connor Pond (MA36039) will no longer be reported on as an approximately 22-acre lake segment since the estimated retention time of this waterbody is approximately two days. It will be considered a run–of-the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01173000 and 01172500) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

MA DFG stocks the East Branch Swift River with trout (MA DFG 2007).

MA DFG conducted fish population sampling in the East Branch Swift River at East Street below Browning Pond (Site 877) in Petersham on 21 July 2003 using a backpack electro-shocker (Richards 2006). Fifteen pumpkinseed, fifteen common shiner, ten brown bullhead, seven eastern blacknose dace, four chain pickerel, three white sucker, three longnose dace, two brown trout and one tessellated darter were collected (67 fish total). MA DFG biologists noted the water level was low during sampling and that the two brown trout collected were stocked fish.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although the presence of six fluvial specialist/dependent species is generally indicative of a stable flow regime the low numbers of fish and low water levels noted by MA DFG suggests otherwise. All fish species present (with exception of stocked brown trout) are classified as being tolerant or moderately tolerant to pollution. The presence of macrohabitat generalists is most likely a result of this reach's proximity to Browning Pond. It should be noted that although native trout were not collected or observed, this stream is considered a Coldwater Fishery Resource by MA DFG (Richards 2006)

MA DFG also conducted fish population sampling in the East Branch Swift River at Quaker Road crossing (Site 874) in Petersham on 21 July 2003 using a backpack electro-shocker (Richards 2006). Seventy-three eastern blacknose dace, fifteen longnose dace, fourteen fallfish, five yellow bullhead, four common shiner, three white sucker and one tessellated darter were collected (115 fish total). MA DFG fishery biologists noted that the water level was low at this sampling site.

Despite low water levels noted on the date of sampling, all fish collected at this station, except yellow bullhead, are classified as fluvial specialist/dependents, which usually indicates a stable flow regime. Overall number of fluvial specialist/dependents was low (n= 38).

MA DFG conducted fish population sampling in the East Branch Swift River below Connors Pond Road (Site 870) in Petersham on 21 July 2003 using a backpack electro-shocker (Richards 2006). Ninety-eight golden shiner, twenty-three longnose dace, twenty-three eastern blacknose dace, eighteen common shiner, ten pumpkinseed, nine tessellated darter, four yellow perch, two white sucker and two yellow bullhead were collected (189 fish total). MA DFG fishery biologists noted that the water level was very low at this sampling site.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although the presence of five fluvial specialist/dependent species is generally indicative of a stable flow regime the golden shiner dominance (macrohabitat generalists) in the sample and the low flow levels suggest otherwise. All fish species present are classified as being tolerant or moderately tolerant to pollution. The presence of macrohabitat generalists may be a result of this reach's proximity to Connors Pond.

MA DFG conducted fish population sampling in the East Branch Swift River upstream the Glen Valley Road crossing (Site 895) in Petersham on 8 August 2003 using a backpack electro-shocker (Richards 2006). One hundred and eighteen eastern blacknose dace, twenty-three longnose dace, eighteen fallfish, fourteen bluegill, seven white sucker, five tessellated darter, four largemouth bass, three golden shiner, two yellow perch, two yellow bullhead, two pumpkinseed and one chain pickerel were collected (199 fish total). MA DFG fishery biologists noted that the water level was low at this sampling site and they covered 85 percent of the river in the sampling reach during sampling.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although the presence of seven macrohabitat generalist species is generally indicative of compromised flow regime the sample was heavily dominated by fluvial specialist/dependent species. All fish species present are classified as being tolerant or moderately tolerant to pollution. Eastern blacknose dace dominance in the sample (n= 118) suggests the possibility of nutrient enrichment at this site (Maietta 2007).

MA DFG conducted fish population sampling in the East Branch Swift River near the intersection of Glen Valley Road and the powerlines (Site 896) in Petersham on 8 August 2003 using a backpack electro-shocker (Richards 2006). Sixty-four eastern blacknose dace, fifty-five white sucker, twenty-nine fallfish, twenty-three longnose dace, thirteen common shiner, ten tessellated darter, ten golden shiner, ten largemouth bass, three bluegill, three brook trout, and one yellow perch were collected (221 fish total). MA DFG fishery biologists noted sampling started at end of long pond and estimated they caught 70% of the fish and covered 100% of river. MA DFG fishery biologists also noted that the brook trout caught were wild.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although four macrohabitat generalist species were present, the sample was heavily dominated by fluvial specialist/dependent species. With the exception of brook trout (wild), which are intolerant to pollution, all other fish species present are classified as being tolerant or moderately tolerant to pollution. Atlhough the numbers of wild brook trout were low (n=3) their presence suggests excellent water and habitat quality and corroborates MA DFG's classification of the East Branch Swift River as a Coldwater Fishery Resource.

MA DFG conducted fish population sampling in the East Branch Swift River near the Route 32A crossing (Site 878) in Petersham on 8 August 2003 using a backpack electro-shocker (Richards 2006). Thirty-nine fallfish, thirty-eight longnose dace, thirty-one eastern blacknose dace, seven yellow bullhead, five largemouth bass, four pumpkinseed, four bluegill, three yellow perch, three brook trout, three white sucker and one golden shiner were collected (139 fish total). MA DFG fishery biologists noted that they used two backpack electro-shockers and that the three brook trout collected were wild.

The fish sample was a mix of fluvial specialist/dependent and macrohabitat generalist species. Although six macrohabitat generalist species were present, the sample was dominated by fluvial specialist/dependent species. With the exception of brook trout (wild), which are intolerant to pollution, all other fish species present are classified as being tolerant or moderately tolerant to pollution. Although the numbers of wild brook trout were low (n=3) their presence suggests excellent water and habitat quality and corroborates MA DFG's designation of the East Branch Swift River as a Coldwater Fishery Resource.

Water Chemistry

Other than the MA DFG fish population work, no other recent quality-assured data are available for East Branch Swift River.

East Branch Swift River is classified by MassDEP as a Class A waterbody. It is not only stocked with trout by MA DFG but is also designated a Cold Water Fishery Resource by MA DFG(Richards 2006). Wild trout were only found at two of the six sites sampled and their numbers were low. MA DCR sampling data for temperature indicate that the East Branch of the Swift River often exceeds 20°C during summer month s (MA DCR 2006a). Fish assemblages varied between sites and although a compromised flow regime was suggested at a few sites while other sites appeared to be supporting a fluvial fish community. Macrohabitat generalists dominated at two sites that were located in close proximity to mainstem impoundments. The *Aquatic Life Use* is assessed as support given the presence of pollution intolerant wild trout. This segment is given an "Alert Status" due to the low numbers of trout observed despite it's designation as a Coldwater Fishery Resource.

Primary and Secondary Contact Recreation and Aesthetics Uses

No objectionable conditions have been reported in the West Branch Fever Brook, which is protected and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent quality-assured data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

East Branch Swift River (Segment MA36-35) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Coordinate with MA DCR on future water quality data collection on this segment. Conduct water quality monitoring and benthic macroinvertebrate monitoring to assess *Aquatic Life Use*.

Future fish population monitoring should concentrate sampling on areas further from mainstem impoundments and include extended deployment of temperature sensors during the summer to better document the extent of the wild trout population.

SWIFT RIVER (SEGMENT MA36-09)
Location: Windsor Dam, Belchertown, to Upper Bondsville Mill Dam, Belchertown/Palmer.
Segment Length: 5.6 miles.
Classification: Class B, Cold Water Fishery.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Massachusetts Division of Fisheries and Wildlife (McLaughlin& Palmer State Fish Hatchery) registration/permit (10802402/9P10802401)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D1, D4)
Massachusetts Division of Fisheries and Wildlife (McLaughlin& Palmer State Fish Hatchery) (MA0110043)
Belchertown (MAR0411002)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
USGS maintains a gage (Gage 01175500) on the Swift River in West Ware, MA, 1.4 mi downstream from the Quabbin Reservoir. The drainage area is 189 mi^2 including 1.6 mi^2 drained by Beaver Brook, flow that is diverted from the Ware River Basin (USGS 2007). The period of record is July 1910 to present (USGS 2007). The average discharge after completion of Quabbin Reservoir (1940-2005) is 94.4 cfs (USGS 2007). The maximum discharge occurred on 19 March 1936 (7,590 cfs). The maximum discharge since the construction of Quabbin Reservoir in 1939 occurred on 1 June 1984 (3,070 cfs). The minimum discharge occurred on 15 December 1968 (9.1 cfs) (USGS 2007).

The USGS remarks that flow has been regulated by Quabbin Reservoir since August 1939 (USGS 2007). The flow has been diverted from the Ware River to Quabbin Reservoir since 1940, from Quabbin Reservoir to Wachusett Reservoir since 1941, from Quabbin Reservoir to Chicopee Valley aqueduct since 1950, and from Quabbin Reservoir to the city of Worcester at times since 1966 (Socolow *et al.* 2004). Records with estimated daily discharge above 200 cfs are considered fair by USGS while all other records are considered good. During 2003 the Quabbin Reservoir released a total of 9236.4 million gallons or 25.3 MGD into the Swift River (MA DCR 2004). The Swift River's largely steady flow mimics this discharge (Appendix B).

The Swift River begins at the Windsor Dam with flow regulated by the MWRA via a control structure in the Quabbin power plant. From 1 December through 31 May, MA DCR is required to release 20 MGD out of Quabbin Reservoir to the Swift River. From 1 June through 30 November, the required releases (per order of the US War Department) are dependent on the streamflow of the Connecticut River at the USGS Montague gage. When the flow of the Connecticut River is <4900 cfs, the required release at Quabbin Reservoir is 45 MGD and when the flow is <4650 cfs, the required release at Quabbin Reservoir is 71 MGD. In practice, however, the MA DCR releases either 20 or 71 MGD from the reservoir or more depending on reservoir operating conditions (Austin 1993).

The wetlands and waterways in this segment of the Swift River are identified as habitat for rare and endangered species by the state's Natural Heritage and Endangered Species Program. The Swift River contains a variety of habitat types. The river's gradient, cold water coming from the depths of Quabbin Reservoir, and the impoundment and extensive wetlands formed by the Upper Bondsville Mill Dam in the village of Bondsville, Palmer, result in a mix of cold and warmwater fisheries habitat. The Upper Bondsville Mill Dam, however, has been classified by MA DCR's

Office of Dam Safety as a high hazard dam. There is currently no responsible party to implement dam safety improvements or removal.

The Swift River is heavily stocked with trout and is fished all year long by anglers, including icefishing. Special fishing regulations apply to two different portions of this river segment (see *MA DFG Abstracts of the Massachusetts Fish and Wildlife Laws* for details).

In July 2006 Mass Riverways conducted a habitat improvement project on this segment. The project entitled "Swift River Rock Structure Removal" improved habitat by eliminating flow constriction caused by rock piles left in the river by a former bridge (Graber 2004). The goal was to change pool habitat into new riffles. Mass Riverways staff conducted longitudinal and cross-sectional profiles off the stream before project implementation (Graber 2004). Since the river now carries approximately one quarter of the flow it experienced before the Quabbin Reservoir, they found a channel that was deeply incised, largely uniform in structure and disconnected from the floodplain (Graber 2004). A new channel has formed inside of the former channel, which was sized by historic flows. Riverways staff also found the bed structure to be comprised of a larger particle size distribution, typical of a stream that saw higher flows than currently found (Graber 2004).

Biology
MA DFG stocks this stream with trout (MA DFG 2007). Graber (2004) found significant number of rainbow trout and brook trout during their pre-project implementation habitat survey. The rainbow trout were found to be largely adults while multiple age classes of brook trout were found (Graber 2004).

Water Chemistry
DWM conducted water quality monitoring at Station SR03 (Cold Spring/Old Belchertown Road, Belchertown) along this segment of the Swift River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. There is also a MassDEP Central Environmental Regional Office (CERO) Strategic Monitoring and Assessment for River Basin Teams (SMART) station on this segment off River Road, at the USGS flow gage, west of River Road in Ware. DWM conducted water quality at this station (SRG) on the Swift River between May and August 2003 (Appendix B). CERO SMART crews also conduct water quality monitoring at this location each year in addition to DWM sampling. The DWM data collected in 2003 at both stations (SR03 and SRG) as part of DWM monitoring is summarized below.

Parameter	DWM 2003
DO (mg/L)	8.2 – 11.4 (n=13)
Percent Saturation (%)	82 – 108 (n=13)
pH (SU)	5.9-6.5 (n=13)
Temperature (°C)	8.9 – 14.6 (n=13)
Conductivity (µS/cm at 25°C)	43.5 – 67.0 (n=13)
Total phosphorus (mg/L)	0.008- 0.034 (n=7)
Ammonia- nitrogen (mg/L)	<0.02- 0.15 (n=6)
Total suspended solids (mg/L)	<1 -<2 (n=3)

All water quality data meets standards except pH, which was found to be slightly lower than the criterion on the majority of sampling events. Given the good water quality and the presence of multiple age classes of brook trout this segment supports the *Aquatic Life Use*. This use is identified with an "Alert Status" due to the low pH found.

Primary and Secondary Contact Recreation Uses
DWM conducted water quality monitoring at one station (SR03-Cold Spring/Old BelchertownRoad, Belchertown) along this segment of the Swift River between April and October 2003 (Appendix B). The geometric mean of *E. coli* counts was 5.1 cfu/100 mL. The bacteria

samples collected are summarized below. None of the DWM or CERO field crews noted any objectionable conditions (objectionable deposits, scums, or odors) at this site during the sampling season with the exception of two occasions when the water had a manure odor (Appendix B).

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<0.9 - 100
Geometric mean	8.1
E. coli (cfu/100mL)	<0.9 - 80
Geometric mean	5.1

Both *Primary* and *Secondary Contact Recreational Uses* are supported given the low bacteria levels found at this site. The *Aesthetics Use* is supported for the Swift River.

Swift River (Segment MA36-09) Use Summary Table

Designated Uses	Status
Aquatic Life	SUPPORT*
Fish Consumption	NOT ASSESSED
Primary Contact	SUPPORT
Secondary Contact	SUPPORT
Aesthetics	SUPPORT

* Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct benthic macroinvertebrate and fish population sampling to assess *Aquatic Life Use*.

SWIFT RIVER (SEGMENT 36-10)
Location: Upper Bondsville Mill Dam, Belchertown/Palmer, to confluence with Ware River, Palmer.
Segment Length: 3.9 miles.
Classification: Class B, Cold Water Fishery, CSO.

Although this segment is classified as a CSO in the 2006 Massachusetts Water Quality standards, all CSOs in this segment have been eliminated (see below) and this should not be classified with a CSO qualifier.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

The Old Bondsville Factory, a Tier 1A Hazardous Waste Site (#1-0000968), is located along the upper reach of this segment (Mass DEP 2001)

The Upper Bondsville Mill Dam has been classified as a high hazard dam (MA DCR 2002). The Belchertown Land Trust currently owns it.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Bondsville Fire and Water Department registration/permit (10822704/9P210822702)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Palmer WTTP (MA0101168)
Belchertown (MAR041002)
Palmer (MAR041017)

Palmer WWTP (MA0101168) is permitted to discharge via three wet weather CSOs (outfalls 024, 025, and 026) to this segment of the Swift River. Hydraulic modeling performed as part of Palmer's CSO Abatement Plan conducted in 1994-1996 estimated the following discharge quantities based on a three-month frequency storm.

Village of Bondsville (upstream to downstream)
- Outfall #026 – 1,380 gallons (intersection of Main Street with Spring Street)
- Outfall #025 – 8,650 gallons (intersection of Main Street with Depot Street)
- Outfall #024 – 7,230 gallons (intersection of Main Street with First Street)

The Town's permit was reissued on 29 September 2000. Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate CSO outfalls 024, 025, and 026 was proposed for the third phase of work at an estimated cost of $810,000. In 1999 Palmer submitted a request for MA SRF financing for the first three phases of work and in November 1999 was selected to receive financing for $7.1 million dollars. MassDEP approved sewer separation, including drainage areas to CSO outfalls #024, 025, and 026, in December 2000 as part of CW SRF-423. Sewer Separation has been completed and there are no known remaining CSO's on this Swift River segment (Boisjolie 2007a).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Water Chemistry
DWM conducted water quality monitoring at one station (SR02- Rte 181/State St., Palmer) along this segment of the Swift River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, ammonia-nitrogen and total phosphorus (Appendix B).

A summary of measured water quality parameters at the DWM station on this segment is below.

Parameter	DWM 2003
DO (mg/L)	9.2 – 11.1 (n=9)
Percent Saturation (%)	98 – 105 (n=9)
pH (SU)	6.8 –7.0 (n=9)
Temperature (℃)	11.9 – 19.5 (n=9)
Conductivity (µS/cm at 25℃)	56.0 – 66.0 (n=9)
Total phosphorus (mg/L)	0.023- 0.033 (n=5)
Ammonia- nitrogen (mg/L)	<0.02-< 0.10 (n=6)
Total suspended solids (mg/L)	< 2 (n=6)

Dissolved oxygen, pH, and temperature all meet criteria at the DWM station on the Swift River. Ammonia-nitrogen concentrations were low while total phosphorus concentrations ranged from 0.020 mg/L and 0.033 mg/L. Given the good water quality conditions found the *Aquatic Life Use* is assessed as support.

Primary and Secondary Contact Recreation and Aesthetics Uses

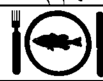
DWM conducted water quality monitoring at one station (SR02- Rte 181/State St., Palmer) along this segment of the Swift River between April and October 2003 (Appendix B). The geometric mean of *E. coli* counts was 34.4 cfu/100 mL and no count was greater than 235 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 140
Geometric mean	40.4
E. coli (cfu/100mL)	2 - 120
Geometric mean	34.4

DWM field crews found trash on four occasions (mainly cans and bait worm containers) although the extent of the trash was not extensive. White foam was noted on three occasions but generally no scums were noted. No water odor was noted with the exception of one occasion when the water had a rotting vegetable smell. No shoreline erosion was found at this station as the banks were armored.

Both *Primary* and *Secondary Contact Recreational Uses* are supported given the low bacteria counts found at this site. Due to the lack of objectionable conditions, the *Aesthetics Use* is assessed as support for this segment of the Swift River

Swift River (Segment MA36-10) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Conduct water quality monitoring (water chemistry, multiprobe) to assess the *Aquatic Life Use.*

Conduct bacteria sampling to assess the *Primary* and *Secondary Contact Recreational Uses*.

The Ware River Subbasin

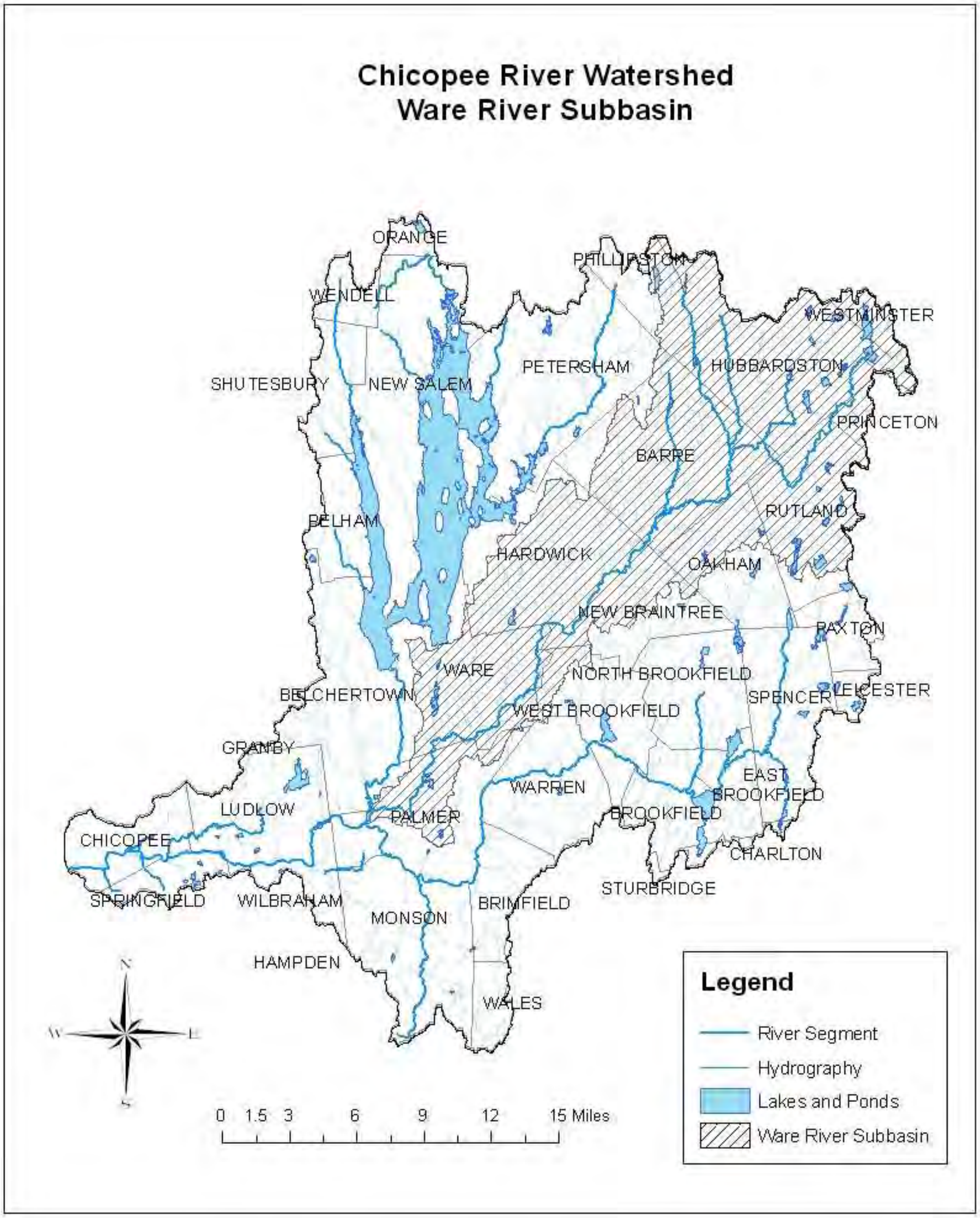


Figure 8: Ware River Subbasin

EAST BRANCH WARE RIVER (SEGMENT MA36-01)
Location: Outlet Bickford Pond, Hubbardston, to confluence with the West Branch Ware River, Barre.
Segment Length: 12.4 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Organic enrichment/low DO (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Fitchburg Water Department registration/permit (20809701/9P20809701)

The Fitchburg Water Department's use of water from the Bickford Reservoir and Mare Meadow Reservoir for drinking water purposes, have the potential to influence streamflows in the East Branch Ware River. This withdrawal also represents an out-of-basin transfer of water as the drinking water is consumed and the wastewater is disposed of in Fitchburg in the Nashua River Basin.

NPDES SURFACE WATER DISCHARGES (APPENDIX E, TABLE E4)
Town of Rutland (MAR041154)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG conducted fish population sampling on the East Branch Ware River near Intervale Road in Rutland (Site 889) and at the Prison Camp Road crossing in Rutland (Site 891) on 26 August 2003 using a backpack electro-shocker (Richards 2006). Fourteen longnose dace, five fallfish, three common shiner, one tessellated darter, one chain pickerel, one brown trout and one eastern blacknose dace were found at the Intervale Road site (Site 889, 26 fish total). Fluvial specialists/dependants dominated the sample. Although overall fish numbers were low at this site, it should be noted that fish sampling efficiency was rated as poor due to dark stained water. It is unclear what effect the presence of numerous beaver dams (upstream and downstream) may be having on the fish assemblage at this site.

At the Prison Camp Road crossing site (Site 891) eighteen redbreasted sunfish, five longnose dace, five fallfish, five common shiner, four chain pickerel, three yellow bullhead, three tessellated darter, and one brown trout were collected (44 fish total). Although the sample was dominated by redbreast sunfish, a macrohabitat generalist, five fluvial specialists/dependants were also present. This sampling station was located just upstream from a wetland dominated reach, which likely contributed to the large number of redbreast sunfish.

Although the fish community was fairly diverse and fluvial specialist/dependant species were well represented, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
No recent quality-assured bacterial data are available for East Branch Ware River.
No objectionable conditions have been reported in the East Branch Ware River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

East Branch Ware River (Segment MA36-01) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Review USGS report (2006-5044) and forthcoming reports on reservoir operations and flow management practices.

Evaluate the flow management practices (e.g., outlet control operations) of the lakes in this subwatershed.

Conduct continuous temperature to determine the temperature dynamics during the summer months.

WEST BRANCH WARE RIVER (SEGMENT MA36-02)

Location: Outlet Brigham Pond, Hubbardston, to confluence with the East Branch Ware River, Barre
Segment Length: 4.5 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

MA DFG stocks the West Branch Ware River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the West Branch Ware River near Brigham Road crossing in Barre (Site 890) on 26 August 2003 using a backpack electro-shocker (Richards 2006). Sixteen fallfish, fifteen tessellated darter, eight longnose dace, six chain pickerel, six banded sunfish, one wild brook trout, one common shiner and one redbreast sunfish were collected (54 fish total). Fluvial specialists/dependants dominated the sample and the presence of a single native brook trout is noteworthy. Although only brook trout are classified as being intolerant to pollution, the additional presence of longnose dace and tessellated darter (moderately tolerant) suggests good water quality and quantity. Overall fish numbers were low given the length of the reach that was sampled.

Water Chemistry

No recent quality-assured water quality data are available for West Branch Ware River.

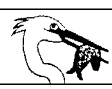
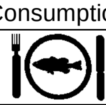
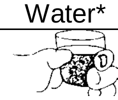
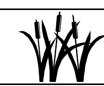
Although the fish community was fairly diverse and fluvial specialist/dependant species were well represented, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics

No recent quality-assured bacterial data are available for the West Branch Ware River.
No objectionable conditions have been reported in the West Branch Ware River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

West Branch Ware River (Segment MA36-02) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Conduct water quality and biological monitoring to evaluate designated uses.

Deploy multiple multiprobes along this segment to determine the effects if any of large wetland areas on oxygen dynamics in this segment.

CANESTO BROOK (SEGMENT MA36-36)
Location: Headwaters northwest of Hubbardston State Forest near the Hubbardston/Templeton town line to the confluence with Ware River, Barre
Segment Length: 7.3 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG conducted fish population sampling in the Canesto Brook near the Route 62 crossing in Barre (Site 883) on 14 August 2003 using a backpack electro-shocker (Richards 2006). Twelve eastern blacknose dace, five white sucker, four tessellated darter, one banded sunfish, and one chain pickerel were collected (23 fish total). Fluvial specialists/dependants dominated the sample. Overall fish numbers were low given the length of the reach sampled although sampling efficiency was noted as poor due to high and cloudy waters at the sampling site (Richards 2006).

Water Chemistry
No recent quality-assured water quality data are available for Canesto Brook.

Although the fish community was largely composed of fluvial specialist/dependant species, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
No objectionable conditions have been reported in Canesto Brook, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The Primary and Secondary Contact Recreation Uses are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Canesto Brook (Segment MA36-36) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct water quality and biological monitoring to evaluate designated uses.

BURNSHIRT RIVER (SEGMENT MA36-37)
Location: Headwaters - Outlet Stone Bridge Pond, Templeton/Phillipston, to the confluence with Canesto Brook, Barre
Segment Length: 8.6 miles
Classification: Class A, Public Water Supply

Williamsville Pond (MA36167) will no longer be reported on as an approximately 57-acre lake segment since the estimated retention time of this waterbody is approximately five days. It will be considered a run-of-the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01173000 and 01172500) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks the Burnshirt River with trout (MA DFG 2007).

MA DFG conducted fish population sampling in the Burnshirt River downstream from Gilbert Road in Barre (Site 881) on 19 August 2003 using a backpack electro-shocker (Richards 2006). Forty-three common shiner, twenty-three eastern blacknose dace, sixteen fallfish, ten brown bullhead, seven longnose dace, six white sucker, two yellow bullhead, two bluegill, one brown trout, one tessellated darter, and one chain pickerel were collected (112 fish total). Fluvial specialists/dependent species dominated the sample.

The presence of longnose dace and tessellated darter (moderately tolerant) suggests good water quality and quantity. Although the presence of brown trout, an intolerant fluvial specialist is notable, only one specimen assumed to have been stocked was collected. Overall fish numbers were good.

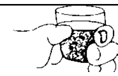
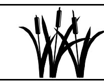
Water Chemistry
No recent quality-assured data are available for Burnshirt River.

Although the fish community was largely composed of fluvial specialist/dependant species, too limited data are available, so the *Aquatic Life Use* is not assessed.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
No recent quality-assured data are available for Burnshirt River. No objectionable conditions have been reported in Burnshirt River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Burnshirt River (Segment MA36-37) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct water quality and biological monitoring to evaluate designated uses.

A review of flow management practices at Queen Lake, Stone Bridge and Williamsville ponds could be conducted to determine the effects if any of said practices on temperatures in the Burnshirt River.

WARE RIVER (SEGMENT MA36-27)
Location: Headwaters - Confluence of East Branch Ware and West Branch Ware rivers to MDC intake, Barre
Segment Length: 4.9 miles
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Organic Enrichment/low DO and thermal modifications (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
MDC-MWRA Ware River diversion, registration (10830901)

The Massachusetts Water Resources Authority (MRWA) is allowed to divert the Ware River via Shaft 8 in Barre into either the Quabbin or Wachusett Reservoirs (WMA registration number 10830901). The diversions are allowed between 15 October and 15 June when flow in the Ware River exceeds 85 MGD. All other diversions require MassDEP approval (MDC 1997).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
The U.S. Army Corps of Engineers (ACOE) owns and maintains Barre Falls Dam, a dry bed reservoir built in 1958 for flood control purposes, along this segment of the Ware River Segment near the Barre/Hubbardston town boundary. The Barre Falls Dam does not maintain a conservation or recreation pool, so inflow equals outflow except during flood-control operations. According to the ACOE (US ACOE 2003), during daily operations and maintenance activities "the minimum outflow should be the less of inflow or 55 cfs from October through March, 220 cfs from April through May and 30 cfs from June to September". The ACOE operations procedure "stipulates a minimum release of 30 cfs at dam during periods of regulation to sustain downstream fish life" (US ACOE 2003). Active dam operations may influence the flow of water in this segment.

USGS maintains a gage near Barre, MA, on the Ware River (Gage 01172500) 700 feet downstream from the Barre Falls Reservoir. The average annual discharge at the gage is 95.3 cfs (period of record 1946 to 2005) (USGS 2007). The drainage area is 55.1 mi^2 and the maximum discharge occurred on 16 October 1955 (1,890 cfs) (USGS 2007). Since the construction of the Barre Falls Reservoir in 1958, the maximum discharge for this gage occurred on 13 April 1987 (1,630 cfs) (Socolow *et al*. 2004). The minimum daily discharge occurred on 8 September 1995 and 11 September 1995 (0.1cfs) (Socolow *et al*. 2004). During the period of 3-8 September and on 13 September 1996 this gage experienced no flow for at least part of the day (Socolow *et al*. 2004).

The USGS remarks that there was slight regulation at low flow at times by Long Pond before August 1955. The flow has been regulated by the Barre Falls Reservoir since 1958 and since 1955 has been diverted at times from 6.5 mi^2 upstream the station for municipal drinking water supply to Fitchburg (Socolow *et al*. 2004). Estimated daily discharge records are considered fair by the USGS (Socolow *et al*. 2004).

<u>Biology</u>
MA DFG stocks the Ware River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the Ware River upstream from Route 122 in Barre (Site 893) on 10 September 2002 using a backpack electro-shocker (Richards 2006). This sampling station is within the impounded portion of the Ware River formed by the MDC intake dam. One hundred and forty golden shiner, thirty-four chain pickerel, twenty-seven common shiner, sixteen white sucker, twelve pumpkinseed, ten yellow perch, nine bluegill, six creek chubsucker, two largemouth bass, two fallfish, one rainbow trout and one redbreast sunfish were collected (260 total fish). The fish

assemblage at this station was a mix of macrohabitat generalists and fluvial specialist/dependent species. Although macrohabitat generalists dominated the sample, this is not surprising given the lentic nature of this narrow impoundment.

Geosyntec Consultants as part of their 2006 Quabbin Reservoir/Ware River aquatic macrophytes assessment sampled in this segment of the Ware River. Aquatic macrophytes were sampled at 22 stations in a one mile stretch of river immediately upstream from the Quabbin Reservoir's Shaft #8 (Geosyntec Consultants, 2006). The majority of stations were characterized as having no plant growth or very sparse plant growth and the remaining stations had sparse plant growth. Yellow water lily (*Nuphar variegatum*), pickerelweed (*Pontederia cordata*) and common bladderwort (*Utricularia vulgaris*) were the three most dominant species found (Geosyntec Consultants, 2006). The Ware River has a wide shallow channel in portions of the reach sampled.

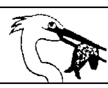
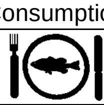
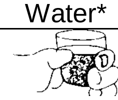
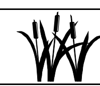
<u>Water Chemistry</u>
No recent quality-assured data are available for the Ware River. The *Aquatic Life Use* is not assessed due to a lack of sufficient information.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
There are two beaches along the shoreline of Ware River in this segment: Cozy Cabin Beach and Barre Dam. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH, as required by the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No objectionable conditions have been reported in this segment of the Ware River, which is protected and managed by MA DCR as part of the Ware River Watershed (Bishop 2006).

The *Primary* and *Secondary Contact Recreation Uses* are not assessed given the lack of recent data. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Ware River (Segment MA36-27) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

WARE RIVER (SEGMENT MA36-03)
Location: MDC intake, Barre to dam in South Barre
Segment Length: 2.1 miles
Classification: Class B, Cold Water Fishery, High Quality Water

Powder Mill Pond (MA36126) and South Barre Reservoir (MA36141) will no longer be reported on as approximately 18-acre and 19-acre lake segments, respectively, since the retention time of these waterbodies was estimated at less than one day. They will be considered run of the river impoundments (McVoy 2006). The retention time estimates were based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01173000 and 01172500) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life, Primary Contact, Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
MDC-MWRA Ware River diversion, registration (10830901)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
The USGS maintains a gage near Barre, MA, on the Ware River at the intake works above diversion dam on Ware River, 2.7 miles downstream from Burnshirt River (Gage 01173000). The drainage area is 96.3 mi^2 (Socolow *et al*. 2004). The period of record for this gage is 1928 to present and the average discharge from 1929-2004 is 168 cfs (Socolow *et al*. 2004). The maximum discharge occurred on 21 September 1938 (14,000 cfs) by computation of flow over dam. Since the construction of Barre Falls Reservoir in 1958, the maximum discharge occurred on 14 April 1987 (1,590 cfs) while the minimum discharge, which was caused by unusual regulation, occurred on 15 September 1987 (0.46 cfs) (Socolow *et al*. 2004).

The USGS remarks that each year discharge is diverted as needed for the Boston Metropolitan district (now MA DCR) from 15 October to 14 June and at other times for emergency flood-control purposes as authorized by U.S. Army Corps of Engineers. The flow has been regulated 4.3 mi upstream by Barre Falls Reservoir since 1958, and since 1955 it has been diverted at times from 6.5 mi^2 upstream from the station for municipal drinking water supply to Fitchburg *(Socolow et al. 2004)*.

Biology
One potential non-native aquatic macrophyte species, *Myriophyllum* sp., was identified in Powder Mill Pond during the 1998 synoptic lake survey (MassDEP 1998). Confirmation of the species is needed.

Water Chemistry
There is a MassDEP Central Regional Office Strategic Monitoring and Assessment for River Basin Team (SMART) station on this segment off River Road, at the USGS flow gage, west of River Road in Ware. The DWM conducted water quality at this station (CBG) on the Ware River between May and August 2003 (Appendix B). CERO crews have conducted water quality monitoring at this location yearly from 1998 to the present. DWM also conducted water quality monitoring at Station WAWV (New Braintree Rd. bridge, White Valley, S. Barre) along this segment of the Ware River between April and October 2003 (Appendix B). *In-situ* parameters

were measured in 2003 on nine occasions (three during pre-dawn hours) at Station WAWV and on four occasions (three during pre-dawn hours). Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus at both locations (Appendix B).

Water quality data met dissolved oxygen criteria at the stations on the Ware River. pH was below the criterion the majority of the time at both stations, but the low pH is considered to be naturally-occurring. Low alkalinity and hardness values, recorded at Station WAWV located below Powder Mill Pond (Appendix B), are indicative of poor buffering ability. Temperature exceeded the criterion in July and August at both stations. The duration and extent of high temperatures is currently unknown. All nutrient concentrations were generally low with the exception of one slightly elevated total phosphorus concentration measured in July at Station WAWV. The *Aquatic Life Use* is assessed as support for this segment but listed as "Alert Status" due to temperature issues and the possible presence of a non-native macrophytes species.

Fish Consumption
The MA DPH (MA DPH 2005) has issued a fish consumption advisory due to mercury contamination for Powder Mill Pond, Barre, as follows.

> "*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Powder Mill Pond in order to prevent exposure to developing fetuses, nursing infants and young children to mercury. The general public should limit consumption of all fish species from Powder Mill Pond to two meals per month*".

Because of the site-specific fish consumption advisory due to mercury contamination, the *Fish Consumption Use* is assessed as impaired for the 0.3 mile reach of the Ware River through Powder Mill Pond. Although sources are unknown, atmospheric deposition is a suspected source. The close proximity of this pond to the Martone Landfill must also be noted however.

Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
The DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (WAWV and CBG) along this segment of the Ware River between April and October 2003 (Appendix B). Only one *E.coli* sample was collected at station CBG. The geometric mean of *E. coli* counts at station WAWV was 12.3 cfu/100 mL. Neither DWM nor CERO field crews noted any objectionable conditions (objectionable deposits, scums, or odors) at these sites during the sampling season with the exception of isolated trash at Station WAWV. White foam, believed to be naturally-occurring, was also noted at both stations.

Parameter	DWM Station WAWV 2003 (n=5)
Fecal coliform (cfu/100mL)	<2 - 100
Geometric mean	18.0
E. coli (cfu/100mL)	<2 - 70
Geometric mean	12.4

The *Primary* and *Secondary Contact Recreational Uses* and the *Aesthetics Use* are assessed as support given the low bacteria counts and the lack of objectionable conditions.

Ware River (Segment MA36-03) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		IMPAIRED (0.3 miles- Powder Mill Pond) Cause: Mercury in fish tissue Source: Unknown Suspected source: Atmospheric deposition NOT ASSESSED (1.8 miles-rest of segment)
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct water quality and biological monitoring to evaluate designated uses.

Conduct temperature monitoring along the Ware River especially above and below impoundments on this segment and determine conditions that result in exceedences of standards.

Conduct macrophyte mapping in Powder Mill Pond to ascertain whether any non-natives species are present.

WARE RIVER (SEGMENT MA36-04)
Location: Dam in South Barre to Wheelwright Dam, New Braintree
Segment Length: 5.36 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Barre Water Department Registration # (2021000)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Barre Wastewater Treatment Plant WWTP- (MA0103152)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks the Ware River with trout (MA DFG 2007). The MA DFG conducted fish population sampling in the Ware River well upstream from the Wheelwright Impoundment, approximately one half mile downstream from Barre Plains in Barre (Site 462) on 2 October 2001 using a boat shocker (Richards 2006). One hundred nineteen golden shiner, one hundred three common shiner, twenty-six white sucker, twenty-four chain pickerel, twelve pumpkinseed, ten yellow perch, five fallfish, five brown bullhead, four bluegill, three largemouth bass, two yellow bullhead, one creek chubsucker and one tessellated darter were collected (315 fish total).

MA DFG conducted fish population sampling in the Ware River near Airport Road approximately 1.6 miles downstream from Barre Plains near the Barre/Hardwick town line (Site 463) on 2 October 2001 using a boat shocker (Richards 2006). Seventy-one yellow perch, ten golden shiner, eight chain pickerel, five pumpkinseed, five common shiner, four white sucker, three creek chubsucker, two brown bullhead, one black crappie, one largemouth bass, one bluegill and one fallfish were collected (66 fish total).

MA DFG conducted fish population sampling in the Ware River upstream from the Wheelwright Impoundment near the Barre-Hiller Airport in Hardwick (Site 464) on 2 October 2001 using a boat shocking technique (Richards 2006). Thirty-eight golden shiner, twenty-one pumpkinseed, twenty-one chain pickerel, eighteen yellow perch, eighteen brown bullhead, thirteen white sucker, nine bluegill, five black crappie, four largemouth bass, and one creek chubsucker were collected (148 fish total)

The fish assemblage in this segment was dominated by macrohabitat generalists with limited numbers of fluvial specialist/dependent species. Although macrohabitat generalists dominated the samples, this is not surprising given the impounded nature of this reach.

<u>Toxicity</u>
Ambient
The Barre Wastewater Treatment Plant (WWTP) staff collected water from the Ware River at the Route 32 Bridge for use as dilution water in the facility's whole effluent toxicity tests. Between July 2000 and May 2007 survival of *C. dubia* exposed (48 hours) to the Ware River water ranged from 90 to 100% (n=28). For August 2002 survival of *P. promelas* exposed (48 hours) to the Chicopee River water was 100% (n=1). Hardness ranged from 12 mg/L to 28 mg/L (n=28).

Effluent
Whole effluent toxicity tests have been conducted on the Barre Wastewater Treatment Plant (WWTP) treated effluent. Between July 2000 and May 2007 thirteen valid chronic tests were conducted using *C. dubia*. Results of the *C. dubia* chronic whole effluent toxicity tests (CNOEC) ranged from <6.25 to 100% effluent. The LC_{50} using *C. dubia* ranged from 18.30% to >100% effluent (n=28). Of the 28 valid tests, ten did not meet the LC_{50} limit, which is $\geq$100%. Seven of the nine acutely toxic samples were during the January/February or April/May testing period. The LC_{50} using *P. promelas* was >100% (n=1).

Ammonia-nitrogen concentrations reported in the whole effluent toxicity reports between July 2000 and May 2007 ranged from 0.150 mg/L to 70.0 mg/L (n=28). Total residual chlorine (TRC) concentrations reported in the whole effluent toxicity reports between July 2000 and May 2007 ranged from 0.010 to 0.150 mg/L (n=28).

<u>Water Chemistry</u>
DWM conducted water quality monitoring at Station WAIR (between the confluence of Pine Hill Brook and Broadmeadow Brook, Hardwick) along this segment of the Ware River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three during pre-dawn hours occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). Both temperature and dissolved oxygen met criteria. pH was below the criterion the majority of the time but generally within 0.5 units of the criterion. Total phosphorus concentration was elevated in the July sample (Appendix B).

The *Aquatic Life Use* is assessed as support for this segment based on the good survival of test organisms exposed to river water and good water quality conditions, but listed as "Alert Status" due to acute whole effluent toxicity of the Barre Wastewater Treatment Plant discharge and low instream pH values.

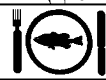
Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics
DWM conducted fecal coliform and *E. coli* bacteria monitoring at Station WAIR (between the confluence of Pine Hill Brook and Broadmeadow Brook, Hardwick) along this segment of the Ware River between April and October 2003 (Appendix B). Bacteria counts were low at this station and the geometric mean of *E. Coli* counts was 47.5 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 400
Geometric mean	67.6
E. coli (cfu/100mL)	<2 - 200
Geometric mean	47.5

DWM field crews did not note objectionable deposits at this site with the exception of one occasion when trash was noted. A pollen sheen was noted on three occasions and an oily sheen was noted once although generally no scums were noted. DWM field crews did not note any water odor. Slight undercut banks were noted on the left bank at this station.

The *Primary* and *Secondary Contact Recreational Uses* and the *Aesthetics Use* are assessed as support given the low bacteria counts and the general lack of objectionable conditions.

Ware River (Segment MA36-04) Use Summary Table

<table>
<tr><th colspan="2">Designated Uses</th><th>Status</th></tr>
<tr><td>Aquatic Life</td><td></td><td>SUPPORT*</td></tr>
<tr><td>Fish Consumption</td><td></td><td>NOT ASSESSED</td></tr>
<tr><td>Primary Contact</td><td></td><td rowspan="3">SUPPORT</td></tr>
<tr><td>Secondary Contact</td><td></td></tr>
<tr><td>Aesthetics</td><td></td></tr>
</table>

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct water quality and biological monitoring to evaluate designated uses.

Macroinvertebrate sampling upstream and downstream of the Barre WWTP discharge should be conducted to ascertain if the discharge is having any adverse effects on aquatic life.

Barre WWTP should conduct a toxicity identification and reduction evaluation (TIE/TRE). If one is not conducted before their NPDES permit renewal, one should be required as part of their permit renewal.

PRINCE RIVER (SEGMENT MA36-08)
Location: Source, outlet Hemingway Pond to confluence with Ware River, Barre.
Segment Length: 7.1 miles.
Classification: Class B, Cold Water Fishery, High Quality Water.

Old Reservoir (MA36114) is a pond based on retention time, so the portion of the river that overlaps the reservoir will no longer be considered part of this segment.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Barre Water Department Registration # 2021000

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
No known NPDES discharges are present on this segment.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aesthetics* (MassDEP 2007b).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks the Prince River with trout (MA DFG 2007). MA DFG conducted fish population sampling in Prince River near the Williamsville Road crossing (Site 884) in Barre on 14 August 2003 using a backpack electro-shocker (Richards 2006). Fifteen eastern blacknose dace, nine white sucker, two tessellated darter, two brown bullhead, and one brook trout were collected (29 fish total).

Although fluvial specialist/dependent species dominated the sample at Williamsville Road and the presence of a single brook trout is noteworthy, blacknosed dace and white sucker (fluvial specialist/dependent species) are both classified as tolerant to pollution while the brook trout was most likely a stocked fish. In light of the classification of the Prince River as a coldwater fishery the absence of reproducing brook trout must be noted. Overall fish numbers were low given the length of the reach that was sampled.

MA DFG conducted fish population sampling in Prince River near the Valley Road crossing (Site 888) in Barre on 19 August 2003 using a backpack electro-shocker (Richards 2006). Ninety eastern blacknose dace, six longnose dace, five white sucker, three brook trout, one yellow bullhead, one pumpkinseed, one tessellated darter and one brown trout were collected (108 fish total). Fluvial specialist/dependent species dominated the sample collected at the Valley Road crossing. In addition, although multiple age classes of brook trout suggest a reproducing population, only three specimens were collected. A stocked brown trout and one tessellated darter (in addition to a couple of macrohabitat generalist species) complete the sample.

Too limited quality-assured data are available for Prince River. Although there was evidence of a reproducing population of brook trout the numbers were very low and don't allow a definitive assessment of *Aquatic Life Use*. All designated uses are not assessed.

Prince River (Segment MA36-08) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED				

RECOMMENDATIONS
Conduct water quality and biological monitoring (fish population and macroinvertebrate) to evaluate designated uses.

Conduct bacteria monitoring in this segment to assess the *Primary* and *Secondary Contact Recreation Uses*.

WARE RIVER (SEGMENT MA36-05)
Location: Wheelwright Dam, New Braintree, to Ware Dam, Ware
Segment Length: 11.5 miles
Classification: Class B, Warm Water Fishery. CSO**

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life and Aesthetics* (MassDEP 2007b).

** Although the river as defined in the 2006 standards inclusive of this segment has a CSO qualifier, there are no CSOs in this segment, so the CSO qualifier does not apply to this segment. All Class B standards apply.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Ware Water Department Registration/Permit (10806101/9P210830903)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Town of Hardwick (Hardwick Pollution Control Facility- Gilbertville) (MA01001021)
Town of Hardwick (Hardwick Pollution Control Facility- Wheelwright) (MA0102431)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG stocks the Ware River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the Ware River off Route 32 in Hardwick (Site 879) on 7 July 2003 using barge shocking (Richards 2006). Fifteen fallfish, nine yellow perch, nine yellow bullhead, nine golden shiner, eight bluegill, seven redbreast sunfish, six longnose dace, five tessellated darter, three chain pickerel, three rock bass, two pumpkinseed, two common shiner, one eastern blacknose dace, and one largemouth bass were collected (80 fish total).

The fish assemblage in this segment consisted of a diverse mix of macrohabitat generalists and fluvial specialist/dependent species. Although detailed information regarding habitat type is not available it appears that a mix of habitat types was sampled. This accounts for the wide variety of species collected. Given the amount of flow and wide width in this reach of the Ware River, fish sampling efficiency was less than optimal.

MA DFG conducted fish population sampling in the Ware River near the Church Street crossing in Ware (Site 873) on 31 July 2003 using the barge shocking technique (Richards 2006). One hundred fifty-nine tessellated darter, one hundred four spot-tail shiner, fifty-nine redbreast sunfish, forty-six white sucker, fifteen rock bass, fifteen pumpkinseed, ten yellow bullhead, six fallfish, four bluegill, four largemouth bass, three longnose dace, two chain pickerel, one yellow perch, one eastern blacknose dace, and one brown trout were collected (430 fish total).

The majority of fish collected at both sites were macrohabitat generalists, although good numbers of fluvial specialists/dependent species were also present at both sites.

<u>Toxicity</u>
Ambient
The Hardwick Water Pollution Control Facility staff collected water from the Ware River, approximately 50 yards above the outfall at the Wheelwright facility, for use as dilution water in the Wheelwright facility's whole effluent toxicity tests. Between May 2000 and May 2007 survival of *C. dubia* exposed (48 hours) to the Ware River was all 100% (n=15). Between May 2000 and May 2003 survival of *P. promelas* exposed (48 hours) to the Ware River water ranged from 95 to 100% (n=7). Hardness ranged from 8.0 mg/L to 27.0 mg/L (n=14).

The Hardwick Pollution Control Facility staff collected water from the Ware River, approximately 50 yards above the outfall at the Gilbertville WWTP, for use as dilution water in the Gilbertville facility's whole effluent toxicity tests. Between May 2000 and November 2007 survival of *C. dubia* exposed (48 hours) to the Ware River water was all 100% (n=15). Between May 2000 and May 2003 survival of *P. promelas* exposed (48 hours) to the Ware River water was all 100% (n=7). Hardness ranged from 12.0 mg/L to 61.0 mg/L (n=14).

The Ware Treatment Plant (WWTP) staff collected water from the Ware River, off of Upper Church Street by the northern end of the landing strip, for use as dilution water in the facility's whole effluent toxicity tests. Between November 2005 and May 2006 survival of *C. dubia* exposed (approximately 7 days) to the Ware River water was 100% (n=3). Hardness ranged from 8.0 mg/L to 20.0 mg/L (n=3).

Effluent
Whole effluent toxicity tests have been conducted on the Hardwick Water Pollution Control Facility in Wheelwright treated effluent. Between May 2000 and November 2007 fifteen valid tests were conducted using *C. dubia* and seven using *P. promelas*. The LC_{50}'s using *C. dubia* ranged from 10.9% to >100% effluent (n=15). Overall of the 15 tests, six did not meet the limit of $\geq$100%. The LC_{50}'s using *P. promelas* were all >100% (n=7) with the exception of May 2002, which was 57.4% (Appendix D).

Whole effluent toxicity tests have been conducted on the Hardwick Water Pollution Control Facility in Gilbertville treated effluent. Between May 2000 and May 2007 fifteen valid tests were conducted using *C. dubia* and seven using *P. promelas*. The LC_{50} using *C. dubia* was all >100% effluent (n=15), except for May 2001 (93.90%), and November 2001 and 2002 (both results = 70.70%) and August 2006 (79.4% effluent). The LC_{50} using *P. promelas* were all >100% (n=7) (Appendix D).

<u>Water Chemistry</u>
DWM conducted water quality monitoring at two stations, WA06A (Upper Church St. Ware) and WAX (Creamery Road/Unitas Road, Hardwick/New Braintree), along this segment of the Ware River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). Total phosphorus concentrations at both locations were slightly elevated in June, July and August. All water quality data meets criteria, although pH was slightly low on occasion.

The *Aquatic Life Use* is assessed as support for this segment based on good survival of test organisms exposed to river water at all three locations, the presence of fluvial specialists/dependent fish species and good water quality conditions. The segment is given "Alert Status" due to acute whole effluent toxicity in both the Hardwick Water Pollution Control Facilities in Wheelwright and Gilbertville discharges and the slightly elevated total phosphorus concentrations.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations, WA06A (Upper Church St. Ware) and WAX (Creamery Road/Unitas Road, Hardwick/New Braintree), along this segment of the Ware River between April and October 2003 (Appendix B). DWM field crews did not note any objectionable conditions (trash, scums, odors, etc) at either station (Appendix B). White foam was generally noted at both stations, although it is believe to be natural (Appendix B).

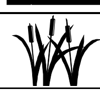
At Station WAX *E. coli* counts ranging from 2 – 880 cfu/100 and the geometric mean of 87.6 met criteria. Only one bacteria count exceeded 235 cfu/100ml at this station and this sample represented wet weather conditions.

At Station WA06A, *E. coli* counts ranging from 2 - 1100 cfu/100 and the geometric mean of 143.4 exceeded the primary contact recreation criterion. Three bacteria counts exceeded 235 cfu/100ml at this station. The highest counts represented both wet and dry weather conditions.

Parameter	Station WAX (n=6)	Station WA06A (n=6)
Fecal coliform (cfu/100mL)	8 - 1200	4 - 3700
Geometric mean	142.6	260.1
E. coli (cfu/100mL)	2 - 880	2 - 1100
Geometric mean	87.6	143.4

The *Primary Contact Recreational Use* is assessed as support in the upper 3.8 mile reach of this segment based on bacteria counts at Station WAX and the lower 7.7 miles of this segment is assessed as impaired for this use due to elevated *E. coli* counts at station WA06A. The *Secondary Contact Recreational Use* is supported as bacteria levels at both stations met the criterion. The *Aesthetics Use* is assessed as support given the lack of objectionable conditions.

Ware River (Segment MA36-05) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT (Upper 3.8 miles) IMPAIRED (Lower 7.7 miles) Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Given the high *E. coli* counts found at Station WA06A bacteria source tracking should be conducted in this area and the Gilbertville area.

Continued water quality sampling and macroinvertebrate sampling should be conducted along this segment to assess the *Aquatic Life Use*.

The Hardwick Water Pollution Control Facilities in Wheelwright and Gilbertville should reduce their whole effluent toxicity to achieve compliance with permit limits.

WARE RIVER (SEGMENT MA36-06)
Location: Ware Dam, Ware, to Thorndike Dam, Palmer
Segment Length: 10.1 miles
Classification: Class B, Warm Water Fishery, CSO**

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5- Waters requiring a TMDL. Pollutants needing TMDLs: Pathogens (MassDEP 2007b).

** Although this segment is classified as a CSO in the 2006 standards, there are currently no CSOs in this segment, so this should not be classified with a CSO qualifier. Future standards will reflect this fact.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Cascades Diamond Inc. Registration # 10822705
Ware Water Department Registration/Permit (10806101/9P210830903)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D1, D2, D4)
Town of Ware- Ware Wastewater Treatment Plant (MA0100889)
Palmer Water Pollution Control Facilities (MA0101168)
Town of Palmer (MAR041017)
Quabbin Wire & Cable Co. Inc (MA0030571, MAR00A028)

Palmer WWTP (MA0101168) was permitted to discharge through two CSO outfalls (# 019 and 020) in this segment of the Ware River. The permit was issued (29 September 2000). Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate CSO #019 (and to disconnect the 100 GPM stream from entering the sewer system) was proposed for the first phase of work at an estimated cost of $135,000. In 1999 the Town of Palmer submitted a request for Massachusetts SRF financing for the first three phases of work and was selected to receive financing for the $7.1 million dollars worth of sewer separation work to be performed in the first three phases. MassDEP approved sewer separation, including drainage areas to CSO #019, in December 2000 as part of CW SRF-423. CSO #020 was blocked and inactive by 2001, while CSO #019 was blocked in 2003 (Boisjolie 2005), so the combined sewer overflow has been eliminated.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
The USGS maintains a gage on the Ware River (Gage 01173500) 0.5 mi upstream from Gibbs Crossing. The drainage area for this gage is 197 mi^2 and the average annual discharge is 294 cfs (period of record 1931-2005 (USGS 2007). The maximum discharge occurred on 21 September 1938 (22,700 cfs) *(Socolow et al. 2004)*. The maximum discharge since the construction of Barre Falls Reservoir in 1958, occurred on 6 March 1979 (5,050 cfs) (Socolow 2004). The minimum discharge occurred on 24 August 1995 (4.2 cfs) *(Socolow et al. 2004)*. The USGS remarks that there have been diversions at times since March 1931 from 96.3 mi^2 to supply water to Boston Metropolitan district (now MA DCR) and since 1955 from 6.5 mi^2 for municipal water supply to Fitchburg *(Socolow et al. 2004)*. Since 1958 flow has been regulated by mills upstream and by Barre Falls Reservoir *(Socolow et al. 2004)*.

Biology
On April 16th 2003 the CERO crew noticed heavy sand deposits near the Gibbs Crossing (Route 32) bridge. These deposits were also noticed later during the 2003 field season (May 16) by DWM field crews. Beaudoin (2006) states that the "bottom at this site shows ever-increasing embeddedness but not yet covered in sand".

Toxicity

Effluent

Whole effluent toxicity tests have been conducted on the Ware Wastewater Treatment Plant (WWTP) treated effluent. Between July 2000 and May 2007 twenty-eight valid chronic tests were conducted using *C. dubia.* The chronic whole effluent toxicity tests using *C. dubia* ranged between <6.25% and 100% effluent (n=28). Of the 28 tests, twenty did not meet the required limit of >7%. The January 2001 test and the tests from November 2002 to May 2007 were all $\leq$6.25%. The LC_{50} ranged from 71% to 100% effluent. Five of the 24 tests did not meet the required limit (Appendix D).

Water Chemistry

DWM conducted water quality monitoring at one station (WA09A-Route 32 at Gibbs Crossing, Ware) along this segment of the Ware River between May and August 2003 (Appendix B). *In-situ* parameters were measured on four occasions with three measurements during pre-dawn hours. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

The DWM station is also a MassDEP Central Regional Office Strategic Monitoring and Assessment for River Basin Teams' station. CERO crews also conduct water quality monitoring at this location yearly in addition to DWM sampling (1998 to present).

Water quality parameters met state standards and nutrient concentrations were generally low at this station with the exception of one elevated total phosphorus concentration in June 2003. *In-situ* measurements from 2001 to 2003 as collected by DWM and CERO crews indicated good water quality conditions. *The Aquatic Life Use* is assessed as support given good water quality conditions. This use is given an "Alert Status" due to the acute and chronic whole effluent toxicity from the Ware Wastewater Treatment Plant discharge.

Primary and Secondary Contact Recreation and Aesthetics Uses

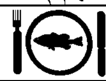
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (WA09A-Route 32 at Gibbs Crossing, Ware) along this segment of the Ware River on one occasion in May (Appendix B). CERO crews in coordination with the DWM sampling effort conducted fecal coliform and *E. coli* bacteria monitoring on three occasions. Bacteria samples collected on August 20th, 2003 did not meet data quality objectives in terms of reproducibility (Appendix B).

Parameter	DWM 2003 (n=4)
Fecal coliform (cfu/100mL)	<2 -190
Geometric mean	37.8
E. coli (cfu/100mL)	2 - 150
Geometric mean	26.6

Both DWM field crews and CERO crews found objectionable deposits in the form of garbage and trash on the stream banks and in the stream (including tire, metals, bottles etc.) throughout the sampling season. The extent of trash coverage in this segment is not known, but isn't considered to be widespread. Water odors were not noted by either field crew. DWM field crews did not notice any scums, although CERO crews noticed small quarter size patches of foam in June, July, August and October. Water clarity was generally clear. Field crews also noted undercut banks.

The samples collected by DWM and CERO crews had low fecal coliform and *E. coli* bacteria counts but only four samples were collected and more data are needed to assess the *Primary* and *Secondary Contact Recreation Uses*, so both uses are not assessed. Given the general lack of objectionable conditions the *Aesthetics Use* is assessed as support for this segment.

Ware River (Segment MA36-06) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

The Ware Wastewater Treatment Plant should reduce their whole effluent and chronic toxicity to achieve compliance with permit limits.

Continued water quality sampling and macroinvertebrate sampling should be conducted along this segment to assess *Aquatic Life Use*.

A habitat walk should be conducted at Station WA09A to determine the extent of sedimentation and embeddednessat this station. Best management practices should be instituted to prevent further degradation of in-stream habitat.

Conduct bacteria sampling to assess recreational uses.

WARE RIVER (SEGMENT MA36-07)
Location: Thorndike Dam, Palmer, to confluence with Quaboag River (forming headwaters Chicopee River), Palmer
Segment Length: 2.5 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2 D4)
Town of Palmer- Palmer Water Pollution Control Facilities (MA0101168)
Town of Palmer- (MAR041017)

Palmer WWTP (MA0101168) is permitted to discharge via six wet weather CSOs in this segment of the Ware River. The Town's permit was issued on 29 September 2000. Hydraulic modeling performed as part of Palmer's CSO Abatement Plan estimated the following discharge quantities based on a three-month frequency storm.

Village of Thorndike:	021A	no data avalaible
	021B	sealed, no longer discharges
	22	8,000 gallons
	023A	5,000 gallons
	023B	no data available
Village of Three Rivers:	18	23,000 gallons

Palmer's May 1999 final Long Term Control Plan for CSO abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate CSO #021A, 022, 023A, 023B and 018 is not scheduled until the fourth phase, which has an estimated cost of approximately 1.32 million dollars. However, the regulator structures to CSO # 018, 023A, 023B and 022 were scheduled to be adjusted (raised) in Phase I of the project, in order to maximize the flow to the WWTP and minimize CSO discharges from these regulators. The final adjustment of these weirs has not yet been completed. If successful, the fourth phase of sewer separation may not be required or considered to be cost effective (MassDEP 2001).

In 1999 Palmer submitted a request for MA SRF financing for the first 3 phases of work, and in November 1999 was selected to be eligible for $7.1 million in financing for the first 3 phases of sewer separation (including raising overflow weirs at CSO # 022, 023A, 023B and 018). The MassDEP in December 2000 approved this work as part of CW SRF-423. The contract was awarded in 2001 (Boisjolie 2001). Currently CSO #018, 23A, 023B and 022 are active and final adjustments of their weirs has not been completed (Boisjolie 2007a). The fourth phase of work is currently scheduled by the Town for 2012 (Boisjolie 2007a).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Toxicity</u>
Ambient
Palmer Water Pollution Control Facility staff collect water from the Ware River, about 500 feet from the railroad tracks and about a half mile from where the Ware River and the Quaboag River converge, for use as dilution water in the facility's whole effluent toxicity. Between July 2000 and

March 2007 survival of *C. dubia* exposed (approximately 7 days) to the Ware River water ranged from 80 to 100% (n=27). Hardness ranged from 12.0 mg/L to 52.0 mg/L (n=27).

Effluent
Whole effluent toxicity tests have been conducted on the Palmer Water Pollution Control Facility treated effluent. Between July 2000 and March 2007 twenty-six valid chronic tests were conducted using *C. dubia.* Results of the chronic whole effluent toxicity tests using *C. dubia* ranged from 6.25% to $\geq$100% effluent (n=26). June 2001 showed a significant difference in reproduction for 25% effluent. The LC_{50} results were all 100% effluent (n=28) with the exception of September 2004, which was 33.0% (Appendix D).

Water Chemistry
DWM conducted water quality monitoring at one station (WA12 – Route 181, Palmer) along this segment of the Ware River between May and August 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). All parameters met water quality criteria. All water samples collected at this station had low ammonia-nitrogen concentrations and total phosphorus was generally low although somewhat elevated in June and July (Appendix B).

Based on the good survival of test organisms exposed to river water and good water quality conditions, the *Aquatic Life Use* is assessed as support.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (WA12 – Route 181, Palmer) along this segment of the Ware River between April and October 2003 (Appendix B). The geometric mean for *E. coli* of samples collected at this station was 50.1 cfu/100mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	2 – 510
Geometric mean	101.5
E. coli (cfu/100mL)	2 – 180
Geometric mean	50.1

No objectionable deposits or water odors were noted by DWM field crews at this site. A white foam, believed to be naturally-occurring, was noted on the majority of occasions during the 2003 sampling season. Water clarity was generally either clear or slightly turbid. DWM field crews noted that the banks are slightly undercut at this location.

The *Primary* and *Secondary Contact Recreation Use* are assessed as support given the low geometric mean of *E. coli* counts but given the presence of CSOs are identified with an “Alert Status”. Given the lack of objectionable conditions at this location the *Aesthetics Use* is assessed as support.

Ware River (Segment MA36-07) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT *
Secondary Contact		SUPPORT *
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Continue water quality monitoring to evaluate designated uses. Water quality monitoring should include water chemistry and bacteria monitoring to assess the progress in CSO abatement. Particular attention should be given to a sampling below CSO# 018 and the cluster of CSOs near Summer Street in Thorndike.

Benthic macroinvertebrate sampling should be conducted along this segment to assess the *Aquatic Life Use.*

Quaboag River Subbasin

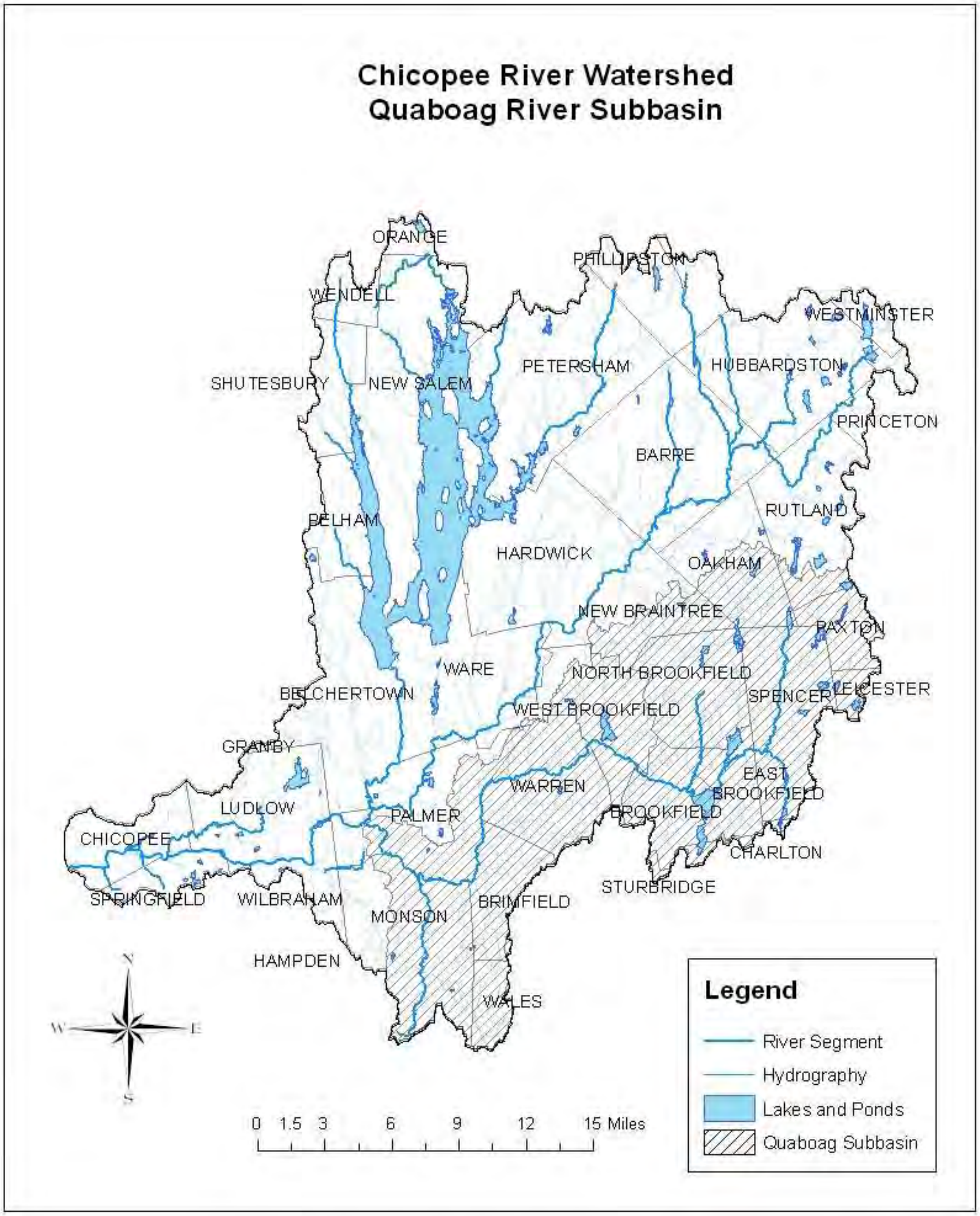


Figure 9: Quaboag River Subbasin

SEVENMILE RIVER (SEGMENT MA36-11)
Location: Source, outlet Browning Pond Spencer to confluence with Cranberry River, Spencer.
Segment Length: 7.3 miles.
Classification: Class B, Warm Water Fishery, High Quality Water.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Bond Construction Company Registration (20828002)
Spencer Water Department Registration/Permit (20828001/9P20828001)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
Town of Spencer (MAR041162)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
The USGS maintained a gage near Spencer, MA, on the Sevenmile River (Gage 01175670) 40 feet upstream from the bridge on Cooney Road and 1.5 miles north of Spencer. In August 2005 the UGSS gage was relocated to the downstream side of the Cooney Road bridge. The drainage area for this gage is 8.81 mi^2 and the period of record is October 1960 to present. The average discharge is 14.9 cfs (1961-2005) (USGS 2007). The maximum discharge occurred on 18 March 1968 (412 cfs) while the minimum discharge occurred on 6, 7, 9, and 18 September 2001 (0.03 cfs) *(Socolow et al. 2004)*. According to the USGS records are good except for estimated daily discharges, which are poor *(Socolow et al. 2004)*. The Sevenmile River has been subject to occasional regulation by upstream ponds since 1971 *(Socolow et al. 2004)*. Flow fluctuations in the Sevenmile River due to the Bond Construction Company's withdrawal have been reported (Conners, 2007).

<u>Biology</u>
MA DFG stocks the Sevenmile River with trout (MA DFG 2007). MA DFG conducted fish population sampling in the Sevenmile River at numerous locations in Spencer.

MA DFG conducted fish population sampling near the Route 31-North Spencer Road crossing and Hasting Road in Spencer (Site 1151) on 29 July 2005 using a backpack electro-shocker (Richards 2006). Twenty-two common shiner, seven pumpkinseed, five tessellated darter, three yellow bullhead, two white sucker, two largemouth bass, two chain pickerel, one fallfish and one bluegill were collected (45 fish total). Although the majority of fish collected at this site are fluvial dependent/fluvial specialist species, a number of macrohabitat generalist species were also represented.

MA DFG conducted fish population sampling upstream from the Cooney Road crossing in Spencer (Site 789) on 18 July 2002 using a backpack electro-shocker (Richards 2006). Seventy-two common shiner, thirty longnose dace, thirty-six eastern blacknose dace, nineteen fallfish, thirteen yellow bullhead, eleven tessellated darter, five white sucker, three chain pickerel, and one brook trout were collected (197 fish total). The fish community was dominated by fluvial dependent/fluvial specialist species.

MA DFG conducted fish population sampling downstream from the Cooney Road crossing in Spencer (Site 791) on 18 July 2002 using a backpack electro-shocker (Richards 2006). Thirty-two fallfish, twenty-eight common shiner, twenty-three tessellated darter, nineteen longnose dace, eighteen yellow bullhead, seven eastern blacknose dace, four white sucker, three chain pickerel, two bluegill, two brown bullhead, one hybrid redfin/chain pickerel, and one golden shiner were collected (140 fish total). The majority of fish collected at this site are fluvial dependent/fluvial specialist species.

MA DFG conducted fish population sampling south of the Cooney Road crossing in Spencer (Site 1150) on 28 July 2005 using a backpack electro-shocker (Richards 2006). Fifty-six fallfish, eight yellow bullhead, four longnose dace, two yellow perch, two common shiner, two white sucker, and one brown trout were collected (75 fish total). The majority of fish collected at this site are fluvial dependent/fluvial specialist species.

The Sevenmile River is considered to be a Coldwater Fishery Resource (CFR) under criteria developed by the MA DFG. One brook trout was collected in 2002 and appeared to be a wild fish. It is unclear why the Sevenmile River is considered a CRF as historic MA DFG data seems to suggest otherwise. The four trout listed within their historic dataset were all greater than >140 millimeters. It seems possible that these were stocked fish. Although the MA DFG fish surveys did not firmly establish the presence of a reproducing salmonid population, fluvial specialist/dependent species dominated the fish samples at all four locations. The fish assemblages varied somewhat between stations and time, however the consistent fluvial specialist/dependent species suggest a stable flow regime. In addition, a number of the species present are considered only moderately tolerant to pollution. It should be noted that water temperatures as high as 24.3° C have been recently documented by MassDEP (MassDEP 2006a).

Water Chemistry

DWM conducted water quality monitoring at two stations (SMG – Cooney Road at the USGS flow gaging station and SM01- upstream from the Route 9 bridge, Spencer) along this segment of the Sevenmile River between May and October 2003 (Appendix B). Station SMG is also the MassDEP, Central Regional Office, Strategic Monitoring and Assessment for River Basin Teams station. CERO crews conduct water quality monitoring at this location yearly from 1998 to present. CERO data collected between 2001 and 2003 are summarized in this report. Between both crews *in-situ* parameters were measured on ten occasions at Station SMG in 2003 with three measurements during pre-dawn hours. *In-situ* parameters were measured on eight occasions at Station SM01 in 2003 with three measurements during pre-dawn hours. Grab samples were also collected and analyzed for TSS, turbidity and nutrients at both sites (Appendix B).

All water quality parameters at Station SMG met state criteria with the exception of a few low pH measurements in the winter during the CERO sampling. Generally nutrient concentrations at this station were low. The total phosphorus concentration was greater than 0.050 mg/L on only one occasion (MassDEP 2006a). For a summary of water quality data collected at Station SMG by both crews see table below.

Parameter	DWM 2003	CERO (2001-2003)
DO (mg/L)	7.3 – 10.6 (n=4)	7.2 – 13.6 (n=16)
pH (SU)	6.6 - 6.8 (n=4)	5.7 – 6.8 (n=17)
Temperature (℃)	12.7 – 22.3 (n=4)	-0.11 – 24.3 (n=17)
Conductivity (µS/cm at 25℃)	86.0 –102 (n=4)	64.1 – 108 (n=17)
Ammonia- nitrogen (mg/L)	<0.02 (n=1)	<0.02 –0.06 (n=17)
Nitrate – nitrite nitrogen (mg/L)	--	<0.02 – 0. 19 (n=17)
Total Kjeldahl nitrogen (mg/L)	--	0.14 – 0.43 (n=17)
Total phosphorus (mg/L)	0.009 – 0.014 (n=2)	0.009 – 0.069 (n=17)
Alkalinity (mg/L)	--	3 – 11 (n=17)
Total suspended solids (mg/L)	2 (n=1)	<1 – 16 (n=17)
Turbidity (NTU)	0.77 (n=1)	0.65 – 9.0 (n=17)

Low dissolved oxygen concentrations, which does not meet standards criteria, were documented on five of the eight sampling events at Station SM01, although on three occasions the DO measurements were taken during predawn, worst-case conditions (Appendix B). Site SM01 is downstream from the Great Meadow wetland area and the Sevenmile River is relatively low gradient along this stretch of the river, which may contribute to naturally low dissolved oxygen. There are also large areas of agriculture upstream from the Great Meadows wetland area. pH is also slightly below the criterion at Station SM01. TDS and conductivity are also higher at SM01 than Station SMG (Appendix B). Nutrients at this station were low (Appendix B).

The *Aquatic Life* use is assessed as support given the presence of fluvial specialists/dependent fish species and generally good water quality conditions. However, the segment is identified with an "Alert Status" due to the low dissolved oxygen and low pH found at SM01. There is uncertainty over whether low DO is due to natural conditions. Historic measurements in the 1980s met the criterion and were higher than found during 2003 sampling (Kimball 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (SMG – Cooney Road at the USGS flow gaging station and SM01- upstream from the Route 9 bridge, Spencer) along this segment of the Sevenmile River between May and October 2003 (Appendix B). DWM and CERO crews collected four bacteria samples in 2003. All of these samples had low bacteria counts and represent both wet and dry weather conditions (Appendix B, MassDEP 2006a). Six bacteria samples were collected by DWM at Station SM01 and, with the exception of the October 15th sample, all samples had low bacteria counts. The October 15th sample result was 1000 cfu/100 ml *E. coli* and represents wet weather conditions. The geometric mean of all bacteria samples collected by DWM crews at Station SM01 is 51.7 cfu/100mL. Not enough data was collected at station SMG to compute a geometric mean.

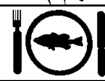
Parameter	DWM SM01 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 1000
Geometric mean	53.6
E. coli (cfu/100mL)	<2 - 1000
Geometric mean	40.9

CERO crews noted that sunken granite blocks from a partially dismantled dam were present at Station SMG. Neither DWM field crews nor CERO crews noted any objectionable deposits at Station SMG. No water odors were noted but white foam was commonly observed at this site. The river at Station SMG appears to be a depositional area for sand/gravel, possibly from extraction activities upstream. A large gravel bar has formed on the western bank and has blocked flow through the western culvert except on extreme high flows.

DWM field crews did not find any objectionable deposits at Station SM01 with the exception of minimal trash on one occasion. No scums were noted at Station SM01 and no water odor was noted with the exception of one occasion when a musty smell was noted. Slight bank erosion and undercut banks were noted at this station.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on low bacteria counts. One wet weather sample on October 15th had a high bacteria count, so the *Primary Contact Recreation Use* is identified with an "Alert" status". The *Aesthetics Use* is assessed as support given the general lack of objectionable conditions noted by both DWM and CERO field crews.

Sevenmile River (Segment MA36-11) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Continue water quality monitoring to evaluate designated uses.

Conduct bacteria sampling during wet weather events to determine whether bacterial source tracking is warranted with special attention paid to Station SM01.

Conduct macroinvertebrate sampling to fully assess the *Aquatic Life Use*.

CRANBERRY RIVER (SEGMENT MA36-20)
Location: Source, outlet Cranberry Meadow Pond in Spencer to confluence with Sevenmile River, Spencer
Segment Length: 3.6 miles
Classification: Class B, High Quality Water

Howe Pond (MA36073) will no longer be reported on as an approximately 12-acre lake segment since the estimated retention time of this waterbody is approximately 3 days. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01175670 and 01173000) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Spencer Water Department Registration/Permit (20828001/9P20828001)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Town of Spencer- Spencer Wastewater Treatment Plant (MA0100919)
Town of Spencer- MAR041162

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks the Cranberry River and Howe Pond with trout (MA DFG 2007). MA DFG conducted fish population sampling in Cranberry River near Howe Road, Spencer State Park, Spencer (Site 1147), on 2 August 2005 using a backpack electro-shocker (Richards 2006). Thirty yellow bullhead, twelve pumpkinseed, nine bluegill, eight white sucker, six chain pickerel, two brown trout, two largemouth bass, one black crappie, one tadpole madtom, and one fallfish were collected (72 fish total).

The Cranberry River is considered to be a Coldwater Fishery Resource under criteria developed by the MA DFG. At one station in 1983 multiple age classes of reproducing brook trout were collected (Richards 2006). Although the 2005 survey did not result in the collection of brook trout it is unclear as to the exact location of the 1983 sampling station. The fish assemblage documented as result of the 2005 survey consists of mostly macrohabitat generalist species. It is possible that the species composition is habitat related since the 2005 sampling station is just downstream from Howe Pond in and upstream from a forested wetland. Additional monitoring of the Cranberry River in an attempt to document the continued presence and extent of brook trout within this watershed is warranted.

Toxicity
Ambient
The Spencer Wastewater Treatment Plant (WWTP) staff collected water from the Cranberry River at the South Spencer Road Crossing for use as dilution water in the facility's whole effluent toxicity tests. Between May 2003 and May 2007 survival of *C. dubia* exposed (approximately 7 days) to the Cranberry River water ranged from 70 to 100% (n=17). Survival was <75% in only one test. Hardness ranged from 18.0 mg/L to 44.0 mg/L (n=17).

Effluent
Whole effluent toxicity tests have been conducted on the Spencer Wastewater Treatment Plant (WWTP) treated effluent. Between May 2000 and May 2007, twenty-two valid chronic tests were

conducted using *C. dubia.* The chronic whole effluent toxicity tests using *C. dubia* were all >100% effluent (n=27). Results of the LC_{50} were all 100% effluent (n=24) (Appendix D).

Water Chemistry
DWM conducted water quality monitoring at one station (CRN01-South Spencer Road, Spencer) along this segment of the Cranberry River between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). On two occasions dissolved oxygen did not meet the criterion and pH was generally below the criterion, but by less than 0.5 SU. There are large wetland areas upstream from the sampling station. A beaver dam was noted in May near this station and by November it was breached with the installation of a culvert. Beaver activity is common upstream from the sampling station. There is also a large impoundment upstream from the sampling station. Given these factors it is likely that low dissolved oxygen and pH values are due to natural conditions. Nutrients at this station were also low.

The *Aquatic Life Use* is assessed as support given the good survival of test organisms and good water quality conditions. However, this use is identified with an "Alert Status" due to occasional low dissolved oxygen concentrations and the absence of brook trout and other fluvial species. The low dissolved oxygen conditions are likely to be naturally-occurring.

Primary and Secondary Contact Recreation and Aesthetics Uses
Howe Pond Beach in Spencer State Forest is present on this segment. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, this information is not used to assess the contact recreational uses. The pond is currently marked with "No Swimming" signs.

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CRN01-South Spencer Road, Spencer) along this segment of the Cranberry River between April and October 2003 (Appendix B). Bacteria counts during both wet and dry weather at this site were low with the exception of October 15th, which had a bacteria count of 480 cfu/100mL and represents a wet weather sampling event. The geometric mean of *E. coli* counts was 53.3 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	2 - 500
Geometric mean	72.4
E. coli (cfu/100mL)	2 - 480
Geometric mean	53.3

DWM field crews did not find any objectionable deposits with the exception of trash on one occasion and sand from the road on two occasions. No water odors or scums were noted by DWM field crews. Slight shoreline erosion was noted at this site.

The *Primary* and *Secondary Contact Recreational Uses* are assessed as support as the geometric mean of E. coli counts meets the criterion. *Primary Contact Recreation Use* is identified with an "Alert Status" given the one wet weather sample that exceeded 235 cfu/100mL. Given the lack of objectionable conditions at this location the *Aesthetics Use* is assessed as support.

Cranberry River (Segment MA36-20) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses. Water quality monitoring below the Spencer WWTP could test for total phosphorus and copper to document in stream conditions before any future Spencer WWTP upgrades.

SEVENMILE RIVER (SEGMENT MA36-12)
Location: Confluence with Cranberry River, Spencer, to confluence with East Brookfield River, East Brookfield
Segment Length: 2.5 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from this subwatershed.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
Town of Spencer (MAR041162)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
DWM field crews noted sand deposits coming from Route 49 at one water quality monitoring station (SM02, Route 49 Bridge, Spencer). Slight erosion was noted at this site in addition to sand deposits. On April 16th 2003 the sand deposits were characterized as "forming large delta from Route 49" and it was noted that the road lacks a catch basin (Appendix B).

Biology
MA DFG stocks the Sevenmile River with trout (MA DFG 2007).

Water Chemistry
DWM conducted water quality monitoring at one station (SM02, Route 49 Bridge, Spencer) along this segment of the Sevenmile River between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). Generally pH was slightly less than the criterion. On one occasion (during worst-case conditions) dissolved oxygen did not meet the criterion. Ammonia-nitrogen and total phosphorus concentrations at Station SM02 were generally low.

The *Aquatic Life Use* is assessed as support for this segment given generally good water quality conditions.

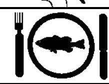
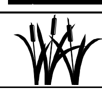
Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (SM02, Route 49 Bridge, Spencer) along this segment of the Sevenmile River between April and October 2003 (Appendix B). Bacteria counts during both wet and dry weather at this site were low with the exception of October 15th, which had a bacteria count of 440 cfu/100mL and represents a wet weather sampling event. The geometric mean of *E. coli* counts was 42.0 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	< 2-1100
Geometric mean	89.3
E. coli (cfu/100mL)	<2 - 440
Geometric mean	42.0

DWM field crews did not find any objectionable deposits with the exception of two occasions where sand deposits coming from Route 49 were observed. Slight erosion was noted at this site in addition to sand deposits. No water odors or scums were noted except on one occasion when a chlorine smell was noted and an oil sheen was found. Water clarity was generally recorded as slightly turbid.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on low bacteria counts. Elevated bacteria counts found during wet weather sampling by DWM are a cause of concern. Elevated bacteria counts at the Route 49 bridge found by ESS in 2002 during both dry and wet weather are also a cause of concern (ESS 2005). Given these facts this segment is given “Alert Status” for *Primary Contact Recreation Use*. Given the general lack of objectionable conditions at this location the *Aesthetics Use* is assessed as support.

Sevenmile River (Segment MA36-12) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
The recommendations of the Quaboag and Quacumquasit Ponds TMDL (MassDEP 2006b) affecting this tributary should be implemented.

Best management practices should be instituted to stop sand deposition in the Sevenmile River where it crosses under Route 49 in Spencer. A habitat walk should be conducted to determine the extent of sand deposition and quality of habitat along this reach.

Macroinvertebrate sampling should be conducted to determine water quality and assess *Aquatic Life Use* in this segment.

Effluent from the Spencer WWTP generally has greater copper concentrations than its permitted value and may have adverse affects on aquatic life in the upper part of this segment. Recently a copper removal optimization engineering report required by an Administrative Order from the EPA was written for the town of Spencer. The engineering report outlines steps to reduce copper in town drinking water and treatment techniques available at the Spencer WWTP to reduce copper concentrations in the plants effluent. Copper testing in the upper Sevenmile River to document conditions before any future Spencer WWTP upgrades may be conducted.

EAST BROOKFIELD RIVER (SEGMENT MA36-13)
Location: Outlet Lake Lashaway East Brookfield to Quaboag Pond, East Brookfield
Segment Length: 2.4 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
East Brookfield Water Department Registration # 20808401
Brookfield Water Department Registration # 20804501

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
Flow into the East Brookfield River is controlled by the outlet structure on Lake Lashaway. During the fall the outlet structure is adjusted to release water in order to draw down the lake. This management practice was instituted in 1984 to prevent excessive macrophyte growth and has been conducted annually since then.

Biology
In July and August the invasive species fanwort (*Cabomba carolinia)* was found at in the river near Shore Road (Station EB04A). The close proximity to Quaboag Pond explains the presence of many pond plant species found there.

Water Chemistry
DWM conducted water quality monitoring at two stations (EB04 – below Lake Lashaway outlet structures and EB04A – Shore Road, East Brookfield) along this segment of the East Brookfield River between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). These stations were also part of DWM 2003 TMDL monitoring for Quaboag Pond. For a complete analysis of nutrients loading in and from the East Brookfield River consult *Quaboag and Quacumquasit Ponds Total Phosphorus Total Maximum Daily Load* (Mass DEP 2006b). Station EB04 meets all criteria and its location below Lake Lashaway makes it very different from EB04A, which is located below a large wetland.

Station EB04A has lower temperature and generally lower pH than Station EB04. Station EB04A did not meet the dissolved oxygen criterion on four occasions. It's location below a large swamp may be the cause of the low dissolved oxygen levels found there. Nutrient concentrations (ammonia-nitrogen and total phosphorus) at both EB04 and EB04A were fairly low.

Although the first 0.6 miles of this segment, from Lake Lashaway to the confluence with the Sevenmile River exhibits good water quality conditions it is assessed as impaired for the entire length due to the presence of the non-native plant species, *Cabomba caroliniana* [see below] The lower 1.85 miles of the river, from the confluence with the Sevenmile River to Quaboag Pond, is assessed as impaired based on low dissolved oxygen concentrations and best professional judgement.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (EB04 – below Lake

Lashaway outlet structures and EB04A – Shore Road, East Brookfield) along this segment of the East Brookfield River between April and October 2003 (Appendix B). All samples collected at both stations had low bacteria counts. The geometric mean of *E. coli* counts was less than 15 cfu/100 mL at both stations.

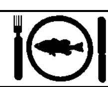
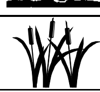
Parameter	DWM 2003 EB04 (n=12)	DWM 2003 EB04A (n=12)
Fecal coliform (cfu/100mL)	<2-100	<2 - 152
Geometric mean	12.2	16.9
E. coli (cfu/100mL)	<2-90	<0.9 – 100
Geometric mean	9.4	10.6

On four occasions DWM field crews noted objectionable deposits at Station EB04. Limited trash was found on one occasion, sunken concrete debris on another occasion and two flocculent masses on two occasions (one rust colored). On the majority of occasions DWM field crews did not note any objectionable deposits. Water odor was not noted with the exception of a musty smell on one occasion and a fishy smell on two occasions. White foam was generally noted at this station, but was considered to be naturally-occurring. Water clarity was often slightly turbid, otherwise it was clear. The west bank (opposite lake discharge pipe) was observed to be eroding according to DWM field crews.

DWM field crews did not find any objectionable deposits at Station EB04A during the sampling season. No water odors or scums were noted. No shoreline erosion was found and water clarity was generally slightly turbid. Field crews found sparse to dense amounts of many different types of aquatic plants (submerged, emergent and floating) during the sampling season.

Both *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on low bacteria counts. Given the generally good aesthetic conditions found at both stations the *Aesthetics Use* is assessed as support.

East Brookfield River (Segment MA36-13) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants, low DO Source: Introduction of non-native organisms, Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

RECOMMENDATIONS

Implement recommendations of the Quaboag and Quacumquasit TMDL (MassDEP 2006b) with special attention to the recommended slow drawdown of Lake Lashaway in the fall.

Due to the presence of large wetlands in the lower section of this segment and Lake Lashaway's impact on the upper section of this segment it is difficult to find an ideal sampling location to assess this segment. Multiple multiprobes could be deployed along this segment especially at the beginning of the wetland-influenced section of this segment and also at the confluence with Sevenmile River to evaluate the dissolved oxygen regime.

On-going non-native plant control in Lake Lashaway should continue in order to keep source populations from spreading to the East Brookfield River at a minimum. A stream walk to determine the extent and amount of non-native plants in the East Brookfield River should also be conducted.

QUABOAG RIVER (SEGMENT MA36-14)
Location: Outlet of Quaboag Pond, Brookfield, to Route 67 bridge, West Brookfield.
Segment Length: 6.1miles.
Classification: Class B, Warm Water.

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, "No Uses Assessed" (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
For a two-mile section the channel bottom of the Quaboag River in West Brookfield is perched, or higher in elevation, than the channel bottom at the outlet of Quaboag Pond (MassDEP 2006b).

Biology
MA DFG conducted fish population sampling in the Quaboag River near the Route 148 bridge in Brookfield (Site 892) on 29 September 2003 using a boat shocker (Richards 2006). Thirty-seven bluegill, twenty-three yellow perch, twenty-one chain pickerel, fifteen golden shiner, eleven pumpkinseed, nine largemouth bass, three creek chubsucker, one black crappie, one brown bullhead, one American eel, one white sucker and one yellow bullhead were collected (124 fish total). The fish sample was heavily dominated by macrohabitat generalist species, which is to be expected given the nature of this reach. The reach is slow, meandering and wetland dominated. Sampling efficiency may have been affected by very poor visibility due to deep and silty water.

DWM conducted water quality monitoring at two stations (QA100 – Route 148, Brookfield and QAOBO –Long Hill Road bridge, West Brookfield) along this segment of the Quaboag River between April and October 2003 (Appendix B). DWM crews made notes of conditions at these sites throughout the sampling season. At Station QA100 phytoplankton was not found with the exception of May 14th when a moderate population was found. Early in the field season sparse coverage of emergent aquatic plants was found. Between June and October a moderate density of aquatic plants (emergent, submerged, and floating) was found at this site. Many pond species were found at this site consistent with its wide shallow nature with extensive wetlands and location below Quaboag Pond. During the first three survey dates moderate coverage of green algae was found on the river bottom, while during the remainder of the sampling season sparse to moderate coverage of thin brown films were noted (Appendix B).

At Station QAOBO sparse to moderate density of aquatic plants was found throughout the sampling season. Arrowhead (*Sagittaria* sp.), lily pads and grass and rush-like plants were found. A moderate phytoplankton was found on August 20th, although generally phytoplankton was not noted. No periphyton coverage was recorded early in the sampling season but by July a moderate coverage of green filamentous algae was found. A moderate coverage of green algae was also found in August, but in October periphyton coverage was not found (Appendix B).

Water Chemistry
DWM conducted water quality monitoring at two stations (QA100 – Route 148, Brookfield, and QAOBO –Long Hill Road bridge, West Brookfield) along this segment of the Quaboag River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. These stations were also part of DWM 2003 TMDL monitoring for Quaboag Pond. Grab samples were also collected and analyzed at both stations for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen was slightly low (4.4 mg/L) and did not meet the criterion at Station QA100 on two occasions (one occasion; pre-dawn worst-case conditions). There are large wetland areas along the Quaboag River near Station QA100.

Dissolved oxygen did not meet the criterion on three occasions (two occasions; pre-dawn worst-case measurements) at Station QAOBO. The extremely low dissolved oxygen concentration (1.9 mg/L) on August 21st, 2003 at Station QAOBO is a concern (Appendix B). A moderate phytoplankton bloom was also noted at this station on August 20th, 2003 during dry weather conditions (Appendix B). Large wetlands are also present just upstream from Station QAOBO. Given the presence of large area of wetlands directly upstream, dry weather conditions, and the fact that the Long Hill Road bridge and the nearby railroad bridge are flow constriction points for the Quaboag River, low dissolved oxygen at this station may be naturally-occurring. pH was below the criterion on occasion but generally met standards. More information on the frequency and duration of low dissolved oxygen at both sites is needed. Total phosphorus concentrations were slightly elevated throughout the summer at both sites. Ammonia-nitrogen concentrations were low at both sites (Appendix B).

The *Aquatic Life Use* is assessed as support for the upper 1.9 miles given the generally good water quality conditions while the lower 4.2 miles is not assessed given uncertainty over whether low dissolved oxygen is naturally-occurring because of the large wetland areas and meandering nature of this reach of the river. The segment is given an “Alert Status” due to the low dissolved oxygen values recorded at both locations.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at two stations (QAOBO – Long Hill Road bridge, West Brookfield, and QA100 – Route 148, Brookfield) along this segment of the Quaboag River between April and October 2003 (Appendix B). On 15 October 2003 the *E. coli* count was 460 cfu/100ml at Station QA100 and represents wet weather sampling. All other bacteria counts at the two stations were low. The geometric mean of *E. coli* counts was less than 20 cfu/100 mL at both stations.

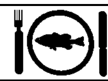
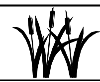
Parameter	DWM 2003 QAOBO 2003 (n=6)	DWM 2003 QA100 (n=6)
Fecal coliform (cfu/100mL)	<2 -410	<2-800
Geometric mean	45.5	15.9
E. coli (cfu/100mL)	<2-120	<2 - 460
Geometric mean	19.7	9.5

No objectionable deposits were found at Station QA100 with the exception of one occasion when limited amounts of plastic bags were noted. DWM field crews noted no scums or water odors. Some limited erosion around a boat launch area was noted early in the sampling season but generally erosion was not noted.

Objectionable deposits in the form of siltation on the left bank from a storm drain and sand deposits on the right bank coming from the road were noted on three occasions at Station QAOBO. Water odor was not noted by DWM field crews and scums were not found with the exception of two occasions when limited patches of scum were noted. Water clarity was clear on all sampling occasions and no erosion was noted.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on the low bacteria counts. Given the general lack of objectionable conditions noted by DWM field crews, the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-14) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT (Upper 1.9 miles)* NOT ASSESSED (Lower 4.2 miles)*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

Multiprobe sampling further downstream at the route 67 bridge in West Brookfield in addition to sampling at the Long Hill Bridge may be warranted to determine the extent and duration of low dissolved oxygen.

FORGET-ME-NOT-BROOK (SEGMENT MA36-18)
Location: Headwaters to North Brookfield WWTP, North Brookfield
Segment Length: 1.7 miles
Classification: Class B, Cold Water Fishery, High Quality Water

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life and Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Toxicity
Ambient
The North Brookfield Wastewater Treatment Facility (WWTF) staff collected water from Forget-Me-Not Brook approximately 10 feet north of East Brookfield Road for use as dilution water in the facility's whole effluent toxicity tests. Between July 2000 and February 2006 survival of *C. dubia* exposed (approximately 7 days) to the Forget-Me-Not Brook water ranged from 80 to 100% (n=23). Between July 2000 and February 2006 survival of *P. promelas* exposed (approximately 7 days) to the Forget –Me-Not Brook water ranged from 63 to 100% (n=23). Three tests were less than 75%. Hardness ranged from 20.0 mg/L to 64.0 mg/L (n=26).

Water Chemistry
DWM conducted water quality monitoring in Forget-Me-Not Brook upstream from the East Brookfield Road bridge in North Brookfield, MA (Station DB08) between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperatures were above 20 degrees C on four occasions while dissolved oxygen concentrations were less than 6 mg/L on three occasions. pH met the criteria on all occasions. Ammonia-nitrogen concentrations in the collected samples were generally low. Total phosphorus concentrations collected during the June, July and August sampling dates were elevated.

The *Aquatic Life Use* is assessed as support given the good survival of test organisms and generally good water quality conditions, however elevated temperatures and elevated total phosphorus concentrations are of concern so this use is identified with an "Alert Status".

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (DB08) along this segment of Forget-Me-Not Brook between April and October 2003 (Appendix B). The two highest *E. coli* counts were 1050 cfu/100mL and 4100 cfu/100mL during the June and October sampling dates, respectively. These high bacteria counts were collected during wet weather sampling while bacteria counts were low during dry weather conditions. The geometric mean of *E. coli* counts was 100.5 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 6000
Geometric mean	183.3
E. coli (cfu/100mL)	<2 - 4100
Geometric mean	100.5

No objectionable deposits were found at Station DB08 with the exception of one occasion when a heavy, rusty brown bottom floc was noted. No scums were found and no water odors were noted with the exception of one date when a musty water smell was noted. Water clarity was generally slightly turbid at this location and no streambank erosion was noted.

The *Primary* and *Secondary Contact Recreation Use* are assessed as support as the geometric mean of *E. coli* counts meets the criterion. Due to the two elevated bacteria counts these uses are identified with an "Alert Status". The *Secondary Contact Recreation Use* is assessed as support given the low geometric mean of *E. coli* counts. The *Secondary Contact Recreation Use* is given an "Alert Status" due to the two elevated bacteria counts. Given the lack of objectionable conditions, the *Aesthetics Use* is assessed as support for this segment

Forget-Me-Not-Brook (Segment MA36-18) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct benthic invertebrate monitoring upstream from the North Brookfield Wastewater Treatment Facility in this segment and in the downstream segment to assess the impact of the treatment plant on Forget-Me-Not Brook and assess *Aquatic Life Use*.

Conduct temperature monitoring on Forget-Me-Not Brook to determine whether it is meeting temperature standards for a cold water fishery.

Conduct bacteria source tracking at Station DB08 to determine the source of high wet weather bacteria counts.

Conduct water chemistry monitoring above the North Brookfield Wastewater Treatment Plant to compare to values below the treatment plant

FORGET-ME-NOT-BROOK (SEGMENT MA36-28)
Location: North Brookfield WWTP, North Brookfield, to confluence with Dunn Brook, East Brookfield/Brookfield
Segment Length: 1.3 miles.
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Cause unknown, unknown toxicity, organic enrichment/low DO, taste, odor and color (MassDEP 2007b).

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Town of North Brookfield- North Brookfield Wastewater Treatment Facility (MA0101061)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
DWM conducted water quality monitoring at one station (DB07) along this segment of Forget-Me-Not Brook downstream from the North Brookfield Wastewater Treatment Plant's discharge between May and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. Moderate densities of green algae and sparse to moderate densities of thin, brown film algae were found on substrates at this site during the sampling season. A brown floc on the stream bottom was also found on August 20th. Sparse and moderate amounts of phytoplankton were found on May 14th and June 18th, respectively, although none were found on the other survey dates. Sparse densities of grasses were found early in the sampling season but later in the sampling season no aquatic plants were noted.

MA DFG conducted fish population sampling in Forget-Me-Not-Brook at the West Main Street crossing in North Brookfield (Site 1391) on 4 August 2005 using a backpack electro-shocker (Richards 2006). Nine white sucker, seven blacknosed dace, three yellow bullhead, two chain pickerel, one pumpkinseed, and one bluegill were collected (23 fish total). MA DFG fish biologists noted that they sampled 90% of the sample reach and that the water was cloudy.

Toxicity
Effluent
Whole effluent toxicity tests have been conducted on the North Brookfield Wastewater Treatment Facility (WWTF) treated effluent. Between July 2000 and May 2007 twenty-eight valid chronic tests were conducted using *C. dubia* and 30 using *P. promelas.* The chronic whole effluent toxicity tests using *C. dubia* were all 100% effluent (n=28) with the exception of five occasions. Generally no distinct pattern relating effluent chemistry and the poor *C. dubia* CNOEC tests exists, although in February 2005 ammonia-nitrogen was elevated. The chronic whole effluent toxicity tests using *P. promelas* were all 100% (n=23) with the exception of July 2001 which was 25%. In the May 2007 CNOEC test, using *P. promelas,* significant effects were observed in 25% effluent, although the lab reported CNOEC = 100% effluent. Results of the LC_{50} were all $\geq$100% effluent. Ambient toxicity tests for the North Brookfield Wastewater Treatment plant were sampled upstream of the treatment plant in Forget-Me-Not-Brook (Segment MA36-18) and are detailed in that segment.

Water Chemistry
DWM conducted water quality monitoring in Forget-Me-Not Brook downstream from the East Brookfield Road bridge in North Brookfield, MA (Station DB07), between May and October 2003 (Appendix B). This station is downstream from the North Brookfield Wastewater Treatment Plant's discharge. *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All dissolved oxygen, pH and temperature measurements met standards at the DWM monitoring station. Ammonia-nitrogen concentrations were low in the samples collected by DWM although total phosphorus concentrations were all elevated.

The *Aquatic Life Use* is assessed as support given the good water quality conditions. However, the segment is given an “Alert Status” due to the observed chronic effluent toxicity of the North Brookfield Wastewater Treatment Plant’s discharge and the elevated total phosphorus concentrations.

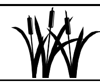
Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (DB07) along this segment of Forget-Me-Not Brook between April and October 2003 (Appendix B). *E. coli* bacteria counts were elevated on two wet weather sampling events. The highest *E. coli* count of 5100 cfu/100 mL was measured on 15 October 2003, a wet weather sampling event. Station DB08 is located downstream from the North Brookfield Wastewater Treatment Plant’s discharge. During dry weather *E. coli* counts were low or at the treatment plant’s permitted discharge (200 cfu/100mL). Although wet weather sampling events generally had high bacteria counts, the May sampling date low bacteria counts are the exception to this generalization. The geometric mean for *E. coli* at Station DB08 is 194.9 cfu/ 100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	96 - 5200
Geometric mean	255.3
E. coli (cfu/100mL)	60 – 5100
Geometric mean	194.9

No objectionable deposits or scums were noted although the water was often found to have either a septic or musty smell. The septic smell is not surprising given the station’s close proximity to the treatment plant’s discharge. On one occasion a slight chlorine smell was noted in addition to a septic smell. A brown floc on the stream bottom was also found on August 20th. The water clarity was clear, slightly turbid and highly turbid on two occasions each. No erosion was noted at this site. The MA DFG fish sampling crew also noted the water column was cloudy.

The *Primary Contact Recreation Use* is impaired for Forget-Me-Not Brook due to the elevated geometric mean of *E. Coli* counts. The *Secondary Contact Recreation Use* is assessed as support as the geometric mean of *E. coli* counts meets the criterion. The *Secondary Contact Recreation Use* is given an “Alert Status” due to the one elevated bacteria count. The *Aesthetics Use* is supported given the general lack of objectionable conditions, but is given an “Alert Status” due to the noted water odors and turbidity at Station DB08.

Forget-Me-Not-Brook (Segment MA36-28) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct benthic invertebrate monitoring downstream of the North Brookfield Wastewater Treatment Facility in this segment to assess the impact of the treatment plant on Forget-Me-Not Brook and assess *Aquatic Life Use*.

Conduct water chemistry monitoring below the North Brookfield Wastewater Treatment Plant. The presence of a beaver dam along this segment should be verified and investigated before any future sampling.

DUNN BROOK (SEGMENT MA36-19)
Location: From confluence with Forget-Me-Not Brook, East Brookfield/Brookfield, to confluence with Quaboag River, Brookfield
Segment Length: 2.4 miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3- No Uses Assessed (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
Wetlands are present along much of this segment. A large wetland and beaver dam area is located in the upper part of this segment. Immediately upstream (<500 feet) from the DWM sampling station (DUN01 – Quaboag Street, Brookfield) there is a beaver dam along with sizeable wetland areas.

Biology
DWM conducted water quality monitoring at one station (DUN01) in Dunn Brook between May and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. Sparse to moderate amounts of aquatic plants were found during the sampling season and included mosses, duckweed, various emergents and pond plants. Dense green filamentous algae were found on substrates in April and July while green filamentous coverage was sparse in May. Moderate densities of a brown alga were found on substrates on the June, August and October survey dates. Sparse to moderate abundances of phytoplankton were noted throughout the sampling season.

Water Chemistry
DWM conducted water quality monitoring at one station (DUN01 – Quaboag Street, Brookfield) along Dunn Brook between May and October 2003 (Appendix B). *In-situ* parameters were measured on eight occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B). DWM sampled at DUN01 at the Quaboag Street bridge.

pH was always within 0.5 standard units of the criterion. Dissolved oxygen at Station DUN01 was generally low (minimum 2.6 mg/L) and was below the criterion on four occasions (three worst case conditions). The minimum measured dissolved oxygen value was 2.6 mg/L during the morning of 30 July 2003. On 14 May 2003 dissolved oxygen was 7.5 mg/L, the maximum measured value at this station. Ammonia-nitrogen concentrations were low at this station. Total phosphorus concentrations were elevated (as high as 0.23 mg/L) (Appendix B).

It is unclear the exact cause of low dissolved oxygen concentrations and evidence of nutrient enrichment found in Dunn Brook. It should be noted that the station on this segment of Dunn Brook is located downstream from a beaver dam and a large wetland area as well as being below the North Brookfield Wastewater Treatment Plant (MA0101061). It should also be noted that the stretch of the brook above Route 9 and downstream from the sampling station is very low gradient. The North Brookfield WWTP has reduced their load of biological oxygen demand (BOD) and under their new permit will achieve more stringent total phosphorus limits (Appendix D). Low dissolved oxygen has been documented upstream from the route 9 crossing of Dunn Brook as far back as the 1970's (Firmin 1981). Discharge monitoring reports of the North Brookfield Wastewater Treatment Plant's effluent during the months of June, July and August 2004 indicated that BOD was less than 3.5 mg/L (monthly average) (MassDEP undated).

Therefore, at this time low dissolved oxygen readings are considered natural given the sampling stations immediate proximity to a beaver dam and a large wetland area.

The *Aquatic Life Use* for Dunn Brook is not assessed due to lack of sufficient data given the complexity of the system. The *Aquatic Life Use* is given an “Alert Status” due to the low dissolved oxygen and elevated total phosphorus concentrations.

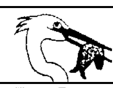
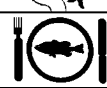
Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (DUN01) along Dunn Brook on five occasions between April and October 2003 (Appendix B). *E. coli* bacteria counts were generally low during both dry and wet weather sampling with the exception of 15 October 2003. The highest *E. coli* count of 960 cfu/100 mL was measured on 15 October 2003, a wet weather sampling event. The geometric mean of the *E. coli* counts is 37.6 cfu/100 mL.

Parameter	DWM 2003 (n=5)
Fecal coliform (cfu/100mL)	<2 -1400
Geometric mean	47.5
E. coli (cfu/100mL)	4 - 960
Geometric mean	37.6

No objectionable deposits or scums were noted by DWM field crews at this location. No water odors were found with the exception of one occasion when the water had a musty odor. Water clarity was generally slightly turbid.

The *Primary Contact and Secondary Contact Recreation Uses* are assessed as support based on the low geometric mean of *E. coli* counts. The Primary Contact Recreation Use is identified with an “Alert Status” due to the one elevated bacteria count. Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Dunn Brook (Segment MA36-19) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESED*
Fish Consumption		NOT ASSESED
Primary Contact		SUPPORT*
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct biological monitoring to assess the *Aquatic Life Use*.

Conduct multiprobe monitoring with the intent of determining dissolved oxygen dynamics in this system.

QUABOAG RIVER (SEGMENT MA36-15)
Location: Route 67 bridge West Brookfield, to Warren WWTP, Warren
Segment Length: 6.3miles
Classification: Class B, Warm Water Fishery

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Aquatic Life and Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1)
William E. Wright Limited Partnership (MAG2500031) (MA0001074)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
DWM conducted water quality monitoring at one station (QA06A – Gilbert Road bridge- Warren) along this segment of the Quaboag River between May and October 2003. DWM crews made notes of conditions at this site throughout the sampling season. DWM field crews did not note phytoplankton and only once a sparse coverage of aquatic plants were found. In May a sparse coverage of green filamentous algae was found on substrates while in July a moderate coverage of brown thin films was noted. In August a sparse coverage of periphyton was found (Appendix B).

MA DFG conducted fish population sampling in the Quaboag River near River Street in Warren (Site 886) on 30 July 2003 using barge shocking (Richards 2006). Forty-five redbreast sunfish, twelve bluegill, eight yellow bullhead, five fallfish, four tessellated darter, three largemouth bass, two American eel, one chain pickerel and one pumpkinseed were collected (81 fish total). MA DFG fish biologists noted low sampling efficiency due to reach width and the lack of riffle to stop fish.

MA DFG conducted fish population sampling in the Quaboag River near the intersection of Route 67 and Gilbert Road (upstream from the Warren Wastewater Treatment Plant and downstream from a dam-Site 871) in Warren on 29 July 2003 using backpack electro-shocking (Richards 2006). Seventeen longnose dace, nine redbreast sunfish, eight bluegill, three smallmouth bass, three brown bullhead, two yellow bullhead, two white sucker, two fallfish, two eastern blacknose dace, one American eel, and one pumpkinseed were collected (50 fish total). MA DFG fish biologists used two backpacks to electroshock and estimated sampling efficiency at 25% due to the river's width.

Although macrohabitat generalist species dominated both fish samples MA DFG noted very low sampling efficiencies due the river's width and/or lack of riffle to stop fish. Despite the low abundance the presence of fallfish, tessellated darter, longnose dace, eastern blacknose dace, and white sucker (fluvial species) is indicative of a stable flow regime.

<u>Toxicity</u>
Ambient
The Warren Treatment Plant staff collected water from the Quaboag River (MA36-15) at Gilbert Street, approximately 500 feet upstream from the discharge site, for use as dilution water in the facility's whole effluent toxicity tests. Between September 2000 and November 2005 survival of *C. dubia* exposed (approximately 7 days) to the Quaboag River water ranged from 90 to 100% (n=21). Between September 2000 and November 2001 survival of *P. promelas* exposed (approximately 7 days) to the Quaboag River water was 100% (n=1). Hardness ranged from 12.0 mg/L to 30.0 mg/L (n=21).

Water Chemistry
DWM conducted water quality monitoring at one station (QA06A – Gilbert Road bridge- Warren) along this segment of the Quaboag River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All measured water quality parameters met criteria and guidelines. Dissolved oxygen was high at this station throughout the sampling season, which is logical given the station's location below a dam. Ammonia-nitrogen concentrations at Station QA06A were generally low, but total phosphorus concentrations were slightly elevated during the majority of the sampling season.

The *Aquatic Life Use* is assessed as support given the good survival of test organisms and good water quality conditions.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (QA06A – Gilbert Road bridge- Warren) along this segment of the Quaboag River between April and October 2003 (Appendix B). *E. coli* counts were generally low during both wet and dry weather sampling events with the exception of 15 October 2003. The highest *E. coli* count of 690 cfu/100 mL was measured on that date, a wet weather sampling event. Wet weather *E. coli* counts at this station were generally higher than when compared to dry weather counts. The geometric mean of *E. coli* counts was 47cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -800
Geometric mean	112
E. coli (cfu/100mL)	<2 - 690
Geometric mean	47.2

With the exception of May 14, 2003, when garbage and trash were noted on the banks, no objectionable deposits were found. No water odor was noted, but white foam was often found issuing from the upstream dam. No other scums were noted and the white foam is considered naturally-occurring. Water clarity was generally listed as clear or slightly turbid during the sampling season.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as support based on the low geometric mean of *E. coli* counts. Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-15) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		SUPPORT
Aesthetics		

RECOMMENDATIONS

Conduct macroinverterbrate sampling along this segment to assess the *Aquatic Life Use*. A station along Route 67 west of Warren center is recommended.

QUABOAG RIVER (SEGMENT MA36-16)
Location: Warren WWTP, Warren, to the Route 32 bridge, Palmer/Monson
Segment Length: 8.7miles
Classification: Class B, Warm Water Fishery, CSO**

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens, taste, odor and color (MassDEP 2007b).

** Although the river as defined in the 2006 standards inclusive of this segment has a CSO qualifier, there are no CSOs in this segment, so the CSO qualifier does not apply to this segment. All class B standards apply.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from this subwatershed.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2)
Town of Warren-Warren Treatment Plant (MA0101567)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
The USGS maintain a gage in West Brimfield, MA, on the Quaboag River (Gage 01176000) 10 feet upstream from abandoned highway bridge site at West Brimfield, 0.9 mi upstream from Blodgett Mill Brook. The drainage area is 150 mi^2 and the period of record is from August 1909 to July 1912 (twice daily gage height) and August 1912 to present *(Socolow et al. 2004)*. The average discharge is 249 cfs (1912-2005) (USGS 2007). The maximum discharge occurred on 19 August 1955 (12,800 cfs) and the minimum discharge occurred on 28 and 29 September 1957 (6.6 cfs) *(Socolow et al. 2004)*. The USGS remarks that before 1956 slight diurnal fluctuation at low flow was caused by a mill upstream. Since 1965 high flow has been slightly affected by retarding reservoirs *(Socolow et al. 2004)*. The estimated daily discharge is considered to be poor by the USGS, but otherwise records at this gage are considered good.

Biology
MA DFG conducted fish population sampling in the Quaboag River near Route 67 and Warren Street above both a Route 67 rest area and an unnamed tributary on the Warren/Palmer border (Site 876) on 30 July 2003 using backpack shocking (Richards 2005). Eleven longnose dace, eight fallfish, seven white sucker, six smallmouth bass, three eastern blacknose dace, two golden shiner, one bluegill, one rock ass, one pumpkinseed, and one tessellated darter were collected (41 total fish). MA DFG fishery biologists noted that two backpacks were used on the Quaboag River's channel on both sides of the river while the middle of the river was not sampled. MA DFG fishery biologists also noted that some white suckers were not collected due to fast flow.

MA DFG conducted fish population sampling in the Quaboag River near a Route 67 rest area and the USGS gage in West Brimfield (Site 880) on 30 July 2003 using barge shocking (Richards 2006). Eleven white sucker, nine redbreast sunfish, seven bluegill, five yellow perch, five longnose dace, three American eel, three tessellated darter, two yellow bullhead, two blacknosed dace, two rock bass, two smallmouth bass, one common shiner, one largemouth bass, and one pumpkinseed were collected (54 fish total). MA DFG fishery biologists noted that they shocked two large pool areas with poor results.

Toxicity

Effluent

Whole effluent toxicity tests have been conducted on the Warren Treatment Plant treated effluent. Between September 2000 and November 2005, nineteen valid chronic tests were conducted using *C. dubia*. The chronic whole effluent toxicity tests using *C. dubia* ranged between 13.0 to 100% effluent (n=19), all of which meet the permit limit of >13.0, except for May 2001 which was exactly 13.0%. Results of the LC_{50} for *C. dubia* were all $\geq$100% effluent, with the exception of the LC_{50} of 38.0% in May 2003 and the LC_{50} of 66.0%.in May 2004.

Water Chemistry

DWM conducted water quality monitoring at one station (QRG- near USGS flow gauging station 01176000) along this segment of the Quaboag River between May and October 2003 (Appendix B). Station QRG is also the MassDEP, Central Regional Office's Strategic Monitoring and Assessment for River Basin Team (SMART) station. CERO crews conduct water quality monitoring at this location throughout each year. CERO data collected between 2001 and 2003 are summarized in this report. Between both crews *in-situ* parameters were measured on nine occasions at Site QRG in 2003 with three measurements during pre-dawn hours. Grab samples were also collected and analyzed for TSS, turbidity and nutrients at this site (Appendix B).

All water quality parameters at Station QRG met state standards with the exception of a single pH value on one occasion (Appendix B). Dissolved oxygen concentrations were generally close to saturation. Ammonia-nitrogen concentrations were generally low at this station. Most of the total phosphorus concentrations at Station QRG were greater than 0.05 mg/L (Appendix B, MassDEP 2006a). Nitrate-nitrite-nitrogen concentrations were generally low at this station while total Kjeldahl nitrogen concentrations were on average around 0.5 mg/L. For a summary of water quality data collected at Station QRG by both crews see table below.

Parameter	DWM 2003	CERO (2001-2003)
DO (mg/L)	7.4-10.7 (n =4)	8.1 – 14.6 (n =16)
pH (SU)	7.0 – 7.4 (n =4)	6.1 – 8.1 (n =16)
Temperature (℃)	15.3 – 23.5 (n =4)	-0.08 – 24.6 (n =16)
Conductivity (µS/cm at 25℃)	117 –173 (n =4)	102 – 377 (n =16)
Ammonia- nitrogen (mg/L)	<0.02 (n =1)	<0.02 – 0.17 (n =15)
Nitrate – nitrite nitrogen (mg/L)	--	<0.06 – 0.45 (n =15)
TKN (mg/L)	--	0.19 – 0.55 (n =15)
Total phosphorus (mg/L)	0.049 (n =1)	0.026 – 0.20 (n =16)
Alkalinity (mg/L)	--	4 – 22 (n =15)
Hardness (mg/L)	--	7 – 25 (n =15)
Total suspended solids (mg/L)	5 (n =1)	<1 – 7.3 (n =15)
Turbidity (NTU)	1.3 (n =1)	0.87 – 3.8 (n =15)

Given the good water quality conditions this segment of the Quaboag River is assessed as support for *Aquatic Life Use*. This segment is given an "Alert" Status though due to elevated total phosphorus concentrations measured at Station QRG.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (QRG, near USGS Gage 01176000) along this segment of the Quaboag River between May and October 2003 (Appendix B). Four bacteria samples were collected during the 2003 sampling season by either DWM or CERO crews. The samples collected represent both wet and dry weather conditions. Two of the samples had low *E. coli* counts (both wet and dry weather sampling) while the other two samples during dry weather sampling had slightly elevated *E. coli* counts. The geometric mean of *E. coli* counts was 47.7 cfu/ 100 mL.

Parameter	DWM 2003 (n=4)
Fecal coliform (cfu/100mL)	6 - 380
Geometric mean	78.4
E. coli (cfu/100mL)	<2 - 300
Geometric mean	47.7

Both DWM and CERO crews found garbage and trash throughout the 2003 survey season at this site (tires, old appliances, metals, floatables, assorted trash, etc) and on two occasions May 14th and October 22nd sand and silt deposits were noted. The trash and debris at this site are believed to be localized. Water odor was not noted by DWM or CERO crews during 2003. Scums were not noted with the exception of small isolated patches of foam found on three occasions by CERO crews. MassDEP field crews noted some minor erosion. Water clarity was generally clear although slightly turbid on two occasions. DWM and CERO crews noted that the water color was typically reddish at Station QRG. Hardwick Knitters and Wm. E. Wright both have industrial discharges that go to the Warren WWTP plant (Kimball 2007a). Both companies use dyes and Wm. E. Wright attempted to pre-treat their discharge before treatment at the Warren WWTP while Hardwick Knitters have reduced their effluent color through operational changes (Kimball 2007a). These dyes may explain the reddish color seen in the field by crews although natural conditions are also indicated. Recently in December 2006 Wm. E. Wright announced that they were closing their operations in Warren. Hardwick Knitters has also recently gone out of business.

Since only four bacteria samples were collected at this site and five samples are required to assess both contact uses, both the *Primary* and *Secondary Contact Recreation Uses* are not assessed. Given the localized nature of objectionable conditions the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-16) Use Summary Table

Designated Uses	Status
Aquatic Life	SUPPORT
Fish Consumption	NOT ASSESSED
Primary Contact	NOT ASSESSED
Secondary Contact	NOT ASSESSED
Aesthetics	SUPPORT

RECOMMENDATIONS

Conduct macroinverterbrate sampling to assess the *Aquatic Life Use* along this segment.

Collect an adequate number of bacteria samples along this segment to assess *Contact Recreational Uses*.

QUABOAG RIVER (SEGMENT MA36-17)
Location: Route 32 bridge, Palmer/Monson, to the confluence with Ware River, forming headwaters of Chicopee River, Palmer
Segment Length: 5.3 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Palmer Water Department registration (10822702)
Three Rivers Fire District registration/permit (10822701/9P210822701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Town of Palmer (MAR041017)
Palmer WWTP (MA0101168)

Palmer WWTP (MA0101168) is permitted to discharge an estimated 21 MG per year of combined sewage via 14 wet weather CSOs along this segment of the Quaboag River. Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges (MassDEP 2001). Sewer separation work to eliminate 13 of the 14 CSO discharges into this segment of the Quaboag River is included in the first three phases of work. In 1999 the Town of Palmer submitted a request for MA SRF financing for the first three phases of work and in November 1999 was selected to receive financing for $7.1 million dollars. Sewer separation was approved by the MassDEP in December 2000 as part of CW SRF-423. The regulations in thirteen of the fourteen CSOs were plugged in 2003 (Boisjolie, 2005). CSO Outfall #008 (near Pump Station #2, on Route 181) is the one CSO in Palmer on the Quaboag River that was not scheduled to be eliminated in the first 3 phases of sewer separation work. Modeling of this CSO, however, indicates that it has little discharge (does not discharge during a three-month storm) (Boisjolie 2001). Currently CSO #008 is still active (Boisjolie, 2007).

An EPA superfund site is located at the PCS Resources site at 10 Water Street, Palmer, MA. This site has undergone significant remedial action and is the subject of continued monitoring. According to the EPA, groundwater contamination is mainly benzene and methylene chloride (volatile organic compounds). Polychlorinated biphenyls (PCBs), including Aroclor-1248 and Aroclor-1260, and lead have also been found in soils on this site in the past (EPA 2006). Contamination has been found in soils on site and groundwater in nearby wetlands. Cleanup of the contaminated soils and contaminated wetlands soils has been completed. In the 2005 five-year progress report on this site the EPA notes that groundwater contaminants have generally fallen and only benzene and vinyl chloride have exceeded their cleanup targets (EPA 2006). The EPA also notes that surface water cleanup levels in the Quaboag River have been met and the sediment contaminant cleanup levels have been met with the exception of lead, which will continue to be monitored (EPA 2006).

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Water Chemistry
DWM conducted water quality monitoring at one station (QA09A –Palmer Street bridge, Palmer) along this segment of the Quaboag River between April and October 2003 (Appendix B). *In-situ* parameters were measured on nine occasions, including three pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All water quality parameters measured by DWM met criteria. Dissolved oxygen concentrations at Station QA09A were always greater than the criterion and often near saturation, while pH was generally neutral. Ammonia-nitrogen concentrations were low at the DWM station. Total phosphorus concentrations collected at Station QA09A were generally around 0.050 mg/L with the highest sample (0.078 mg/L) collected in June.

Given the good water quality conditions, the *Aquatic Life Use* is assessed as support.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (QA09A –Palmer Street bridge, Palmer) along this segment of the Quaboag River between April and October 2003 (Appendix B*).* The DWM station was downstream from numerous CSOs that were eliminated during the summer of 2003. Without the exact dates when the CSOs were eliminated it is impossible to determine what impacts these CSOs would have on bacteria levels during the 2003 sampling season. It is known, though, that CSO #008 was active during the period of DWM sampling.

E. coli bacteria counts were high on both wet and dry weather sampling dates. The highest *E. coli* count of 2160 cfu/100mL was collected on 15 October 2003 during wet weather sampling. The *E. coli* geometric mean was 156.8 cfu/100 mL and four samples were greater than 235 cfu/100 mL. Only the October sample had an *E. coli* count greater than 1260 cfu/100 mL. Given the high *E. coli* bacteria counts it appears that the CSOs in the Quaboag River were still having an effect on in-stream bacteria levels during DWM sampling, but it is impossible to estimate the extent of their impact.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -410
Geometric mean	277.5
E. coli (cfu/100mL)	<2 - 2160
Geometric mean	156.8

Garbage and trash were noted on the stream banks on two occasions and in-stream trash was noted on two occasions, while on four occasions no objectionable deposits were noted. No water odor was observed. On three occasions white foam was noted while on the majority of occasions no scums were found. Water clarity was generally clear or slightly turbid during the sampling season. A sparse coverage of irises (*Iris* sp*.*) was found throughout the sampling season but no periphyton or phytoplankton were observed. Erosion was found on the right bank, which was undercut at this site.

The *Primary Recreation Contact Use* is assessed as impaired due to elevated *E. coli* bacteria counts. *Secondary Contact Recreation Use* is assessed as support given an *E. coli* geometric mean less than criterion. The *Secondary Contact Recreation Use* is given an "Alert Status" due to the presence of an active CSO discharge and the one high *E. coli* count. Given the general lack of objectionable conditions along this segment, the *Aesthetics Use* is assessed as support.

Quaboag River (Segment MA36-17) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Combined sewer overflows Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Continue bacteria monitoring in this segment below Palmer WPCF CSO #008 to assess recreational contact uses. A bacteria monitoring station in the upper part of this segment (Bridge St., etc) is recommended.

Conduct fish toxics work downstream of the PCS Resources superfund site to assess *Fish Consumption Use*.

Conduct benthic macroinvertebrate and fish population sampling in this segment to assess *Aquatic Life Use*.

CHICOPEE BROOK (SEGMENT MA36-21)
Location: Headwaters, east of Peaked Mountain, Monson, to confluence with Quaboag River, Monson
Segment Length: 9.9 miles
Classification: Class B, Cold Water Fishery

Chicopee Brook Pond (MA36031) will no longer be reported on as an approximately 9-acre lake segment since the estimated retention time of this waterbody is less than one day. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from USGS two stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, “No Uses Assessed” (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Monson Water and Sewer Department registration (10819101)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1)
Double A Plastics Co. Inc. (MAG250027)
Thermotech (MAG250376)
Polymer Injection Molding (MAG250376)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks Chicopee Brook with trout (MA DFG 2007).

Water Chemistry
All designated uses are not assessed due to the lack of quality-assured data available for Chicopee Brook.

Chicopee Brook (Segment MA36-21) Use Summary Table

Designated Uses	Status
Aquatic Life	NOT ASSESSED
Fish Consumption	
Primary Contact	
Secondary Contact	
Aesthetics	

RECOMMENDATIONS
Conduct water quality monitoring (water chemistry, multiprobe, bacteria sampling) to evaluate designated uses.

Conduct fish population sampling and temperature monitoring along this segment to assess the *Aquatic Life Use*. Although listed as a coldwater fishery no recent fish population work has been done.

Chicopee River Subbasin

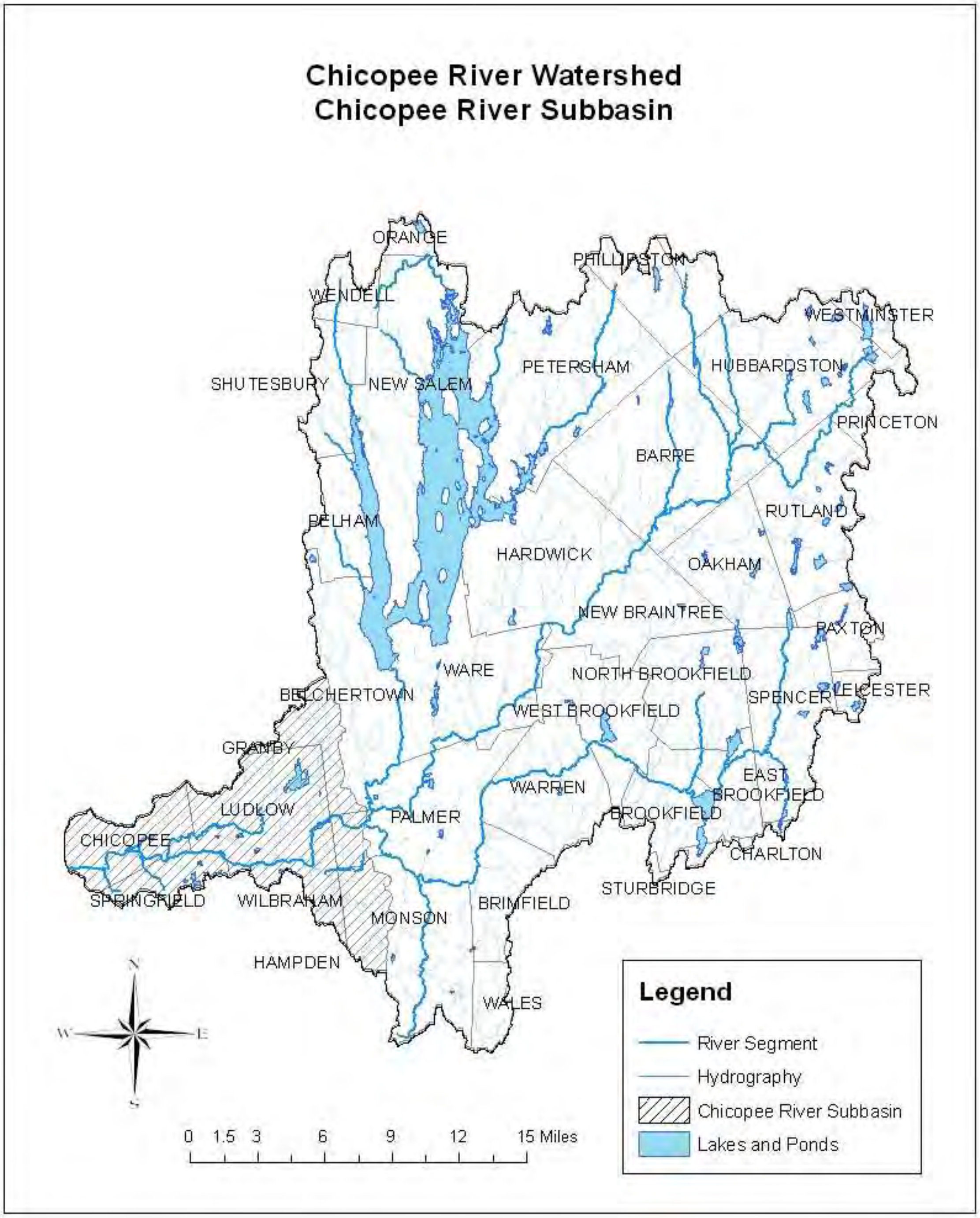


Figure 10: Chicopee River Subbasin

CHICOPEE RIVER (SEGMENT MA36-22)
Location: Source, confluence of Ware River and Quaboag River, Palmer, to Red Bridge Impoundment Dam, Wilbraham/Ludlow
Segment Length: 2.8 miles
Classification: Class B, Warm Water Fishery, CSO

Red Bridge Impoundment (MA36171) will no longer be reported as an approximately 73 acre lake segment since the estimated retention time of this waterbody is approximately one day. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from USGS two stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dam reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D2, D4)
Palmer Waste Water Treatment Plant (WWTP) (MA0101168)
Town of Palmer (MAR041017)
Town of Wilbraham (MAR041025)

Palmer WWTP (MA0101168) is authorized to discharge 5.6 MGD of treated wastewater to the Chicopee River via Outfall 027. The Town's permit was reissued in September 2000. The Palmer WWTP is also permitted to discharge an estimated 4 MG per year of combined sewage via three wet weather CSOs in this segment of the Chicopee River. As of September 2000 CSO #015 (Springfield St., Three Rivers) was blocked. Palmer's May 1999 Final Long Term Control Plan for CSO Abatement identified four phases of sewer separation throughout Palmer to eliminate CSO discharges. Sewer separation work to eliminate two of these three CSO discharges to the Chicopee River is included in the first three phases of work (Appendix E). In 1999 Palmer submitted a request for MA SRF financing for the first three phases of work and in November 1999 was selected to receive financing for $7.1 million dollars. Sewer separation was approved by the MassDEP in December 2000 as part of CW SRF-423. As part of this work all three CSOs in this segment have been blocked in 2003 (Boisjolie, 2005) .The sewer separation work began in 2002 and was completed in spring 2004 (Boisjolie 2007b). In August 2004 an illicit connection to CSO Outfall #014 was removed (Boisjolie 2005). The Town continues to monitor for illicit connections.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Flow is influenced by the Red Bridge Dam hydropower project (see Segment MA36-23 for details).

<u>Toxicity</u>
Effluent
Whole effluent toxicity tests have been conducted on the Palmer Water Pollution Control Facility treated effluent. Between July 2000 and March 2006, twenty-two valid chronic tests were conducted using *C. dubia.* Results of the chronic whole effluent toxicity tests using *C. dubia* ranged from 6.25% to 100% effluent (n=22). Results in June 2001 showed a significant difference in reproduction for 25% effluent. The LC_{50} results were all >100% effluent (n=24) with the exception of September 2004, which was 33.0% effluent (Appendix D).

Water Chemistry

DWM conducted water quality monitoring at one station (CH01 – near the intersection of New Hampshire Avenue and Springfield Street, Palmer) along this segment of the Chicopee River between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen, temperature and pH all met criteria. Ammonia-nitrogen concentrations in samples collected at Station CH01 were low, while total phosphorus concentrations were slightly elevated during the summer (Appendix B).

Given generally good water quality conditions the *Aquatic Life Use* is assessed as support for this segment.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CH01 – near the intersection of New Hampshire Avenue and Springfield Street, Palmer) along this segment of the Chicopee River between April and October 2003 (Appendix B*).* The DWM station is downstream from numerous CSOs and the Palmer WWTP discharge.

DWM sampling dates included both wet weather and dry weather sampling. *E.coli* counts were generally elevated during wet weather sampling but no strong pattern was found relating *E. coli* counts and sampling conditions. Both high and low *E. coli* counts were measured on dry weather sampling dates. The highest *E. coli* count of 1520 cfu/100 mL was found on 15 October 2003, a wet weather sampling date. The geometric mean for *E. coli* was 194.5 cfu/100 mL.

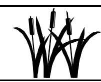
Parameter	DWM 2003 (n=16)
Fecal coliform (cfu/100mL)	20 –1800
Geometric mean	304.7
E. coli (cfu/100mL)	30 - 1520
Geometric mean	194.5

Currently without the exact dates when CSOs were eliminated it is impossible to determine what impacts CSOs would have on bacteria levels during the 2003 sampling season. It is known, though, that CSO #014 had an illicit connection removed in 2004.

No objectionable deposits, scums or water odor were recorded by DWM field crews. Water clarity was generally noted to be clear although on two occasions it was noted to be slightly turbid. Erosion was noted on one occasion only. Aquatic vegetation, periphyton and phytoplankton were unobservable or not observed.

Given the elevated *E. coli* counts, the *Primary Contact Recreation Use* is assessed as impaired. Since the geometric mean for *E. coli* meets the *Secondary Recreation Contact Use* criterion the *Secondary Contact Recreation Use* is assessed as support. The *Secondary Contact Recreation Use* is given an “Alert Status” due to CSO discharges upstream and the one high *E. coli* count. Given the general lack of objectionable conditions along this segment the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-22) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Combined sewer overflows Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Continue to collect bacteria data during wet and dry weather to evaluate the effectiveness of CSO abatement work and assess the *Primary* and *Secondary Contact Recreational Uses*.

Conduct water quality sampling (chemistry and multiprobe) along this segment to assess *Aquatic Life Use.*

CHICOPEE RIVER (SEGMENT MA36-23)
Location: Red Bridge Impoundment Dam to Wilbraham Pumping Station (old WWTP), Wilbraham/Ludlow
Segment Length: 3.8 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

The MassDEP awarded money for the 604(b) grant entitled Chicopee River Watershed Basin Assessment. This project will address watershed assessment needs in the communities of Chicopee, Ludlow, Springfield, and Wilbraham that fall within the Chicopee River Basin. Stormwater infrastructure components will be identified, compiled into a database, and mapped; existing BMPs will be mapped and recommendations for future BMP implementation will be generated; existing water quality data will be compiled into a comprehensive database and analyzed to determine data gaps and to recommend future sampling efforts; and local water quality protection ordinances and bylaws will be reviewed and draft water protection bylaws prepared for communities within the study area.

FERC
Western Mass Electric Co. (Consolidated Edison Energy), Red Bridge Impoundment Station, is a FERC-exempt facility (FERC Exempt #10676) operating a 3,600-Kilowatt hydroelectric power station on the Chicopee River in Wilbraham (FERC 20 December 2000). Under its exempt status, the facility is required to release a continuous flow of 237 cfs from the Red Bridge Impoundment Dam. This facility is permitted to draw down the Red Bridge Impoundment to one-foot below crest from April to June and two-feet below crest during the remainder of the year. In 1997 MA DFW reached agreement with Consolidated Edison Energy, MA, on an interim measure, that their Red Bridge Impoundment Station could use between 140 – 300 cfs if a constant spillage is maintained over the spillway. The water levels at Red Bridge Impoundment are monitored and recorded and fluctuations are limited to three inches with a minimum flow released over the entire width of the spillway (Kleinschmidt Associates and CEEI 1999). In a 1998 letter to Consolidated Edison Energy, Inc. the USFWS described the minimum continuous flow release method at the Red Bridge Impoundment Station as inadequate (McCollum 2001). A slide gate has been installed at the Red Bridge Impoundment to ensure a more reliable minimum continuous flow release (Slater 2007).

I. Maxmat Co. (176 Cottage St., Wilbraham), Collins Dam Station, is a FERC-exempt facility (FERC Exempt #6544) operating a 1,500-Kilowatt hydroelectric power station on this segment of the Chicopee River (FERC 20 December 2000). The dam has a hydroelectric facility leased by Swift River Co., which, for the most part, maintains minimum flows of approximately 200 cfs. The Collins Dam was built in 1985 and is eight feet tall with four-foot flashboards.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1)
Consolidated Edison Energy Massachusetts Inc. (CEEMI) (MA0035823)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Flow is regulated by two hydropower projects (discussed above) on this segment.

Water Chemistry
DWM conducted water quality monitoring at one station (CH02B–Miller Street/Cottage Avenue bridge, Ludlow/Wilbraham) along this segment of the Chicopee River between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen, temperature and pH at Station CH02B all met criteria. Ammonia-nitrogen concentrations in samples collected at Station CH02B were low, while total phosphorus concentrations were slightly elevated during the summer (Appendix B).

Given the generally good water quality conditions, the *Aquatic Life Use* is assessed as support. Due to the potential impacts of hydropower operations this segment is identified with an "Alert Status."

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CH02B–Miller Street/Cottage Avenue bridge, Ludlow/Wilbraham) along this segment of the Chicopee River between April and October 2003 (Appendix B*).*

E. coli bacteria counts were low on both dry and wet weather sampling dates. The highest *E. coli* count was 160 cfu/100mL on 15 October 2003, a wet weather sampling date. The geometric mean of the *E. coli* counts was 20.8 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -120
Geometric mean	28.2
E. coli (cfu/100mL)	<2 - 160
Geometric mean	20.8

No objectionable deposits, odors or scums were noted by DWM field crews with the exception of one occasion when an oily sheen and rusty flow was noticed on the downstream left bank. Water clarity, although sometimes unobservable, was generally noted to be clear with one occasion of slight turbidity. Aquatic plant density, periphyton and plankton were generally noted as unobservable.

Given the low bacteria counts, both *Primary* and *Secondary Recreation Contact Uses* are assessed as support. Given the general lack of objectionable conditions along this segment, the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-23) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Fish population and benthic invertebrate monitoring in this segment to assess the *Aquatic Life Use* should be conducted.

Conduct multiprobe monitoring upstream from the Collins Dam to collect more representative data and determine *Aquatic Life Use.*

Monitor the effects of hydropower activities on the Chicopee River.

Fish passage plans should be considered at the hydropower dams along this segment.

CALKINS BROOK (SEGMENT MA36-26)
Location: Headwaters, southeast of Baptist Hill, Palmer, to confluence with Twelvemile Brook, Wilbraham
Segment Length: 2.7 miles
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3, “No Uses Assessed” (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Calkins Brook. All designated uses are not assessed.

Calkins Brook (Segment MA36-26) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED				

RECOMMENDATIONS
Conduct water quality sampling (water chemistry, multiprobe and bacteria) to assess the *Aquatic Life Use* and the *Primary* and *Secondary Recreational Contact Uses*.

CHICOPEE RIVER (SEGMENT MA36-24)
Location: Wilbraham Pumping Station, Wilbraham/Ludlow, to Chicopee Falls, Chicopee
Segment Length: 9.1 miles
Classification: Class B, Warmwater Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1):
Dauphinais & Son Inc. registration (10833901)

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLES D1,D2,D4)
Connecticut Valley Sanitary Waste Disposal Inc. (MA0033847)
Consolidated Edison Energy Massachusetts Inc. (CEEMI) (MA0035815) (MA0035831)
Solutia Inc. (MA0001147)
Town of Ludlow (MA0101338)
City of Chicopee, Chicopee Water Pollution Control (MA0101508)
Springfield Water and Sewer Commission (MA0103331)
Town of Ludlow (MAR041014)
City of Springfield (MAR041023)
City of Chicopee (MAR041003)
Town of Wilbraham (MAR041025)

Ludlow Sewage Collection System (MA0101338) permit was issued in August 1985. The permit authorized the discharge of combined sewer overflows via five outfalls to the Chicopee River. The sewage has been tied into Springfield's collection system and four of the five outfalls were blocked as of December 1998. The single outfall described as "south of the primary plant" (referred to as Outfall #005 in the compliance evaluation inspection report, which is likely Outfall #007 in the NPDES permit) still remains physically connected to the river (McCollum 2000). The inspection report indicated there was no evidence of dry weather overflows. Since the permit's expiration the Town of Ludlow has worked with the City of Springfield to craft a Long Term CSO Plan. CSO #005 is the only CSO now active and it is currently scheduled to be eliminated by May 2009 (Boisjolie, 2007b).

The City of Chicopee, Chicopee Water Pollution Control (MA0101508), is permitted to discharge via CSO #037 (East Main Street-House 227) to this segment. The estimated discharge from this CSO is 0.1 MG/year.

The Springfield Water and Sewer Commission (SWSC) NPDES permit (MA0103331) issued in 2003 allows the discharge from six CSOs into this segment (CS0#033-0037, CSO#043, CSO#044). The estimated discharge from these CSOs is 22.6 MG/year. The status of the remaining CSOs and their estimated CSO discharge is listed below. All discharge estimates listed below are from the SWSC Long Term Control Plan. Springfield is currently scheduled to begin its Chicopee River Abatement Project in 2007 and will reduce CSO discharges by May 2009. The goal of this 31 million dollar project will be to limit CSO discharges from Springfield's permitted CSOs to twice per year or less, with the cumulative volume of CSO discharge reduced from 22.6 MG/yr to less than 1.0 MG/yr (Boisjolie 2007b). A summary of Springfield CSOs is below.

NAME	ADDRESS	NO_	Estimated CSO Discharge Million Gallons/year (MG/yr)
SPRINGFIELD CSO	Front St.	033	*Eliminated*
SPRINGFIELD CSO	Main St.	034	9.8 MG/yr
SPRINGFIELD CSO	Front & Oak St.	035	0.2 MG/yr

NAME	ADDRESS	NO_	Estimated CSO Discharge Million Gallons/year (MG/yr)
SPRINGFIELD CSO	Pinevale & Water St.	036	0.7 MG/yr
SPRINGFIELD CSO	Cedar St.	037	10.8 MG/yr
SPRINGFIELD CSO	Banner St.	043	0.7 MG/yr
SPRINGFIELD CSO	Rogers Ave.	044	0.4 MG/yr

FERC

Western Mass Electric Co. (Consolidated Edison Energy, Inc.), Putts Bridge Dam Station, is a FERC-exempt facility (FERC Exempt #10677) operating a 3,200-Kilowatt hydroelectric power station on the Chicopee River in Ludlow/Springfield (FERC 20 December 2000). Under its exempt status, the dam is not subject to Part 12 FERC Inspections and is operating within the exemption conditions for one-foot drawdown of the pool. The dam has 1.7' high flashboards. There are no current provisions to allow fish passage (Kleinschmidt Associates and CEEI 1999).

Western Mass Electric Co. (Consolidated Edison Energy), Indian Orchard Station, is a FERC-exempt facility (FERC Exempt #10678) operating a 3,700-Kilowatt hydroelectric power station on the Chicopee River in Ludlow/Springfield (FERC 20 December 2000). Under its exempt status, the dam is subject to FERC Part 12 Inspection requirements. The license exemption requires a continuous minimum flow release of 247 cfs, or inflow, at the base of the dam. The order also limits pond drawdown to one foot below the top to the flashboards, or to permanent crest during flashboard outage. There are no current provisions to allow fish passage (Kleinschmidt Associates and CEEI 1999).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

<u>Habitat and Flow</u>

The USGS maintains a gage in Springfield, MA, on the Chicopee River (Gage 01177000) 1000 ft downstream from West Street Bridge at Indian Orchard and 1.1 mi upstream from Fuller Brook. The drainage area of this gage is 689 mi^2 and the period of record is August 1928 to present (pre-Nov. 1938 published as "at Bircham Bend") (Socolow 2005). The average discharge is 909 cfs (1928-2005) and the maximum discharge occurred on 21 September 1938 (45,200 cfs) while the minimal discharge of 16 cfs occurred several times in 1929-31 (USGS 2007 and Soclolow *et al.* 2005).

The USGS remarks that flow diversion has occurred since 1941 from 186 mi^2 in Swift River basin and at times since 1931 from 97 mi^2 in Ware River Basin for Boston Metropolitan District (now MA DCR) (Socolow *et al* 2005). Diversions have also occurred since 1950 for Chicopee, since 1952 for South Hadley, at times since 1966 for Worcester, and at times since 1955 from 6.5 mi^2 in Ware River Basin for Fitchburg. Diversion from Ludlow Reservoir for Springfield and, prior to 1952, for Chicopee has also occurred. Flow is regulated by powerplants upstream, by Quabbin Reservoir 21 mi upstream on the Swift River since 1939, by Barre Falls Reservoir on the Ware River since 1958, by Conant Brook Reservoir since 1966, and by smaller reservoirs (Socolow 2005). Discharge records are considered to be good except for estimated daily discharges, which are poor. (Socolow *et al* 2005).

There are two dams on this segment of the Chicopee River: Putts Bridge Dam at Route 21 between Ludlow and Indian Orchard (part of Springfield) and the Indian Orchard Dam north of Route 141 adjacent to an old mill on Front Street. The Putts Bridge Dam was constructed in 1918 as a concrete gravity structure. It rises 22' from the bed of the Chicopee River. The Indian Orchard Dam is a cut stone dam with 28' of height above the river. Both dams are owned and operated by CEEI as hydroelectric power plants. They generate and release minimum flows depending on the release from the Red Bridge Dam (located further upstream on the Chicopee River) (Kleinschmidt Associates and CEEI 1999). This segment of the Chicopee River ends at the Chicopee Falls Dam, which is a hydroelectric facility owned by the City of Chicopee.

Water Chemistry
DWM conducted water quality monitoring at one station (CH06– River Street/West Street bridge, Springfield/Ludlow) along this segment of the Chicopee River between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Dissolved oxygen, pH and temperature met criteria on all sampling dates. It should be noted though that the DWM station was below the Indian Orchard Impoundment. Total phosphorus concentrations during June and August 2003 sampling dates were slightly elevated. Ammonia-nitrogen concentrations were low on all sampling dates.

The *Aquatic Life Use* is assessed as support for this segment of the Chicopee River based on the good water quality conditions but is given an "Alert Status" due to the presence of CSOs and the potential impacts of hydromodification due to hydropower operations.

Primary and Secondary Contact Recreation and Aesthetics Uses
Metcalf and Eddy (2006), as part of CSO work for the Connecticut River Bacteria Monitoring Project, collected bacteria samples at the Route 21 bridge on the Springfield/Ludlow border. This station is upstream from the Indian Orchard Impoundment and upstream from the DWM sampling site. Metcalf and Eddy staff collected two samples along a transect. Samples were taken from the river bank east of the bridge on both sides of the river. Dry weather sampling was conducted on 8 August 2001 and wet weather sampling on three occasions: between 25 -27 September 2001; 15-16 September 2002 and 16-18 October 2002. This project had a MassDEP-approved Quality Assurance Project Plan. The sampling conducted between 25-27 September 2001 had quality control issues and the data for this sampling are not used for purposes of this assessment report nor detailed in this report. Six samples were collected during one sampling occasions in 2001 and the *E. coli* geometric mean was 22.8 cfu/100 mL. In 2002 sixteen samples were collected during two wet weather sampling events and the *E. coli* geometric mean was 61.8 cfu/100 mL. None of the *E. coli* counts reported by Metcalf and Eddy (2006) and used in this report were greater than 235 cfu/ 100 mL. High fecal coliform counts were found in numerous samples but the corresponding *E. coli* counts were not high.

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CH06– River Street/West Street bridge, Springfield/Ludlow) along this segment of the Chicopee River between April and October 2003 (Appendix B*).* This site is downstream from 13 CSOs and located just upstream from the USGS gage at Indian Orchard. There is a dam and a mill upstream from this station. The river channel is large and wide. Samples were collected by the bridge drop method at this station.

The *E. coli* bacteria counts in samples collected by DWM at Station CH06 were generally low. The highest *E. coli* bacteria count of 126 cfu/100 mL was found in the sample collected on 15 October 2003, a wet weather sampling date. It appears the elevated streamflow was largely due to rain in the upper Chicopee watershed as no significant rainfall was recorded at the NOAA rain gauge in Springfield. This wet weather sampling date may not have captured local CSO discharges. The *E. coli* geometric mean for Station CH06 was 35.4 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	2 - 248
Geometric mean	39.4
E. coli (cfu/100mL)	4 - 126
Geometric mean	35.4

No objectionable deposits, scums or water odor were recorded by DWM field crews although conditions were often unobservable. Water clarity was clear on all days when noted. When observable there were no phytoplankton noted and on the one occasion when periphyton was observable it was characterized as sparse. On three occasions (July 30th, July 31st and August 20th) dense submerged aquatic plants were noted (principally grasses) while on the rest of sampling days aquatic plants were unobservable.

Given the low *E. coli* bacteria counts the *Primary* and *Secondary Contact Recreation Uses* are assessed as support. Due to the presence of CSOs both *Primary* and *Secondary Contact Recreation Uses* are listed with an "Alert Status." Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-24) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Conduct bacteria sampling at multiple stations along this segment to document the progress of Ludlow, Chicopee, and Springfield's CSO abatement activities.

Monitor the effects of hydropower activities on the Chicopee River. This may involve fish population sampling or benthic invertebrate sampling.

Fish passage plans should be considered at the hydropower dams along this segment.

HIGHER BROOK (SEGMENT MA36-42)
Location: Headwaters south of Route 21, Ludlow, thru Harris Pond (formerly reported as Segment MA36067) to the Ludlow/Chicopee corporate boundary where the stream name changes to Fuller Brook
Segment Length: 6.3 miles
Classification: Class B

Harris Pond (MA36067) will no longer be reported on as an approximately 14 acre lake segment since the estimated retention time of this waterbody is less than two days. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from USGS two stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals from this segment but the management of Springfield Reservoir would affect this waterbody. Currently the reservoir is not in use.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2, D4)
Springfield Water and Sewer Commission (MAG640022)
Town of Ludlow (MAR041014)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Water Chemistry</u>
DWM conducted water quality monitoring at one station (FULL02–West Street bridge, south of Roy Street, Ludlow) along Higher Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All the temperature, dissolved oxygen and pH measurements at Station FULL02 met criteria. Ammonia-nitrogen concentrations were low in samples collected by the DWM. Total phosphorus concentrations were generally low but were elevated on one occasion (wet weather sampling event) at Station FULL02 (Appendix B).

The *Aquatic Life Use* is assessed as support based on the generally good water quality conditions.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (FULL02–West Street bridge, south of Roy Street, Ludlow) along Higher Brook between April and October 2003 (Appendix B). The *E. coli* bacteria counts showed no absolute correlation with rainfall, but the two highest counts were measured during wet weather sampling. The highest *E. coli* count of 800 cfu/100mL was recorded on 15 October 2003 and the next highest count of 370 cfu/100 mL was measured on 18 June 2003. The *E. coli* geometric mean was 83.3 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	10 - 1800
Geometric mean	168.6
E. coli (cfu/100mL)	4 - 800
Geometric mean	83.3

With the exception of one day on which small amounts of trash were found, no objectionable deposits were noted at this site. No water odors or scums were observed. Sparse coverage of moss was found in June while in August and October burreed (*Sparganium* sp.) was noted at this station. The presence of phytoplankton was not noted. Sparse coverage of green filamentous algae was found on substrates on the first two survey dates while in July and August respectively sparse and moderate algal coverage was found (Appendix B).

The geometric mean for *E. coli* meets the criteria for both the *Primary* and *Secondary Contact Recreation Use* criteria so these uses are assessed as support. The *Aesthetics Use* is assessed as support due to the lack of objectionable conditions.

Higher Brook (Segment MA36-42) Use Summary Table

<table>
<tr><th colspan="2">Designated Uses</th><th>Status</th></tr>
<tr><td>Aquatic Life</td><td></td><td>SUPPORT</td></tr>
<tr><td>Fish Consumption</td><td></td><td>NOT ASSESSED</td></tr>
<tr><td>Primary Contact</td><td></td><td rowspan="3">SUPPORT</td></tr>
<tr><td>Secondary Contact</td><td></td></tr>
<tr><td>Aesthetics</td><td></td></tr>
</table>

RECOMMENDATIONS

Conduct bacteria monitoring to assess the contact recreational uses.

Conduct water chemistry and multiprobe monitoring along this segment to assess *Aquatic Life Use*.

FULLER BROOK (SEGMENT MA36-41)
Location: From the Ludlow/Chicopee corporate boundary where the stream name changes from Higher Brook to the confluence with the Chicopee River, Chicopee
Segment Length: 1.9 miles
Classification: Class B

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1, D4)
Connecticut Valley Sanitary Waste Disposal, Inc. (MA0033847/ MAR05C657)
City of Chicopee (MAR041003)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks Fuller Brook with trout (MA DFG 2007). MA DFG conducted fish population sampling in Fuller Brook from the mouth of Fuller Brook to Shawinigan Drive (Site 96) on April 20' 2000 using a backpack electro-shocker (Richards 2006). Sixty-nine fallfish, forty-one common shiner, thirty-eight eastern blacknose dace, fourteen white sucker, fourteen tessellated darter, fourteen longnose dace, two yellow bullhead, two brook trout, one American eel, one rock bass, one pumpkinseed, and one brown trout were collected (198 total fish). Sampling was conducted in a sandy stretch between two beaver dams.

The sample was heavily dominated by fluvial specialist/dependent species (98%). While most species present are classified as tolerant or moderately tolerant to pollution, brook trout and brown trout (n=3) were also collected and the brook trout appear to be part of a reproducing population. MA DFG identifies Fuller Brook as a Coldwater Fishery Resource (Richards 2006). The aforementioned dominance by fluvial species and the presence of brook and brown trout are indicative of a stable flow regime and excellent water quality. It should be noted that brook trout numbers were very low and that beaver activity may be affecting habitat within the sampled reach.

DWM conducted water quality monitoring at one station (FULL01) in Fuller Brook (Station 96) between April and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. When observable no phytoplankton was found and only on June 18th was a sparse coverage of moss noted; otherwise no aquatic plants were found. Sparse coverage of thin green films on substrates was noted on April 16th and a sparse coverage of green filamentous algae was noted on June 18th. Later, on June 30th and August 20th, a dense coverage of green and brown algae was found attached to the rocks.

Toxicity
Ambient
The Connecticut Valley Sanitary Waste Disposal, Inc. staff collected water from the Fuller Brook just upstream from New Lombard Road for use as dilution water in the facility's whole effluent toxicity tests. Between May 2000 and September 2004 survival of *C. dubia* exposed (48 hours) to the Fuller Brook water was 100% (n=9). Between May 2000 and September 2004 survival of *P. promelas* exposed (48 hours) to the Fuller Brook water ranged from 95 to 100% (n=9).

Effluent
Whole effluent toxicity tests have been conducted on the Connecticut Valley Sanitary Waste Disposal, Inc. treated effluent. Between May 2000 and September 2004 nine valid tests were conducted using *C. dubia* and *P. promelas*. The LC_{50} resuts were all $\geq$100% effluent for both test species (n=9).

Water Chemistry
DWM conducted water quality monitoring at one station (FULL01–between Route 90 and Shawinigan Drive, Chicopee) along Fuller Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All the temperature, dissolved oxygen and pH measurements at Station FULL01 met criteria. Ammonia-nitrogen concentrations ranged from <0.10 to 0.20 mg/L in samples collected at this site. Total phosphorus concentrations in samples collected by DWM were slightly elevated to elevated at this site. The highest total phosphorus concentration (0.088 mg/L) was found on 18 June 2003, a wet weather sampling date.

Given the good ambient and effluent whole effluent toxicity results, the good water quality conditions, and fish population information Fuller Brook is assessed as support for *Aquatic Life Use*. This use is identified with an "Alert Status" due to elevated total phosphorus concentrations.

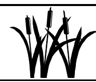
Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (FULL01–between Route 90 and Shawinigan Drive, Chicopee) along Fuller Brook between April and October 2003 (Appendix B*)*. The *E. coli* bacteria counts were generally low during dry weather but elevated during wet weather. The highest *E. coli* bacteria count of 1120 cfu/100 mL was found in the sample collected 15 October 2003, a wet weather sampling date. The second highest E. coli count of 450 cfu/100 mL was found in the 18 June 2003 sample, a wet weather sampling date. The geometric mean of *E. coli* counts was 152.2 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	20 - 5500
Geometric mean	365.9
E. coli (cfu/100mL)	14 - 1120
Geometric mean	152.2

The Fuller Brook station (FULL01) is downstream from a large landfill and Interstate 90. On April 16th and August 20th trash and debris were noted at this station. Additionally, sedimentation likely due to adjacent roadwork was noticed on April 16th. Objectionable deposits were not noted on any other sampling dates. No scums or water odors were noted during the sampling season. Water clarity was generally described as slightly turbid at this station during the sampling season except on the first two sampling dates when the water was clear. Minimal erosion was noted on two occasions and the presence of riprap was recorded. DWM field crews noted sparse to moderate coverage of algae on substrates at this location during the summer of 2003.

The geometric mean of *E. coli* counts did not meet the *Primary Contact Recreation Use* criterion, so the *Primary Contact Recreation Use* is assessed as impaired. The *Secondary Contact Recreation Use* is assessed as support based on the geometric mean of *E. coli* counts meets the criterion. It is believed that the negative aesthetic conditions found at Station FULL01 are limited in extent so the *Aesthetics Use* is assessed as support.

Fuller Brook (MA36-41) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct bacteria monitoring to assess the *Contact Recreational Uses*.

Conduct water chemistry sampling and multiprobe monitoring along this segment to assess *Aquatic Life Use*.

Conduct field reconnaissance and a habitat walk along this segment to evaluate current conditions.

UNNAMED TRIBUTARY TO THE CHICOPEE RIVER (SEGMENT MA36-39)
Location: Unnamed tributary to the Chicopee River, locally known as "Poor Brook," from headwaters near the Conrail tracks in Springfield to the confluence with the Chicopee River, Chicopee
Segment Length: 2.2 miles
Classification: Class B

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1, D4)
Doncasters Inc. MAG250947
City of Springfield (MAR041023)
City of Chicopee (MAR041003)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Geosyntec Consultants (Geosyntec Consultants, undated), as part of the Chicopee River Watershed Degraded Stream Survey, made field observations downstream from Route 141 (East Main Street bridge) on 16 May 2003. They found bank erosion, sand deposits and point bar formations, undercut banks and exposed roots. Erosion was noted at the DWM sampling station (POOR01–Route 141 (East Main Street bridge, Chicopee) throughout the 2003 sampling survey.

<u>Toxicity</u>
Effluent
Downcasters Inc. conducted a whole effluent toxicity test using *C. dubia* on 14 May 2001 on their non-contact cooling water using soft reconstituted freshwater as diluent. The forty-eight hour LC_{50} test was >100% and A-NOEC was 100% effluent. The C-NOEC test was 50%. Ammonia-nitrogen was <0.20 mg/L while total residual chlorine (TRC) was 0.19 mg/L.

<u>Water Chemistry</u>
DWM conducted water quality monitoring at one station (POOR01–Route 141 (East Main Street bridge) in Chicopee) along Poor Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

All the temperature, dissolved oxygen and pH measurements at Station POOR01 met criteria. The conductivity measured at this site was elevated throughout the sampling season. Ammonia-nitrogen concentrations were elevated in the April, May and June samples collected by DWM but not at toxic levels. Total phosphorus concentrations in the samples collected at this station were generally low but were elevated on one wet weather survey date (Appendix B).

Given generally good water quality conditions Poor Brook is assessed as support for *Aquatic Life Use*. The elevated ammonia-nitrogen concentrations measured at this site, elevated conductivity and habitat quality degradation associated with erosion and sedimentation at the sampling location are a cause for concern, so this segment is identified with an "Alert Status." The concentration of TRC in the Doncasters Inc. discharge is also of concern.

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (POOR01–Route 141 (East Main Street bridge), Chicopee, along Poor Brook between April and October 2003 (Appendix B*).*

E. coli bacteria counts were generally low during dry weather sampling but were high during wet weather sampling. The highest *E. coli* count of 4200 cfu/100 mL was measured on 18 June 2003, a wet weather sampling date. The second highest *E. coli* count of 1880 cfu/100 mL was measured on 15 October, 2003, a wet weather sampling date. The geometric mean of *E. coli* counts was 246.2 cfu/ 100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	6 - 6100
Geometric mean	279.9
E. coli (cfu/100mL)	30 - 4200
Geometric mean	246.2

On April 16th and July 30th objectionable deposits of silt and sand were found covering bottom substrate, but no objectionable conditions were noted on other survey dates. No water odors were noted with the exception of a musty water smell on two occasions and no scums were found. Erosion, principally on the left bank, was noted throughout the survey. Generally, water clarity was high at this site, although on June 18th the water was highly turbid. Aquatic plants and phytoplankton were not noted at this site. Moderate and sparse green filamentous algae were noted on substrates on the first two survey dates, respectively, but periphyton cover, when observable, was not found on the remaining days.

Due to the elevated *E. coli* geometric mean, the *Primary Contact Recreation Use* is assessed as impaired. The *Secondary Contact Recreation Use* is assessed as support given a geometric mean of E. coli counts below the criterion. Given the two counts > 1260 cfu/100 mL this use is identified with an "Alert Status". It is believed that objectionable conditions are localized, so the *Aesthetics Use* is assessed as support.

Poor Brook (MA36-39) Use Summary Table

Designated Uses	Status
Aquatic Life	SUPPORT*
Fish Consumption	NOT ASSESSED
Primary Contact	IMPAIRED Cause: Elevated *E. coli* Sources: Unknown Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact	SUPPORT*
Aesthetics	SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct bacteria sampling to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Conduct field reconnaissance and a habitat walk along this segment to determine current conditions and assess the extent of habitat degradation. Where appropriate develop and implement best management practices to reduce erosion and sedimentation.

Conduct benthic invertebrate monitoring along this segment to assess *Aquatic Life Use*. There is evidence of degraded habitat along this segment and indications that the benthic community may be impacted (Geosyntec Consultants, undated).

Doncasters Inc.'s NPDES permit should be reissued with appropriate limits for TRC.

COOLEY BROOK (SEGMENT MA36-38)
Location: From the outlet of the Chicopee Reservoir, Chicopee, to the confluence with the Chicopee River, Chicopee (segment includes “braid” that confluences with the Chicopee River upstream from the mouth of Cooley Brook)
Segment Length: 1.2 miles
Classification: Class B

This is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals affecting this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D2,D4)
City of Chicopee (MA0101508)
Westover Airforce Base (MAR05B973)
City of Chicopee (MAR041003)

Westover Air Force Base’s individual permit (MA0005444) has been terminated. Multi-sector general stormwater permits (MAR05A820 and MAR05A728) were issued to Westover Air Reserve Base and Westover Metro Airport in Chicopee for outfalls 003-008. An artificial wetland was constructed near Outfall 001 to treat stormwater discharge affected by aircraft deicing. Outfall 001 and Outfall 002 both have oil water separators in-line in the event of a fuel spill. These two outfalls are now covered by multi-sector general permit number MA05B973 issued in 2002.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
MA DFG stocks Chicopee Reservoir upstream from this segment of Cooley Brook with trout (MA DFG 2007). DWM conducted water quality monitoring at one station (COOL01) in Cooley Brook between April and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. No aquatic plants or phytoplankton were noted during the sampling season at this location and the water was clear with the exception of April 16th when water clarity was slightly turbid. Undercutting of both banks was noted throughout the sampling season. Periphyton cover was described as moderate on April 16th, August 20th and October 15th and sparse on May 14th and July 30th;none was observed on June 18th. The periphyton consisted of brown thin films attached on rocks and an orange floc on April 16th while green periphyton on rocks and green filamentous algae were found on May 14th. On other sampling dates the periphyton was described as brown algae attached on rocks.

Water Chemistry
DWM conducted water quality monitoring at one station (COOL01– apparent diversion of Cooley Brook at Fuller Road, approximately 1100 feet northwest of Haynes Circle, Chicopee) in this Cooley Brook segment between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperature, pH and dissolved oxygen measurements at Station COOL01 met criteria on all DWM sampling dates. Ammonia-nitrogen concentrations at this station were generally low while total phosphorus concentrations were slightly elevated during the May and June sampling dates and very high (0.23 mg/L) on the August sampling date (Appendix B).

The Aquatic Life Use is assessed as support given the generally good water quality conditions. The one sample with a high total phosphorus concentration is a cause for concern, so this segment is identified with an “Alert Status” for *Aquatic Life Use.*

Primary and Secondary Contact Recreation and Aesthetics Uses
DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (COOL01– apparent diversion of Cooley Brook at Fuller Road, approximately 1100 feet northwest of Haynes Circle, Chicopee) between April and October 2003 (Appendix B*).*

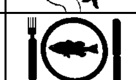
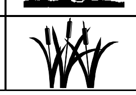
E. coli counts at Station COOL01 were generally low during dry weather sampling events. The highest *E. coli* count of 1100 cfu/100 mL was found on 15 October 2003 a wet weather sampling event. The second highest *E. coli* count of 300 cfu/100 mL was found on 20 August 2003, a dry weather sampling event. The geometric mean of *E. coli* counts was 61.9 cfu/ 100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 - 4700
Geometric mean	101.3
E. coli (cfu/100mL)	10 – 1100
Geometric mean	61.9

On April 16th the DWM field crews observed heavy siltation at Station COOL01 on the river bottom. No other objectionable deposits were noted at this station. With the exception of April 16th, when the water was noted to have both a septic and rotting vegetable odor, DWM field crews did not note water odors. No scums, aquatic plants or phytoplankton were noted during the sampling season at this location and the water was clear with the exception of April 16th when water clarity was slightly turbid.

Given the low geometric mean of *E. coli* counts, the *Primary Contact Recreation Use* is assessed as support. Two samples were greater than 235 cfu/100 mL, so this use is given an “Alert Status”. Given the low geometric mean of *E. coli* counts and the fact that none of the counts were greater than 1260 cfu/100 mL, the *Secondary Contact Recreation Use* is assessed as support. Given the general lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Cooley Brook (Segment MA36-38) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct bacteria monitoring to assess *Primary* and *Secondary Contact Recreational Uses*.

Conduct field reconnaissance and a habitat walk along this segment to determine current conditions.

Benthic invertebrate monitoring could be conducted along this segment to assess *Aquatic Life Use*.

CHICOPEE RIVER (SEGMENT MA36-25)
Location: Chicopee Falls to confluence with Connecticut River, Chicopee
Segment Length: 3.0 miles
Classification: Class B, Warm Water Fishery, CSO

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals in this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D1, D2, D4)
City of Chicopee (MA0101508)
City of Chicopee (MAR041003)
Consolidated Edison Energy Massachusetts Inc. (CEEMI) (MA0035777)
Eastern Etching & Manufacturing Company (MA0000647)

The City of Chicopee, under NPDES Permit MA0101508, is authorized to discharge via 12 CSOs (10 currently active) into this segment of the Chicopee River. Cumulatively the active CSOs discharge an estimated 76.0 MG/year. Two CSOs have been plugged. CSO #023 was plugged in early 2002, while CSO #025 was plugged on June 29, 2005. The following CSOs are considered active and the best current estimates of their discharge are also listed below. Updated estimates and an abatement schedule for the remaining CSOs will be completed in the Final Long Term Control Plan due to be completed in 2008 (Boisjolie 2007b).

Address	CSO ID Number	Estimated CSO Discharge Million Gallons/year (MG/yr)
Bell & Front St.	26	0.1 MGD
Topors & Front St	27.1	8.0 MG/yr
Chicopee Elec. Light -	29	0.1 MG/yr
Chicopee Elec. Light -	31.1	1.1 MG/yr
Easment N of Front St.	31.3	30.7 MG/yr
Under Deady Bridge	32	Cumulative = 6.1 MG/yr from CSO Regulators #32.2, 32.3, 32.4, and 32.5
Grove & Oak St.	32.1	2.5 MG/yr
Grattan & Hearthstone	34.1	7.7 MG/yr
Hearthstone Terrace	34.2	0.2 MG/yr
Old Fuller	34.3	19.5 MG/yr**
All CSOs		76.0 MG/yr

** This discharge is estimated from the 2002 Notice of Project Change, which reduced the estimated annual discharge from previously estimated 60.7 MG/yr in the 2001 Draft Long Term Control Plan (DLTCP). All other estimates are from the 2001 DLTCP.

This segment begins at the Chicopee Falls Dam at Route 33 in Chicopee Falls. This dam is a 10' high masonry stone dam that was constructed in the late 1800s. It is currently owned by the City of Chicopee and used as a hydroelectric facility. A second dam, the Dwight Station Dam, was constructed in 1920 and is a 15' high masonry dam that is owned and operated by CEEMI as a hydroelectric power plant. The dam generates and releases a minimum flow depending on the flows released at the upstream Red Bridge Impoundment Dam (Kleinschmidt Associates and CEEI 1999).

The former Uniroyal Complex is listed as a Tier 1A Hazardous Waste Site (#1-0000436). This site was listed for oil and hazardous material. This site is currently a Phase 4 site and cleanup work has been conducted and is ongoing.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The hydroelectric power plant at the Chicopee Falls Dam is a FERC exempt facility (FERC-exempt #6522). The facility operates a 2,500-Kilowatt hydroelectric power station on this segment of the Chicopee River (FERC 20 December 2000). Under its exempt status, the facility releases 127 cfs in the bypass reach and 230 cfs downstream. The dam has 18-inch flashboards and has all flow releases and power generation are automated. There are no current provisions to allow fish passage (Kleinschmidt Associates and CEEI 1999).

Consolidated Edison Energy Massachusetts Inc. (CEEMI) Dwight Station is a FERC-exempt facility (FERC-exempt #10675) operating a 3,700-Kilowatt hydroelectric power station on the Chicopee River in Chicopee (FERC 20 December 2000). Under its exempt status, the dam is not subject to FERC Part 12 Inspection requirements. The dam had 2.3' high flashboards that have been removed to assist in the passage of minimum flow. The canal system is currently in disrepair and the hydraulic capacity is limited because of unreliable canal head gates. During the spring the Station is shut down. Since the 1998 Chicopee WQAR report, an eelway has been built at the Dwight Dam through a USFWS grant and cooperation from the Chicopee River Watershed Council Silvio O. Conte Anadromous Fish Research Center and CEEMI (MA EOEA, 2007).

Biology

DWM conducted water quality monitoring at one station (CTO3 – Route 116 Bridge, Chicopee) in this Chicopee River segment between April and October 2003 (Appendix B). DWM crews made notes of conditions at this site throughout the sampling season. Although aquatic plant density was characterized as unobservable on the majority of sampling days, on August 20th aquatic plant density was noted to be moderate and composed of submerged plants, principally moss on rocks and milfoil (*Myriophyllum* sp.). Sparse periphyton coverage was noted on two occasions (April 16th and July 30th) while moderate coverage was noted on May 15th and August 20th. On the remaining sampling days periphyton coverage was unobservable or not recorded. On June 18th phytoplankton presence was described as sparse while the majority of occasions when observable or recorded no phytoplankton were noted.

Toxicity

Ambient

The Eastern Etching & Manufacturing Company staff collected water from the Chicopee River approximately 100 feet upstream from the Eastern Etching east parking lot, off of Riverview Terrace, for use as dilution water in the facility's whole effluent toxicity tests. Between May 2000 and May 2002 survival of *C. dubia* exposed (48 hours) to the Chicopee River water ranged from 90 to 100% (n=5). Between May 2000 and May 2002 survival of *P. promelas* exposed (48 hours) to the Chicopee River water was all 100% (n=5). Hardness ranged from 19.0 mg/L to 29.0 mg/L (n=5).

Effluent

Acute whole effluent toxicity tests have been conducted on the Eastern Etching & Manufacturing Company treated effluent. Between May 2000 and May 2002 five valid tests were conducted using *C. dubia* and *P. promelas*. The LC_{50} using *C. dubia* ranged from 56.10% to >100% effluent (n=5). The LC_{50} tests using *P. promelas* were all >100% (n=5). All of the tests met the limit of $\geq$50%.

Ammonia-nitrogen concentrations reported in the whole effluent toxicity reports between May 2000 and May 2002 ranged from 0.17 mg/L to 3.40 mg/L (n=5). Total residual chlorine (TRC) concentrations reported in the whole effluent toxicity reports between May 2000 and May 2002 ranged from <0.020 to 0.150 mg/L (n=5). Between May 2000 and May 2002 the total aluminum limit was exceeded once on May 10, 2000 when the effluent had an aluminum concentration of 5.3 mg/L (n=5).

Water Chemistry

DWM conducted water quality monitoring at one station (CTO3 – Route 116 Bridge, Chicopee) in this Chicopee River segment between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperature, pH and dissolved oxygen measurements at the DWM station all met criteria on DWM sampling dates (Appendix B). It should be noted, though, that this station is below the Dwight Dam and this may affect dissolved oxygen concentrations. Ammonia-nitrogen concentrations measured in DWM samples were low while total phosphorus concentrations ranged from 0.024 mg/L to 0.057 mg/L with the highest concentrations found on 18 June 2003, a wet weather sampling date (Appendix B).

Given the good survival of test organism and the generally good water quality conditions, the *Aquatic Life Use* is assessed as support. The *Aquatic Life Use* is identified with an "Alert Status" due to potential impacts of hydropower operations and CSOs.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* bacteria monitoring at one station (CTO3 – Route 116 Bridge, Chicopee) between April and October 2003 (Appendix B*).* This station is approximately 900 feet below Chicopee CSO #025, which was active during the time of DWM sampling. This station was also below eleven other Chicopee CSOs (during time of sampling). *E. coli* counts were generally low with the exception of one sample collected on 15 October 2003, which had an *E. coli* count of 2980 cfu/ 100 mL. This high bacteria sample was collected on a wet weather sampling date.

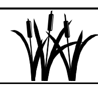
Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	8 – 7700
Geometric mean	151.1
E. coli (cfu/100mL)	4 - 2980
Geometric mean	91.6

Metcalf and Eddy (2006), as part of CSO work for the Connecticut River Bacteria Monitoring Project, collected bacteria samples at the Route 116 bridge in Chicopee which was downstream from 12 Chicopee CSOs at the time of sampling. Metcalf and Eddy staff sampled three points (equidistant from one another) along a transect going from both banks of the river. They conducted dry weather sampling on 8 August 2001 and wet weather sampling on three occasions: 25 September 2001; 15 September 2002 and 16 October 2002. This project had a MassDEP-approved Quality Assurance Project Plan. Eighteen samples were collected in 2001 by Metcalf and Eddy (1 dry weather event, 1 wet weather event- two days total) and the *E. coli* geometric mean was 400 cfu/100 mL. Eight of the nine *E. coli* bacteria counts were greater than 235 cfu/100 mL on 8 August 2001 while none were greater than 1260 cfu/100 mL. Six of the nine *E. coli* counts collected on 25 September 2001 were greater than 235 cfu/100 mL while three of the nine *E. coli* counts were greater than 1260 cfu/100 mL. Eighteen samples were collected in 2002 by Metcalf and Eddy (2 wet weather events-2 days total) and the *E. coli* geometric mean was 412.8 cfu/100 mL. Seven of the *E. coli* bacteria counts collected on 15 September 2002 were greater than 235 cfu/100 ml and one sample was greater than 1260 cfu/100 mL. Eight of the nine *E. coli* counts collected on 16 October 2002 were greater than 235 cfu/100 mL and two *E. coli* counts were greater than 1260 cfu/100 mL.

No objectionable deposits, scums or water odor were recorded by DWM field crews. The water clarity was described as clear or slightly turbid when noted. Minimal erosion was observed on two occasions. Although aquatic plant density was characterized as unobservable on the majority of sampling days, on August 20th aquatic plant density was noted to be moderate and composed of submerged plants, principally moss on rocks and milfoil (*Myriophyllum sp*.). Sparse periphyton coverage was noted on two occasions (April 16th and July 30th) while moderate coverage was noted on May 15th and August 20th. On the remaining sampling days periphyton coverage was unobservable or not recorded. On June 18th phytoplankton presence was described as sparse while the majority of occasions when observable or recorded no phytoplankton were noted. On April 16th the water level was noted to be extremely high and the storm drains under the bridge were observed to be flowing. On June 18th a storm drain near the bridge on the right bank was flowing.

The *Primary* and *Secondary Contact Recreation Uses* are assessed as impaired because of elevated *E. coli* counts. The highest bacteria counts were collected during wet weather events. Given the lack of objectionable conditions the *Aesthetics Use* is assessed as support.

Chicopee River (Segment MA36-25) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated *E. coli* Sources: Combined sewer overflows Suspected Sources: Illicit connections/hook-ups to storm sewers, unspecified urban stormwater
Secondary Contact		
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS

Track progress of the City of Chicopee's CSO abatement activities. Conduct bacteria sampling to evaluate the effectiveness of the CSO abatement and to assess *Primary* and *Secondary Contact Recreation Uses.* Wet weather sampling will give the best gage of CSO abatement activities, as *E. coli* counts in dry weather samples were low at this site.

Additional data are needed to evaluate the impact of hydropower activities on aquatic life conditions. This may include monitoring streamflow conditions and conducting fish population or benthic invertebrate monitoring.

Fish passage at the hydropower dams especially should be considered.

ABBEY BROOK (SEGMENT MA36-40)
Location: Headwaters west of Saint James Avenue, Springfield, thru Bemis Pond (formerly reported as segment MA36011) to the confluence with the Chicopee River, Chicopee
Segment Length: 1.5 miles
Classification: Class B

Bemis Pond (MA36011) will no longer be reported on as an approximately 4 acre lake segment since the estimated retention time of this waterbody is less than nine days. It will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two USGS stream gages in the Chicopee River Basin (01177000 and 01176000) and the normal storage volume of the dams reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and MA DCR 2002).

In 2000 MA DEM (MA DEM 2002a) awarded the City of Chicopee a $10,000 grant for Bemis Pond to repair the auxiliary spillway wall at the Bemis Pond dam, which stabilized the shoreline and prevent further erosion in the area. In 2002 DEM (DEM 2002b) awarded the City of Chicopee a $15, 000 grant to repair a wall of the auxiliary spillway on lower Bemis Pond to stabilize shoreline and control erosion. This work also removed fallen trees in the channel, which impeded flow between the two ponds.

Bemis Pond is on the Massachusetts Year 2006 Integrated List of Waters – Category 5, “Waters requiring a TMDL”. Pollutants needing TMDLs: Suspended Solids (MassDEP 2007b).

Abbey Brook itself is a newly designated segment by MassDEP and as such has not been reported on before in a Massachusetts Integrated List of Waters on the condition of waters in Massachusetts.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated water withdrawals from this segment.

NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
City of Chicopee (MAR041003)
City of Springfield (MAR041023)

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
Geosyntec Consultants (Geosyntec undated) as part of the Chicopee River Watershed Degraded Stream Survey, made field observations of Abbey Brook downstream from the Front Street bridge on 19 May 2003. They found bank erosion and substrate fouling. DWM field crews made observations throughout the 2003 field season at Station AB01 (Front Street Bridge, upstream side, Chicopee). They noted minimal erosion, especially on the right bank, on three occasions. Riprap was found along the banks.

Biology
DWM conducted water quality monitoring at one station (AB01, Front Street Bridge, Chicopee) in Abbey Brook between April and October 2003 (Appendix B). DWM crews made notes on conditions at this site throughout the sampling season. No aquatic plants or phytoplankton were found or recorded. Periphyton was noted on five occasions and described as dense on May 14, 2003. In April thin film algae and filamentous algae were noted, while in May a filamentous periphyton was noted. On the rest of the observable occasions a brown periphyton was noted. Water clarity was noted to be slightly turbid on five occasions and clear on three other occasions.

Water Chemistry

DWM conducted water quality monitoring at one station (AB01, Front Street Bridge, Chicopee) in Abbey Brook between April and October 2003 (Appendix B). *In-situ* parameters were measured on seven occasions, including two pre-dawn occasions. Grab samples were also collected and analyzed for TSS, turbidity, ammonia-nitrogen, and total phosphorus (Appendix B).

Temperature, pH and dissolved oxygen measurements at the DWM station all met criteria on DWM sampling dates (Appendix B). Conductivity was slightly elevated at this station. Ammonia-nitrogen concentrations were low. Total phosphorus concentrations ranged from 0.035 to 0.079 mg/L with the two highest concentrations found on the sampling dates in July and August 2003 (Appendix B).

The *Aquatic Life Use* is assessed as support based primarily on the limited water quality data, which indicates generally good water quality conditions. This use is identified with an “Alert Status” due erosion and sedimentation (Geosyntec undated) particularly in the lower reach near the confluence with the Chicopee River.

Primary and Secondary Contact Recreation and Aesthetics Uses

DWM conducted fecal coliform and *E. coli* monitoring at one station (AB01, Front Street Bridge, Chicopee) between April and October 2003 (Appendix B*).* *E. coli* counts were generally low with the exception of 15 October 2003, a wet weather sampling date, when the *E. coli* count was 10,000 cfu/100 mL. The geometric mean of *E. coli* counts was 90 cfu/100 mL.

Parameter	DWM 2003 (n=6)
Fecal coliform (cfu/100mL)	<2 -13500
Geometric mean	168.6
E. coli (cfu/100mL)	2 - 10000
Geometric mean	90

Objectionable deposits consisting of trash were noted on April 14th, July 30th and August 20th by DWM field crews. It is believed that the garbage and trash were localized. In addition to the trash noted on April 14th sand and silt were noted at this station. No scums were noted and, with the exception of one occasion on which a musty water odor was recorded, no odors were noted.

The *Primary and Secondary Recreation Contact Uses* area assessed as support based on the geometric mean of E. coli counts. Due to the one very high *E. coli* count both *Primary* and *Secondary Contact Recreation Uses* are identified with an “Alert Status.” Given the general lack of extensive objectionable conditions the *Aesthetics Use* is assessed as support.

Abbey Brook (Segment MA36-40) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct bacteria sampling to evaluate to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Conduct field reconnaissance and a habitat walk along this segment to determine current conditions and assess the extent of habitat degradation. Where appropriate develop and implement best management practices to reduce erosion and sedimentation.

Conduct water quality sampling in Bemis Pond to address a TMDL for TSS.

Chicopee River Watershed - Lake Assessments

A number of Chicopee River Watershed Lakes have no updated or pertinent information to report (TMDL completion, WMA withdrawals, NPDES permit, etc.) and lack new information with which to make an assessment of designated uses. Information on these waterbodies is summarized below. All these waterbodies are not assessed for all uses.

Lake	Location	WBID	Size (Arces)	Class	2006 Integrated List Category
Brooks Pond	Petersham	MA36022	86	A	3
Carter Pond	Petersham	MA36029	44	A	3
Crystal Lake	Palmer	MA36043	16	B	2
Knights Pond	Belchertown	MA36077	36	A	2
Town Barn Beaver Pond	Petersham	MA36156	20	B	3
Alden Pond	Ludlow	MA36003	4	B	5
Haviland Pond	Ludlow	MA36069	25	B	2
Murphy Pond	Ludlow	MA36103	6	B	3
Adams Pond	Oakham	MA36001	30	B	3
Asnacomet Pond	Hubbardston	MA36005	126	A	2
Bemis Road Pond	Hubbardston	MA36012	17	B	3
Bennett Street Pond	Palmer	MA36014	6	B	3
Cloverdale Street Pond	Rutland	MA36036	19	A, Public Water Supply	3
Cunningham Pond	Hubbardston	MA36044	27	A	3
Edson Pond	Rutland	MA36180	36	A	3
Lovewell Pond	Hubbardston	MA36085	82	A	3
Muddy Pond	Oakham/Rutland	MA36102	23	A	3
Old Reservoir	Barre	MA36114	37	B	4c
Pattaquattic Pond	Palmer	MA36117	18	B	2
Peppers Mill Pond	Ware	MA36121	11	B	3
Queen Lake	Phillipston	MA36132	139	A	2
Stone Bridge Pond	Templeton	MA36148	32	A	3
Thayer Pond	Rutland	MA36181	45	A	3
Waite Pond	Hubbardston	MA36161	34	A	2

Lake	Location	WBID	Size (Arces)	Class	2006 Integrated List Category
Brookhaven Lake	West Brookfield	MA36021	34	B	5
Cranberry Meadow Pond	Spencer/Charlton	MA36040	69	B	3
Cusky Pond	New Braintree	MA36045	28	B	3
Eames Pond	Paxton	MA36056	58	B	5
Lake Whittemore	Spencer	MA36165	52	B	5
Moose Hill Reservoir	Spencer/Leicester	MA36179	52	B	3
Paradise Lake	Monson	MA36116	18	B	2
Shaw Pond	Leicester	MA36138	64	B	2

Swift River Subbasin Lakes

GASTON POND (SEGMENT MA36065)
Location: Barre
Segment Size: 15 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3- No Uses Assessed (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
One aquatic macrophyte species, *Myriophyllum sp.*, was identified in Gaston Pond in 1997 (MassDEP 1997). No recent quality-assured data are available for Gaston Pond. All designated uses are not assessed. Due to the possible presence of a non-native form of *Myriophyllum* Gaston Pond is given an “Alert Status” for *Aquatic Life Use*.

Gaston Pond (Segment MA36065) Use Summary Table

Aquatic Life*	Fish Consumption	Drinking Water**	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED*					

*Alert Status issues identified, see details in use assessment section
** The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence, if any, of non-native species.

POTTAPAUG POND (SEGMENT MA36125)
Location: Petersham
Segment Size: 568 acres
Classification: Class A.

This segment is on the Massachusetts Year 2006 Integrated List of Waters- Category 5- "Pollutants Needing a TMDL" – Metals (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Habitat and Flow
The Quabbin Reservoir Dam influences the level of water in this segment.

Biology
Geosyntec Consultants (undated) conducted an aquatic macrophytes survey in Pottapaug Pond on July 18, 2006. They found the highest plant densities in the northeastern and eastern parts of the north basin and in the shallow littoral areas along the western and northern parts of the main pond. Biovolume was found to be highest in shallow littoral zones. At 21% of the stations surveyed plant density was found to be dense (51-75%) while at another 21% of the stations surveyed it was found to be very dense (76-100%). Plant biomass was found to be high at 22% of stations and very high at 19% of stations.

Geosyntec Consultants (undated) surveyed 58 stations in the pond and found that a non-native species, variable milfoil (*Myriophyllum heterophyllum*), was the most dominant and spatially distributed plant in the pond. They found variable milfoil at 74% of the stations sampled and the plant was dominant at 24% of all sampling stations. The plant was especially dominant in stations located in the north basin. Floating-leaf vegetation, including White Water Lily (*Nymphaea odorata*), Yelllow Water Lilly (*Nuphar* sp.), Little Floating Heart (*Nymphoides cordata*), Watershield (*Brasenia schreberi*), was also abundant in the pond with White Water Lily being dominant at 21% of all stations. Other commonly observed species included: Common Bladderwort (*Utricularia vulgaris*), Purple Bladderwort (*Utricularia purpurea*) and a number of pondweed species (*Potamogeton* spp.).

Due to the presence of a non-native macrophyte, Pottapaug Pond is assessed as impaired for the *Aquatic Life Use*. The high plant density and biomass at this pond is a cause of concern, but it's shallow nature and probable role as a filter for the Quabbin Reservoir, a major drinking water supply must be noted.

Fish Consumption Use
It has been determined that the fish consumption advisory for the Quabbin Reservoir also applies to Pottapuag Pond (Celona 2007). The fish consumption advisory for the Quabbin Reservoir is detailed below.

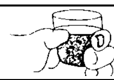
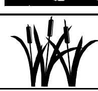
> "*Children younger than 12, pregnant women, and nursing women should refrain from consuming all fish in Quabbin Reservoir except Lake Trout less than 24 inches long and Salmon.*
> *The general population should refrain from consuming Smallmouth Bass, Largemouth Bass, and Lake Trout greater than 24 inches long. The general public may consume unlimited Salmon and lake trout less than 24 inches long. The general public should limit consumption of all other fish species to one five-ounce meal per week."*

Because MA DPH recommends that the site-specific fish consumption advisory for Quabbin Reservoir due to mercury should also apply to Pottapuag Pond (Celona 2007) this pond is assessed as impaired for the *Fish Consumption Use*.

A TMDL, a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards, was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Pottapuag Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Pottapaug Pond (Segment MA36125) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-Native Aquatic Plants Source: Introduction of non-native organisms
Fish Consumption		IMPAIRED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition-toxics
Drinking Water*		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Conduct fish toxics monitoring in Pottapaug Pond to more fully assess the *Fish Consumption Use.*

QUABBIN RESERVOIR (SEGMENT MA36129)
Location: Petersham/Pelham/Ware/Hardwick/Shutesbury/Belchertown/New Salem
Segment Size: 24012 acres
Classification: Class A, Public Water Supply

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 5- Pollutants Needing a TMDL – Metals (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
MWRA (registration #10830901)
The Massachusetts Water Resources Authority (MRWA) is allowed to withdraw (WMA Registration Number 10830901) 186.7 MGD from the reservoir. The majority of this water is transferred out of the Chicopee River Basin to supply potable water to 44 communities in the Metropolitan Boston area and three Western Massachusetts communities.

NPDES SURFACE WATER DISCHARGES
There are no permitted discharges to this drinking water supply reservoir.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
Geosyntec Consultants (2006) conducted aquatic macrophytes surveys in the Quabbin Reservoir between July 17, 2006 and August 16, 2006. They conducted surveys in a number of littoral areas in the reservoir including: northern settling pond, Fishing Area 3 & Shaft 11A, Fishing Area 2, Fishing Area 1, Quabbin-North Dana, Quabbin-Millington and Quabbin-Mt. Russ.

The northern settling pond, a small 47 acre area directly north of Fishing Area 2, was surveyed on July 24, 2006. Fifty-one stations were sampled. Forty-three percent of the stations in the northern settling pond were found to have moderate to very dense plant densities, although only 5% of that total was very dense. Moderate plant biomass was found at 43% of stations and high plant biomass was found at 19% of stations, while the remaining stations had low or zero biomass. Plant species in order of dominance (number of stations at which they were the most abundant) include: White Water Lily (*Nymphaea odorata)*, Pickerelweed (*Pontederia cordata*),Variable Milfoil (*Myriophyllum heterophyllum*), Purple Bladderwort (*Utricularia purpurea*), various pondweeds (*Potamogeton* spp.), Low Watermilfoil (*Myriophylum humile*) and Watershield (*Brasenia schreberi*).

In addition to the northern settling pond, Geosyntec sampled for aquatic macrophytes at 327 stations in the Quabbin Reservoir. Aquatic plant growth was found to be sparse and when found, it was mainly located in shallow areas in coves and along the shores of the Quabbin (Geosyntec Consultants 2006). Eighty-three percent of all stations sampled had low plant densities (0-25%) and dense and very dense plant growth was located at only 17% of stations (Geosyntec Consultants 2006). High plant densities were found in “coves along the northern and eastern portions of North Dana, the area north of Mount L in Millington and the southeast cove near Shaft 11A of Fishing Area 3” (Geosyntec Consultants 2006). It is important to note that 60% of the stations sampled were characterized as having virtually no plants or very sparse densities (1-5%) (Geosyntec Consultants 2006). Plant biomass was also found to be low in the littoral areas surveyed in the Quabbin Reservoir. Seventy-nine percent of the stations surveyed were characterized as having low or zero plant biomass (Geosyntec Consultants 2006). Moderate biomass was present at 12% of sampled stations, while 9% of the stations had high to very high biomass (Geosyntec Consultants 2006). Fifty-two plant species were observed with golden hedge hyssop (*Gratiola aurea*) dominant at 31% of stations. Other plant species commonly found include: Bur-reed (*Sparganium* sp.), Robbin’s Spike Rush (*Eleocharis robbinsii*), Variable Milfoil (*Myriophyllum heterophyllum*), numerous bladderwort species (*Utricularia sp*.), and Mermaid Weed (*Proserpinaca palustris*).

The non-native species Variable Milfoil (*Myriophyllum heterophyllum*) was dominant at 7% of all stations sampled and largely found in coves (Geosyntec Consultants 2006). Geosyntec staff found Variable Milfoil in coves near Shaft 11, Albertine's Cove, a cove directly west of Albertine's Cove, in coves near Leveau Island, a cove near Pittman Hill, and in a shallow area near Bassett and Fairview Hills (Geosyntec Consultants 2006). Generally the densities and biovolume of aquatic macrophytes in the Quabbin Reservoir is low.

Water Chemistry

MA DCR collects water quality data at numerous locations in the Quabbin Reservoir and its tributaries, although a QAPP and field duplicates were not available for their reservoir sampling.

2003

MA DCR (2004) collected water chemistry data and water column profiles at three stations in 2003. MA DCR documented low turbidity, low color and low specific conductance; the pH ranged from 5.6 –7.2 SU in their samples (MA DCR 2004). Secchi disk depth ranged from 3.8 to 13 m. Dissolved oxygen levels were near saturation or over-saturated in the metalimion and epilimion. At the Shaft #12 sampling site the minimum dissolved oxygen reading was 49.2 % saturation, while the minimum found at Site 202 was 75.9% saturation in the hypoliminion. The average pH of all 54 reservoir samples was 6.64 SU while the average alkalinity of samples from the three MA DCR sampling sites was 4.0 mg/L as CaC03 (MA DCR 2004). Quarterly nutrient sampling was also conducted by MA DCR scientists. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2004).

2004

MA DCR (2005) collected water chemistry data and water column profiles at three stations in 2004. MA DCR documented low turbidity and low specific conductance. The pH ranged from 5.5 –7.0 SU in their samples. Secchi disk depth ranged from 5.8 to 13.1 m. At the Shaft #12 sampling site, the minimum dissolved oxygen reading was 48% saturation while the minimum found at Site 202 was 73% saturation in the hypoliminion. The average pH of all 46 reservoir samples was 6.54 SU while the average alkalinity of samples from the three MA DCR sampling sites was 4.4 mg/l as CaC03. MA DCR scientists also conducted quarterly nutrient sampling. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2005).

2005

MA DCR collected water chemistry data and water column profiles at three stations in 2005. MA DCR documented low turbidity, and the pH ranged from 5.5 –7.0 SU in their samples (MA DCR 2006a). Secchi disk depth ranged from 3.7 to 11.8 m. At the Den Hill sampling site the minimum dissolved oxygen reading was 31% saturation while the minimum found at Site 202 was 55% saturation in the hypoliminion (MA DCR 2006b). The average pH across the three reservoir stations was 6.61 SU while the average alkalinity of samples was 4.85 mg/l as CaC03. MA DCR scientists also conducted quarterly nutrient sampling. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2006b).

2006

MA DCR collected water chemistry data and water column profiles at three stations in 2006. MA DCR documented low turbidity, and the pH ranged from 5.5 –7.7 SU in their samples (MA DCR 2007). Secchi disk depth ranged from 4.0 to 12.6 m. At the Den Hill sampling site the minimum dissolved oxygen reading was 20% saturation while the minimum found at Site 202 was 58% saturation in the hypoliminion (MA DCR 2007). The average pH across the three reservoir stations was 6.34 SU while the average alkalinity of samples was 5.31 mg as CaC03 (MA DCR 2007). Quarterly nutrient sampling was also conducted by MA DCR scientists in 2006. Low ammonia, low nitrate and low total phosphorus concentrations were measured at all three sampling stations (MA DCR 2007).

The *Aquatic Life Use* is assessed as impaired based on the presence of the non-native macrophyte (*Myriophyllum heterophyllum*). The Quabbin Reservoir and its tributaries, including flow diversion from the Ware River, are subject to acid deposition. Acid deposition effects on the reservoir and its tributaries is a cause of concern. MA DCR (2007) notes that productivity within the reservoir is limited by phosphorus, which is found in low concentrations in the reservoir.

Fish Consumption Use
MDPH has issued a fish consumption advisory due to mercury contamination for Quabbin Reservoir as follows.

> "*Children younger than 12, pregnant women, and nursing women should refrain from consuming all fish in Quabbin Reservoir except Lake Trout less than 24 inches long and Salmon.*
> *The general population should refrain from consuming Smallmouth Bass, Largemouth Bass, and Lake Trout greater than 24 inches long. The general public may consume unlimited Salmon and lake trout less than 24 inches long. The general public should limit consumption of all other fish species to one five-ounce meal per week."*

Fish were collected from the Quabbin Reservoir by MassDEP for mercury analysis on April 20th, 2005 as part of an Office of Research and Standards long term trend study (MassDEP 2005). The largemouth bass samples had an average mercury concentration around the 0.5 µg/g Hg trigger level that MA DPH uses to issue no consumption advisories for sensitive population groups and limited consumption general population advisories. The data are summarized below.

Fish Species	Number Collected	Average Length (mm)	Range Length (mm)	Average Wet Weight Whole Specimen(g)	Range Wet Weight Whole Weight (g)	Average Hg of individual fillets(µg/g)	Range Hg-individual fillets (µg/g)
Largemouth Bass	12	385	250-470	927.7	227-1765	0.51	0.17-0.88
Lake Trout	7	550	480-590	1434.3	1029-1770	0.38	0.2-0.51
Yellow Perch	6	218	140-330	146.2	28-347	0.31	0.11-0.63

A TMDL, a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards, was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Pottapuag Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

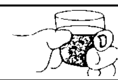
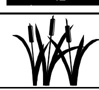
Primary and Secondary Contact Recreation Uses
In 2003 MA DCR sampled at three sites for fecal coliform bacteria and found very low fecal bacteria counts. Only 14 of the 60 samples taken tested positive for fecal coliform bacteria and the greatest count was 3 cfu/100 mL (MA DCR 2004). In 2004 fecal coliform counts were very low with a range from 0 to 1 cfu/100 mL (n=90) (MA DCR 2005). In 2005 MA DCR monitored bacteria levels between May 25 and December 13 (MA DCR 2006b). Fecal coliform counts in 2005 were very low with a range from 0 to 5 cfu/100 mL (n=73) (MA DCR 2006). In 2006 MA DCR monitored bacteria levels between April 20 and December 14 (MA DCR 2007). Fecal coliform counts in 2006 were very low with a range from 0 to 19 cfu/100 mL (n=129, 9 sampling days) (MA DCR 2007). Of the 129 total samples taken, fifty one samples were taken at the three

stations on five sampling days during the primary contact season. The majority of the samples did not show the presence of fecal coliform bacteria. Of the 129 samples taken, *E. coli* was only detected in two samples. These samples, taken on October 19 and November 15, had *E. coli* counts at the minimum detection limit of 10 MPN/100 mL (MA DCR 2007). MA DCR (2007) notes that a “season gull population that roosts on the reservoir overnight has been identified as the primary contributor of fecal coliform bacteria contamination to the reservoir”.

Given the very low fecal coliform counts in 2006 and reported historically at the Quabbin Reservoir the *Primary* and *Secondary Contact Recreational Uses* are assessed as support.

Aesthetics Use
No objectionable conditions have been reported in the Quabbin Reservoir, which is a protected public water supply and managed by MA DCR as part of the Quabbin Watershed (Bishop 2006). Given the lack of objectionable conditions, the *Aesthetics Use* is assessed as support.

Quabbin Reservoir (Segment MA36129) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native
Fish Consumption		IMPARIED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Drinking Water*		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Coordinate future MassDEP sampling with the existing MA DCR sampling program.

Conduct additional fish toxics monitoring in the Quabbin Reservoir to evaluate Hg in response to TMDL implementation.

Conduct efforts to minimize and contain the spread of non-native plants.

Ware River Subbasin Lakes

BEAVER LAKE (SEGMENT MA36010)
Location: Ware
Segment Size: 150 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
Two non-native species (*Myriophyllum heterophyllum* and *Myriophyllum spicatum*) were observed in Beaver Lake during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of non-native species. With the exception of *Aquatic Life Use* no other quality-assured data are available, the remaining designated uses are not assessed.

Beaver Lake (Segment MA36010) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-Native aquatic plants *Myriophyllum spicatum* Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current macrophyte conditions.

Management to control and prevent the spread of non-native macrophytes should be conducted.

BICKFORD POND (SEGMENT MA36015)
Location: Hubbardston/Princeton
Segment Size: 163 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Fitchburg Water Department registration/permit (20809701/9P20809701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Bickford Pond. All designated uses are not assessed

Bickford Pond (Segment MA36015) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

BRIGHAM POND (SEGMENT MA36020)
Location: Hubbardston
Segment Size: 47 acres
Classification: Class A

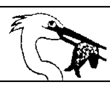
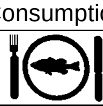
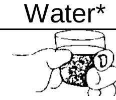
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
One potential non-native aquatic macrophyte species, *Myriophyllum sp.*, was identified in Brigham Pond (MassDEP 1998). The *Aquatic Life Use* is not assessed for Brigham Pond. However, this use is identified with an “Alert” Status because of the potential infestation of non-native form of *Myriophyllum*.

No recent quality-assured data are available for Brigham Pond. All designated uses are not assessed.

Brigham Pond (Segment MA36020) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

DEMOND POND (SEGMENT MA36051)
Location: Rutland
Segment Size: 120 acres
Classification: Class A

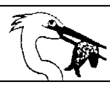
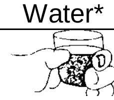
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One potential non-native aquatic macrophyte species, *Myriophyllum sp*., was identified in Demond Pond (MassDEP 1998). The *Aquatic Life Use* is not assessed for Demond Pond. However, this use is identified with an “Alert Status” because of the potential infestation of non-native form of *Myriophyllum*.

No recent quality-assured data are available for Demond Pond. All designated uses are not assessed.

Demond Pond (Segment MA36051) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

FOREST LAKE (SEGMENT MA36063)
Location: Palmer
Segment Size: 45 acres
Classification: Class B

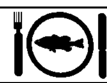
This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Myriophyllum spicatum*) was observed in Forest Lake during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. No recent quality-assured data are available for Forest Lake. All designated uses with the exception of the *Aquatic Life Use* are not assessed.

Forest Lake (Segment MA36063) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: *Myriophyllum spicatum* Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

HARDWICK POND (SEGMENT MA36066)
Location: Hardwick
Segment Size: 67 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Hardwick Pond. All designated uses with the exception of *Aquatic Life Use* are not assessed.

Aquatic Life Use
<u>Biology</u>
Two non-native species (*Cabomba caroliniana*, *Myriophyllum heterophyllum*) were observed in Hardwick Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of two non-native species. No recent quality-assured data are available for Forest Lake. All designated uses with the exception of *Aquatic Life Use* are not assessed.

Hardwick Pond (Segment MA36066) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
An aquatic macrophyte survey should be considered to determine the extent of impairment.

Actions to control non-natives should be taken to minimize their impact in this pond.

LONG POND (SEGMENT MA36082)
Location: Rutland
Segment Size: 167 acres
Classification: Class A

This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Myriophyllum heterophyllum*) was observed in Long Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. No recent quality-assured data are available for Long Pond. All designated uses with the exception of *Aquatic Life Use* are not assessed.

Long Pond (Segment MA36082) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Drinking Water*		NOT ASSESSED
Fish Consumption		
Primary Contact		
Secondary Contact		
Aesthetics		

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
An aquatic macrophyte survey should be considered to determine the extent of non-native plant species.

Actions to control non-natives should be taken to minimize their impact in this pond.

MARE MEADOW RESERVOIR (SEGMENT MA36090)

Location: Westminster/Hubbardston
Segment Size: 240 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

WMA (Appendix E, Table E1)

Fitchburg Water Department registration/permit (20809701/9P20809701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)

Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT

No quality-assured data are available for Mare Meadow Reservoir. All designated uses are not assessed.

Mare Meadow Reservoir (Segment MA36090) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Monitor water withdrawals by the Fitchburg Water Department.

MARE MEADOW RESERVOIR NORTH (SEGMENT MA36178)
Location: Westminster
Segment Size: 38 acres
Classification: Class A

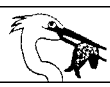
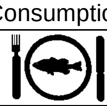
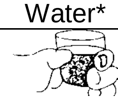
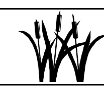
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Fitchburg Water Department registration/permit (20809701/9P20809701)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Mare Meadow Reservoir North. All designated uses are not assessed.

Mare Meadow Reservoir North (Segment MA36178) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS
Monitor water withdrawals by the Fitchburg Water Department.

MOOSEHORN POND (SEGMENT MA36097)

Location: Hubbardston
Segment Size: 67 acres
Classification: Class A

This segment is on the 2006 Integrated List of Waters in Category 4c- *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT

Biology
A non-native species (*Myriophyllum heterophyllum*) was observed in Moosehorn Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. No recent quality-assured data are available for Moosehorn Pond. All designated uses with the exception of the *Aquatic Life Use* are not assessed.

Moosehorn Pond (Segment MA36097) Use Summary Table

Designated Uses	Status
Aquatic Life	IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Fish Consumption	
Drinking Water*	
Primary Contact	NOT ASSESSED
Secondary Contact	
Aesthetics	

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

An aquatic macrophyte survey should be considered to determine the extent of non-native plant species.

Actions to control non-natives should be taken to minimize their impact in this pond.

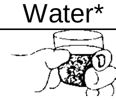
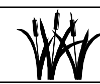
MOULTON POND (SEGMENT MA36098)
Location: Rutland
Segment Size: 65 acres
Classification: Class A

This segment is on the 2006 Integrated List of Waters in Category 3 - *No Uses Assessed* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One potential non-native aquatic macrophyte species, *Myriophyllum sp.*, was identified in Moulton Pond (MassDEP 1998). The *Aquatic Life Use* is not assessed. However this use is identified with an "Alert" Status because of the potential infestation of non-native form of *Myriophyllum*.
No recent quality-assured data are available for Moulton Pond. All designated uses are not assessed.

Moulton Pond (Segment MA36098) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine the presence if any of non-native species.

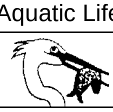
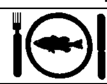
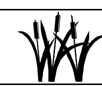
PERRY HILL POND (SEGMENT MA36122)
Location: Hubbardston
Segment Size: 23 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 3 - *No Uses Assessed* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
One potential non-native aquatic macrophyte species, *Myriophyllum sp.*, was identified in Perry Hill Pond during the 1998 synoptic lake survey (MassDEP 1998). This macrophyte may be a non-native and confirmation of the species is needed. The *Aquatic Life Use* is not assessed. However this use is identified with an "Alert" Status because of the potential infestation of non-native form of *Myriophyllum*. No recent quality-assured data are available for Perry Hill Pond. All designated uses are not assessed.

Perry Hill Pond (Segment MA36122) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

THOMPSON LAKE (SEGMENT MA36154)

Location: Palmer
Segment Size: 35 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES

Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT

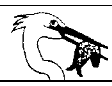
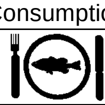
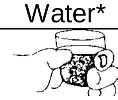
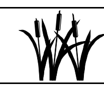
Aquatic Life Use

Biology

The presence of *Myriophyllum heterophyllum* was listed in the herbicide permit files and the lake has been treated with herbicides.

Confirmation of the presence of non-natives macrophytes by DWM personnel is needed. The *Aquatic Life Use* is not assessed for Thompson Lake. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. No recent quality-assured data are available for Thompson Lake. All designated uses are not assessed.

Thompson Lake (Segment MA36154) Use Summary Table

Aquatic Life**	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED**					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
**Alert Status issues identified, see details in use assessment section

Quaboag River Subbasin Lakes

BROOKS POND (SEGMENT MA36023)
Location: N. Brookfield/New Braintree/Spencer/Oakham
Segment Size: 86 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5- *Waters Requiring a TMDL* because of pathogens (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
A milfoil species (*Myriophyllum sp.*) was observed in Brooks Pond during the 1998 synoptic surveys (MassDEP 1998). A private company, Aquatic Control Technologies has reported *Myriophyllum heterophyllum* in Brooks Pond (ACT 2000) and the pond has been treated with herbicides in the past.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Brooks Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Brooks Pond with the exception of macrophytes information. All designated uses are not assessed with the exception of *Aquatic Life Use*.

Brooks Pond (Segment MA36023) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of a non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

Conduct water quality monitoring to evaluate designated uses.

BROWNING POND (SEGMENT MA36025)
Location: Oakham/Spencer
Segment Size: 106 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of pathogens (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.015 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Browning Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The current estimated phosphorous loading of 200 kg/ha/year does not have to be reduced to meet the target estimated loading (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
A non-native species (*Myriophyllum heterophyllum*) was observed in Browning Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Browning Pond (Segment MA36025) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Consult Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

COMINS POND (SEGMENT MA36037)
Location: Warren
Segment Size: 26 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 3 - *No Uses Assessed* (MassDEP 2007b).

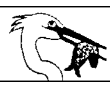
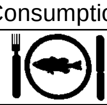
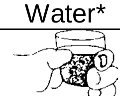
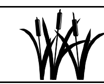
WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Warren Water Department registration/permit (20831102/9P220831102)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Comins Pond (no postings). Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Comins Pond. All designated uses are not assessed.

Comins Pond (Segment MA36037) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.
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CONANT BROOK RESERVOIR (SEGMENT MA36038)
Location: Monson
Segment Length: 4.4 acres
Classification: B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2 - Attaining Some Uses; Other Uses Not Attained. Uses attained are *Secondary Contact Recreation* and *Aesthetics* (Mass DEP 2005a).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
The Town of Monson municipal water supply, which included a large dug well (72 feet wide by 23 feet deep, one of the largest in the country)(US ACOE 2007a) and this 115-acre surface water reservoir, was located here historically. When the U.S. Army Corps of Engineers (ACOE) built the Conant Brook Dam in 1966, this system was replaced by a well field in northern Monson in the Chicopee Brook watershed. The Conant Brook system was officially abandoned as a public drinking water supply and all infrastructure connections were severed in 1996 (Mass DEP 2007c).

Based on the available information, there are no WMA regulated groundwater or surface water withdrawals from or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Historically this water body was approximately 115 acres (Ackerman 1989). The current Conant Brook Reservoir is impounded by the ACOE Conant Brook Dam. This project was built to reduce flooding in the Conant Brook, Chicopee and Connecticut rivers. The earth and rockfill dam is 85 feet high and 1,050 feet long, with a 36-inch reinforced concrete pipe outlet with no gate. It controls a drainage area of 7.8 square miles. The Conant Brook Dam Project is a dry bed reservoir and does not maintain a permanent recreational pool. During flood control activities the 2.25-acre reservoir can increase to a maximum 158 acres, with a storage capacity of 3,740 acre-feet. Water level at Conant Brook Dam is controlled by thirty-six inch diameter conduit without gates (US ACOE 2006). When the dam is not in use for flood control it is operated in a run-of-river mode.

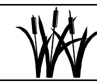
No other water quality data are available for Conant Brook Reservoir so the *Aquatic Life Use* is not assessed.

Primary and Secondary Contact Recreation and Aesthetics Uses
As at all Army Corps projects, primary and secondary contact recreation uses are allowed unless specifically prohibited; swimming, boating, and similar uses are not prohibited at the Conant Brook Dam Project. However, there is no public beach or boat launch located here. Given the lack of recent quality-assured data the *Primary* and *Secondary Contact Recreation Uses* are not assessed for Conant Brook Reservoir.

The Conant Brook Dam Project encompasses 471 acres and is managed by the ACOE for flood control, recreation, and habitat. Recreational opportunities include hunting, fishing, mountain biking, hiking, cross-country skiing, snowshoeing, sightseeing, and photography. Off road vehicles are prohibited, as are dumping and littering, loud noises, and any form of vandalism. These rules are enforced by Army Corps staff (US ACOE 2007b). The Monson-Brimfield-Wales Trail traverses the property; a total of 24 trail miles traverse the project. The ACOE web site for the dam states, "The natural environment of Conant Brook Dam reflects the diverse nature and beauty of New England. Forested, rolling hills frame the river valley in which numerous wildlife species find a home" (US ACOEc).

Based on this and the largely undeveloped watershed surrounding the Conant Brook Reservoir, noted scenic views and active management of the property, the *Aesthetics Use* is assessed as support.

Conant Brook Reservoir (Segment MA36050) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				SUPPORT

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

DEAN POND (SEGMENT MA36049)
Location: Brimfield/Monson
Segment Size: 10 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One potential non-native aquatic macrophyte, *Myriophyllum sp.*, was identified in Dean Pond during the 1998 synoptic lake surveys (MassDEP 1998). In 2003 the MA DCR Lakes and Ponds Program confirmed the presence of the non-native *Myriophyllum heterophyllum* in Dean Pond.

The *Aquatic Life Use* for this waterbody is assessed as impaired based on the presence of a non-native species. No quality-assured data are available for Dean Pond with the exception of macrophytes information. All designated uses are not assessed with the exception of *Aquatic Life Use.*

Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Dean Pond: Dean Pond Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Dean Pond (Segment MA36049) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic plant Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
An aquatic macrophyte survey should be considered to determine the extent of non-native plant species.

DEAN POND (SEGMENT MA36050)
Location: Oakham
Segment Size: 64 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of noxious aquatic plants and turbidity (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

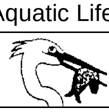
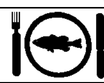
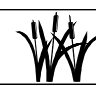
DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
Myriophyllum heterophyllum and *Myriophyllum sp*. were listed as found in Dean Pond in herbicide permit applications between 2003 to 2006 and the pond has been treated with herbicides.

The *Aquatic Life Use* is not assessed for Dean Pond. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. Confirmation of the presence of non-natives macrophytes by DWM personnel is needed.

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Dean Pond: Dean Campground and Pine Acres Campground. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Dean Pond with the exception of macrophyte information. All designated uses are not assessed.

Dean Pond (Segment MA36050) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

DOANE POND (SEGMENT MA36054)
Location: North Brookfield
Segment Size: 28 acres
Classification: Class A

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of noxious aquatic plants (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
North Brookfield Water Department registration (20821201)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Doane Pond. All designated uses are not assessed.

Doane Pond (Segment MA36054) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

HORSE POND (SEGMENT MA36072)
Location: North Brookfield
Segment Size: 63 acres
Classification: Class A

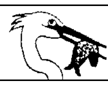
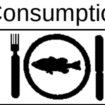
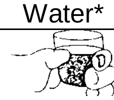
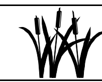
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
North Brookfield Water Department registration (20821201)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Horse Pond. All designated uses are not assessed.

Horse Pond (Segment MA36072) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

LAKE LASHAWAY (SEGMENT MA36079)
Location: North Brookfield/East Brookfield
Segment Size: 274 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters- Category 5 - Pollutants Needing a TMDL – Metals and exotic (non-native) species* (MassDEP 2007b).
*It should be noted that exotic species are not considered a pollutant.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Carbomba caroliniana*) was observed in Lake Lashaway during the 1998 synoptic survey (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native plant species.

Fish Consumption Use
MDPH has issued a fish consumption advisory due to Mercury contamination for Lake Lashaway, East Brookfield/North Brookfield as follows:

> *"Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Lake Lashaway in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury.*
> *The general public should limit consumption of Largemouth Bass fish from Lake Lashaway to two meals per month."*

The *Fish Consumption Use* is assessed as impaired for this waterbody due to a site specific fish consumption advisory.

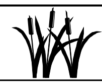
A TMDL was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Lake Lashaway that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Lake Lashaway. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary or Secondary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody. The *Aesthetics Use* is also not assessed.

No recent quality-assured data are available for Lake Lashaway with the exception of macrophyte information and a fish consumption advisory. All designated uses are not assessed with the exception of *Aquatic Life Use* and *Fish Consumption*.

Lake Lashaway (Segment MA36079) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		IMPAIRED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS
Conduct water quality monitoring to evaluate designated uses.

PALMER RESERVOIR (SEGMENT MA36115)
Location: Palmer
Segment Size: 8 acres
Classification: Class A

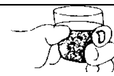
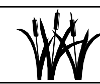
This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2 - Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Palmer Water Department registration (10822702)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No quality-assured data are available for Palmer Reservoir. All designated uses are not assessed.

Palmer Reservoir (Segment MA36115) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

QUABOAG POND (SEGMENT MA36130)
Location: Brookfield/East Brookfield
Segment Size: 544 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of noxious aquatic plants, nutrients, metals and exotic species* (MassDEP 2007b). *It should be noted that exotic species are not considered a pollutant. EPA approved a total phosphorus TMDL for Quaboag and Quacumquasit Ponds on 6 December 2007 (Perkins 2007).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Brookfield Water Department registration (20804501)

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

A 319 grant entitled "Phosphorus and Sediment Load Reduction at Quaboag and Quacumquasit Ponds" has been awarded. The goal of this project is to support the TMDL development and implementation by prioritizing and addressing pollutant sources within the shared watershed of the two lakes. Target pollutants are nutrients and TSS. Some implementation work that has been previously recommended will be undertaken, and plans will be developed for future implementation that will further reduce the NPS coming into the lakes.
Project tasks include:

1. development and implementation of a Quality Assurance Project Plan (QAPP);
2. prioritization of pollutant sources;
3. development of conceptual plans for two or more high-priority BMPs;
4. evaluation of additional control measures, including the backflow between the two lakes; and
5. aquatic vegetation management.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
According to field notes there was a fish kill after a July 21st, 2004 herbicide treatment. A blue-green bloom that may have been exacerbated by the herbicide treatment was later noted in July 2004. After the herbicide treatment the blue-green bloom was extensive, although high nutrient loading also likely contributed to the bloom.

In August 2003, during baseline TMDL sampling, three non-native species (*Myriophyllum heterophyllum, Cabomba caroliniana,* and *Myriophyllum spicatum*) were observed in Quaboag Pond (MassDEP 2006b). The macrophytes density and biovolume was very dense for the majority of the pond in August 2003 (MassDEP 2006b). The density and biovolume of macrophytes was much larger than found in the 1980's and macrophytes also occurred deeper in the water column (3 m versus <2 m) (MassDEP 2006b). These same non-native species were also observed in Quaboag Pond during the 1998 synoptic surveys (MassDEP 1998).

MA DFG conducted fish population sampling in Quaboag Pond (Site 1018) in Brookfield using a boat shocker on 30 June 2004. One hundred and twenty-nine chain pickerel and one alewife were collected (130 fish total) (Richards 2006). MA DFG fish biologists noted the targeted fish, *Escocidae* (chain pickerel and pike), only during their collection. Given the target nature of this sampling no conclusions on the fish population dynamics in Quaboag Pond can be made.

<u>Water Chemistry</u>
The selected target phosphorus concentration and loads necessary to achieve surface water

quality standards for Quaboag Pond are 30 ppb (June through September) and 2588 kg/year, respectively (MassDEP 2006b). For the complete detailing of estimated nutrient loading to Quaboag Pond see the Total Maximum Daily Loads of Total Phosphorus for Quaboag Pond & Quacumquasit Pond (MassDEP 2006b). For the most recent water quality data see Appendix C.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of non-native plant species and excessive algal growth resulting from high total phosphorus. The TMDL estimates nutrient loading from the municipal point source discharge (Spencer WWTP), multiple nonpoint sources, and internal nutrient recycling.

Fish Consumption Use
MA DPH (2005) has issued a fish consumption advisory due to Mercury contamination for Quaboag Pond, Brookfield/East Brookfield as follows:

> "*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Powder Mill Pond in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury.*
> *The general public should refrain from consumption of Largemouth Bass fish from Quaboag Pond. The general public should limit consumption of non-affected fish from Quaboag Pond to two meals per month*".

Due to the site specific fish consumption advisory this waterbody is assessed as impaired for the *Fish Consumption Use*.

Primary and Secondary Contact Recreation Uses
Large populations of the non-native Eurasian milfoil (M*yriophyllum spicatum*) and fanwort (*Cabomba carolinina)* were found in August 2003 (MassDEP 2006b). Macrophyte density in the range of 75-100% was found over the majority of the pond. Macrophytes also occupied 50 to 75% of the biovolume in the majority of the pond and around the edges macrophytes often occupied 75-100% of the biovolume, especially along the northeastern and northwestern shores of the pond. In July 2003 the macrophyte density and biovolume were so great that frequent cleaning of the outboard motor was needed to traverse the pond although conditions improved in August. In July of 2004 an herbicide treatment occurred on Quaboag Pond.

According to MassDEP (2006b), "A bloom of algae was reported to be in the water at the time, but this bloom expanded to become a large, persistent surface bloom of blue-green algae (cyanobacteria) that raised concerns about health impacts." It was estimated that the herbicide treatment likely released a sufficient amount of nutrients to significantly contribute to a large bloom, although it was also noted that phosphorus concentrations in East Brookfield River (an upstream tributary to Quaboag Pond) were also high (50 *u*g/L) in July (MassDEP 2006b).

The *Recreational Uses* are impaired due to high density and biovolume of aquatic macrophytes, including non-natives and excessive algal growth.

Aesthetics Use
MassDEP DWM field crews noted objectionable deposits on two occasions during field visits conducted in 2003 and 2004. Noxious weeds were noted on the two occasions and a bloom of blue-greens (cyanobacteria) was noted in July 2003. On three occasions surface scums were noted, consisting of pollen sheen on one occasion, streaks of foam on one occasion and a blue-green bloom on another occasion. Water odors or other objectionable deposits were not noted during field sampling. The *Aesthetic Use* is impaired due to high density and biovolume of aquatic macrophytes including non-natives and excessive algal growth.

Quaboag Pond (Segment MA36130) Use Summary Table

<table>
<tr><th>Designated Uses</th><th>Status</th></tr>
<tr><td>Aquatic Life</td><td>IMPAIRED
Cause: Non-native aquatic plants, excessive algal growth, high total phosphorus
Source: Introduction of non-native organism, municipal point source discharge, non-point sources, internal nutrient recycling</td></tr>
<tr><td>Fish Consumption</td><td>IMPARIED
Cause: Mercury in fish tissue
Source: Unknown
Suspected Source: Atmospheric deposition toxics</td></tr>
<tr><td>Primary Contact</td><td rowspan="3">IMPAIRED
Cause: Non-native aquatic plants, excessive algal growth
Source: Introduction of non-native organism, municipal point source discharges, internal nutrient recycling
Suspected Sources: Pesticide application</td></tr>
<tr><td>Secondary Contact</td></tr>
<tr><td>Aesthetics</td></tr>
</table>

RECOMMENDATIONS

Follow aquatic macrophytes management plan outlined in TMDL (MassDEP 2006b).

Follow TMDL recommendations in terms of nutrient loading with specif ic emphasis on non-point source loading reductions (MassDEP 2006b).

Conduct monitoring to assess the progress of TMDL implementation.

QUACUMQUASIT POND (SEGMENT MA36131)
Location: Brookfield/East Brookfield/Sturbridge
Segment Size: 223 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of metals and exotic species* (MassDEP 2007b).

*It should be noted that exotic species are not considered a pollutant. EPA approved a total phosphorus TMDL for Quaboag and Quacumquasit Ponds on 6 December 2007 (Perkins 2007). The target load listed for Quacumquasit Pond is considered a preventative TMDL.

A 319 grant entitled “Phosphorus and Sediment Load Reduction at Quaboag and Quacumquasit Ponds” has been awarded. The goal of this project is to support the TMDL development and implementation by prioritizing and addressing pollutant sources within the shared watershed of the two lakes. Target pollutants are nutrients and TSS. Some implementation work that has been previously recommended will be undertaken, and plans will be developed for future implementation that will further reduce the NPS coming into the lakes.
Project tasks include:

1. development and implementation of a Quality Assurance Project Plan (QAPP);
2. prioritization of pollutant sources;
3. development of conceptual plans for two or more high-priority BMPs;
4. evaluation of additional control measures, including the backflow between the two lakes; and
5. aquatic vegetation management.

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Habitat and Flow</u>
Flow of water out of Quacumquasit Pond is controlled by means of a gate structure and the backflow of water from Quaboag Pond to Quacumquasit Pond has been noted (MassDEP 2006b). This backflow of water from Quaboag has been identified as a source of nutrient loading to Quacumquasit Pond (MassDEP 2006b).

<u>Biology</u>
Three non-native species (*Myriophyllum heterophyllum, Myriophyllum spicatum,* and *Cabomba caroliniana*) were observed in Quacumquasit Pond during the 1998 synoptic surveys (MassDEP 1998). Macrophyte mapping was not conducted at this pond in 2003.

<u>Water Chemistry</u>
For a complete detailing of estimated nutrient loading to Quacumquasit Pond please see the Draft Total Maximum Daily Loads of Total Phosphorus for Quaboag Pond & Quacumquasit Pond (MassDEP 2006b). For the most recent water quality data for this pond see Appendix C.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Fish Consumption Use
MA DPH (2005) has issued a fish consumption advisory due to Mercury contamination for Quacumquasit Pond, Brookfield/East Brookfield as follows:

> “*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Quacumquasit*

Pond in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury. The general public should limit consumption of all fish species from Quacumquasit Pond to two meals per month".

Due to the site-specific fish consumption advisory this waterbody is assessed as impaired for the *Fish Consumption Use*.

A TMDL was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont.

The TMDL covers waterbodies including Quacumquasit Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Quacumquasit Pond: South Pond Beach and Camp Frank A Day. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No objectionable deposits, scum or odors were noted by DWM field crews during baseline TMDL sampling in 2003. Macrophyte mapping was not conducted at this pond.

Due to the lack of recent quality-assured bacteria information the *Recreation Uses* are not assessed. Due to the lack of objectionable conditions noted at Quacumquasit Pond by DWM field crews, the *Aesthetics Use* is supported for Quacumquasit Pond.

Quacumquasit Pond (Segment MA36131) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		IMPAIRED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS
Follow aquatic macrophytes management plan outlined in TMDL (MassDEP 2006b).

Efforts should be taken through appropriate gate management and/or raising the gate height to prevent unnecessary nutrient fluxes into the pond (MassDEP 2006b).

SUGDEN RESERVOIR (SEGMENT MA36150)
Location: Spencer
Segment Size: 85 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* for organic enrichment/low DO and nutrients (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.015 mg/L for this water body (MassDEP 2006c).

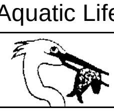
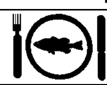
For a complete detailing of estimated nutrient loading to Sugden Reservoir see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 372 kg/ha/year to a target load of 230 kg/ha/year (38% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Primary and Secondary Contact Recreation and Aesthetics Uses
There is one beach along the shoreline of Sugden Reservoir. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Sugden Reservoir. All designated uses are not assessed.

Sugden Reservoir (Segment MA36150) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence if any of non-native species.

Consult Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

THOMPSONS POND (SEGMENT MA36155)
Location: Spencer
Segment Size: 116 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c - *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

In 2000 the Town of Spencer and Concern Citizens Association of Thompsons Pond received a $2,250 grant. The Thompson Pond project goal was to control the spread of Eurasian milfoil, a non-native nuisance aquatic plant, with the use of herbicides. The aquatic plant was affecting recreational pursuits and the ecosystem of the lake. In 2002 an additional $3,750 was awarded to control Eurasian milfoil with the use of herbicides and conduct public education.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
No non-natives aquatic macrophytes were observed by DWM field crews during the 1998 synoptic survey, although abutters claimed Eurasian milfoil (*Myriophyllum spicatum*) was present. The presence of *Myriophyllum* sp. and *Myriophyllum heterophyllum* was listed in the herbicide permit files and the pond has been treated with herbicides.

The *Aquatic Life Use* is not assessed for Thompsons Pond. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. Confirmation of the presence of non-natives macrophytes by DWM personnel is needed.

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Thompsons Pond: Camp Marshall and Thompsons Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Thompsons Pond. All designated uses are not assessed.

Thompsons Pond (Segment MA36155) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to determine current conditions and determine the presence, if any, of non-native species.

TURKEY HILL POND (SEGMENT MA36157)
Location: Rutland/Paxton
Segment Size: 90 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4c - *Impairment Not Caused by a Pollutant* due to the presence of exotic (non-native) species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
A non-native species (*Myriophyllum heterophyllum*) was observed in Turkey Hill Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species. With the exception of macrophytes information, no quality-assured data are available for Turkey Hill Pond. All designated uses are not assessed with the exception of aquatic life use.

Turkey Hill Pond (Segment MA36157) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

WICKABOAG POND (SEGMENT MA36166)
Location: West Brookfield
Segment Size: 315 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 5 - *Waters Requiring a TMDL* because of metals, noxious aquatic plants (CN118.0) and turbidity (CN118.0) (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.015 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Wickaboag Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 1049 kg/ha/year to a target load of 729 kg/ha/year (31% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated water withdrawals from or permitted surface water discharges to this subwatershed.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
The presence of *Myriophyllum* sp. and *Myriophyllum heterophyllum* were listed in herbicide permit files. Aquatic macrophytes are managed with yearly herbicide applications.

The *Aquatic Life Use* is not assessed for Wickaboag Pond. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*. Confirmation of the presence of non-natives macrophytes by DWM personnel is needed.

Fish Consumption Use
MDPH has issued a fish consumption advisory due to Mercury contamination for Wickaboag Pond, West Brookfield as follows:

> "*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Wickaboag Pond in order to prevent exposure to developing fetuses, nursing infants and young children to Mercury. The general public should limit consumption of Largemouth Bass fish from Wickaboag Pond to two meals per month*".

Due to the site-specific fish consumption advisory this waterbody is assessed as impaired for the *Fish Consumption Use*."

A TMDL was recently approved for mercury by the U.S. EPA. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont (Northeast States 2007).

The TMDL covers waterbodies including Wickaboag Pond that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007).

Primary and Secondary Contact Recreation and Aesthetics Uses
There are two beaches along the shoreline of Wickaboag Pond: Main Beach and Small Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure

information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody. The *Aesthetics Use* is also not assessed.

With the exception of a fish consumption advisory, no recent quality-assured data are available for Wickaboag Pond. All designated uses are not assessed except fish consumption.

Wickaboag Pond (Segment MA36166) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		IMPAIRED Cause: Mercury in fish tissue Source: Unknown Suspected Source: Atmospheric deposition toxics
Primary Contact		NOT ASSESSED
Secondary Contact		
Aesthetics		

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Consult Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

Implement the Northeast Regional Mercury Total Maximum Daily Load (TMDL).

Chicopee River Subbasin Lakes

CHICOPEE RESERVOIR (SEGMENT MA36033)
Location: Chicopee
Segment Size: 22 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact and Aesthetics* (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment.

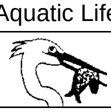
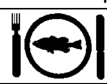
NPDES SURFACE WATER DISCHARGES (APPENDIX D, TABLE D4)
Westover Air Force Base (MAR05B973)
City of Chicopee (MAR041003)

DESIGNATED USE ASSESSMENT

Primary and Secondary Contact Recreation Uses
There is one beach along the shoreline of Chicopee Reservoir, Chicopee Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Chicopee Reservoir. All designated uses are not assessed.

Chicopee Reservoir (Segment MA36033) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Attention should be paid to bacteria monitoring in Cooley Brook above Chicopee Reservoir as this is upstream from the bathing beach at the reservoir.

DIMMOCK POND (SEGMENT MA36053)
Location: Springfield
Segment Size: 9 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3 -No Uses Assessed (MassDEP 2007b).

DESIGNATED USE ASSESSMENT
The *Aquatic Life Use* for this segment is not assessed, however, it is identified with an “Alert Status” because of the possible presence of a non-native species (*Myriophyllum sp.)*, that requires further confirmation when flowering heads are evident.

No quality-assured data are available for Dimmock Pond. All designated uses are not assessed.

Dimmock Pond (Segment MA36053) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to assess *Aquatic Life Use* and determine the presence, if any, of a non-native plant species.

FIVEMILE POND (SEGMENT MA36061)
Location: Springfield
Segment Size: 36 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2- Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact and Aesthetics* (MassDEP 2007b).

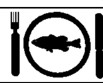
WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
1998 DWM field sheets state that *Myriophyllum heterophyllum* was found although a note made on the field sheets by Richard McVoy, dated 01/03/01, indicates the species found could also be *M. verticillatum* (MassDEP 1998). Due to the lack of confidence in the identification at this site, the *Aquatic Life Use* is not assessed for Fivemile Pond. However, this use is identified with an "Alert Status" because of the potential infestation of a non-native form of *Myriophyllum*.

Primary and Secondary Contact Recreation Uses
There is one beach along the shoreline of Fivemile Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Fivemile Pond. All designated uses are not assessed.

Fivemile Pond (Segment MA36061) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to assess *Aquatic Life Use* and determine the presence if any, of non-native species.

FIVEMILE POND SOUTH (SEGMENT MA36182)
Location: Springfield
Segment Size: 4 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 3 - No Uses Assessed (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
1998 DWM field sheets state that *Myriophyllum heterophyllum* was found, although a note made on the field sheets by Richard McVoy, dated 01/03/01, indicates the species found could also be *M. verticillatum* (MassDEP 1998). Due to the lack of confidence in the identification at this site, the *Aquatic Life Use* is not assessed for Fivemile Pond. However, this use is identified with an "Alert" Status because of the potential infestation of a non-native form of *Myriophyllum*.

No quality-assured data are available for Fivemile Pond. All designated uses are not assessed.

Fivemile Pond South (Segment MA36182) Use Summary Table

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Conduct aquatic macrophyte mapping to assess *Aquatic Life Use* and determine the presence if any of non-native species.

LONG POND (SEGMENT MA36083)
Location: Springfield
Segment Size: 14 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.030 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Long Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 163 kg/ha/year to a target load of 68 kg/ha/year (58% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
One aquatic macrophyte species, *Myriophyllum* sp., was identified in Long Pond during 1998 synoptic surveys (MassDEP 1998). This macrophyte may be a non-native and therefore will require further identification when flowering heads are present. However, this use is identified with an "Alert Status" because of the potential infestation of non-native form of *Myriophyllum*.

No quality-assured data are available for Long Pond. All designated uses are not assessed

Long Pond (Segment MA36083) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED *				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

Confirm species of *Myriophyllum* when flowering heads are present.

LAKE LORRAINE (SEGMENT MA36084)
Location: Springfield
Segment Size: 28 acres
Classification: Class B

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 4c- Impairment caused by something other than a pollutant – exotic species (MassDEP 2007b).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
Biology
A non-native species (*Myriophyllum heterophyllum*) was noted on 1998 synoptic surveys field sheets (MassDEP 1998). It wasn't exactly found during 1998 survey, it was noted on 1998 field sheet that it was found during a 1978 field survey (DWPC undated). Confirmation of the current presence of this species is needed.

Water Chemistry
Lake Lorraine was sampled by DWM as part of the nutrient criteria development project in July 2003 and again in September 2005. In July 2003 oxygen depletion was recorded only at a depth of 10m (Appendix C). The profile data collected in September 2005 indicate oxygen depletion at approximately 8m and below which represents approximately 20% of the lake area. However the data collected in 2005 have not yet been reviewed for quality.

The *Aquatic Life Use* for this segment is assessed as impaired based on the presence of a non-native species.

Primary and Secondary Contact Recreation Uses
There are two beaches along the shoreline of Lake Lorraine: Lake Lorraine and Knights of Columbus beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No quality-assured data are available for Lake Lorraine. All designated uses with the exception of the *Aquatic Life Use* are not assessed.

Lake Lorraine (Segment MA36084) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic plants Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		
Secondary Contact		
Aesthetics		

RECOMMENDATIONS
Conduct macrophyte mapping in Lake Lorraine to determine the presence of any non-native aquatic macrophytes.

Review the data collected for Lake Lorraine as part of the nutrient criteria development project in 2005 to better evaluate the status of the *Aquatic Life Use* and the need for additional monitoring.

MINECHOAG POND (SEGMENT MA36093)
Location: Ludlow
Segment Size: 21 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* for noxious aquatic plants (MassDEP 2007b).

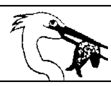
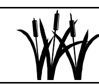
There is a proposed site-specific total phosphorous criterion of 0.030 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Minechoag Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 110 kg/ha/year to a target load of 53 kg/ha/year (52% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Minechoag Pond. All designated uses are not assessed.

Minechoag Pond (Segment MA36093) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

MONA LAKE (SEGMENT MA36094)
Location: Springfield
Segment Size: 11 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* (MassDEP 2007b).

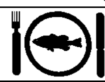
There is a proposed site-specific total phosphorous criterion of 0.030 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Mona Lake please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 47 kg/ha/year to a target load of 19 kg/ha/year (60% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
No recent quality-assured data are available for Mona Lake. All designated uses are not assessed.

Mona Lake (Segment MA36094) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

SPECTACLE POND (SEGMENT MA36142)
Location: Wilbraham
Segment Size: 9 acres
Classification: Class B

This segment is on the 2006 Integrated List of Waters in Category 4a - *TMDL is Completed* (MassDEP 2007b).

There is a proposed site-specific total phosphorous criterion of 0.020 mg/L for this water body (MassDEP 2006c).

For a complete detailing of estimated nutrient loading to Spectacle Pond please see the Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002). The phosphorous loads should be reduced from the current estimate loading of 16.8 kg/ha/year to a target load of 8.7 kg/ha/year (48% reduction) (MassDEP 2002).

WATER WITHDRAWALS AND PERMITTED DISCHARGES
Based on the available information there are no WMA regulated groundwater or surface withdrawals from this segment or permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
An unconfirmed species of *Myriophyllum* is present in Spectacle Pond. Whether or not it is non-native needs to be determined.

The *Aquatic Life Use* is not assessed for Spectacle Pond. However, this use is identified with an “Alert Status” because of the potential infestation of a non-native form of *Myriophyllum*.

Primary and Secondary Contact Recreation Uses
There are two beaches along the shoreline of Spectacle Pond: Spectacle Pond Camp and Spectacle Pond Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No recent quality-assured data are available for Spectacle Pond. All designated uses are not assessed.

Spectacle Pond (Segment MA36142) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED*				

*Alert Status issues identified, see details in use assessment section

RECOMMENDATIONS
Consult and follow recommendations in Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (MassDEP 2002).

Confirm species of *Myriophyllum* when flowering heads are present.

SPRINGFIELD RESERVOIR (SEGMENT MA36145)
Location: Ludlow
Segment Size: 393 acres
Classification: Class A

This segment is on the Massachusetts Year 2006 Integrated List of Waters – Category 2-Attaining Some Uses; Other Uses Not Assessed. Uses attained are *Secondary Contact* and *Aesthetics* (MassDEP 2007b).

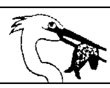
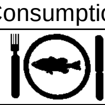
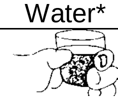
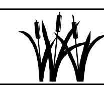
WATER WITHDRAWALS AND PERMITTED DISCHARGES
WMA (Appendix E, Table E1)
Springfield Water Department Registration #10828101

NPDES SURFACE WATER DISCHARGES (APPENDIX D)
Based on the available information there are no permitted surface water discharges to this segment.

DESIGNATED USE ASSESSMENT
Aquatic Life Use
<u>Biology</u>
MA DFG conducted fish population sampling in Springfield Reservoir (Station 494) on 13 July 2001. Forty-four bluegill, forty-two largemouth bass, forty-one yellow perch, thirty white perch, eight pumpkinseed, four black crappie, two smallmouth bass, one rock bass and one redbreast sunfish were collected (173 fish total) (Richards 2006). All of these species are macrohabitat generalists and would be expected in a lentic environment. The fish population data is not sufficient to assess the *Aquatic Life Use*.

No quality-assured data with the exception of fish population data are available for Springfield Reservoir. All designated uses are not assessed.

Springfield Reservoir (Segment MA36145) Use Summary Table

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

* The MassDEP Drinking Water Program maintains current drinking water supply data.

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Executive Office of Environmental Affairs

CHICOPEE RIVER

A Comprehensive Watershed Assessment

2003

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July 29, 2003

Dear Friends of the Chicopee River Watershed:

It is with great pleasure that I present you with the Year 3 Assessment Report for the Chicopee River Watershed. The report outlines the main environmental issues that face the watershed and provides the most current status of the Chicopee River. This report will help formulate the 5-Year Watershed Action Plan that will guide state and local environmental actions within the Chicopee River Watershed. The plan will implement the goals of the Executive Office of Environmental Affairs which include: improving water quality; restoring natural flows to rivers; protecting and restoring biodiversity and habitats; improving public access and balanced resource use; improving local capacity; and promoting a shared responsibility for watershed protection and management.

The former Chicopee River Watershed Team Leader developed this Assessment Report after extensive research and input by state and federal agencies, Regional Planning Agencies, watershed groups and organizations, and team members. The priority issues identified in the report include:

- Water Quality
- Water Quantity
- Biological Resources
- Open Space and Growth Planning
- Outreach
- Local Capacity Building
- Recreation

I commend everyone that was involved with the Chicopee River Watershed Assessment effort. Thank you for your dedication, perseverance, and commitment. The watershed approach is the best way for government and community partners to make significant progress in addressing the environmental challenges of the 21st Century. If you are not currently a participant, I strongly encourage you to become active in the Chicopee River Watershed restoration and protection efforts.

Regards,

Ellen Roy Herzfelder

Ellen Roy Herzfelder

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APPENDICES

LIST OF FIGURES

LIST OF TABLES

Any reference to 'Massachusetts Watershed Initiative (MWI)' in this document pertains to a program that existed at the Executive Office of Environmental Affairs from 1993-2003. Any reference to a 'Watershed Team' refers to a multi-stakeholder team, facilitated by a 'Watershed Team Leader' that existed from 1998-2003 as part of the MWI.

List of Acronyms

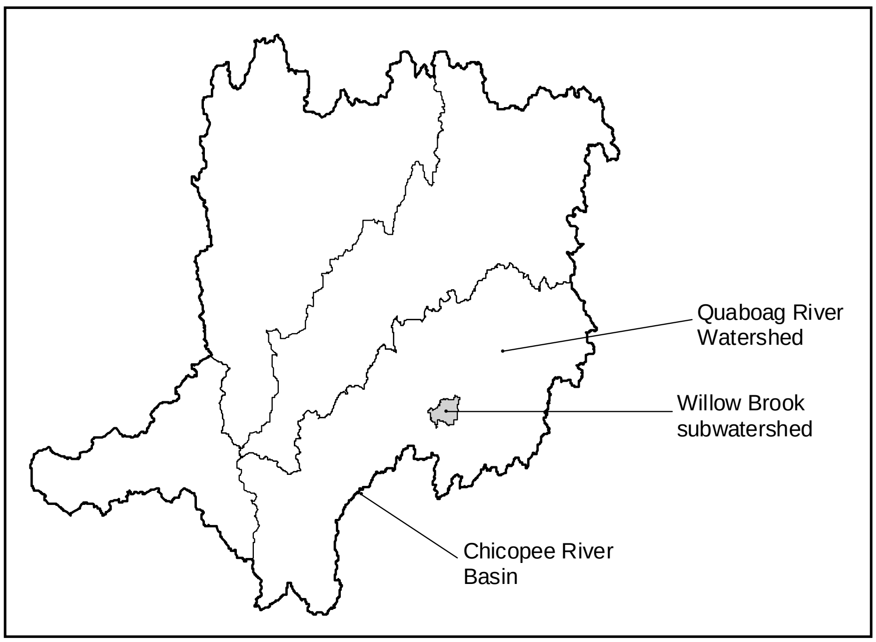
ACOE – Army Corps of Engineers
cfs – cubic feet per second
CMRPC – Central Massachusetts Regional Planning Commission
CSO – Combined Sewer Overflow
CY – Calendar Year
DEM – Department of Environmental Management*
DEP – Department of Environmental Protection
DFW – Division of Fisheries & Wildlife
EO 418 – Executive Order #418
EOEA – Executive Office of Environmental Affairs
EPA – Environmental Protection Agency
ESS – Environmental Science Services, Inc.
FERC – Federal Energy Regulatory Commission
FRCOG – Franklin Regional Council of Governments
FY – Fiscal Year
GIS – Geographic Information Services
IO – Indian Orchard
MAS – Massachusetts Audubon Society
MassGIS – Massachusetts office of Geographic Information Services
MDC – Metropolitan District Commission*
MGD – Million Gallons per Day
MISER – Massachusetts Institute of Social and Economic Research
MRIP – Massachusetts Resource Identification Project
MRPC – Montachusett Regional Planning Commission
MWI – Massachusetts Watershed Initiative
MWRA – Massachusetts Water Resources Authority
NHESP – Natural Heritage and Endangered Species Program
P8 – Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds
PAB – Public Access Board
PVPC – Pioneer Valley Planning Commission
REEA – Regional Environmental Education Alliance
SARIS – Stream And River Information System
SWQS – Surface Water Quality Standards
TAG – Technical Assistance Grant
Team – the Chicopee River Watershed Team
TKN – Total Kjeldahl Nitrogen
TMDL – Total Maximum Daily Load
TP – Total Phosphorous
TSS – Total Suspended Solids
TTOR – The Trustees of Reservations
USFWS – United States Fish & Wildlife Service
USGS – United States Geological Survey
WAP – Watershed Action Plan
WMA – Water Management Act
WTL – Watershed Team Leader
WWTP – Wastewater Treatment Plant

* DEM and MDC are now the Department of Conservation and Recreation

Terminology

Throughout this report, several terms are used to refer to drainage areas. In most cases, the meaning of those terms are as follows:
Basin is used to refer to the entire 721 mi^2 Chicopee River drainage area;
Watershed usually refers to the drainages of the four major river systems in the basin (e.g., the Swift River Watershed), although the lower-case *watershed* is sometimes used in a generic way;
Subwatershed refers to the drainage area of the main tributaries to the major rivers, of which 44 have been delineated in the basin.

Thus, for example, the report might refer to the ***Willow Brook subwatershed, in the Quaboag River Watershed, of the Chicopee River Basin.*** The graphic below further demonstrates the usage of these terms.



I. Introduction

A lone fisherman watches his line along the banks where the ***Quinnetukq"*** (long tidal river) joins the *Chickuppe"* (place of violent waters), much as his Native American predecessors may have done centuries earlier. In the intervening years however, much has happened near this spot. Fishermen still congregate near the confluence of the two great rivers (i.e., the Connecticut and the Chicopee), hoping to catch one of the thousands of American shad, blueback herring, Atlantic salmon, striped bass, and other species that make their annual passage upstream. But close by, cities and industries have sprung up along the riverbanks; tall dams now alter the rivers' flows along with the fishes' migratory routes; and the viewpoints of local residents towards the rivers have come virtually full circle – from viewing them as life-giving and sustaining resources, to using them as open-air sewers, and finally to the re-discovery of the uniqueness of the rivers as vital natural resources.

The Connecticut River originates near the Canadian border in the state of New Hampshire. Along its 400+ mile journey to Long Island Sound, the Connecticut is fed by numerous rivers and streams. The largest of these tributaries is the Chicopee River, which joins with the Connecticut just north of the Connecticut border, in the City of Chicopee, Massachusetts. The Chicopee River drains an area of more than 720 square miles, generally located between Springfield, Worcester, Gardner, and Montague. It is the largest of the 27 major basins delineated for planning purposes in Massachusetts.

This report summarizes much of the physical, ecological, and social information that is currently known about the Chicopee basin. The document is organized in two main sections: 1) a Watershed Description, which includes much of the factual "descriptive" information about the basin, and 2) a Watershed Assessment, in which the information presented in the first section is "assessed" or interpreted. The results of that assessment will form the basis for a Watershed Action Plan that will be subsequently prepared. Much of the information conveyed in the figures of this report comes from the Massachusetts Office of Geographic Information Systems (MassGIS) office at the Executive Office of Environmental Affairs (EOEA). Paul Lyons, former Watershed Team Leader (WTL) for the Chicopee River basin, is the primary author, although information and input for this report comes from a variety of other sources.

II. Watershed Description

A. Physical Characteristics

1. Location: The Chicopee River basin is located in west-central Massachusetts, and is bounded to the west by the Connecticut River basin, to the north by the Miller's River basin, to the south by the French/Quinebaug, and to the east by the Blackstone and Nashua River basins (Figure 1). The basin covers approximately 721 square miles, most of which is considered part of Central New England Upland, except for the lower Chicopee River section, which is in the Connecticut River Valley (UMass LARP 1996).

2. Climate: The climate in the region is considered to be of a modified continental type - warm to hot in summer and moderately cold in winter. The mean annual rainfall over the basin as a whole is 44" although this ranges from <40" in the southwest portion to >50" in the upper basin (DEQE 1981). Approximately half of all rainfall results in runoff, averaging 1.6 cubic feet per second (cfs) per sq mi annually. About half of the total annual rainfall occurs in March, April, and May, with the maximum occurring in April. The region lies in the path of "prevailing westerlies", and is also subject to cyclonic disturbances that contribute to frequent weather changes.

July is generally the warmest month (mean temperature - 67^{o} F), with January and February the coldest (mean - 21^{o} F). Mean monthly precipitation ranges from slightly under 3" in February to over 4" in November (Krejmas and Maevsky 1986).

3. Topography/geology/soils: Most of the basin is considered upland, and consists of rolling hills and valleys generally arranged along a N-S axis (Figure 2). Elevations range from ~50 feet above sea level at the mouth of the Chicopee River, to 1720 feet along the basin divide in Wachusett Mountain State Reservation.

Surficial geology in the central and eastern portions of the basin consists generally of uplands underlain by thin glacial till and/or bedrock interspersed with relatively narrow valleys where thin to moderately thick deposits of stratified drift and recent alluvium are present. Bedrock underlying the basin consists predominantly of metamorphosed plutonic igneous and sedimentary rocks in the central and eastern portions, and unmetamorphosed sedimentary rocks of the Connecticut River Valley in the southwest corner (ECS 1996).

Soils in the basin are largely glacial till, except for the Connecticut River Valley region, which mainly derive from glacial Lake Hitchcock (UMass LARP 1996). Glacio-lacustrine deposits are also locally present in valleys in the central and eastern portions of the basin. Thick glacio-lacustrine and glacio-fluvial deposits are locally present in the southwest portion of the basin. With the exception of that region, soils in the basin are relatively infertile, since most did not develop from bedrock, but instead the parent material was acid crystalline rock deposited by glaciers and glacial melt-water (DEQE 1981). Surficial geology and soil texture classifications are presented in Figures 3 and 4, respectively.

4. Hydrology: The Chicopee River basin consists of 4 major river systems – the Swift, Ware, Quaboag and Chicopee Rivers (Figure 5). The Swift, Ware, and Quaboag river basins each drain areas of approximately 200 square miles; the Chicopee River receives the collective flows of the other three, plus the runoff from an additional 76 square miles of watershed. U.S. Geological Survey stream gaging stations are located at strategic points along the four major rivers (Figure 6), and allow for analyses of the relative contributions of the four rivers to overall flows in the basin.

The Swift River drains approximately 215 square miles in the northwest portion of the basin, including all or parts of 11 communities (Table 1), before joining the Ware River in Palmer. Much of the Swift River drainage is controlled by Winsor Dam and Goodnough Dike, which were constructed in the

Figure 1. Location of Chicopee River basin.

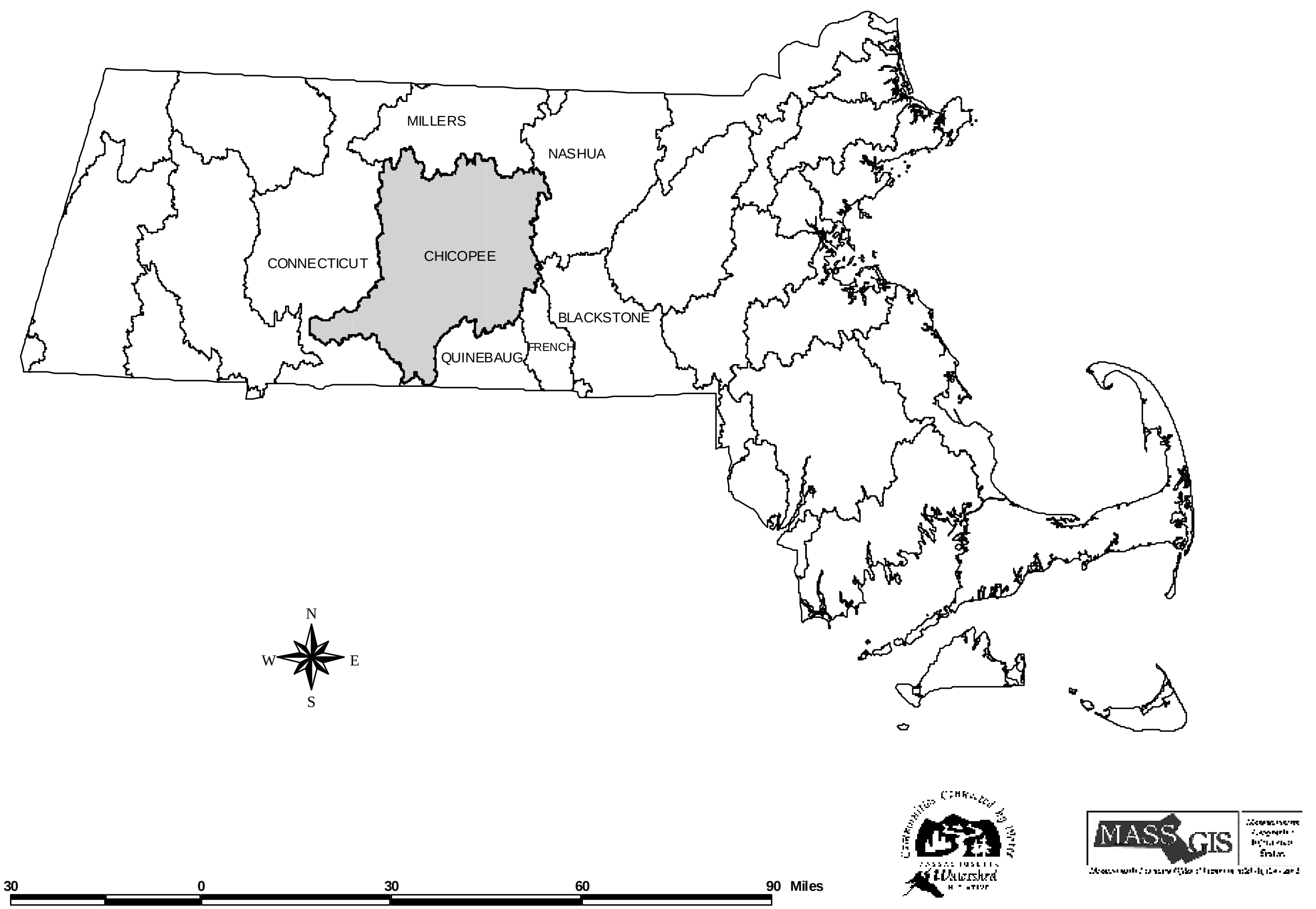


Figure 2. Topography of the Chicopee River basin (30-foot contours).

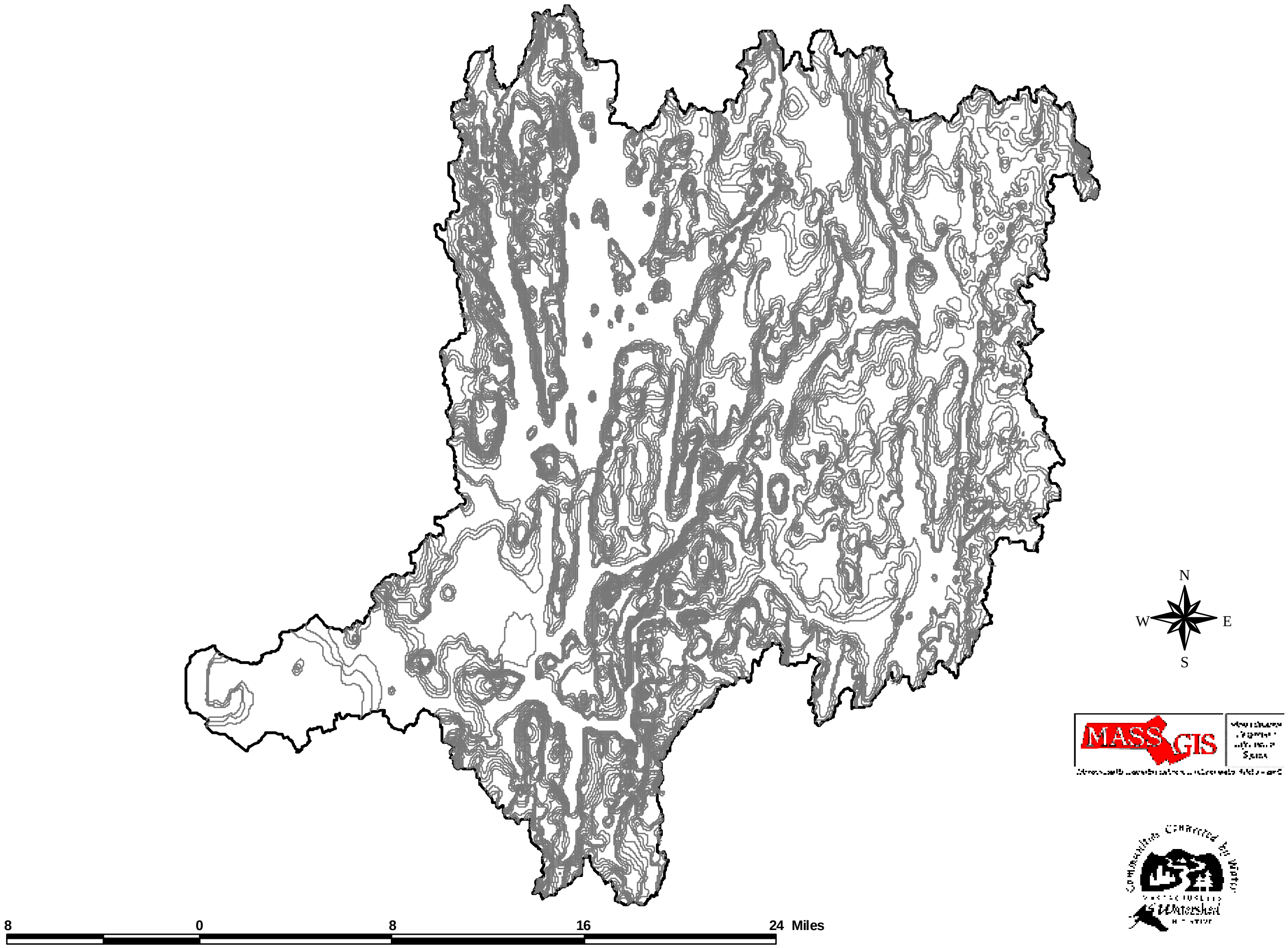


Figure 3. Surficial geology of the Chicopee River basin.

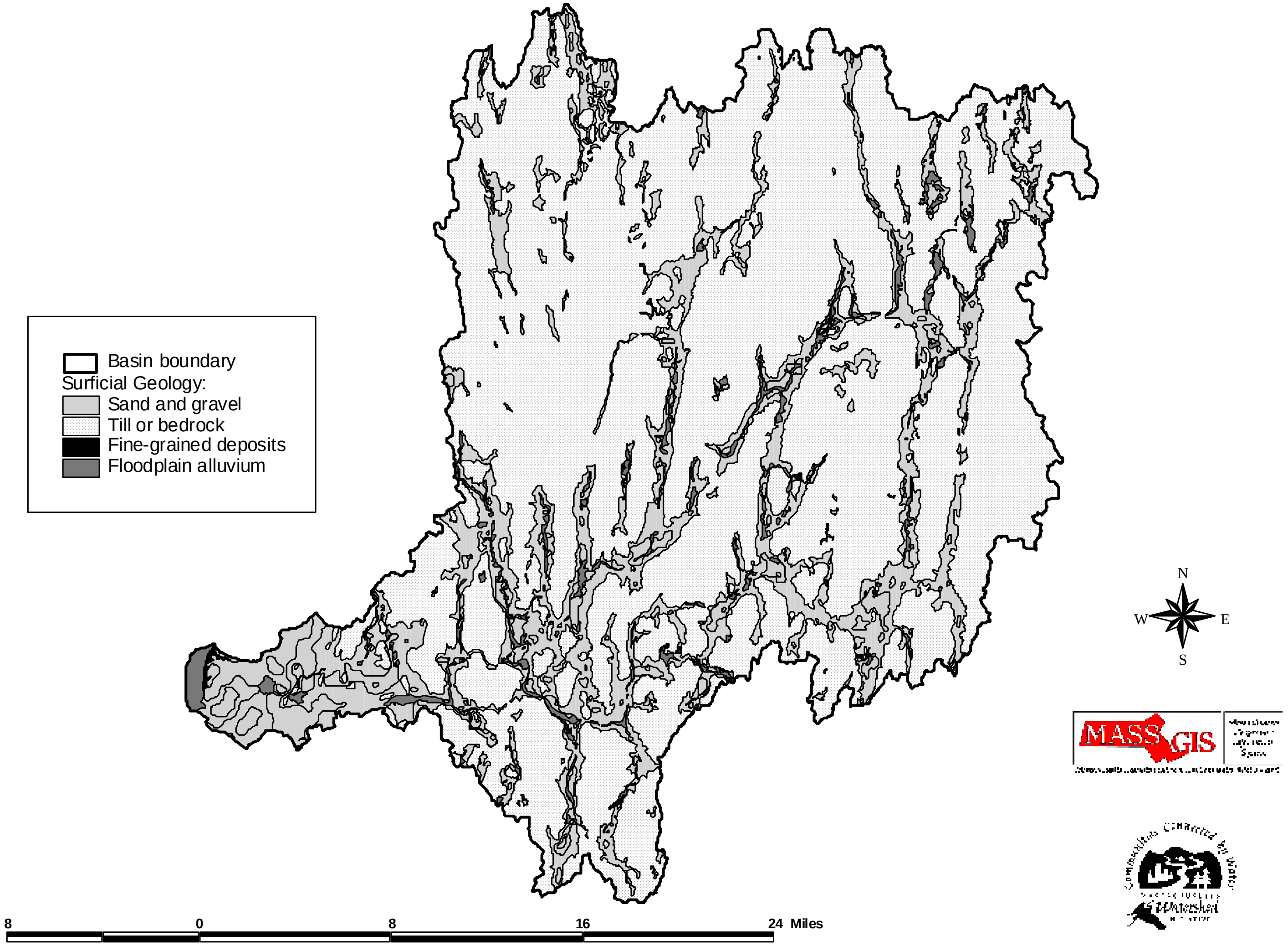
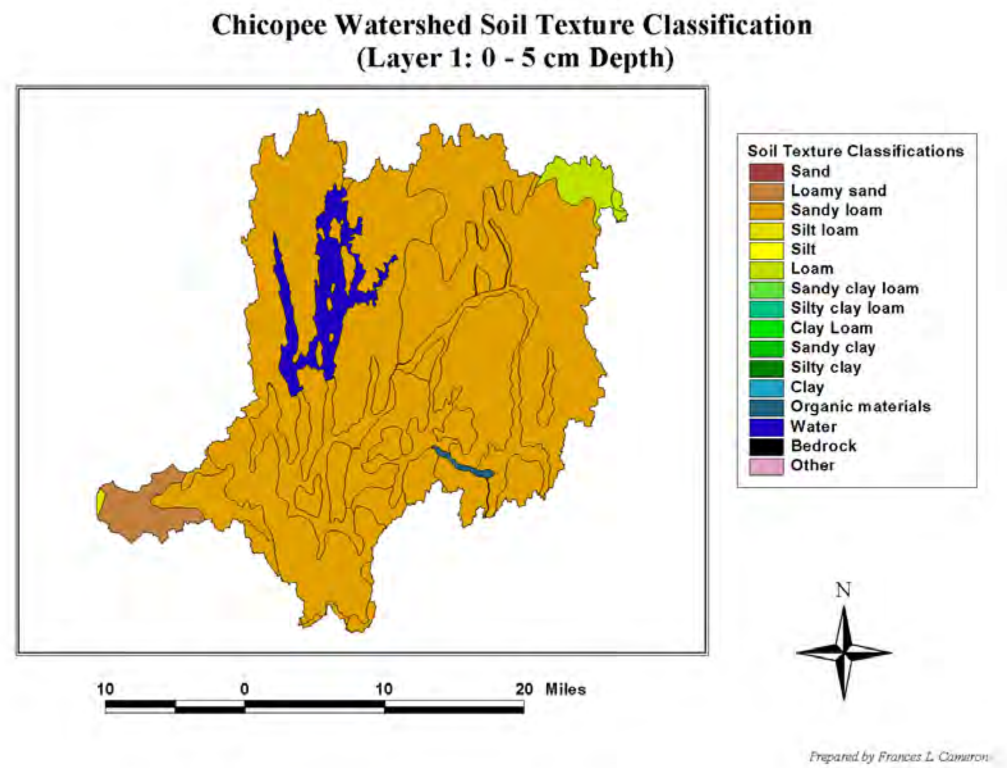


Figure 4. Soil texture classifications for the Chicopee River Basin.



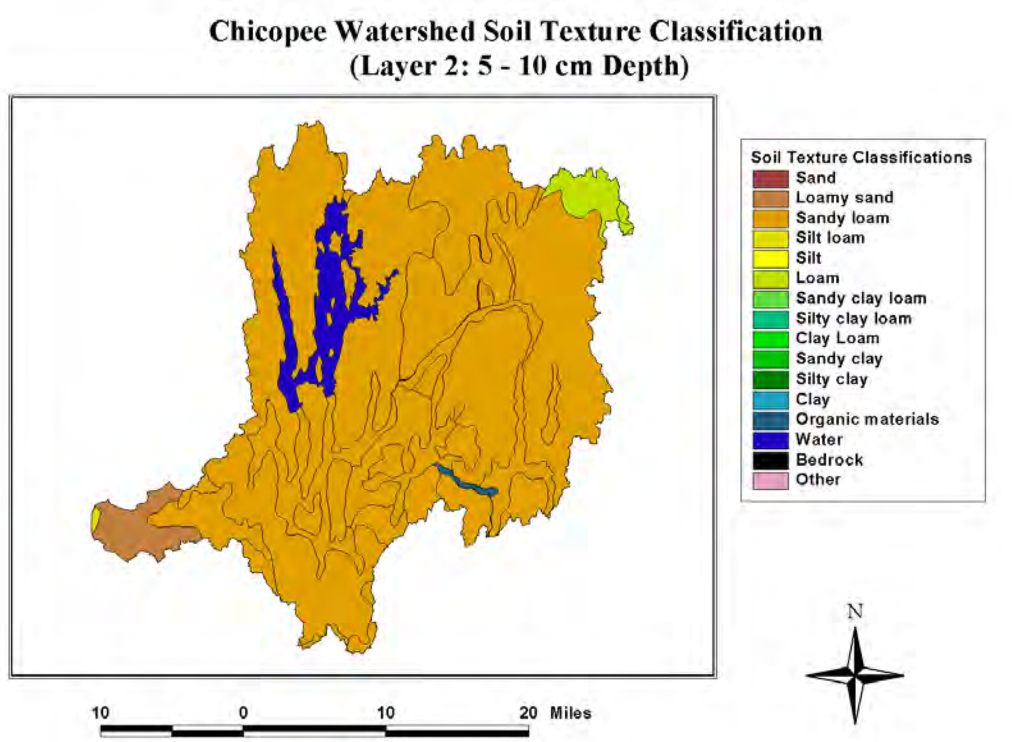
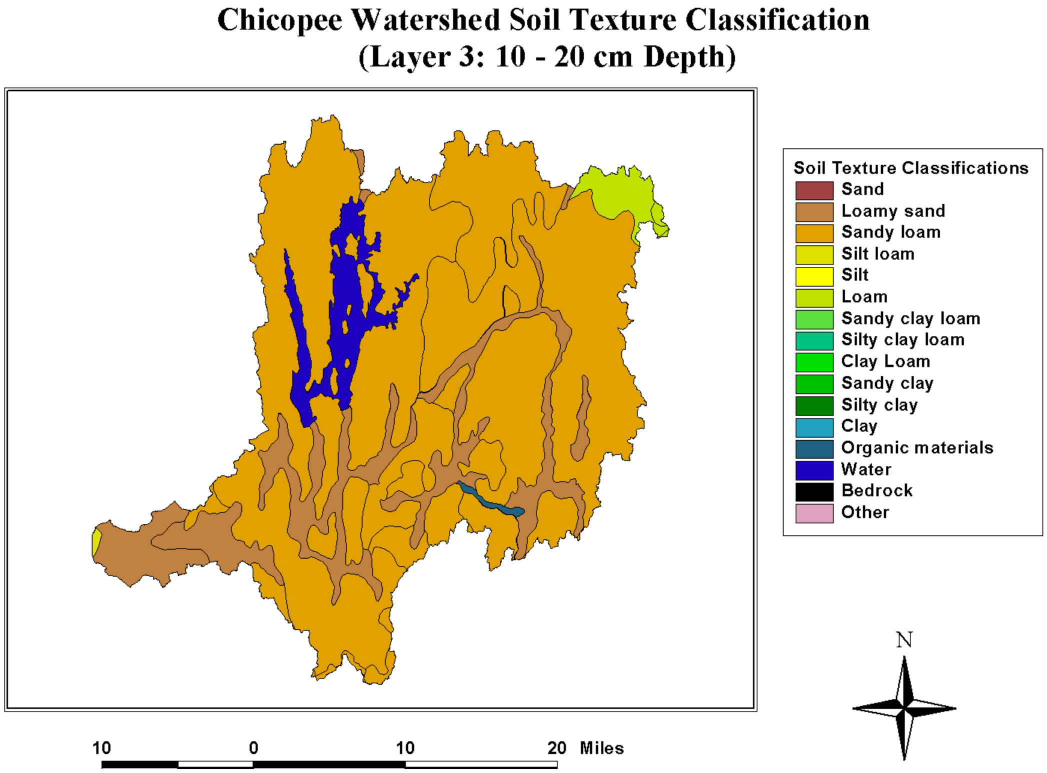
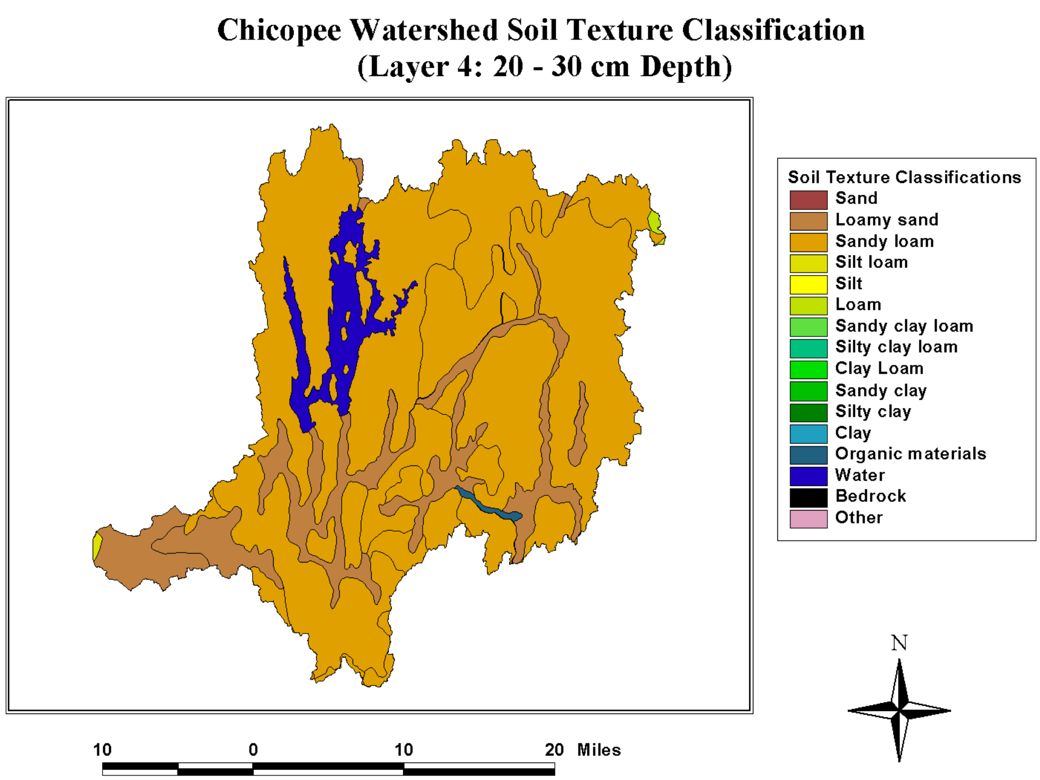


Figure 4 (cont.)





Prepared by Frances L. Cameron

Figure 5. Major watershed areas in the Chicopee River basin.

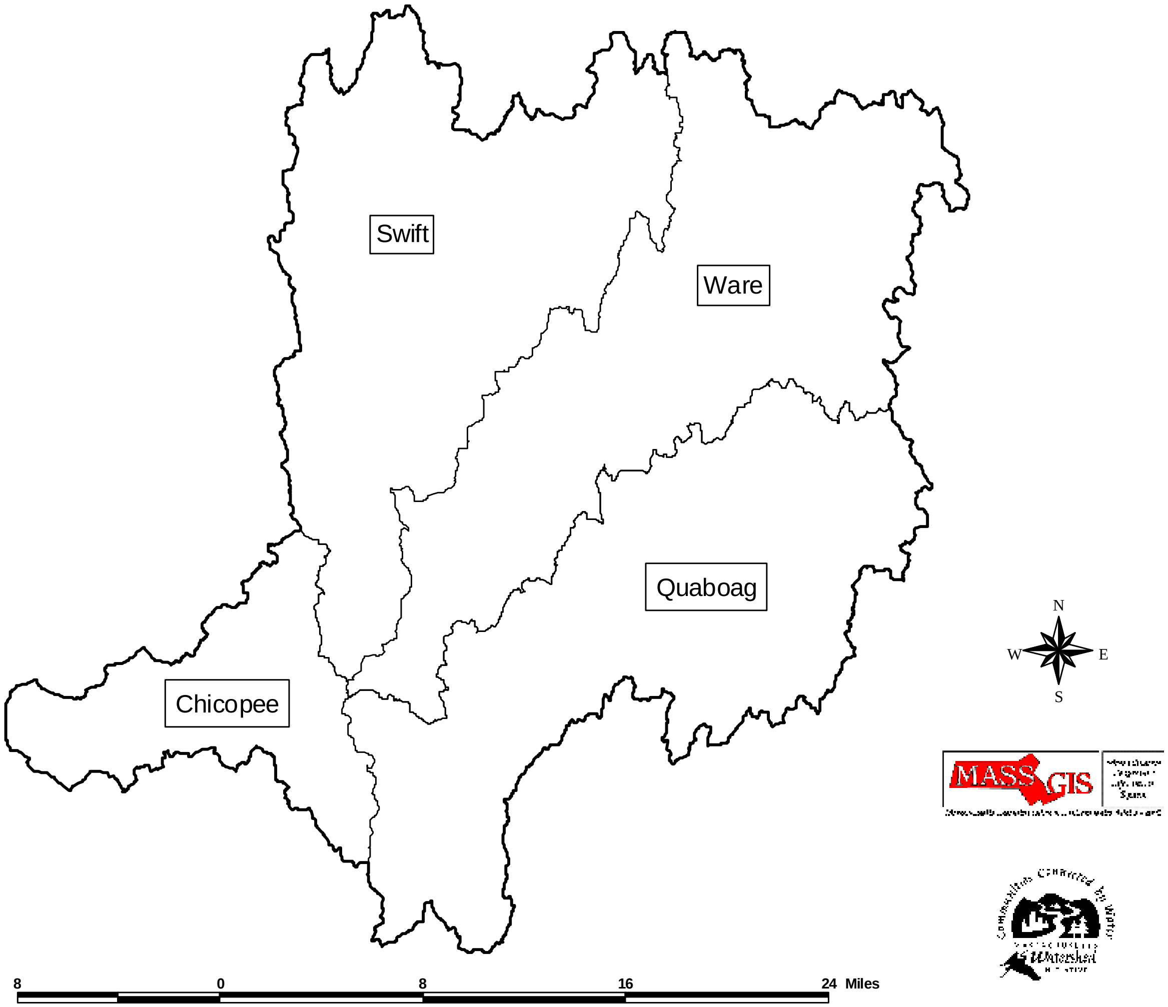
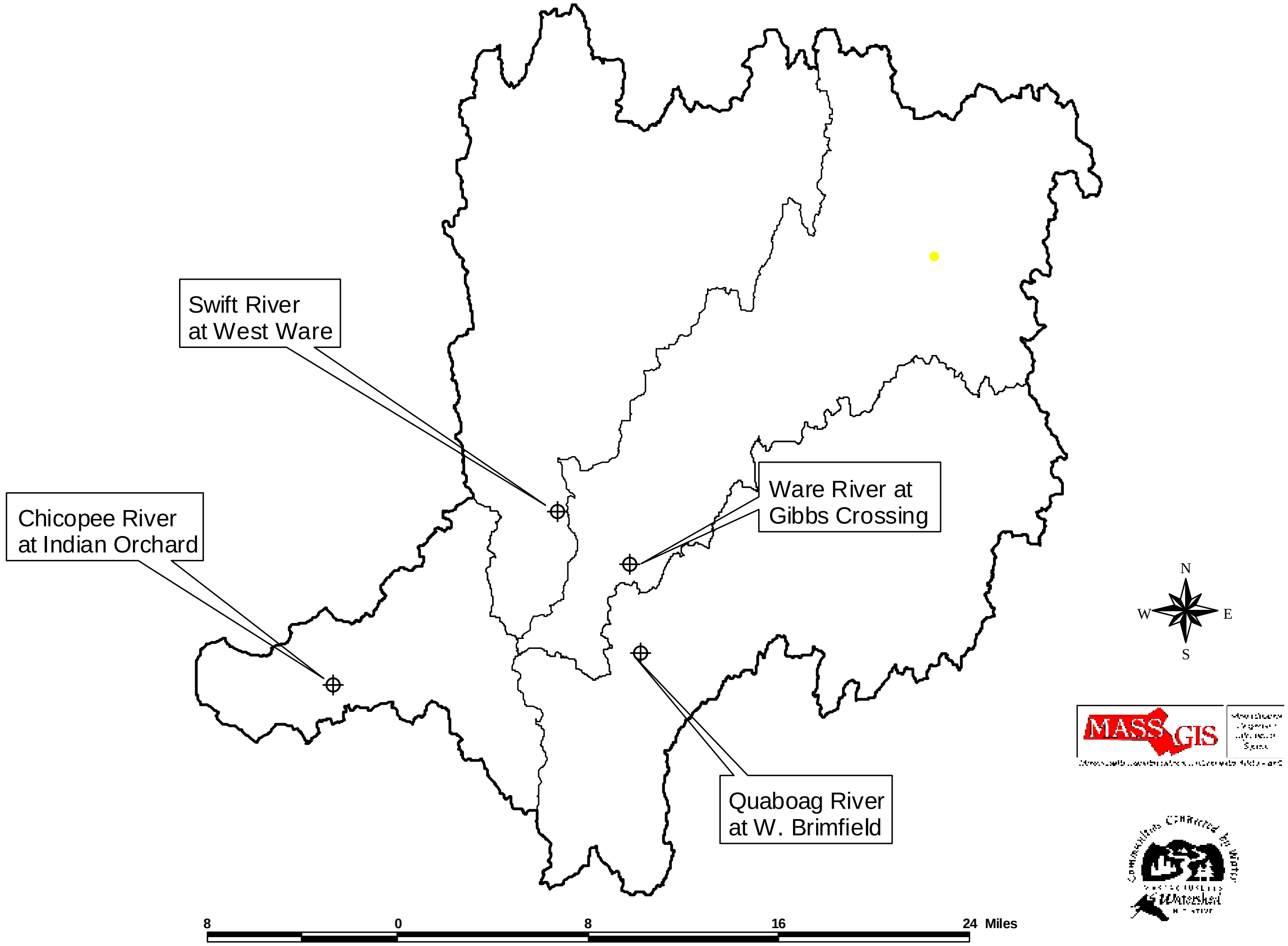


Figure 6. Major USGS stream gages in the Chicopee River basin.



1930's to form the Quabbin Reservoir (Quabbin). Water from the Quabbin is diverted out of the Swift River Watershed through two aqueducts. As a result, streamflows in the Swift River below Quabbin have been significantly altered since 1939 when the dam and dike were completed (Figure 7). Prior to that time, a USGS gaging station located approximately 1½ miles below the dam recorded average annual flows of 315 cfs. Since 1939, those flows have averaged just less than 100 cfs (Table 2).

The Ware River drains approximately 218 square miles in 15 communities (Table 1), from the northeast to the south-central portion of the basin. After receiving the flow of its largest tributary i.e. the Swift River in Palmer, the Ware flows southerly another .8 mile where it joins with the Quaboag River. This marks the beginning of the Chicopee River. A USGS gaging station 9 miles upstream of that confluence provides flow data for 197 mi^2 of the Ware River drainage. Those data show pre-1939 average annual flows of 327 cfs, and post-1939 flows of 285 cfs. It should be noted that the Massachusetts Water Resources Authority (MWRA) operates a diversion facility along the Ware River in Barre, and that water has been diverted from that location into the Quabbin, and sometimes to Wachusett Reservoir (in the Nashua River basin) on an irregular basis over the past 60 years. Since 1985, those diversions have ranged from 0 to 57 MGD (0 - 88 cfs).

The Quaboag River originates in Rutland and Paxton, and drains approximately 212 square miles in 18 communities (Table 1) as it flows from east to west through the southern portion of the basin. A USGS gaging station in Brimfield records flows from approximately 149 square miles of the watershed. The Quaboag River is not affected by major diversions, such as those in the Ware River Watershed and the Swift River Watershed, and has shown relatively consistent flows since the early 1900's (246 cfs prior to 1939; 250 cfs since that time).

The Chicopee River starts in the village of Three Rivers (in the Town of Palmer) at the point where the Ware and Quaboag Rivers join. From there, it flows westerly approximately 18 miles until it empties into the Connecticut River in the City of Chicopee. In addition to receiving the combined flows from the Swift, Ware, and Quaboag Rivers, the Chicopee receives runoff from an additional 76 square miles of watershed adjacent to the river. The USGS gage at Indian Orchard (IO) has recorded flows from a total of 690 square miles of the combined watersheds since 1928. During that period, an average discharge of 909 cfs has been recorded.

Table 1. Characteristics of the four major river systems in the Chicopee River Basin

River System	Drainage Area	Communities
Swift River	215 sq mi	Barre, Belchertown, Hardwick, New Salem, Orange, Pelham, Petersham, Phillipston, Shutesbury, Ware, Wendell
Ware River	218 sq mi	Barre, Hardwick, Hubbardston, New Braintree, Oakham, Palmer, Petersham, Phillipston, Princeton, Rutland, Templeton, Ware, Warren, West Brookfield, Westminster
Quaboag River	212 sq mi	Brookfield, Brimfield, Charlton, E. Brookfield, Leicester, Monson, New Braintree, N. Brookfield, Oakham, Palmer, Paxton, Rutland, Spencer, Sturbridge, Wales, Ware, Warren, W. Brookfield
Chicopee River	(76 sq mi)	Belchertown, Chicopee, Granby, Hampden, Ludlow, Monson, Palmer, Springfield, Wilbraham

USGS gaging station data for the four major rivers is presented in Table 2. Pre- and post-1939 flow data for the three main tributaries of the Chicopee River is also presented in Figures 8 and 9, which clearly show how the creation of the Quabbin has "flattened out" the annual hydrograph of the Swift River. However, since the MWRA is required to release a minimum flow to the Swift River on a daily basis, the annual hydrograph also shows unusual consistency in mean monthly flows for most of the year

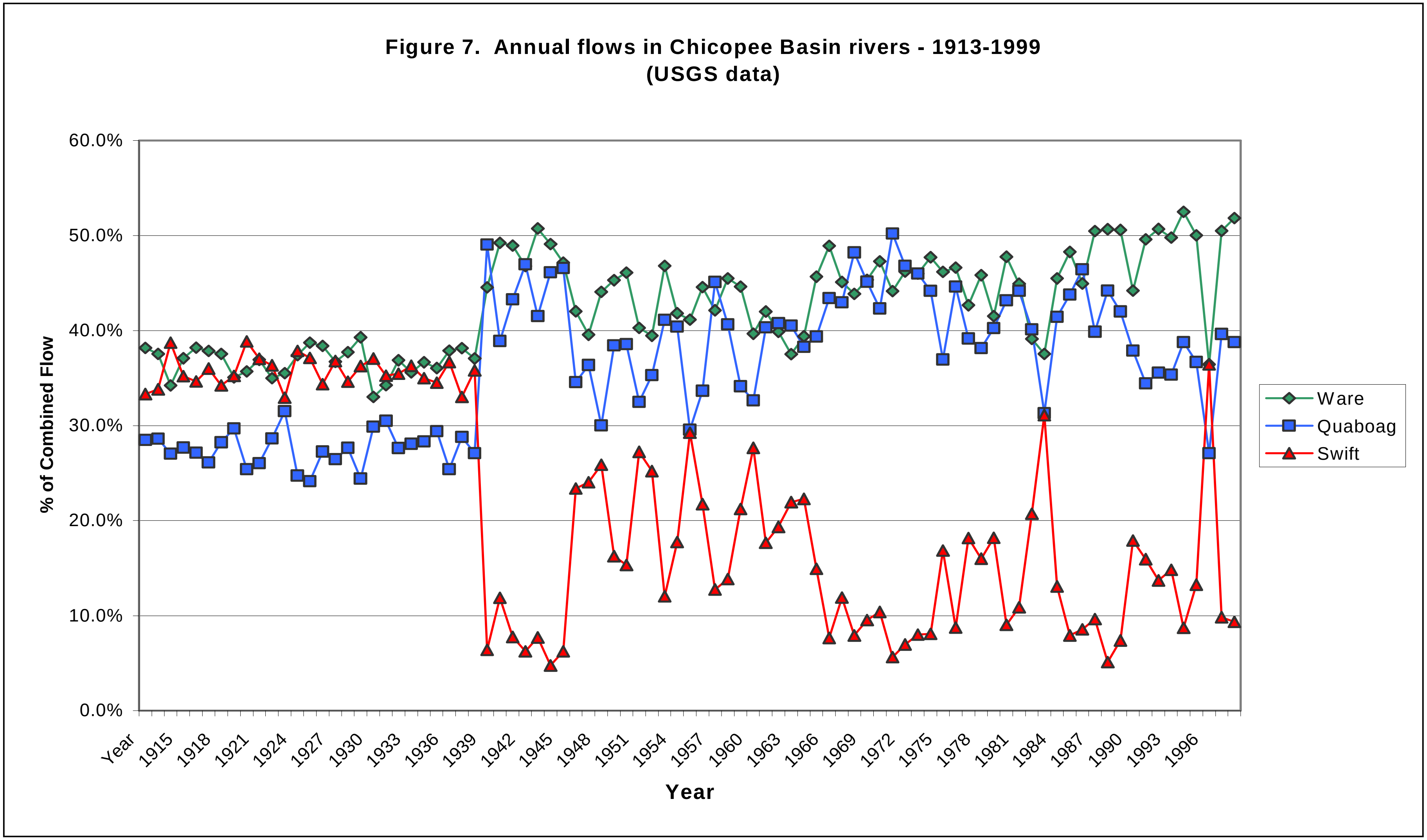


Figure 7. Annual flows in Chicopee Basin rivers - 1913-1999
(USGS data)
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
% of Combined Flow
Year
1915
1918
1921
1924
1927
1930
1933
1936
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
Year
Ware
Quaboag
Swift

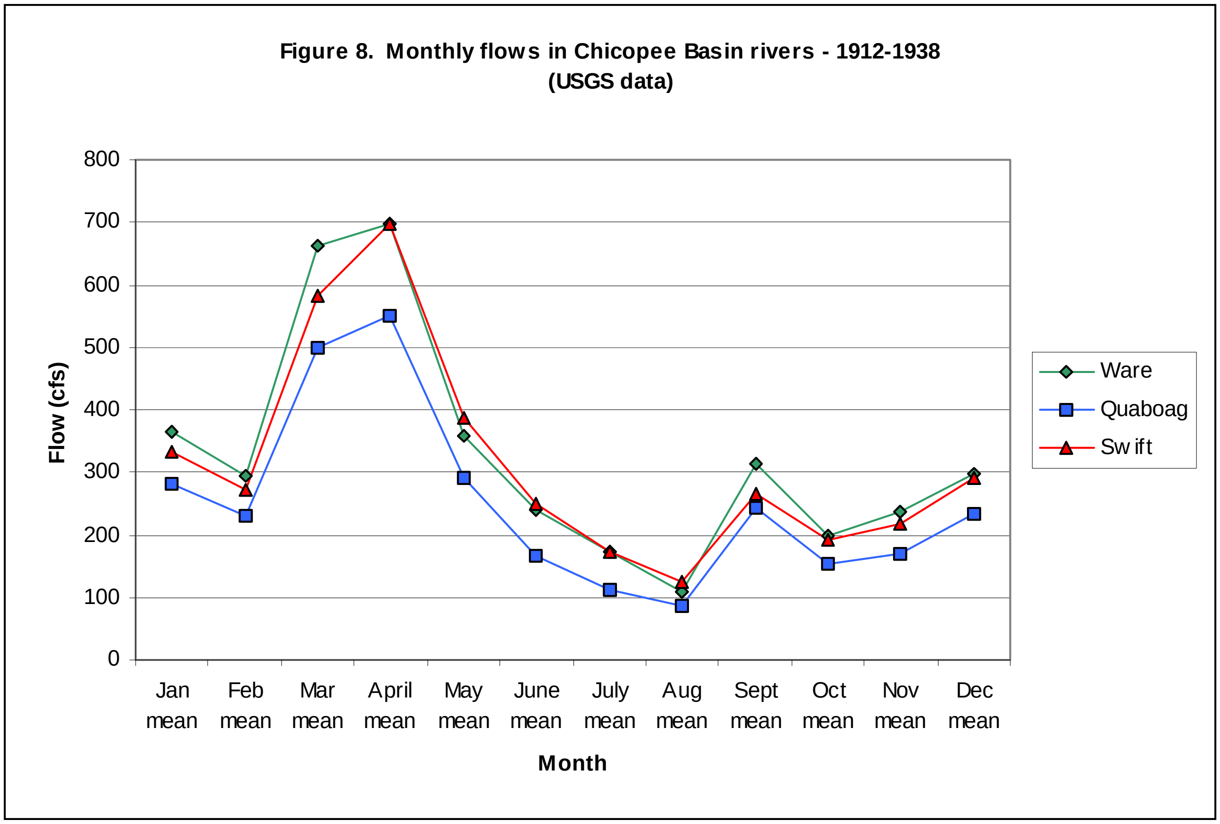


Figure 8. Monthly flows in Chicopee Basin rivers - 1912-1938
(USGS data)
800
700
600
500
400
300
200
100
0
Flow (cfs)
Jan mean
Feb mean
Mar mean
April mean
May mean
June mean
July mean
Aug mean
Sept mean
Oct mean
Nov mean
Dec mean
Month
Ware
Quaboag
Swift

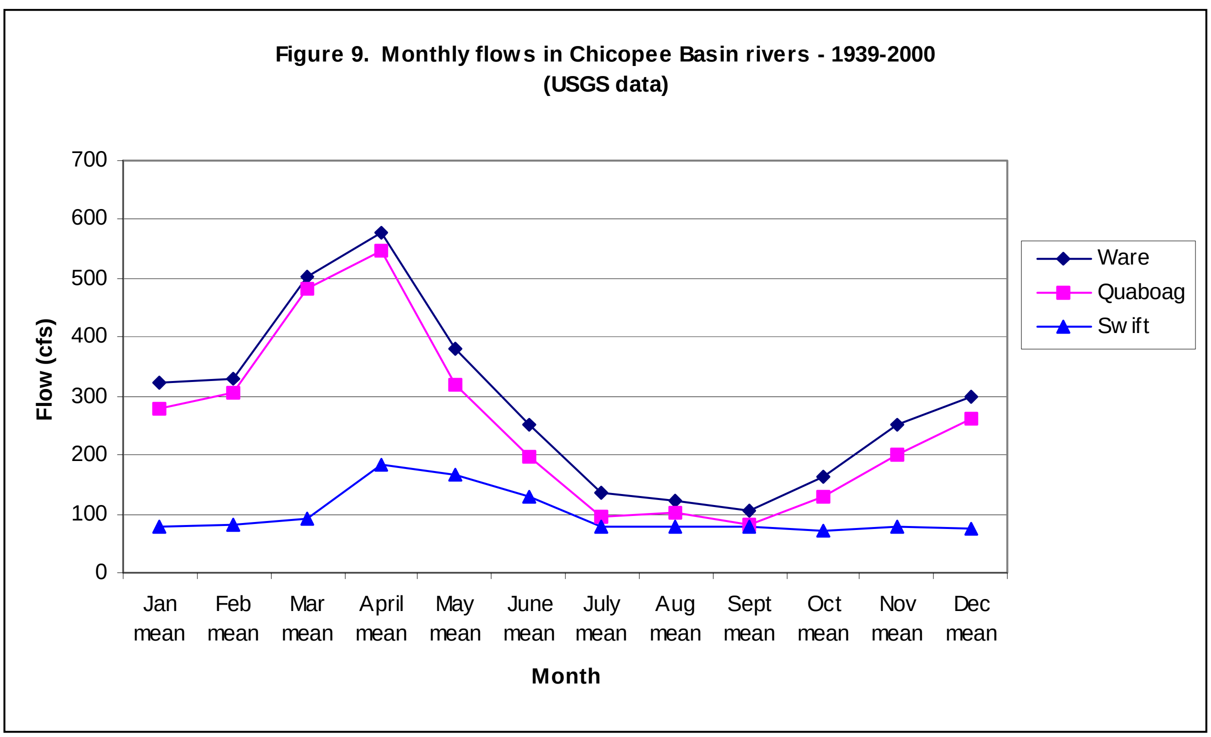


Figure 9. Monthly flows in Chicopee Basin rivers - 1939-2000
(USGS data)
700
600
500
400
300
200
100
0
Flow (cfs)
Jan mean
Feb mean
Mar mean
April mean
May mean
June mean
July mean
Aug mean
Sept mean
Oct mean
Nov mean
Dec mean
Month
Ware
Quaboag
Swift

except for April, May, and June, when a combination of additional controlled releases, spillway overflows and additional runoff below the dam result in higher monthly flows (Figure 9). A secondary effect of this altered flow regime is that the relative contribution of the Swift River to the combined flow of the three main tributaries increases dramatically during the summer's low-flow period. The percent contribution of the Swift River increases from less than 15% during the spring months to more than 35% in September, when the Ware and Quaboag Rivers experience their lowest flows (Figure 10).

Table 2. Flow data for the Swift, Ware, Quaboag and Chicopee Rivers (USGS data, 1912-2000)

	Swift River		Ware River		Quaboag River		Subtotal		Chicopee River (IO)	
	pre 1939	post 1939	pre	post	pre	post	pre	post	pre	post
Mean Annual Flow (cfs)	315	100	327	285	246	250	888	634	1169	871
cfs/mi2	1.67	0.53	1.66	1.45	1.64	1.66	1.66	1.18	1.70	1.26
% of subtotal	35.6	15.0	36.8	45.2	27.6	39.9	--	--	--	--
% of IO flow	27.2	11.1	28.0	32.8	21.5	28.9	76.7	72.7	--	--

In addition to the four major rivers, the Chicopee River basin contains numerous other natural and artificial water bodies, including lakes, ponds, streams, and wetlands (Figures 11 and 12). The Massachusetts Department of Environmental Protection (DEP) includes 136 named streams, flowing an estimated 464 miles, in their Stream and River Information System (SARIS) (DEP 2001). Similarly, their Pond and Lake Information System (PALIS) includes 174 lakes, ponds and impoundments, covering more than 32,000 acres. Major lakes and ponds in the basin are shown in Figure 12.

High and medium-yield aquifers are located throughout the southern portion of the basin (Figure 13), mainly in the stratified sand and gravel deposits left behind by glaciers (Krejmas and Maevsky 1986). The USGS publication "Principal Aquifers of the 48 Contiguous United States (1998)" considers most (691 mi2) of the basin to have "no principal aquifer", with the remaining 30 mi2 to be an "early mesozoic basin aquifer" in sandstone.

B. Ecosystem Characteristics

1. Ecoregion: According to the U.S. Environmental Protection Agency (EPA), the Chicopee River basin lies in three "ecoregions" (Figure 14): "Worcester-Monadnock Plateau" - includes the most hilly areas of the basin, with elevations ranging from 500 to 1400 feet; the high elevations and geology here result in generally cool acidic soils and more northern vegetation than is found in most other parts of MA; forests are transition hardwoods with some northern hardwoods, forested wetlands are common, surface waters tend to be acidic, and many major rivers drain this region.

"Lower Worcester Plateau" – distinct because of the moderate relief of its topography and its low elevation (500-1200 ft); generally acidic soils, but not as cool as those on the Worcester-Monadnock Plateau; supports more southern New England species as a result; lakes, ponds, and acidic wetlands are common; comprised of open hills and transition hardwood and central hardwood forests.

"Connecticut River Valley" – this region is distinguished from the surrounding uplands by its milder climate, relatively rich floodplain soils, and level terrain with some higher outcropping ridges; valley floor is primarily cropland and built land; central hardwoods and transitional hardwoods cover the ridges.

2. Land Cover: The Chicopee River basin is predominantly forested and undeveloped, except for the major Springfield-Chicopee urban area in the southwestern portion of the basin, plus scattered smaller concentrations of population and development in the rest of the basin (Figure 15). Overall, almost

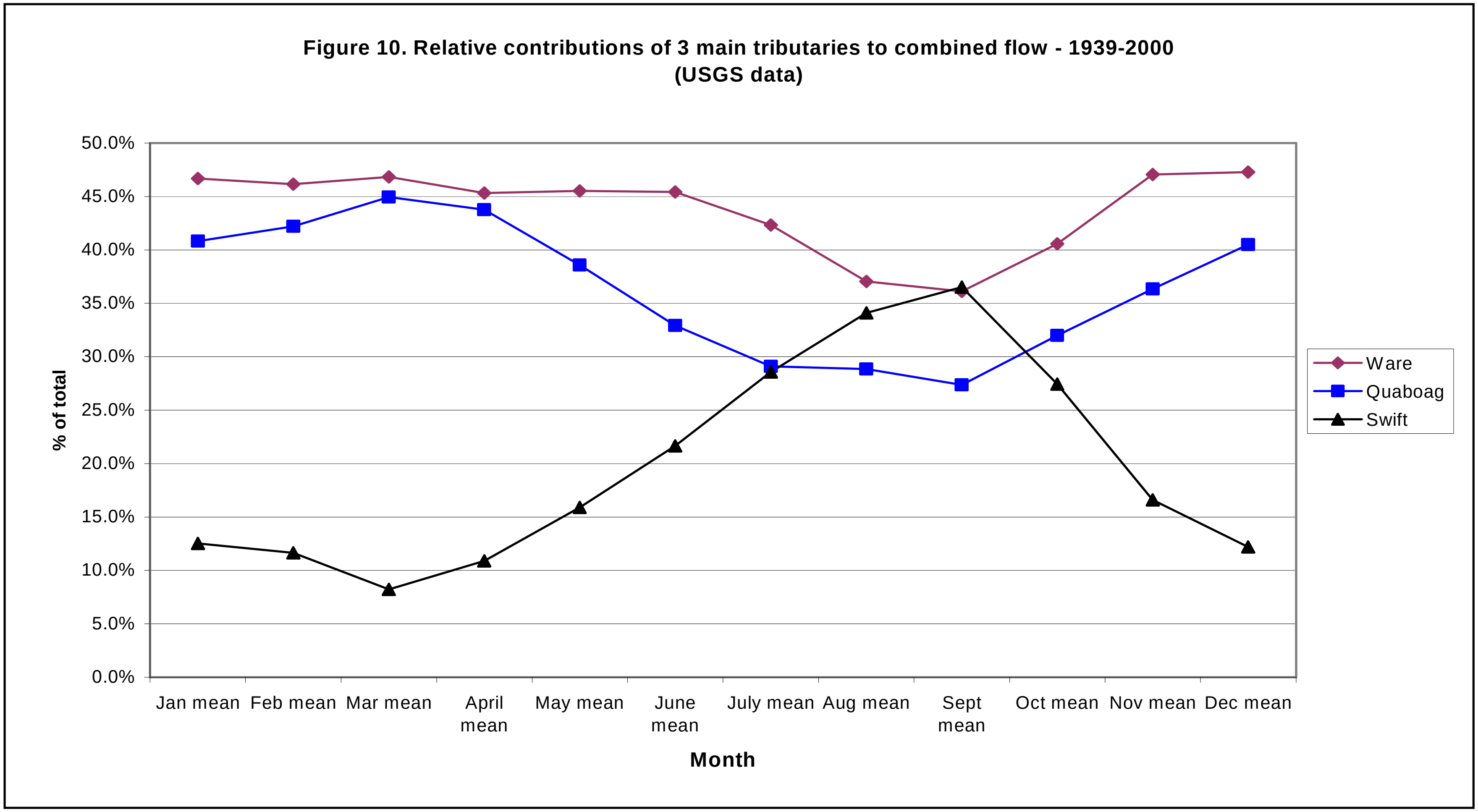


Figure 10. Relative contributions of 3 main tributaries to combined flow - 1939-2000
(USGS data)
50.0%
45.0%
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
% of total
Jan mean
Feb mean
Mar mean
April mean
May mean
June mean
July mean
Aug mean
Sept mean
Oct mean
Nov mean
Dec mean
Month
Ware
Quaboag
Swift

Figure 11. Water Resources in the Chicopee River Basin.

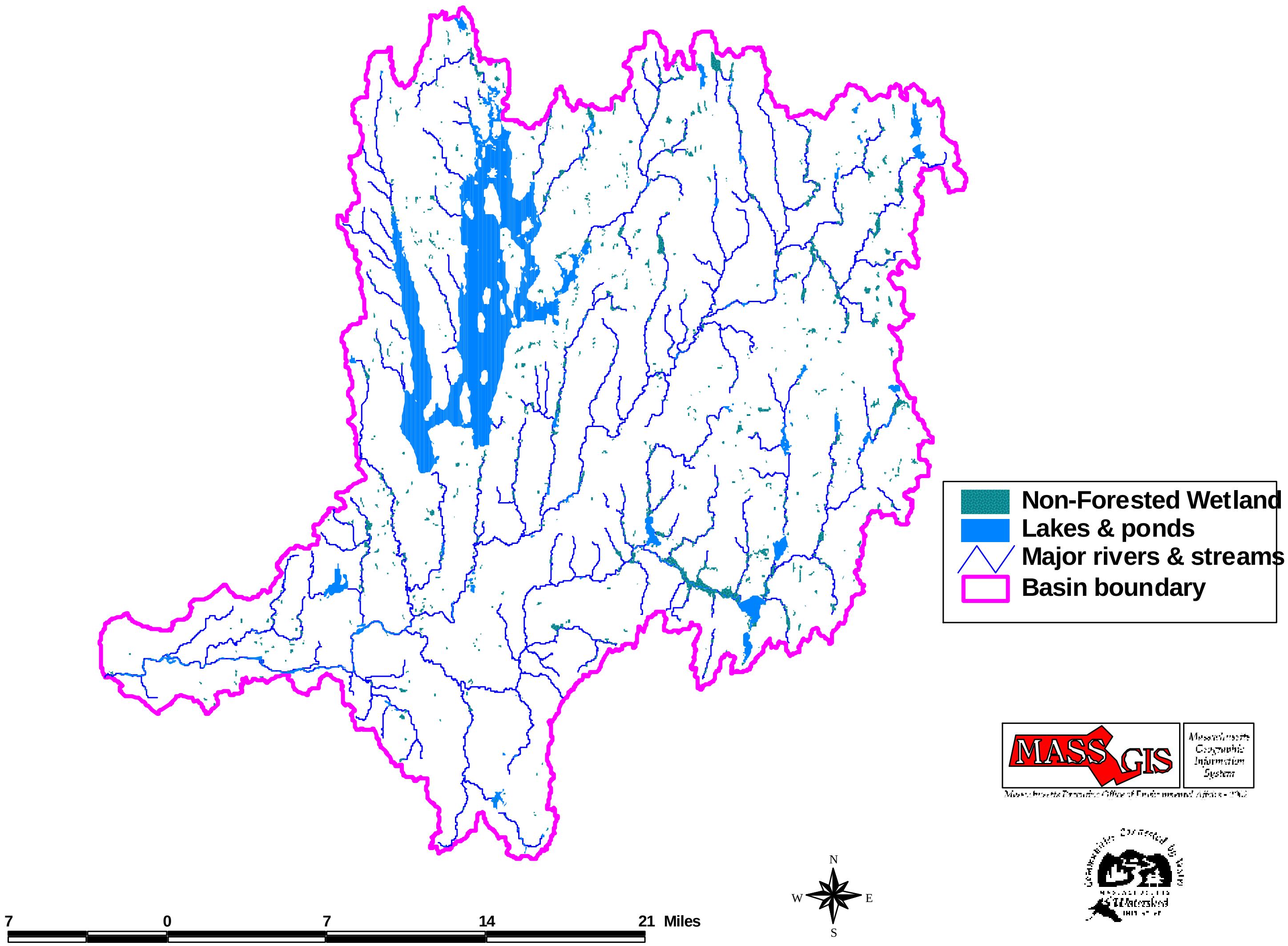


Figure 12. Rivers, streams and shorelines in the Chicopee River Basin.

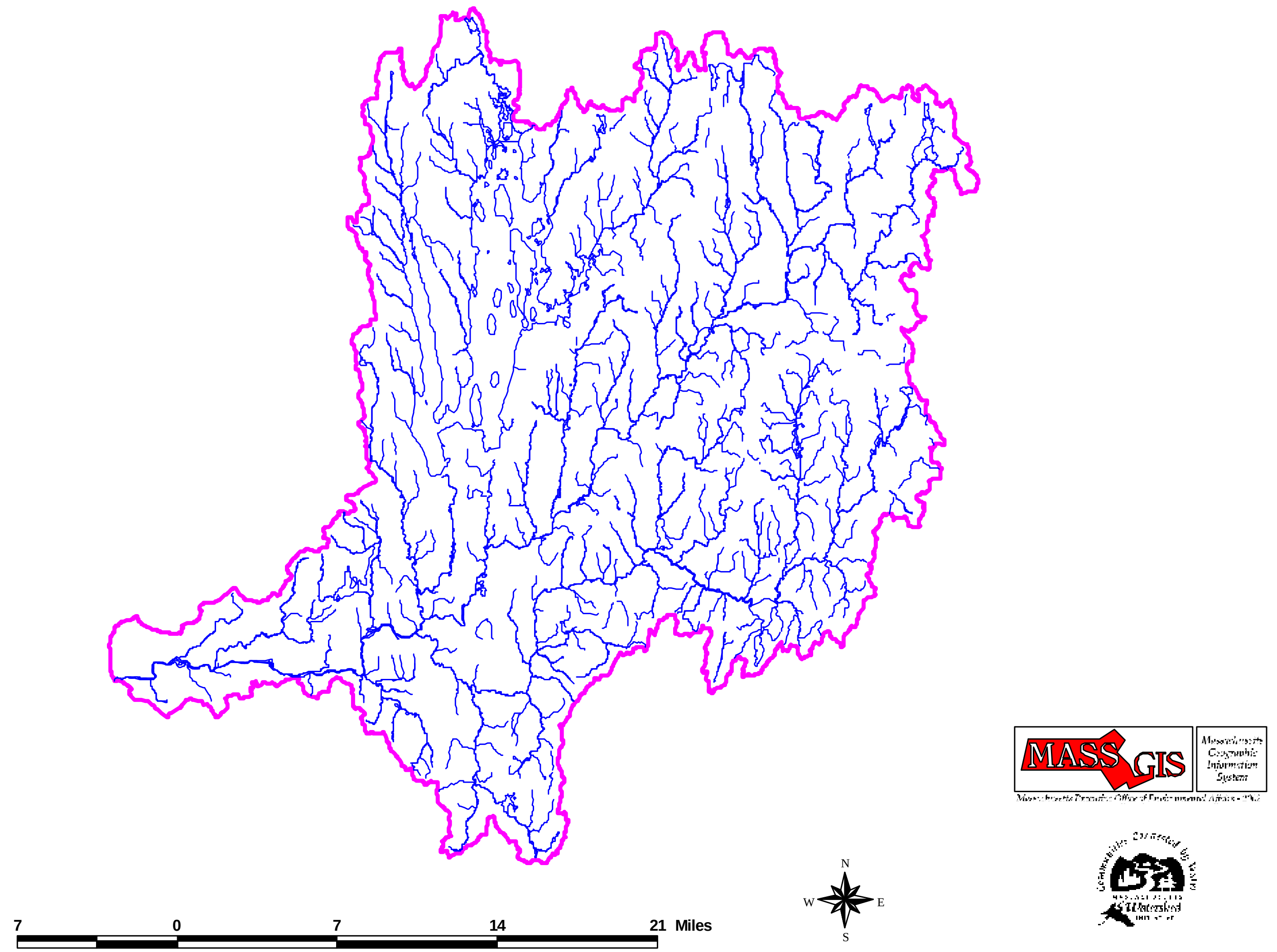


Figure 13. Aquifers in the Chicopee River Basin.

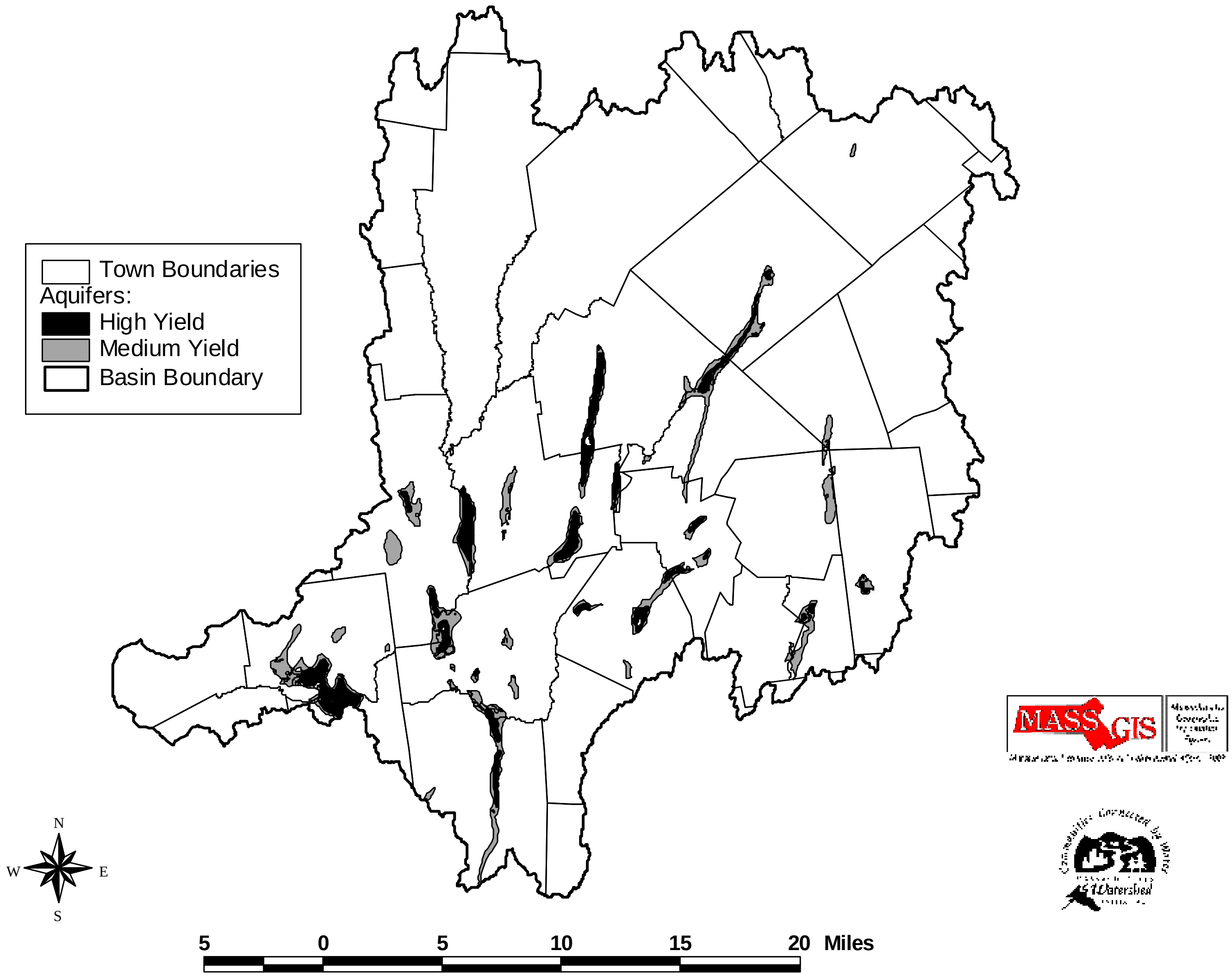


Figure 14. EPA Ecoregions in the Chicopee River Basin.

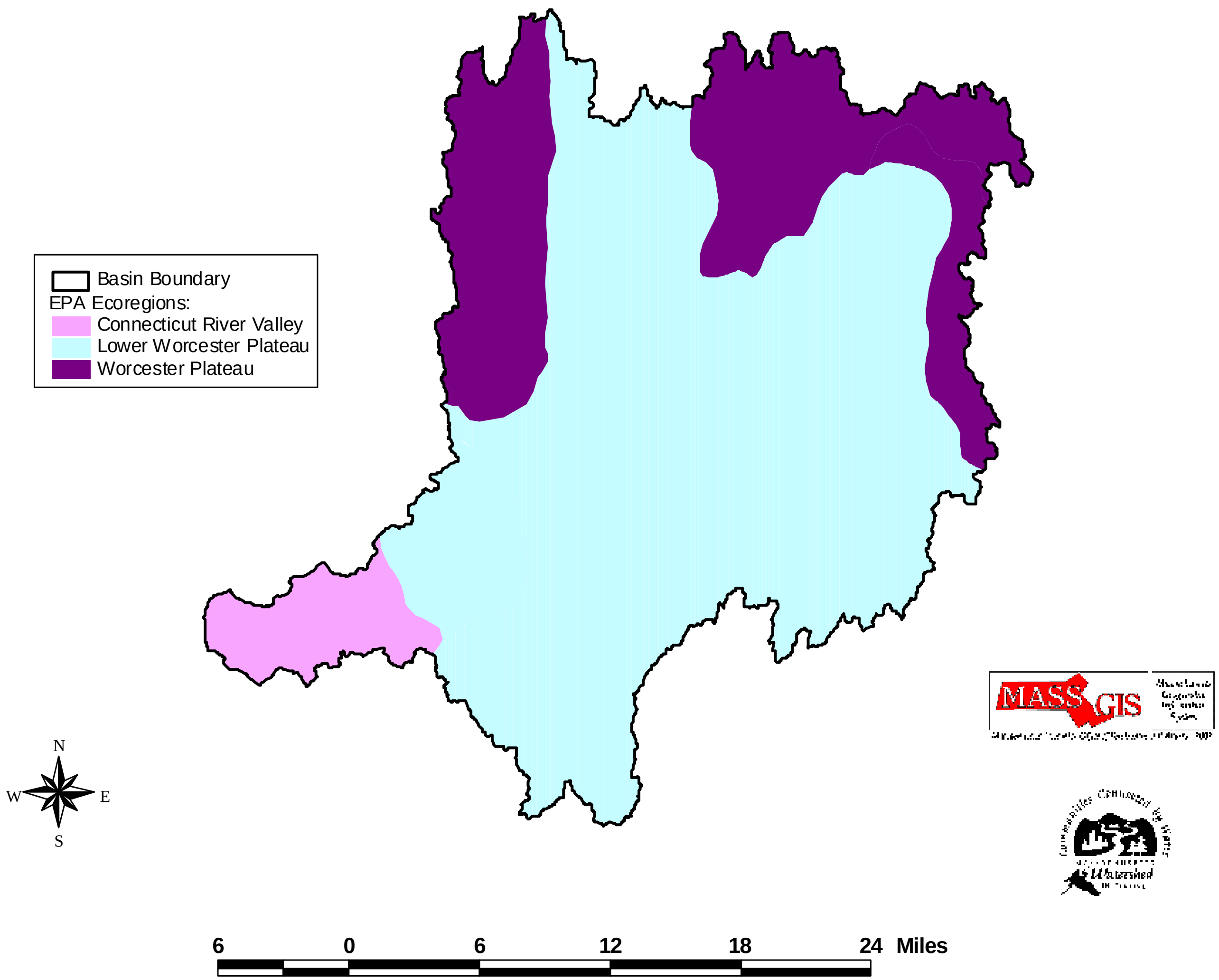
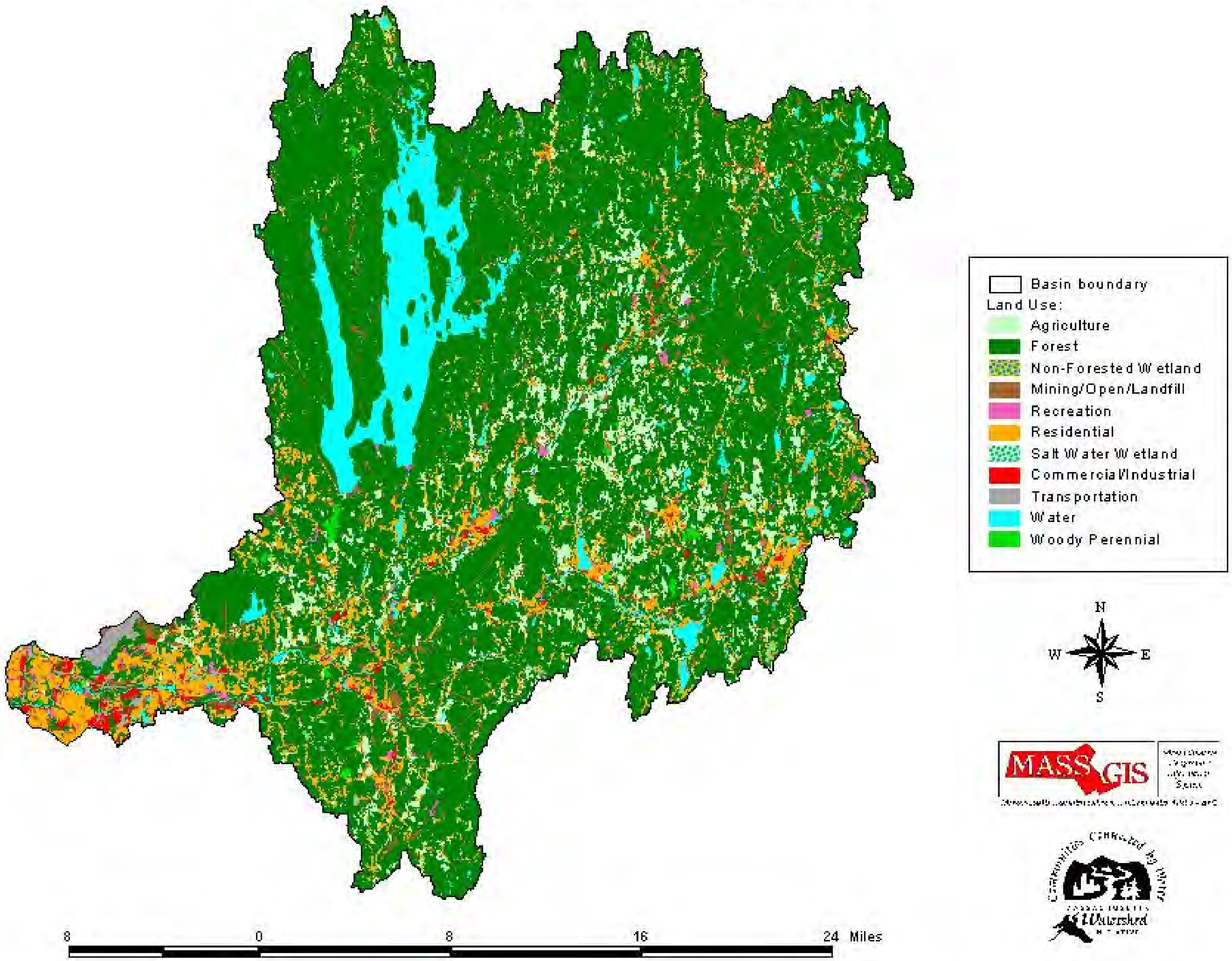


Figure 15. Chicopee River Basin Land Use.



70% of the basin is forested, with an additional 7.2% in agricultural use, 7.1% in water, and 2.3 % in wetlands. Approximately 10% is classified as residential, commercial or industrial (Table 3).

Table 3. Land use in the Chicopee River basin (from MassGIS data)

Land Use Category	Acres (1985)	% of Total ('85)	Acres (1999)	% of Total ('99)
Agriculture	39325.7	8.5	33340.1	7.2
Forest	325724.4	70.5	318336.5	68.9
Wetlands	9474.6	2.0	10511.6	2.3
Open Land	16354.6	3.5	17661.5	3.8
Residential	29645.7	6.4	40153.7	8.7
Commercial	1913.8	0.4	1655.6	0.4
Industrial	4057.4	0.9	4655.2	1.0
Transportation	2865.8	0.6	3041.8	0.7
Water	39932.0	7.1	32950.3	7.1

Generally, the forest cover in the basin is typical of that found in the "transitional forest" in southern New England, except for the southwest corner of the basin, which displays growths typical of a climax community forest (DEQE 1981). The Massachusetts Natural Heritage and Endangered Species Program (NHESP) describes the vegetation in the basin as: "mixed oak/conifer second-growth forest, with red maple in former pasturage and in acidic seepage swamps".

3. Fish & Wildlife

Fish and wildlife occurrences largely reflect the range of habitat conditions in a region, which in turn are affected by geologic and climatic conditions. Since much of the basin shares the acidic glacial till covering acidic, low-nutrient bedrock that is typical of much of Massachusetts, most of the plants and animals of the region are typical of the rest of the state. Many of the plants and animals of the area are habitat generalists, adapted to the widespread conditions in the basin.

Still, the NHESP database indicates that a number of rare habitats and species occur in the basin. Many are found in the Quabbin Reservation that offers refuge to easily-disturbed animals.

a. Vernal Pools: MassGIS data shows 315 certified vernal pools in the Chicopee River basin, although the vast majority of these are in the Town of Hubbardston (Figure 16). It is important to note that the data on certified vernal pools is more a reflection of local efforts to identify and certified those habitats rather than a reflection of the actual distribution of vernal pools in the basin. Interpretation of aerial photographs has resulted in the identification of more than 2300 "potential vernal pools" in the basin (Figure 17). Although most of these are not certified, substantial information on some of these pools is available. For example, the Metropolitan District Commission (MDC) has collected data on vernal pools on the Quabbin and Ware River Reservations for many years.

b. Estimated Habitats: The NHESP periodically publishes maps showing the locations of "estimated habitats of rare wildlife and certified vernal pools" for use in enforcing regulations related to the state Wetlands Protection Act (310 CMR 10.00), Endangered Species Act (321 CMR 10.00), and the Forest Cutting Practices Act (304 CMR 11.00). These maps delineate the approximate geographical extent of habitats of state-protected rare wildlife and indicate approximate locations of certified vernal pools, and are based on documented occurrences of rare species in the state (NHESP 1999). In the Chicopee River basin, more than 80 Estimated Habitats are included in the NHESP database (Figure 18). Current data indicates that at least 16 invertebrates, 21 plants, and 24 vertebrates of special concern occur in the basin (Appendix A).

c. Priority Habitats: As a companion to the Estimated Habitats described above, the NHESP also publishes locations of "Priority Habitats of Rare Species". These maps delineate habitats for rare plant

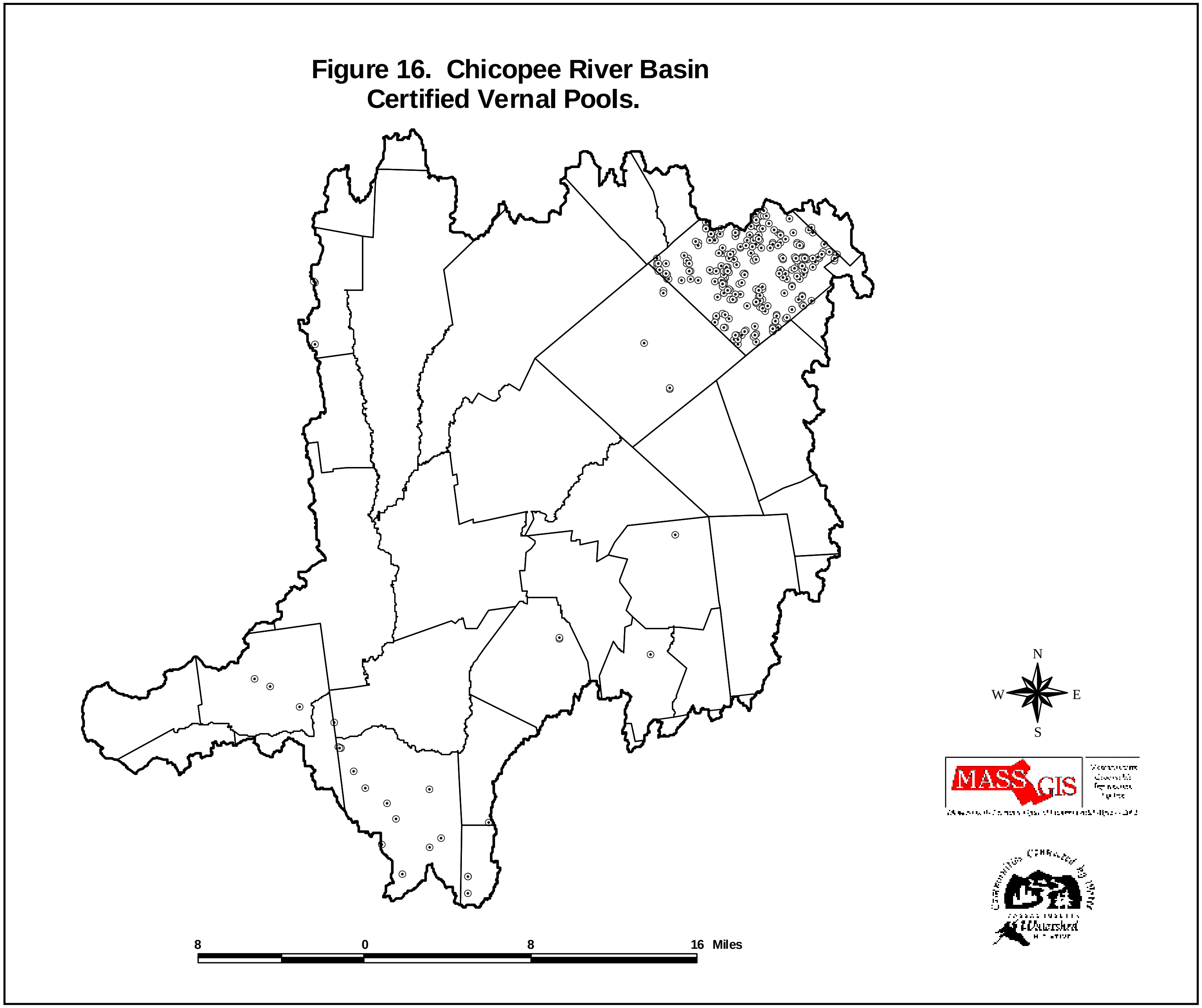


Figure 16. Chicopee River Basin
Certified Vernal Pools.
N
W
E
S
MASS GIS
8
0
8
16 Miles

Figure 17. Potential Vernal Pools in the Chicopee River Basin.

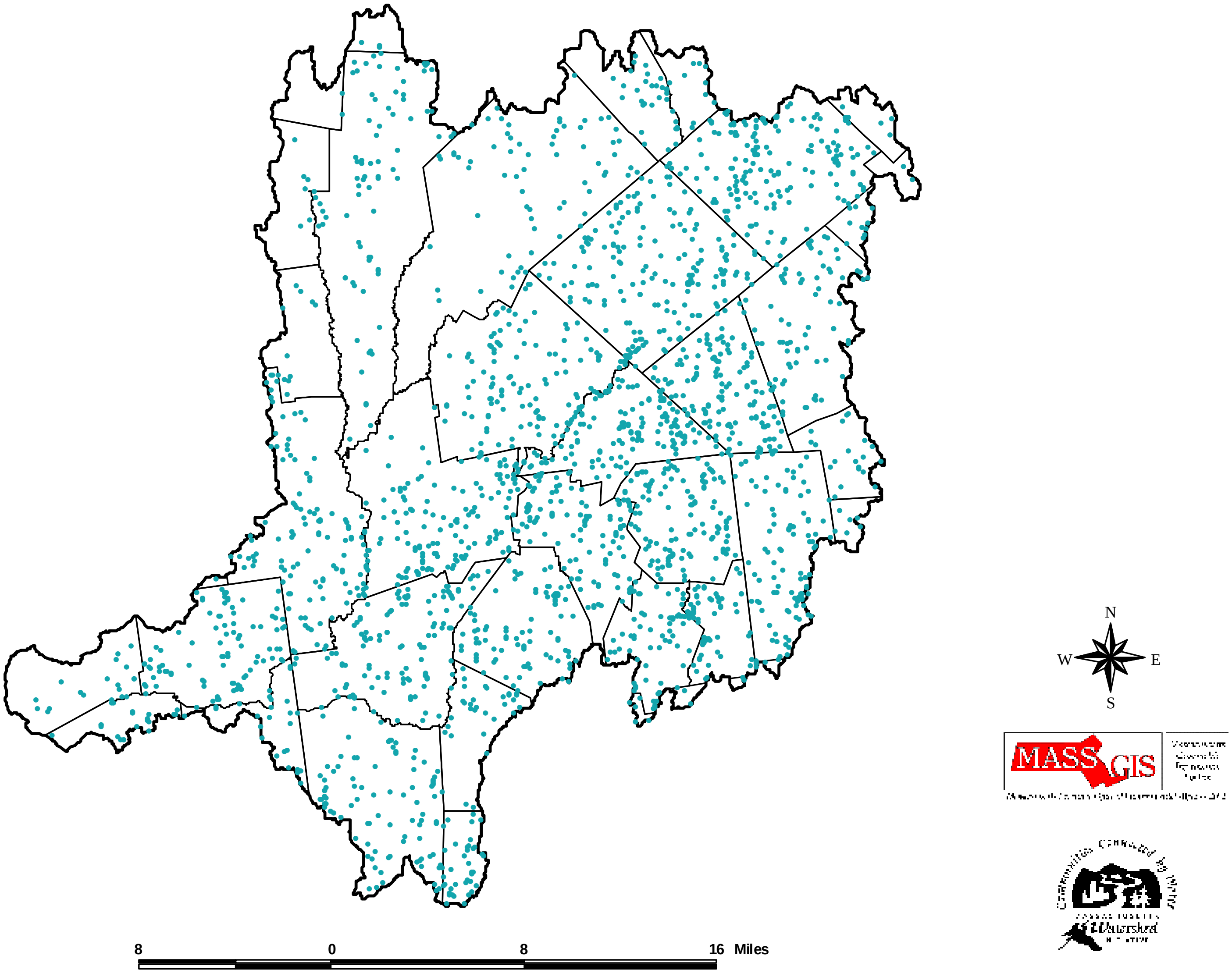
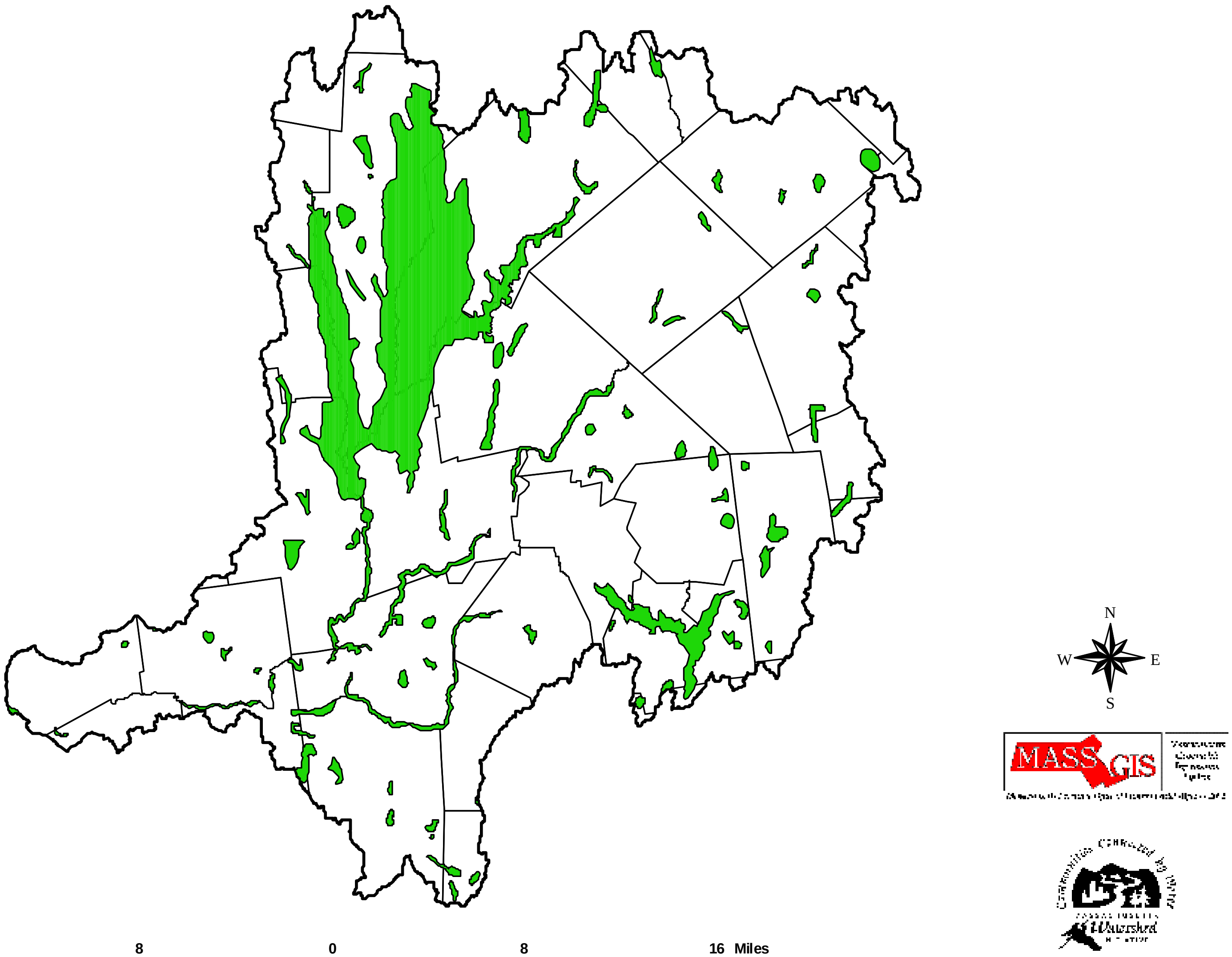


Figure 18. Estimated Rare Species Habitats in the Chicopee River Basin (from NHESP).



and animal populations that are protected under the Massachusetts Endangered Species Act Regulations (321 CMR 10.00), and are based on the approximated extent of rare species populations taken from records in the NHESP database (NHESP 1999). While there is often substantial overlap between locations of Estimated and Priority Habitats, there are also significant differences between the two. In the Chicopee River basin, more than 100 Priority Habitats have been identified (Figure 19), representing 14 different habitat types (Appendix A).

d. Fisheries data: Fisheries data for the Chicopee River basin is not readily available, although with its variety of aquatic habitats, the basin contains a wide variety of fish species. Shad, herring, Atlantic salmon, and other anadromous species migrating up the Connecticut River each spring enter the Chicopee River, although their journey is abruptly stopped at the Dwight Dam, just a short distance upstream of the confluence. This situation makes for some excellent springtime fishing opportunities along the lower reaches of the Chicopee River.

Several portions of the basin, including the Quabbin Reservoir and several rivers or streams, contain cold-water habitat that is suitable for trout and salmon survival. The Division of Fish and Wildlife (MDFW) stocks both of these species in many locations. Numerous other waterbodies provide warm-water habitat, suitable for bass, pickerel, perch, and other warm-water species. Further information on fish habitat will be available in 2003, when a habitat assessment will be conducted by MDFW in the basin.

C. Social Setting

1. Towns and Counties: The Chicopee River basin contains all or part of 39 communities (Figure 20) in 4 counties (Figure 21). Of historical note, prior to the creation of the Quabbin Reservoir, there were 4 additional towns in the basin. When the reservoir was constructed, the Towns of Prescott, Dana, Greenwich, and Enfield were dis-incorporated, and their land area was distributed among the adjacent communities.

The 39 basin communities range in size from 9.89 square miles (East Brookfield) to 54.27 square miles (Petersham), although only 7 communities are totally within the basin (Table 4). Most (37 of 39) are classified as towns; only Springfield and Chicopee are considered cities. Most communities in the basin (i.e., 64 %) are considered “rural economic centers” (16 of 39) or “small rural communities” (9 of 39), in contrast to the state as a whole, in which less than 31% of communities are classified as such. In comparison to communities statewide, basin communities are larger than average (30.5 versus 22.3 mi^2), and contain fewer roads (2.65 miles per mi^2, versus 4.61 statewide) (Table 5).

2. Population and Demographics: Population estimates from the year 2000 U.S. Census confirm that the basin is comprised of mostly small towns. Twenty-nine communities (74%) contain fewer than 10,000 residents (Table 6). Only Ludlow (21,209 residents), Chicopee (54,653) and Springfield (152,082) have more than 20,000 people. Estimates of the number of people actually living in the basin range from about 175,000 to 185,000. Generally, population density in basin communities increased from north to south, with the highest densities in the Springfield area communities in the southwest portion of the basin (Figure 22).

Overall, population in the 39 basin communities increased by 2.3%, from 1990 to 2000. However, changes for individual communities ranged from a low of –3.5% in Chicopee to a high of 39.8% in Hubbardston (see Table 6 and Figure 23). Compared to statewide averages, basin communities are much less dense (average of 361 people/mi2 versus 810 statewide), with more land area per capita (1.77 acres vs. 0.79).

Politically, basin communities appear similar to the rest of the state, with most residents registered as “unenrolled” (57% vs. 56% statewide); 29% are registered as Democrats (29% statewide), and 13.5% as Republican (15% statewide). However, these percentages vary substantially across basin communities. For example, Democratic enrollment ranges from about 15% in Petersham to more than 58% in Ludlow (Table 7).

Figure 19. Priority Habitats in the Chicopee River Basin (from NHESP).

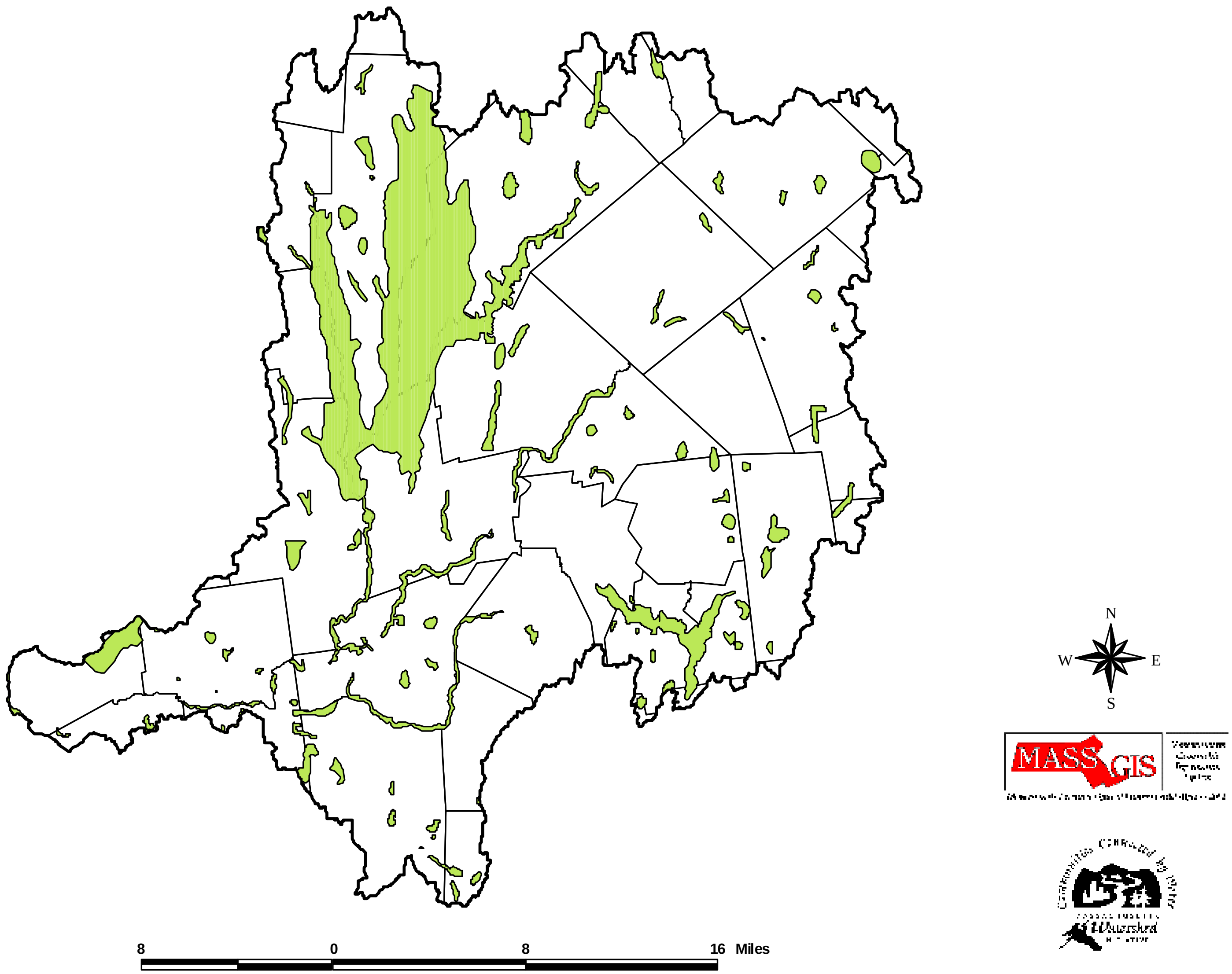


Figure 20. Cities and Towns in the Chicopee River Basin.

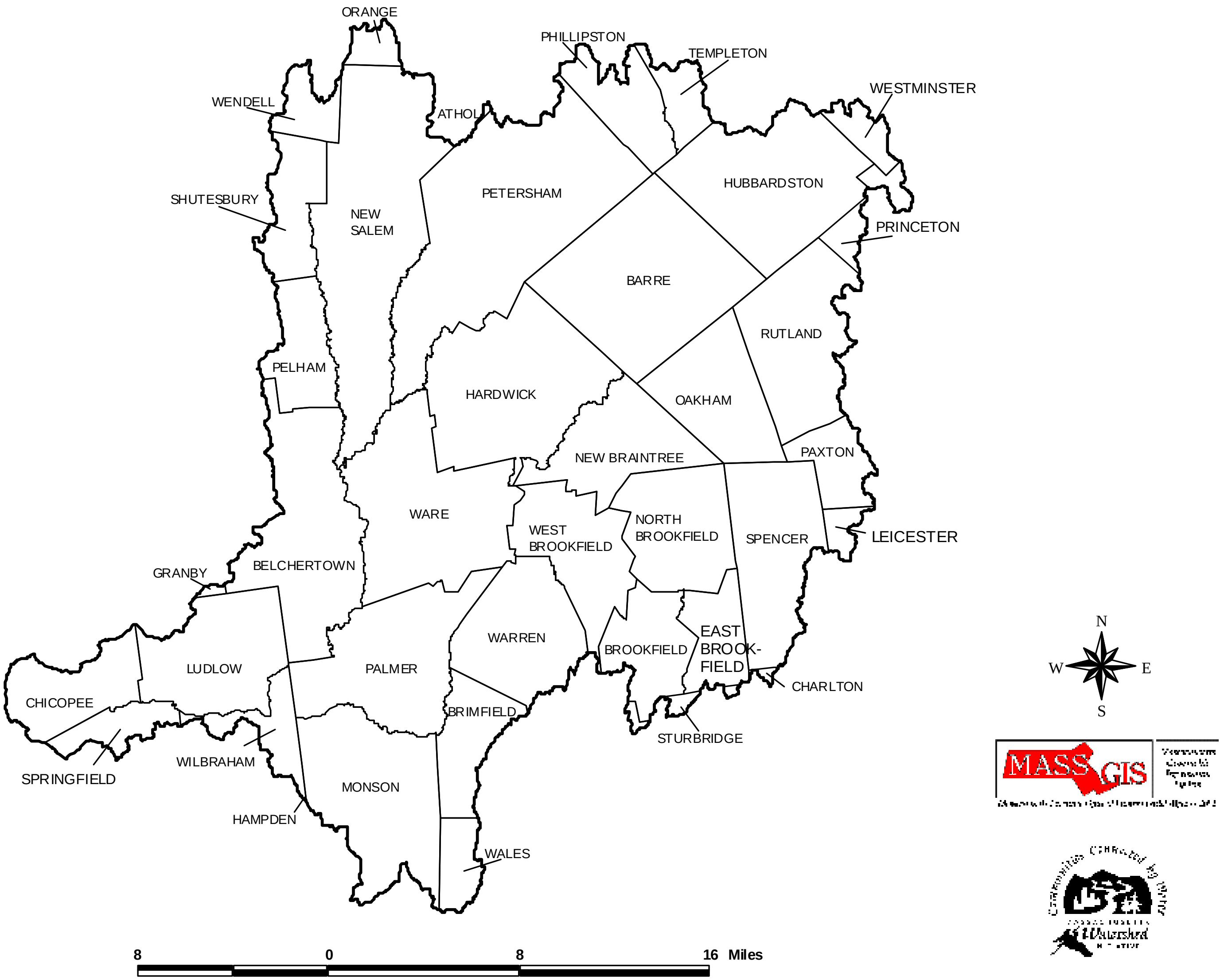


Figure 21. County Boundaries in the Chicopee River Basin.

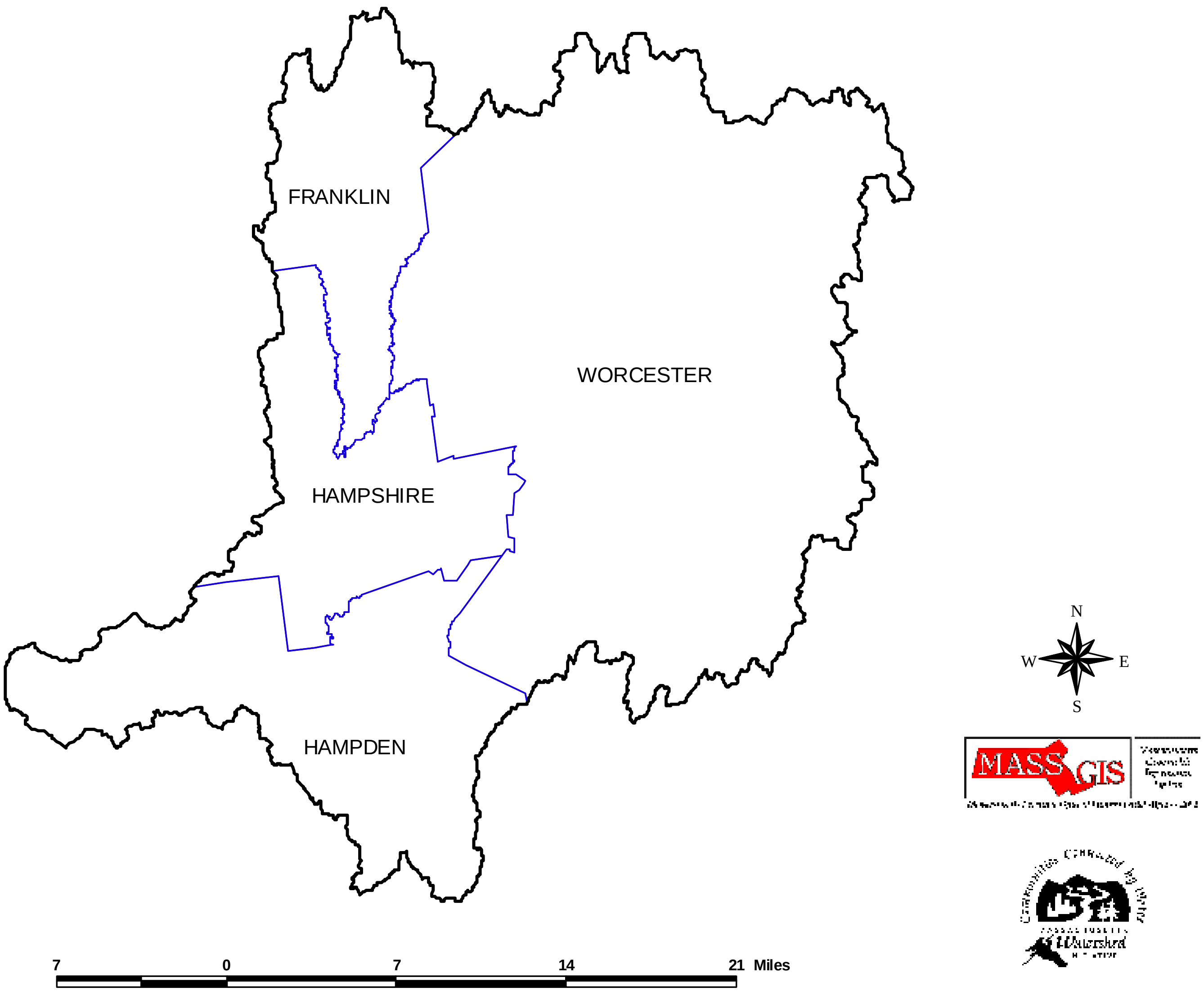


Table 4. Chicopee River Basin Communities

Municipality	County	Land Area (sq. mi.)	Percent in basin	Sq. mi. in basin
Athol	Worcester	32.3	0.6	0.2
Barre	Worcester	44.3	100.0	44.3
Belchertown	Hampshire	52.5	66.7	35.0
Brimfield	Hampden	35.4	35.9	12.7
Brookfield	Worcester	15.7	85.9	13.5
Charlton	Worcester	42.9	0.9	0.4
Chicopee	Hampden	22.9	64.9	14.9
East Brookfield	Worcester	9.9	99.3	9.8
Granby	Hampshire	28.0	1.6	0.4
Hampden	Hampden	19.7	0.04	0.01
Hardwick	Worcester	38.4	100.0	38.4
Hubbardston	Worcester	40.3	88.8	35.8
Leicester	Worcester	22.7	10.7	2.4
Ludlow	Hampden	27.1	89.1	24.2
Monson	Hampden	44.8	76.6	34.4
New Braintree	Worcester	20.8	100.0	20.8
New Salem	Franklin	45.0	93.4	42.1
North Brookfield	Worcester	21.1	100.0	21.1
Oakham	Worcester	21.0	100.0	21.0
Orange	Franklin	35.0	9.3	3.2
Palmer	Hampden	31.4	100.0	31.4
Paxton	Worcester	14.9	52.9	7.9
Pelham	Hampshire	24.8	48.1	11.9
Petersham	Worcester	54.3	93.3	50.6
Phillipston	Worcester	23.7	50.8	12.0
Princeton	Worcester	35.4	14.4	5.1
Rutland	Worcester	35.4	76.5	27.1
Shutesbury	Franklin	26.7	45.3	12.1
Spencer	Worcester	33.2	77.6	25.7
Springfield	Hampden	31.7	20.2	6.4
Sturbridge	Worcester	37.4	4.7	1.8
Templeton	Worcester	31.5	18.9	5.9
Wales	Hampden	16.2	37.9	6.1
Ware	Hampshire	34.9	100.0	34.9
Warren	Worcester	27.5	86.8	23.9
Wendell	Franklin	31.7	18.8	5.9
West Brookfield	Worcester	20.7	98.8	20.4
Westminster	Worcester	35.6	11.7	4.2
Wilbraham	Hampden	22.2	34.9	7.8

Table 5. Miscellaneous information on Chicopee River Basin communities

MUNICIPALITY	KOC	2000 US Census	1989 Income per Capita	Land SQ Miles	1999 Public Rd Mileage	Pop. Per sq mile	Land area per capita	Roads per sq mile
ATHOL	5	11,299	$12,444	32.34	96.45	349.38	1.83	2.98
BARRE	5	5,113	$14,012	44.30	99.59	115.42	5.55	2.25
BELCHERTOWN	3	12,968	$15,493	52.52	118.85	246.92	2.59	2.26
BRIMFIELD	6	3,339	$13,563	35.37	64.27	94.40	6.78	1.82
BROOKFIELD	5	3,051	$12,368	15.68	35.69	194.58	3.29	2.28
CHARLTON	6	11,263	$15,128	42.86	119.30	262.79	2.44	2.78
CHICOPEE	1	54,653	$13,525	22.91	153.37	2385.55	0.27	6.69
EAST BROOKFIELD	5	2,097	$14,988	9.89	19.24	212.03	3.02	1.95
GRANBY	3	6,132	$16,748	28.01	56.71	218.92	2.92	2.02
HAMPDEN	4	5,171	$18,674	19.66	53.09	263.02	2.43	2.70
HARDWICK	5	2,622	$13,387	38.40	86.79	68.28	9.37	2.26
HUBBARDSTON	6	3,909	$15,575	40.34	81.29	96.90	6.60	2.02
LEICESTER	5	10,471	$15,806	22.70	80.62	461.28	1.39	3.55
LUDLOW	3	21,209	$14,273	27.14	100.71	781.47	0.82	3.71
MONSON	5	8,359	$14,454	44.84	101.07	186.42	3.43	2.25
NEW BRAINTREE	5	927	$15,409	20.76	49.44	44.65	14.33	2.38
NEW SALEM	6	929	$14,762	45.04	38.03	20.63	31.03	0.84
NORTH BROOKFIELD	5	4,683	$13,710	21.11	68.62	221.84	2.88	3.25
OAKHAM	6	1,673	$15,162	20.99	43.48	79.70	8.03	2.07
ORANGE	5	7,518	$11,106	35.03	84.06	214.62	2.98	2.40
PALMER	5	12,497	$14,648	31.43	86.69	397.61	1.61	2.76
PAXTON	4	4,386	$20,893	14.87	37.03	294.96	2.17	2.49
PELHAM	4	1,403	$19,640	24.82	22.68	56.53	11.32	0.91
PETERSHAM	6	1,180	$17,542	54.27	62.68	21.74	29.43	1.15
PHILLIPSTON	6	1,621	$13,216	23.70	44.41	68.40	9.36	1.87
PRINCETON	4	3,353	$21,386	35.39	79.68	94.74	6.76	2.25
RUTLAND	6	6,353	$16,661	35.42	66.77	179.36	3.57	1.89
SHUTESBURY	7	1,810	$15,936	26.68	31.15	67.84	9.43	1.17
SPENCER	5	11,691	$14,222	33.15	94.33	352.67	1.81	2.85
SPRINGFIELD	1	152,082	$11,584	31.70	394.64	4797.54	0.13	12.45
STURBRIDGE	3	7,837	$16,642	37.39	78.18	209.60	3.05	2.09
TEMPLETON	5	6,799	$13,347	31.49	68.31	215.91	2.96	2.17
WALES	6	1,737	$13,337	16.21	23.67	107.16	5.97	1.46
WARE	5	9,707	$13,082	34.85	84.42	278.54	2.30	2.42
WARREN	5	4,776	$12,805	27.50	62.83	173.67	3.69	2.28
WENDELL	3	986	$11,990	31.65	48.33	31.15	20.54	1.53
WEST BROOKFIELD	5	3,804	$14,238	20.67	50.28	184.03	3.48	2.43
WESTMINSTER	3	6,907	$16,798	35.64	84.83	193.80	3.30	2.38
WILBRAHAM	4	13,473	$21,748	22.22	91.96	606.35	1.06	4.14
Statewide totals/mean:		6,349,097	$17,801	7839.13	27999.70	809.92	0.79	3.57
Chicopee totals/mean:		429,788	$15,136	1188.94	3063.54	361.49	1.77	2.58

KOC (KIND OF COMMUNITY): 1= Urbanized Center 4= Residential Suburb 7= Resort, Retirement, Artistic
6= Small Rural Community 3= Growth Community 5= Rural Economic Center

Table 6. U.S. Census and other population data for Chicopee River Basin communities

MUNICIPALITY	Population: 1990	Population: 2000	Change 1990 to 2000: Numeric	Change 1990 to 2000: Percent	Pop/sq.mi.	Est. pop in watershed in 2000 based on: % in basin	Est. pop in watershed in 2000 based on: TIGER
Athol	11,451	11,299	-152	-1.3%	349.4	63	19
Barre	4,546	5,113	567	12.5%	115.4	5113	5113
Belchertown	10,579	12,968	2,389	22.6%	246.9	8654	7589
Brimfield	3,001	3,339	338	11.3%	94.4	1198	974
Brookfield	2,968	3,051	83	2.8%	194.6	2619	2829
Charlton	9,576	11,263	1,687	17.6%	262.8	106	131
Chicopee	56,632	54,653	-1,979	-3.5%	2385.6	35475	36082
East Brookfield	2,033	2,097	64	3.1%	212.0	2083	2083
Granby	5,565	6,132	567	10.2%	218.9	97	51
Hampden	4,709	5,171	462	9.8%	263.0	2	1
Hardwick	2,385	2,622	237	9.9%	68.3	2622	2622
Hubbardston	2,797	3,909	1,112	39.8%	96.9	3472	3200
Leicester	10,191	10,471	280	2.7%	461.3	1122	704
Ludlow	18,820	21,209	2,389	12.7%	781.5	18889	20157
Monson	7,776	8,359	583	7.5%	186.4	6405	6875
New Braintree	881	927	46	5.2%	44.7	927	927
New Salem	802	929	127	15.8%	20.6	868	817
North Brookfield	4,708	4,683	-25	-0.5%	221.8	4683	4683
Oakham	1,503	1,673	170	11.3%	79.7	1673	1673
Orange	7,312	7,518	206	2.8%	214.6	695	389
Palmer	12,054	12,497	443	3.7%	397.6	12497	12497
Paxton	4,047	4,386	339	8.4%	295.0	2322	1440
Pelham	1,373	1,403	30	2.2%	56.5	675	625
Petersham	1,131	1,180	49	4.3%	21.7	1101	1038
Phillipston	1,485	1,621	136	9.2%	68.4	824	820
Princeton	3,189	3,353	164	5.1%	94.7	482	352
Rutland	4,936	6,353	1,417	28.7%	179.4	4861	4847
Shutesbury	1,561	1,810	249	16.0%	67.8	820	807
Spencer	11,645	11,691	46	0.4%	352.7	9068	10379
Springfield	156,983	152,082	-4,901	-3.1%	4797.5	30751	19482
Sturbridge	7,775	7,837	62	0.8%	209.6	368	253
Templeton	6,438	6,799	361	5.6%	215.9	1284	876
Wales	1,566	1,737	171	10.9%	107.2	659	552
Ware	9,808	9,707	-101	-1.0%	278.5	9707	9707
Warren	4,437	4,776	339	7.6%	173.7	4143	4455
Wendell	899	986	87	9.7%	31.2	185	183
West Brookfield	3,532	3,804	272	7.7%	184.0	3759	3720
Westminster	6,191	6,907	716	11.6%	193.8	808	812
Wilbraham	12,635	13,473	838	6.6%	606.3	4699	3318
Totals	419,920	429,788	9,868	2.3%	361.5	185,779	173,084

Sources: U.S. Census Bureau, 1990 Census of Population, File STF1 and Census 2000 Redistricting Data Summary File (P.L. 94-171)

Figure 22. Population Density (2000) in Chicopee River Basin Communities.

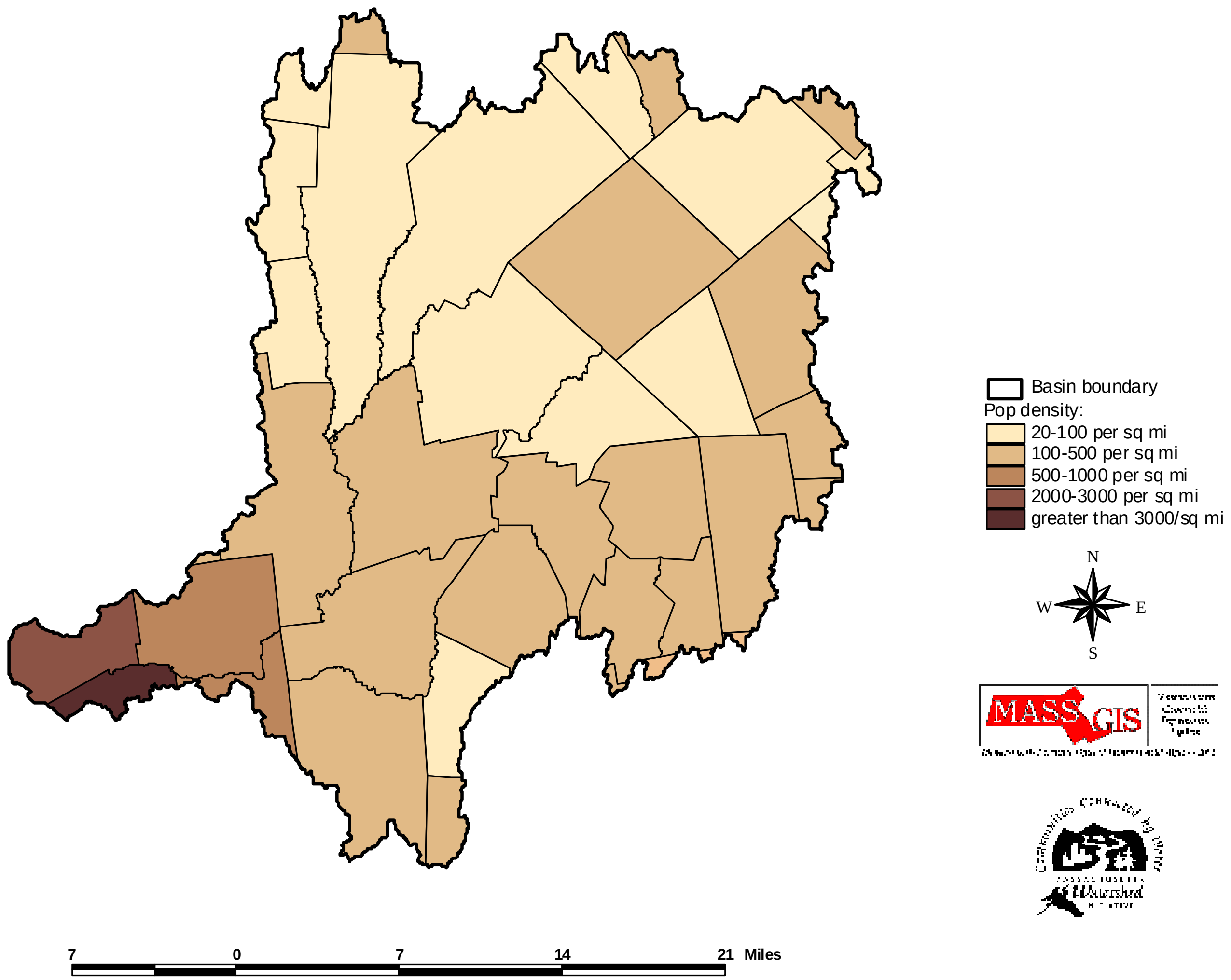


Figure 23. Population Change in Chicopee River Basin Communities (1990-2000).

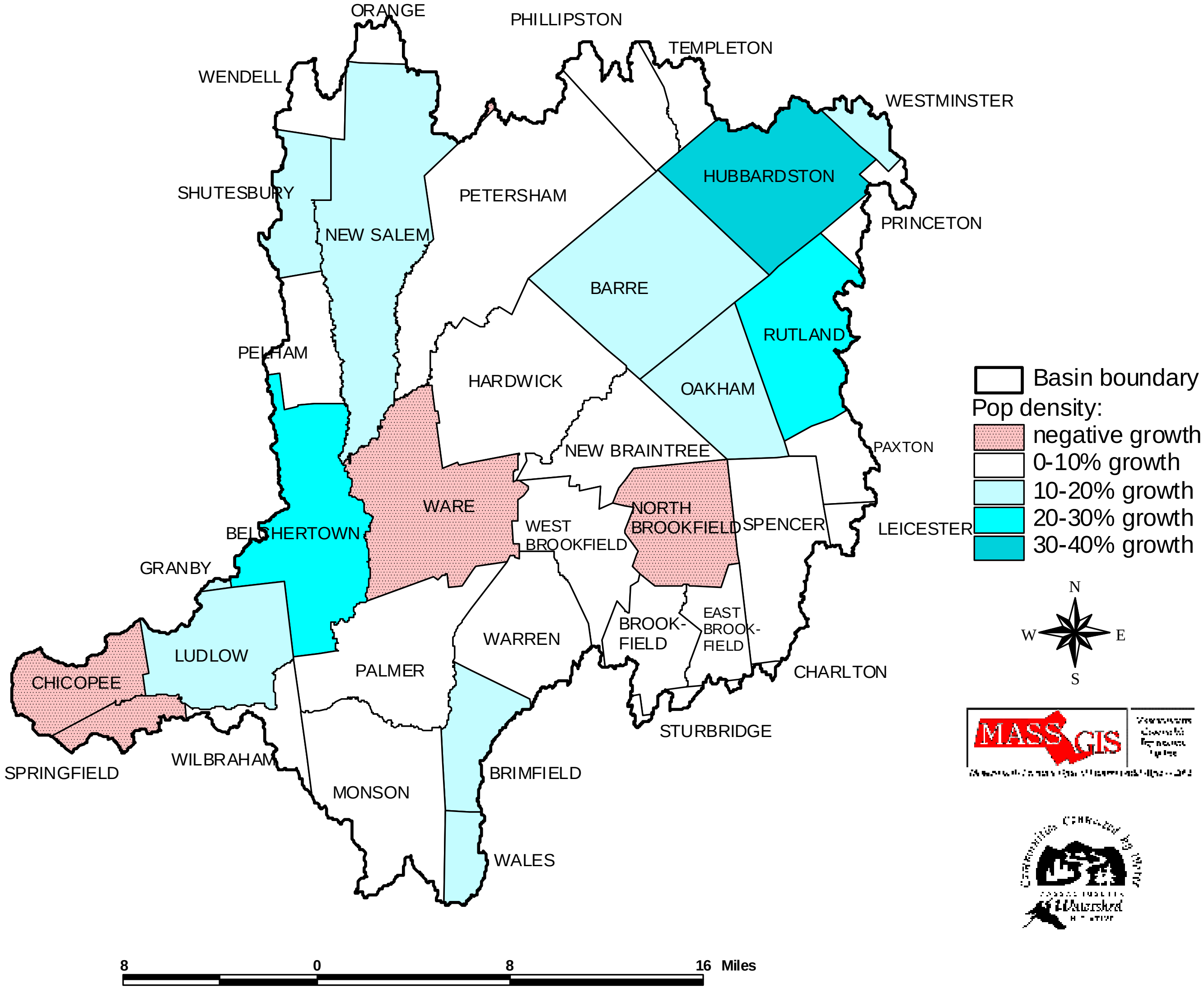


Table 7. Political party affiliation in Chicopee River Basin communities (1996 data from Mass. Sec. of State)

	Registered voters for 1996 state primary election						
Municipality	Total	Democrat	%	Republican	%	Unenrolled	%
ATHOL	5,680	1,460	25.7%	839	14.8%	3,381	59.5%
BARRE	2,723	891	32.7%	330	12.1%	1,502	55.2%
BELCHERTOWN	6,503	1,819	28.0%	904	13.9%	3,780	58.1%
BRIMFIELD	1,862	413	22.2%	295	15.8%	1,154	62.0%
BROOKFIELD	1,692	378	22.3%	201	11.9%	1,113	65.8%
CHARLTON	6,557	1,548	23.6%	1,007	15.4%	4,002	61.0%
CHICOPEE	27,840	15,146	54.4%	2,640	9.5%	10,054	36.1%
EAST BROOKFIELD	1,071	289	27.0%	171	16.0%	611	57.0%
GRANBY	3,312	917	27.7%	538	16.2%	1,857	56.1%
HAMPDEN	2,836	636	22.4%	555	19.6%	1,645	58.0%
HARDWICK	1,495	545	36.5%	148	9.9%	802	53.6%
HUBBARDSTON	1,884	350	18.6%	299	15.9%	1,235	65.6%
LEICESTER	5,545	2,313	41.7%	548	9.9%	2,684	48.4%
LUDLOW	10,208	5,936	58.2%	1,024	10.0%	3,248	31.8%
MONSON	4,206	1,520	36.1%	565	13.4%	2,121	50.4%
NEW BRAINTREE	492	87	17.7%	53	10.8%	352	71.5%
NEW SALEM	547	138	25.2%	89	16.3%	320	58.5%
NORTH BROOKFIELD	2,551	813	31.9%	436	17.1%	1,302	51.0%
OAKHAM	921	166	18.0%	113	12.3%	642	69.7%
ORANGE	3,531	786	22.3%	618	17.5%	2,127	60.2%
PALMER	7,100	2,629	37.0%	700	9.9%	3,771	53.1%
PAXTON	2,399	556	23.2%	452	18.8%	1,391	58.0%
PELHAM	843	328	38.9%	90	10.7%	425	50.4%
PETERSHAM	837	129	15.4%	125	14.9%	583	69.7%
PHILLIPSTON	715	117	16.4%	83	11.6%	515	72.0%
PRINCETON	2,078	385	18.5%	448	21.6%	1,245	59.9%
RUTLAND	3,094	728	23.5%	506	16.4%	1,860	60.1%
SHUTESBURY	1,167	333	28.5%	75	6.4%	759	65.0%
SPENCER	6,047	2,137	35.3%	803	13.3%	3,107	51.4%
SPRINGFIELD	65,506	37,155	56.7%	6,884	10.5%	21,467	32.8%
STURBRIDGE	4,415	1,263	28.6%	702	15.9%	2,450	55.5%
TEMPLETON	3,484	940	27.0%	387	11.1%	2,157	61.9%
WALES	878	162	18.5%	49	5.6%	667	76.0%
WARE	5,199	2,283	43.9%	464	8.9%	2,452	47.2%
WARREN	2,371	897	37.8%	234	9.9%	1,240	52.3%
WENDELL	525	140	26.7%	29	5.5%	356	67.8%
WEST BROOKFIELD	2,122	484	22.8%	341	16.1%	1,297	61.1%
WESTMINSTER	3,728	872	23.4%	595	16.0%	2,261	60.6%
WILBRAHAM	8,195	2,712	33.1%	2,012	24.6%	3,471	42.4%
Mean (Chicopee)			29.4%		13.5%		57.1%
Mean (Statewide)			29.2%		15.0%		55.8%

3. Local Government: 37 of the 39 basin communities (i.e., 95%) have Selectmen and Town Meeting forms of government (compared to 86% statewide). Only 2 (Chicopee and Springfield) have mayors, with either aldermen or city council (Table 8). All but one community with Town Meetings have "Open" Town Meetings; only Ludlow has a "Representative Town Meeting".
Sources of local revenue in basin communities are similar to the state as a whole, although there is substantial variability among individual communities (Table 9). Overall, basin communities derive more than 52% of revenues from the local tax levy (56% statewide), 24% from state aid (vs. 20%), 15% from local receipts (vs. 15%), and 9% from other sources (vs. 8%). Dependence on state aid ranges from a low of about 6% in Wilbraham to almost 62% in Springfield.

4. Regional planning districts: The Chicopee River Basin is split among four Regional Planning Agencies – Pioneer Valley Planning Commission (PVPC), Central Massachusetts Regional Planning Commission (CMRPC), Montachusett Regional Planning Commission (MRPC), and Franklin Regional Council of Governments (FRCOG) (Figure 24). At least two of these have recently developed landuse-based plans or visions for their respective portions of the basin: "Valley Vision", produced by PVPC, and "Development Framework: A Guide for Growth and Change in Central Massachusetts" by CMRPC.

5. Local zoning: Communities use a variety of planning tools to control or otherwise guide growth. Appendix B lists some of the local by-laws and ordinances used in basin communities. That information is also summarized in the table below, which shows the number of basin communities that have enacted various zoning tools. As indicated, many communities in the basin still do not employ many currently-available growth management zoning tools.

	Site Plan Review	Cluster	Phased Growth	Planned Unit Development	Overlay Zoning	Village Center Zoning	Design Review Board	Scenic Roads	Local Historic District
No	25	28	37	33	24	35	38	31	33
Yes	14	11	2	6	15	4	1	7	6

Total communities in basin = 39

6. Legislative districts:
a. Senate: The Chicopee River Basin contains 8 State Senate districts (Figure 25), although the majority of basin is contained in just one (Worcester, Hampden, Hampshire, and Franklin). A list of current senators representing basin communities is included in Table 10.
b. House: There are 18 House districts in the basin (Figure 26); current representatives are listed in Table 11.

7. Conservation organizations: Several regional or statewide conservation organizations have a presence in the basin. These include the Massachusetts Audubon Society (MAS), The Trustees of Reservations (TTOR), Norcross Wildlife Sanctuary, and the Mt. Grace Land Conservation Trust, all of which are holders of protected conservation land in the basin. At least 14 sportsmen's clubs also operate in the basin, and generally hold title to land and/or buildings. Other organizations, such as Trout Unlimited, the Sierra Club, and others, frequently get involved in specific conservation issues that relate to their main areas of interest.

8. Infrastructure
a. Public water supplies: Numerous public water supplies occur throughout the basin (Figure 27). These include 11 surface water reservoirs, 7 of which are currently active (Figure 28 and Table 12). The combined watershed area of these surface supplies is approximately 307 square miles (more than 42% of the basin). Most of this total (276 mi^2) is part of the MDC/MWRA

Table 8. Forms of Government in Chicopee River Basin communities (from Mass. Municipal Association)

MUNICIPALITY	TYPE	# MEMBERS	ADMINISTRATOR	TOWN MEETING
ATHOL	S	5	ES	OTM
BARRE	S	3	TA	OTM
BELCHERTOWN	S	5	TA	OTM
BRIMFIELD	S	3	--	OTM
BROOKFIELD	S	3	AA	OTM
CHARLTON	S	5	TA	OTM
CHICOPEE	M/A	13	--	--
EAST BROOKFIELD	S	3	--	OTM
GRANBY	S	3	AA	OTM
HAMPDEN	S	3	AA	OTM
HARDWICK	S	3	AA	OTM
HUBBARDSTON	S	3	AA	OTM
LEICESTER	S	5	TA	OTM
LUDLOW	S	5	ES	RTM
MONSON	S	3	TA	OTM
NEW BRAINTREE	S	3	AA	OTM
NEW SALEM	S	3	ES	OTM
NORTH BROOKFIELD	S	3	TC	OTM
OAKHAM	S	3	AA	OTM
ORANGE	S	3	TA	OTM
PALMER	S	3	TA	OTM
PAXTON	S	3	--	OTM
PELHAM	S	3	AA	OTM
PETERSHAM	S	3	TS	OTM
PHILLIPSTON	S	3	AA	OTM
PRINCETON	S	3	TA	OTM
RUTLAND	S	3	--	OTM
SHUTESBURY	S	3	TA	OTM
SPENCER	S	5	TA	OTM
SPRINGFIELD	M/C	9	--	(A)
STURBRIDGE	S	5	TA	OTM
TEMPLETON	S	5	TC	OTM
WALES	S	3	--	OTM
WARE	S	3	AA	OTM
WARREN	S	5	AA	OTM
WENDELL	S	3	AA	OTM
WEST BROOKFIELD	S	3	TC	OTM
WESTMINSTER	S	3	TC	OTM
WILBRAHAM	S	3	TA	OTM

TYPE: S=Selectmen; M/A=Mayor and Aldermen; M/C=Mayor and City Council

ADMINISTRATOR: AA=Administrative Assistant; ES=Executive Secretary;
TA=Town Administrator; TC=Town Coordinator; TS=Town Secretary

TOWN MEETING: OTM=Open Town Meeting; RTM=Representative Town Meeting;
(A) = Optional Plan for City Government

Table 9. Sources of local revenues in Chicopee River basin communities (from Mass. Dept. of Revenue, FY-01 data)

MUNICIPALITY	Tax Levy	State Aid	Local Receipts	All Other	Total Receipts	AS % OF THE TOTAL			
						Tax Levy	State Aid	Local Receipts	All Other
ATHOL	$5,869,269	$2,370,763	$3,063,912	$1,108,671	$12,412,615	47.28%	19.10%	24.68%	8.93%
BARRE	3,272,393	919,167	1,711,758	652,626	6,555,944	49.91%	14.02%	26.11%	9.95%
BELCHERTOWN	12,074,175	10,476,060	3,314,232	1,233,832	27,098,299	44.56%	38.66%	12.23%	4.55%
BRIMFIELD	3,256,234	1,913,004	713,720	713,331	6,596,289	49.36%	29.00%	10.82%	10.81%
BROOKFIELD	2,147,236	2,655,006	504,256	535,464	5,841,962	36.76%	45.45%	8.63%	9.17%
CHARLTON	9,074,287	1,416,714	2,006,064	1,115,188	13,612,253	66.66%	10.41%	14.74%	8.19%
CHICOPEE	42,776,247	48,390,757	17,498,571	1,589,164	110,254,739	38.80%	43.89%	15.87%	1.44%
EAST BROOKFIELD	1,318,088	330,351	471,305	516,952	2,636,697	49.99%	12.53%	17.87%	19.61%
GRANBY	4,953,665	3,882,643	1,190,440	2,022,798	12,049,546	41.11%	32.22%	9.88%	16.79%
HAMPDEN	5,733,512	684,001	695,367	349,925	7,462,805	76.83%	9.17%	9.32%	4.69%
HARDWICK	2,001,178	500,473	569,604	703,299	3,774,554	53.02%	13.26%	15.09%	18.63%
HUBBARDSTON	3,058,888	422,356	661,263	421,462	4,563,969	67.02%	9.25%	14.49%	9.23%
LEICESTER	6,940,348	10,858,623	1,080,000	1,155,086	20,034,057	34.64%	54.20%	5.39%	5.77%
LUDLOW	17,191,150	12,821,324	6,583,950	1,800,357	38,396,781	44.77%	33.39%	17.15%	4.69%
MONSON	7,372,425	7,695,351	2,425,299	1,339,407	18,832,482	39.15%	40.86%	12.88%	7.11%
NEW BRAINTREE	897,873	201,506	86,800	156,461	1,342,640	66.87%	15.01%	6.46%	11.65%
NEW SALEM	768,797	189,335	409,800	218,920	1,586,852	48.45%	11.93%	25.82%	13.80%
NORTH BROOKFIELD	2,643,091	4,662,785	1,749,179	895,925	9,950,981	26.56%	46.86%	17.58%	9.00%
OAKHAM	1,263,790	297,999	219,500	251,586	2,032,875	62.17%	14.66%	10.80%	12.38%
ORANGE	4,859,819	7,558,396	2,398,871	2,028,763	16,845,849	28.85%	44.87%	14.24%	12.04%
PALMER	10,133,527	13,741,013	2,884,369	2,838,526	29,597,435	34.24%	46.43%	9.75%	9.59%
PAXTON	4,455,406	598,856	1,176,597	786,403	7,017,262	63.49%	8.53%	16.77%	11.21%
PELHAM	1,822,755	318,139	333,300	162,494	2,636,688	69.13%	12.07%	12.64%	6.16%
PETERSHAM	1,137,515	360,413	381,900	137,681	2,017,509	56.38%	17.86%	18.93%	6.82%
PHILLIPSTON	1,335,354	232,585	224,300	236,482	2,028,721	65.82%	11.46%	11.06%	11.66%
PRINCETON	4,606,374	860,763	823,299	176,388	6,466,824	71.23%	13.31%	12.73%	2.73%
RUTLAND	4,436,949	901,075	1,871,151	1,945,739	9,154,914	48.47%	9.84%	20.44%	21.25%
SHUTESBURY	2,605,201	931,531	357,717	331,986	4,226,435	61.64%	22.04%	8.46%	7.85%
SPENCER	6,382,026	2,480,846	2,783,334	420,778	12,066,984	52.89%	20.56%	23.07%	3.49%

SPRINGFIELD	106,688,830	245,974,458	42,498,239	2,500,000	397,661,527	26.83%	61.86%	10.69%	0.63%
Table 9 (Cont.) STURBRIDGE	9,914,311	2,136,573	3,436,456	1,289,445	16,776,785	59.10%	12.74%	20.48%	7.69%
TEMPLETON	3,773,726	1,395,417	2,502,357	550,787	8,222,287	45.90%	16.97%	30.43%	6.70%
WALES	1,587,645	968,951	284,065	98,240	2,938,901	54.02%	32.97%	9.67%	3.34%
WARE	7,524,985	10,136,264	1,788,000	1,741,100	21,190,349	35.51%	47.83%	8.44%	8.22%
WARREN	3,457,506	785,557	1,188,612	292,887	5,724,562	60.40%	13.72%	20.76%	5.12%
WENDELL	940,197	353,946	271,177	68,222	1,633,542	57.56%	21.67%	16.60%	4.18%
WEST BROOKFIELD	2,726,620	515,046	700,000	958,921	4,900,587	55.64%	10.51%	14.28%	19.57%
WESTMINSTER	7,715,711	831,793	1,453,000	1,867,852	11,868,356	65.01%	7.01%	12.24%	15.74%
WILBRAHAM	17,394,092	1,459,521	4,595,744	1,274,831	24,724,188	70.35%	5.90%	18.59%	5.16%
Statewide means:						56.37%	20.32%	15.30%	7.84%
Chicopee means:						51.96%	23.90%	15.03%	9.12%

Table 10. Senate districts and current senators in Chicopee River Basin, January, 2002

SENATE DISTRICT	SENATOR
1st Hampden and Hampshire	Brian P. Lees (R)
Second Worcester	Guy William Glodis (D)
Hampden	Linda J. Melconian (D)
Second Hampden and Hampshire	Michael R. Knapik (R)
Worcester and Norfolk	Richard T. Moore (D)
Worcester and Middlesex	Robert A. Antonioni (D)
Franklin and Hampshire	Stanley C. Rosenberg (D)
Worcester Hampden Hampshire Franklin	Stephen M. Brewer (D)

Figure 24. Regional Planning Agencies in the Chicopee River Basin.

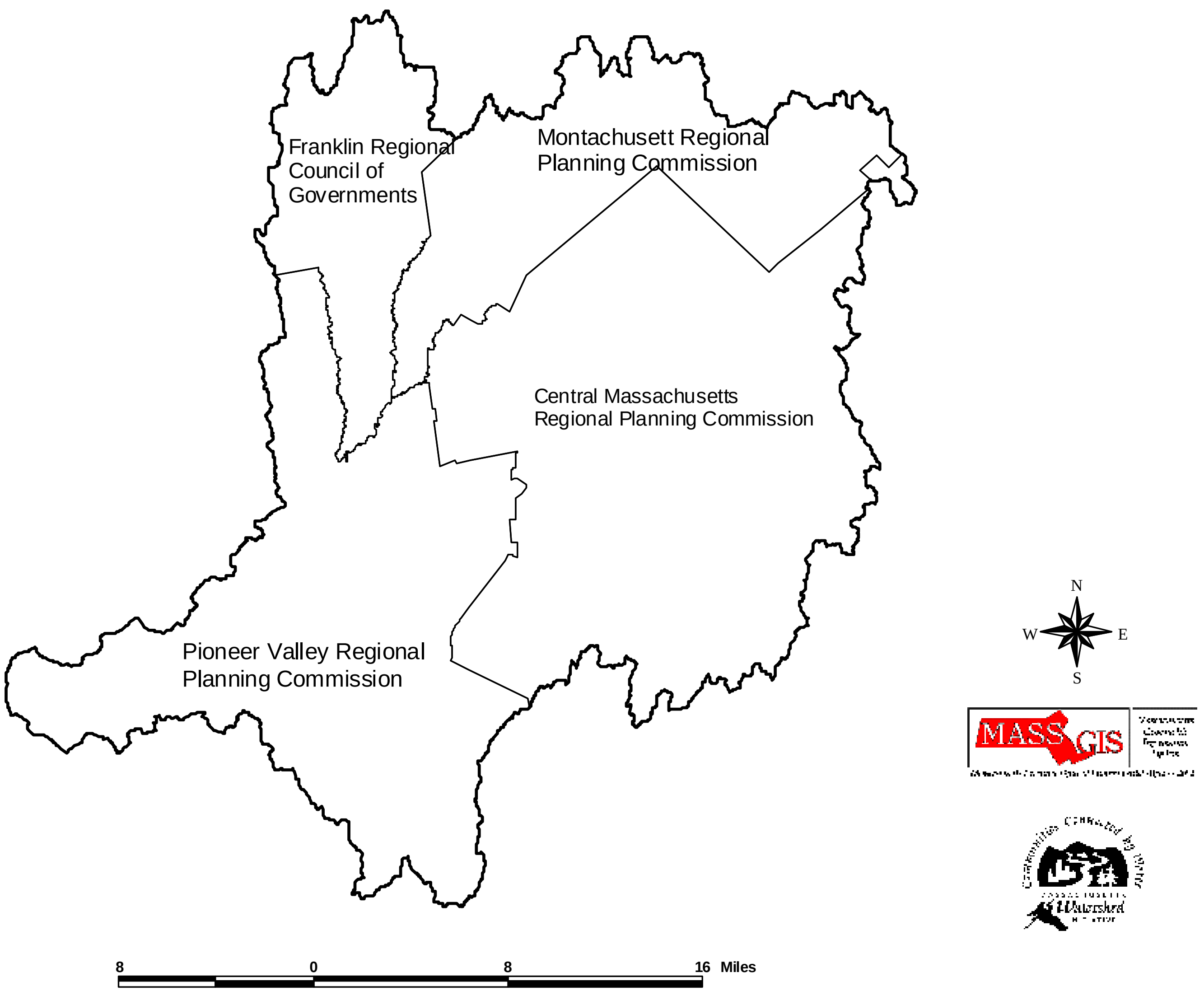


Figure 25. State Senate Districts in the Chicopee River Basin.

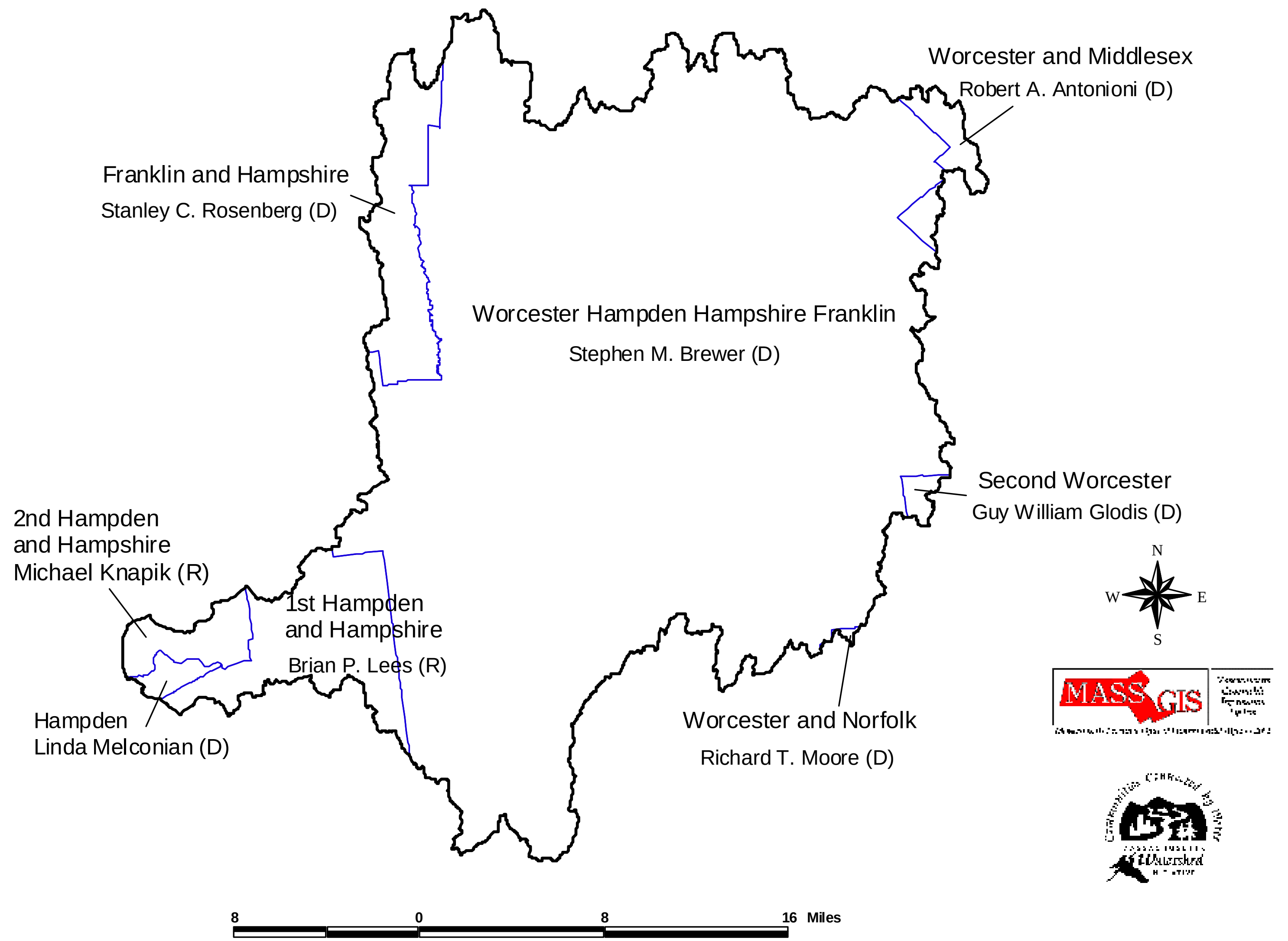


Figure 26. State House Districts in the Chicopee River Basin.

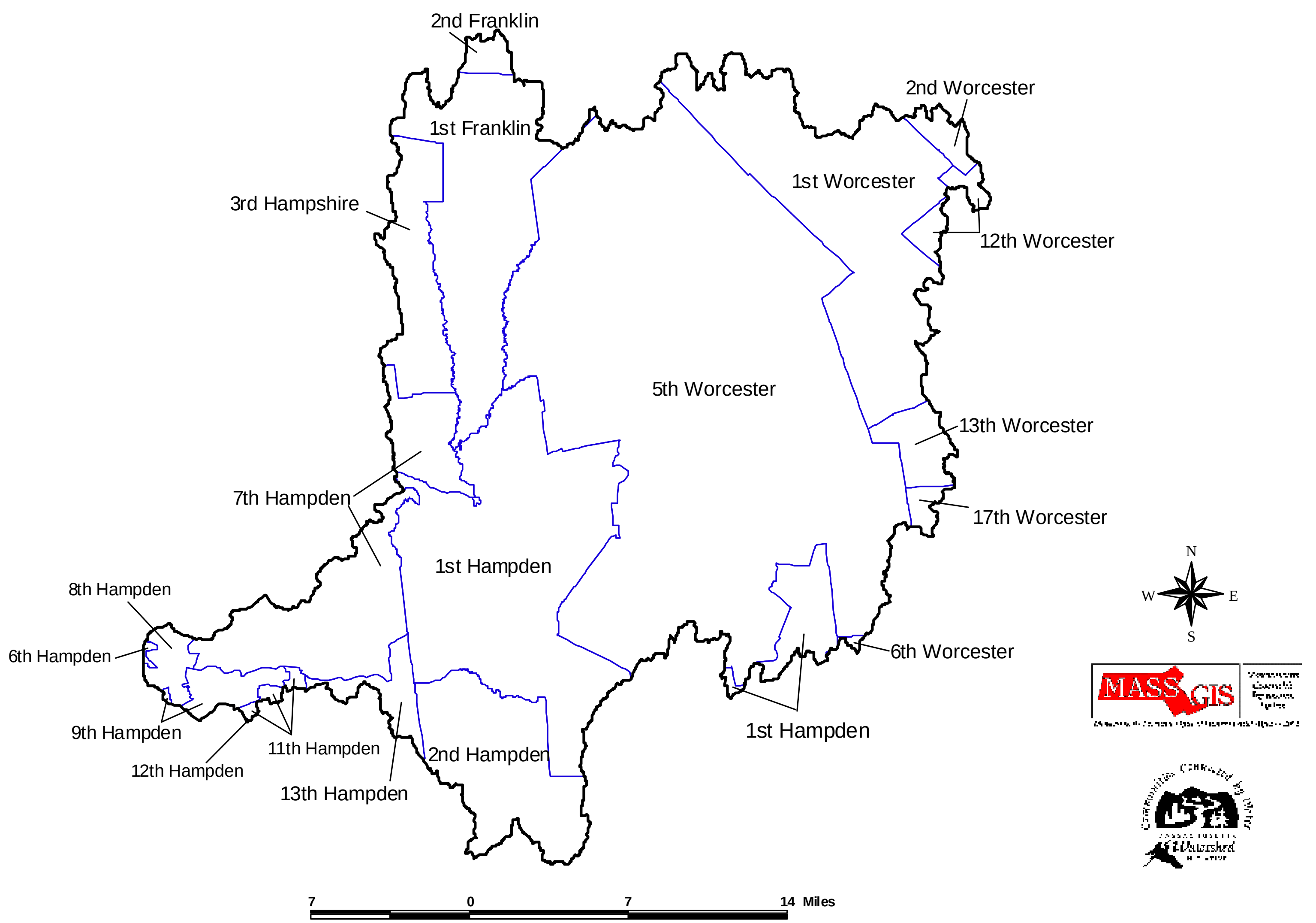


Table 11. House districts and current representatives in Chicopee River Basin, January, 2002

HOUSE DISTRICT	REPRESENTATIVE
1st Franklin	Stephen Kulik (D)
2nd Franklin	John F. Merrigan (D)
1st Hampden	Hillman V. Reed (R)
2nd Hampden	Mary S. Rogeness (R)
6th Hampden	Stephen J. Buoniconti (D)
7th Hampden	Thomas M. Petrolati (D)
8th Hampden	Joseph F. Wagner (D)
9th Hampden	Christopher P. Asselin (D)
11th Hampden	Paul E. Caron (D)
12th Hampden	Benjamin Swan (D)
13th Hampden	Gale D. Candaras (D)
3rd Hampshire	Ellen Story (D)
1st Worcester	David C. Bunker (D)
2nd Worcester	Brian R. Knuuttila (D)
5th Worcester	Anne Gobi (D)
6th Worcester	Mark J. Carron (D)
13th Worcester	Robert Spellane (D)
17th Worcester	John J. Binienda (D)

Figure 27. Public Water Supplies in the Chicopee River Basin.

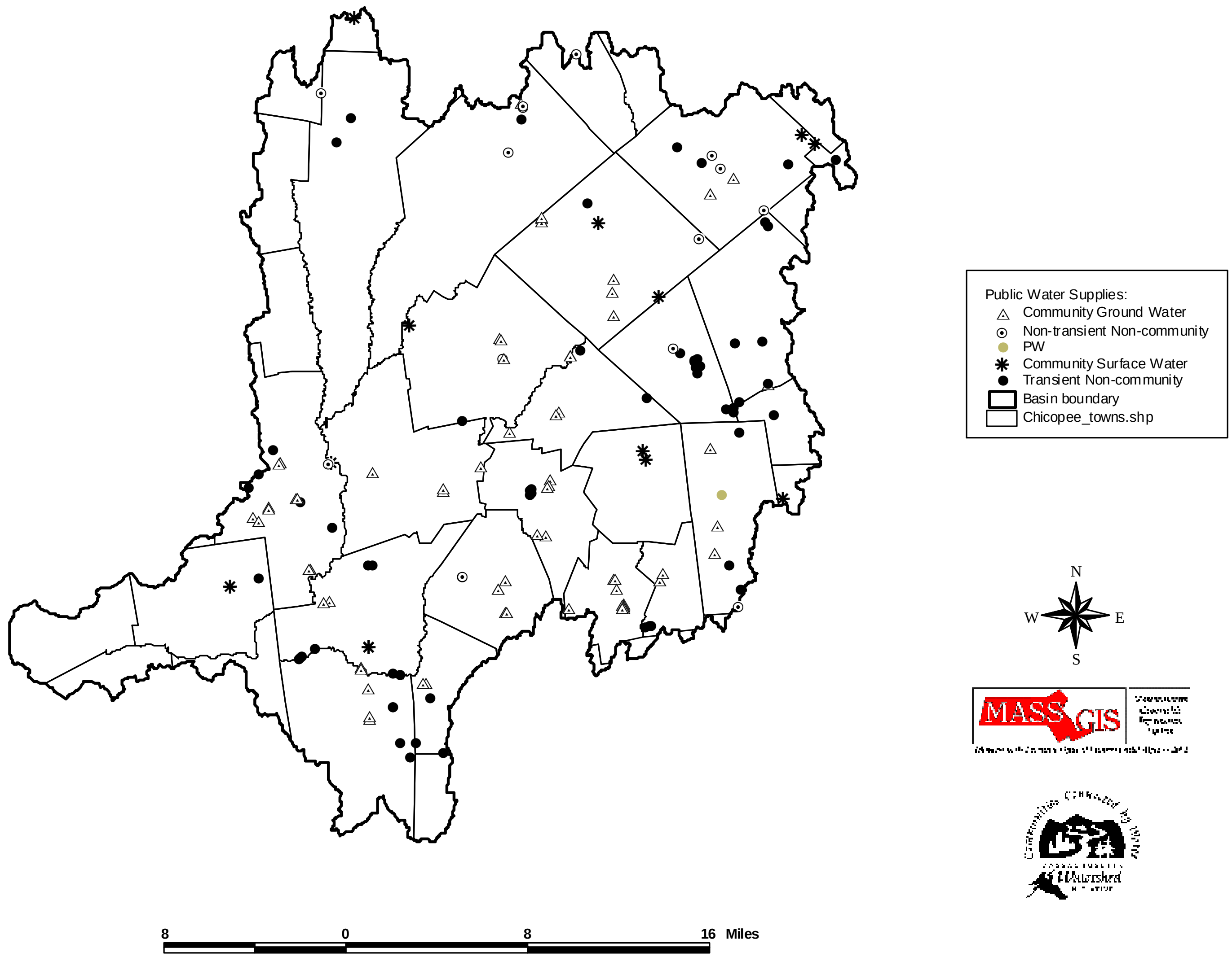


Figure 28. Surface Water Sub-basins in the Chicopee River Basin.

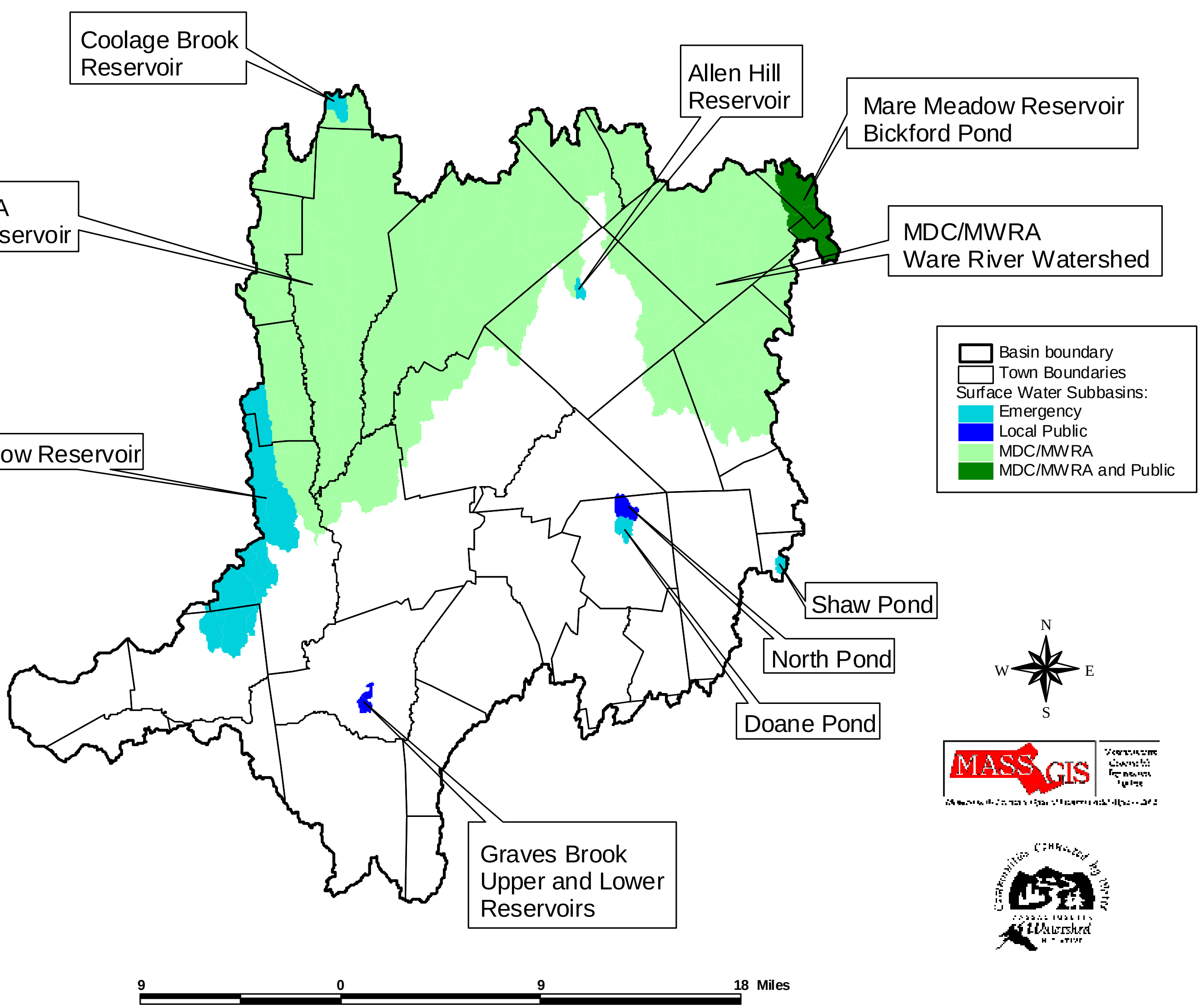


Table 12. Surface water reservoirs in the Chicopee River Basin.

SITE NAME	TOWN	TOWN SERVED	PWSID	STATUS
ALLEN HILL RESERVOIR	BARRE	BARRE	2021000	Emergency
BICKFORD POND	HUBBARDSTON	FITCHBURG	2097000	Active
COOLAGE BROOK RESERVOIR	ORANGE	ORANGE	1223000	Emergency
DOANE POND	NORTH BROOKFIELD	NORTH BROOKFIELD	2212000	Emergency
GRAVES BROOK LOWER RES.	PALMER	PALMER	1227000	Active
GRAVES BROOK UPPER RES.	PALMER	PALMER	1227000	Active
LUDLOW RESERVOIR	LUDLOW	SPRINGFIELD	1161000	Emergency
MARE MEADOW RESERVOIR	HUBBARDSTON	FITCHBURG	2097000	Active
NORTH POND	NORTH BROOKFIELD	NORTH BROOKFIELD	2212000	Active
QUABBIN RESERVOIR	HARDWICK	MWRA COMMUNITIES	6000000	Active
MWRA (Shaft 8)	BARRE	MWRA COMMUNITIES	6000000	Active
SHAW POND	LEICESTER	SPENCER	2280000	Emergency

Quabbin/Ware River system, which provides drinking water to almost half the population of the state. Of the others, approximately 8 mi^2 represent active local supplies; the remaining 23 mi^2 are emergency or backup supplies.
Numerous groundwater supplies also occur in the basin, including many community (Table 13), non-transient non-community (Table 14) and transient non-community supplies (Table 15).

b. Waste Water Treatment Plants (WWTP): Nine WWTP's are currently permitted to discharge treated wastewater into the basin (Figure 29 and Table 16). Four of these (Barre, Gilbertville, Wheelwright, and Ware) discharge to the Ware River; three (Spencer, N. Brookfield and Warren) discharge to the Quaboag River or a tributary; the Palmer WWTP discharges to the Chicopee River, close to the confluence of the Ware and Quaboag Rivers; the Chicopee WWTP discharges to a point at the confluence of the Chicopee and Connecticut Rivers. Together, their permit limits amount to just over 26 MGD. Springfield, Chicopee, and Palmer are also permitted to discharge into the Chicopee River through a number of combined sewer overflows (CSOs).
In addition, wastewater from several additional communities is collected and transferred out of the basin. This occurs in all or parts of Belchertown, Templeton, Rutland, Ludlow, Wilbraham, and Springfield.

c. Roads: Roads of various types cover the Chicopee River basin (Figure 30), including Interstate Highways (I-90, I-291 and I-391), numerous state highways (e.g., Routes 2, 202, 122, 32, 9, 62, 68, 56, 67, 21, 141, 20, 19, 148, 101, 49), and even more local roads. Road density in basin communities is variable (Table 17) ranging from 0.84 mi/mi^2 in New Salem to 12.45 in Springfield. The highest road density in the basin corresponds with the highest population densities in the southwest portion of the basin (Figure 30). Compared to statewide averages, Chicopee River basin communities have lower road density, again reflecting the more rural nature of many of these towns.

d. Landfills: Massachusetts DEP data lists 6 active landfills in the Chicopee River basin (Figure 31). These include several fairly large landfills that deal with municipal solid waste (e.g. ,Chicopee, Martone (Barre), Hardwick), and several smaller local landfills.

e. Railroads: MassGIS data indicates that there are 72 railway segments in the basin, including 50 active segments, 18 that are abandoned, and 4 for which current status is unknown (Figure 32).

f. Dams: In December of 1996, the Connecticut River Coordinators Office of the USFWS published a report on the status of migratory fish passage in the Connecticut River Watershed (USFWS 1996). That report included a listing of known barriers to fish passage along the river, and its tributaries. For the Chicopee River basin, 111 dams were listed. These are located throughout the basin (Figure 33). Eleven of these dams are Federal Energy Regulatory Commission (FERC) regulated hydroelectric generating dams (Table 18). The EPA Index of Watershed Indicators (through their Surf Your Watershed web site) lists 88 dams in the basin, ranging from small dams with just only a couple acre feet of normal storage, to the Winsor Dam at Quabbin Reservoir, with almost 1.3 million acre-feet of storage (Table 19). The combined storage of all 88 listed dams is 1,306,587 acre-feet (about 426 billion gallons, or 57 billion cubic feet). Additional information on dams in the basin is included in Appendix C.

Table 13. Community Ground Water Supplies in the Chicopee River Basin.

TOWN	POPULATION SERVED	SOURCE_ID	SITE_NAME	STATUS
BELCHERTOWN	Belchertown	1024000-01G	WELL #1	Active
BELCHERTOWN	Belchertown	1024000-02G	WELL #2	Active
BELCHERTOWN	Belchertown	1024000-03G	WELL #3	Active
BELCHERTOWN	Belchertown	1024000-04G	WELL #4	Active
BELCHERTOWN	Belchertown	1024000-06G	JABISH BROOK WELLFIELD	Emergency
BELCHERTOWN	Sports Haven Mobile Home Park	1024001-01G	OLD DUG WELL	
BELCHERTOWN	Sports Haven Mobile Home Park	1024001-02G	NEW DUG WELL	Active
BELCHERTOWN	Pine Valley Plantation	1024002-01G	WELL # 1	Active
BELCHERTOWN	Pine Valley Plantation	1024002-02G	WELL # 2	Active
BELCHERTOWN	Pine Valley Plantation	1024002-03G	WELL # 3	Active
BELCHERTOWN	Pine Valley Plantation	1024002-04G	WELL # 4	Active
BRIMFIELD	Meadowbrook Acres	1043001-01G	UPPER WELL	Active
BRIMFIELD	Meadowbrook Acres	1043001-02G	LOWER WELL	Active
MONSON	Monson	1191000-03G	GP WELL # 1 (BETHANY RD WELL)	Active
MONSON	Monson	1191000-04G	GP WELL # 2 (PALMER RD. WELL)	Active
MONSON	Monson	1191000-05G	GP WELL # 3 (BUNYAN RD. WELL)	Active
PALMER	Palmer	1227000-01G	GALAXY WELLFIELD	Active
PALMER	Palmer	1227000-02G	GP WELL # 2	Active
BELCHERTOWN	Bondsville (Palmer)	1227002-01G	WELL # 1	Active
BELCHERTOWN	Bondsville (Palmer)	1227002-02G	WELL # 2	Active
BELCHERTOWN	Bondsville (Palmer)	1227002-03G	WELL # 3	Inactive
BELCHERTOWN	Bondsville (Palmer)	1227002-04G	WELL # 4	Active
PALMER	Three Rivers (Palmer)	1227003-01G	WELL # 1	Active
PALMER	Three Rivers (Palmer)	1227003-03G	WELL # 3	Active
WARE	Ware	1309000-01G	DRIVEN WELLS 1/2/3	Active
WARE	Ware	1309000-02G	GP WELL # 4 SNOW POND	Active
WARE	Ware	1309000-03G	DISMAL SWAMP WELL	Inactive
WARE	Oakwood Park	1309001-01G	WELL # 1	Active
BARRE	Barre	2021000-01G	GP WELL #1	Active

Table 13 (Cont.)

BARRE	Barre	2021000-02G	GP WELL # 2	Active
BARRE	Barre	2021000-03G	SOUTH BARRE GRAVEL PACKED WELL # 3	Active
BARRE	Barre Mobile Home Park	2021001-01G	WELL # 1	Active
BARRE	Barre Mobile Home Park	2021001-02G	WELL # 2	Active
BARRE	Barre Mobile Home Park	2021001-03G	WELL # 3	Active
EAST BROOKFIELD	Brookfield	2045000-02G	QUABOAG ST. 02G GRAVEL DEVELOPED WELL	Active
EAST BROOKFIELD	Brookfield	2045000-03G	QUABOAG ST. 03G GRAVEL DEVELOPED WELL	Active
EAST BROOKFIELD	Brookfield	2045000-04G	QUABOAG ST. 04G GRAVEL DEVELOPED WELL	Active
EAST BROOKFIELD	Brookfield	2045000-05G	QUABOAG ST. 05G GRAVEL DEVELOPED WELL	Active
BROOKFIELD	Nanatomqua Mobile Home Park	2045001-01G	ROCK WELL # 1	Active
BROOKFIELD	Nanatomqua Mobile Home Park	2045001-02G	ROCK WELL # 2	Active
BROOKFIELD	Nanatomqua Mobile Home Park	2045001-03G	ROCK WELL # 3	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-01G	ROCK WELL # 1	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-02G	ROCK WELL # 2	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-03G	ROCK WELL # 3	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-04G	ROCK WELL # 4	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-05G	ROCK WELL # 5	Active
BROOKFIELD	Wagon Wheel Cooperative	2045004-06G	ROCK WELL # 6	Active
BROOKFIELD	Brookfield Meadows	2045005-01G	ROCK WELL # 1	Active
EAST BROOKFIELD	East Brookfield	2084000-01G	WEST ST. GP WELL	Active
HARDWICK	Hardwick Center	2124000-01G	RUGGLES HILL WELL	Active
NEW BRAINTREE	Gilbertville (Hardwick)	2124001-01G	GP WELL # 1	Active
HARDWICK	Wheelwright (Hardwick)	2124002-01G	GP WELL # 1	Active
HARDWICK	Wheelwright (Hardwick)	2124002-02G	GP WELL # 2	Emergency
HARDWICK	Eagle Hill School	2124003-01G	WELL # 1	Active
HARDWICK	Eagle Hill School	2124003-02G	WELL # 2	Active
HUBBARDSTON	Hubbardston Housing Apartments	2140010-01G	ROCK WELL # 1	Active
HUBBARDSTON	Briarwood Townhouses	2140013-01G	WELL # 1	Active
HUBBARDSTON	Briarwood Townhouses	2140013-02G	WELL # 2	Active
NEW BRAINTREE	Mass.State Police Training Acad.	2202001-01G	ROCK WELL #1	Active
NEW BRAINTREE	Mass.State Police Training Acad.	2202001-02G	ROCK WELL #2	Active

Table 13 (Cont.)

PETERSHAM	Sisters of the Assumption Retreat	2234003-01G	ARTESIAN WELL # 1	Active
RUTLAND	Cool Sandy Beach	2257003-01G	DRILLED WELL TAP	Inactive
SPENCER	Spencer	2280000-01G	CRANBERRY BROOK GRAVEL PACKED WELL	Active
SPENCER	Spencer	2280000-02G	MEADOW ROAD GRAVEL PACKED WELL	Active
SPENCER	St. Joseph's Abbey	2280002-01G	SJA MAIN WELL # 1	Active
WARREN	Warren	2311000-01G	COMINS POND TUBULAR WELL FIELD	Active
WARREN	West Warren	2311001-01G	GP WELL # 1	Active
WARREN	West Warren	2311001-02G	GP WELL # 2	Active
WARREN	Heritage Village Mobile Park	2311002-01G	ROCK WELL # 1	Inactive
WARREN	Heritage Village Mobile Park	2311002-02G	ROCK WELL # 2	Active
WARREN	Heritage Village Mobile Park	2311002-03G	ROCK WELL # 3	Active
WARREN	Heritage Village Mobile Park	2311002-04G	ROCK WELL # 4	Active
WEST BROOKFIELD	West Brookfield	2323000-01G	GPW WELL # 1	Active
WEST BROOKFIELD	West Brookfield	2323000-02G	WELL # 2 (DRIVEN)	Active
WEST BROOKFIELD	Woodland Estates	2323002-01G	WELL # 1, ROCK WELL	Active
WEST BROOKFIELD	Woodland Estates	2323002-02G	WELL # 2, DUG WELL	Active
WEST BROOKFIELD	Woodland Estates	2323002-03G	WELL # 3, DUG WELL	Active

Table 14. Non-Transient Non-Community Water Supplies in the Chicopee River Basin.

SITE NAME	TOWN	SOURCE_ID	STATUS
MDC QUABBIN ADMINISTRATION BUILDING	BELCHERTOWN	1024011-01G	Active
SWIFT RIVER ELEMENTARY SCHOOL	WENDELL	1204001-01G	Active
BARRE FALLS DAM / US ARMY ENV. LAB	BARRE	2021005-01G	Active
HARDWICK ELEMENTARY SCHOOL	HARDWICK	2124008-01G	Active
WOODS EQUIPMENT COMPANY [WAIN ROY]	HUBBARDSTON	2140003-01G	Active
HUBBARDSTON CENTER SCHOOL	HUBBARDSTON	2140004-01G	Active
GREAT NORTHERN RECYCLERS	HUBBARDSTON	2140007-01G	?
OAKHAM ELEMENTARY SCHOOL	OAKHAM	2222001-01G	Active
HARVARD SCHOOL OF FORESTRY	PETERSHAM	2234001-01G	Active
HARVARD SCHOOL OF FORESTRY	PETERSHAM	2234001-02G	Emergency
PETERSHAM CENTER SCHOOL	PETERSHAM	2234006-01G	Active
PETERSHAM MONTESSORI SCHOOL	PETERSHAM	2234011-01G	Active
PHILLIPSTON MEMORIAL SCHOOL	PHILLIPSTON	2235002-01G	Active
WILLIAM E. WRIGHT CO. - INACT.	WARREN	2311006-01G	?
WILLIAM E. WRIGHT CO. - INACT.	WARREN	2311006-02G	?
WILLIAM E. WRIGHT CO. - INACT.	WARREN	2311006-03G	?

Table 15. Transient Non-Community Water Supplies in the Chicopee River Basin

TOWN	SOURCE_ID	STATUS	SITE_NAME
BELCHERTOWN	1024004-01G	Active	SWIFT RIVER SPORTSMAN CLUB
BELCHERTOWN	1024006-01G	Active	MILL VALLEY GOLF LINKS, INC.
BELCHERTOWN	1024007-01G	?	C & C FITNESS & BACKROOM LOUNGE
BELCHERTOWN	1024010-01G	Active	TAVERN 21
BELCHERTOWN	1024012-01G	Active	BELCHERTOWN WELLNESS CENTER
BRIMFIELD	1043004-01G	Active	DEM BRIMFIELD STATE FOREST
MONSON	1043004-02G	Active	DEM BRIMFIELD STATE FOREST
LUDLOW	1161002-01G	Inactive	VILLA ROSE RESTAURANT
MONSON	1191001-01G	Active	PARTRIDGE HOLLOW
MONSON	1191004-01G	Active	SUNSET VIEW FARM
MONSON	1191004-02G	?	SUNSET VIEW FARM
MONSON	1191005-01G	?	QUEST ENTERPRISES
MONSON	1191007-01G	Active	WESTVIEW FARM INC
PALMER	1191008-01G	Active	MAGIC LANTERN
NEW SALEM	1204002-01G	?	HAMILTON ORCHARDS
NEW SALEM	1204002-02G	?	HAMILTON ORCHARDS
NEW SALEM	1204003-01G	?	NEW SALEM GENERAL STORE
PALMER	1227005-01G	Active	THE WOODEN SHOE
PALMER	1227006-01G	?	HAPPY VALLEY
PALMER	1227007-01G	Active	CJ'S RESTAURANT
BRIMFIELD	1227008-01G	?	MAPLE LAKE ARMS
PALMER	1227010-01G	Active	CAMP RAMAH
PALMER	1227010-02G	Active	CAMP RAMAH
PALMER	1227010-03G	Active	CAMP RAMAH
PALMER	1227012-01G	Active	ROUTE 20 SPORTS BAR
BARRE	2021006-01G	Active	INSIGHT MEDITATION SOCIETY
EAST BROOKFIELD	2084001-01G	Active	YMCA CAMP FRANK A. DAY
EAST BROOKFIELD	2084001-02G	Active	YMCA CAMP FRANK A. DAY
EAST BROOKFIELD	2084001-03G	Active	YMCA CAMP FRANK A. DAY
HARDWICK	2124007-01G	Active	JUBILEE CONFERENCE & RETREAT CENTER
HUBBARDSTON	2140005-01G	Active	PEACEFUL ACRES CAMPGROUND
HUBBARDSTON	2140006-01G	?	HUBBARSTON ROD & GUN CLUB
HUBBARDSTON	2140008-01G	?	PINECREST - INACT.
NEW BRAINTREE	2202003-01G	Active	CAMP PUTNAM
OAKHAM	2222002-01G	Active	PINE ACRES CAMPGROUNDS
OAKHAM	2222002-02G	Active	PINE ACRES CAMPGROUNDS
OAKHAM	2222002-03G	Active	PINE ACRES CAMPGROUNDS
OAKHAM	2222003-01G	Active	LAKE DEAN CAMPGROUND
OAKHAM	2222003-02G	Active	LAKE DEAN CAMPGROUND
OAKHAM	2222003-03G	Active	LAKE DEAN CAMPGROUND
PAXTON	2228005-01G	Active	DEM MOORE STATE PARK
PETERSHAM	2234009-01G	?	MARIA ASSUMPTION ACADEMY
PRINCETON	2241011-01G	Active	HARRINGTON FARMS RESTAURANT
RUTLAND	2257001-01G	Active	TREASURE VALLEY SCOUT RESERVATION
OAKHAM	2257001-02G	Active	TREASURE VALLEY SCOUT RESERVATION
OAKHAM	2257001-03G	Active	TREASURE VALLEY SCOUT RESERVATION

Table 15 (cont.)

OAKHAM	2257001-04G	Active	TREASURE VALLEY SCOUT RESERVATION
RUTLAND	2257002-01G	Active	POUT & TROUT CAMPRGOUND
RUTLAND	2257004-01G	Active	DEM RUTLAND STATE PARK
RUTLAND	2257005-01G	Active	RUTLAND SPORTSMANS CLUB
SPENCER	2280004-01G	?	PINE TREE DRIVE IN
SPENCER	2280006-01G	Active	POMEROYS BLACK WHITE REST
SPENCER	2280008-01G	Active	DEM SPENCER ST.PARK HOWE POND
WEST BROOKFIELD	2323001-01G	Active	HIGH VIEW VACATION CAMPGROUND
WEST BROOKFIELD	2323001-02G	Active	HIGH VIEW VACATION CAMPGROUND
WEST BROOKFIELD	2323001-03G	Active	HIGH VIEW VACATION CAMPGROUND
WEST BROOKFIELD	2323001-04G	Active	HIGH VIEW VACATION CAMPGROUND

Table 16. Information on Wastewater Treatment Plants in Chicopee River Basin

Facility Name	**NPDES No.**	**Receiving water body**	**Mean Monthly Flow (MGD)**	**Design Flow (MGD)**	**Town(s) served**	**Population Served**
Barre WWTP	MA0103152	Ware River	.21	.3	Barre	(1670)
Chicopee WWTP	MA0101508	Chicopee and Connecticut Rivers	9.8	15.5	Chicopee	(54590)
Gilbertville WWTP	MA0100102	Ware River	.14	.23	Hardwick	1270
North Brookfield WWTP	MA0101061	Dunn Brook	.47	.76	N. Brookfield	2800
Palmer WWTP	MA0101168	Chicopee River	2.26	5.6	Palmer, Monson	(13,200)
Spencer	MA0100919	Cranberry Brook	.67	1.08	Spencer	(6500)
Ware WWTP	MA0100889	Ware River	.72	1.0	Ware	(6030)
Warren WWTP	MA0101567	Quaboag River	.67	1.5	Warren	(2830)
Wheelwright WWTP	MA0102431	Ware River	.027	.043	Hardwick	160
Totals:			*14.97*	*26.01*		*(89050)*

NOTE: Information is from Medalie (1996) and the individual NPDES permits for the facilities. Numbers in parentheses are from 1990, and therefore are likely to be underestimates.

Table 17. Road data for Chicopee River Basin communities (from MassDOR)

MUNICIPALITY	2000 Population	Area (mi^2)	Road Mileage	Roads/mi^2	Road miles/capita
ATHOL	11299	32.34	96.45	2.98	0.009
BARRE	5113	44.3	99.59	2.25	0.019
BELCHERTOWN	12968	52.52	118.85	2.26	0.009
BRIMFIELD	3339	35.37	64.27	1.82	0.019
BROOKFIELD	3051	15.68	35.69	2.28	0.012
CHARLTON	11263	42.86	119.3	2.78	0.011
CHICOPEE	54653	22.91	153.37	6.69	0.003
EAST BROOKFIELD	2097	9.89	19.24	1.95	0.009
GRANBY	6132	28.01	56.71	2.02	0.009
HAMPDEN	5171	19.66	53.09	2.70	0.010
HARDWICK	2622	38.4	86.79	2.26	0.033
HUBBARDSTON	3909	40.34	81.29	2.02	0.021
LEICESTER	10471	22.7	80.62	3.55	0.008
LUDLOW	21209	27.14	100.71	3.71	0.005
MONSON	8359	44.84	101.07	2.25	0.012
NEW BRAINTREE	927	20.76	49.44	2.38	0.053
NEW SALEM	929	45.04	38.03	0.84	0.041
NORTH BROOKFIELD	4683	21.11	68.62	3.25	0.015
OAKHAM	1673	20.99	43.48	2.07	0.026
ORANGE	7518	35.03	84.06	2.40	0.011
PALMER	12497	31.43	86.69	2.76	0.007
PAXTON	4386	14.87	37.03	2.49	0.008
PELHAM	1403	24.82	22.68	0.91	0.016
PETERSHAM	1180	54.27	62.68	1.15	0.053
PHILLIPSTON	1621	23.7	44.41	1.87	0.027
PRINCETON	3353	35.39	79.68	2.25	0.024
RUTLAND	6353	35.42	66.77	1.89	0.011
SHUTESBURY	1810	26.68	31.15	1.17	0.017
SPENCER	11691	33.15	94.33	2.85	0.008
SPRINGFIELD	152082	31.7	394.64	12.45	0.003
STURBRIDGE	7837	37.39	78.18	2.09	0.010
TEMPLETON	6799	31.49	68.31	2.17	0.010
WALES	1737	16.21	23.67	1.46	0.014
WARE	9707	34.85	84.42	2.42	0.009
WARREN	4776	27.5	62.83	2.28	0.013
WENDELL	986	31.65	48.33	1.53	0.049
WEST BROOKFIELD	3804	20.67	50.28	2.43	0.013
WESTMINSTER	6907	35.64	84.83	2.38	0.012
WILBRAHAM	13473	22.22	91.96	4.14	0.007
Statewide Means:				4.61	0.014
Chicopee Means:				2.65	0.017

Table 18. Hydroelectric projects exempted from FERC licensing requirements in the Chicopee River Basin

PROJECT #	STATE	COUNTY	ISSUED	RIVER	PROJECT NAME	KW	OWNER NAME
6522	MA	HAMPDEN	821208	CHICOPEE R	CHICOPEE	2500	CHICOPEE MUNICIPAL LIGHTING PLANT
6544	MA	HAMPDEN	840209	CHICOPEE R	COLLINS	1500	I MAXMAT CORP
10675	MA	HAMPDEN	920911	CHICOPEE R	DWIGHT	1440	WESTERN MASS ELECTRIC CO
10676	MA	HAMPSHIRE	920911	CHICOPEE R	RED BRIDGE	3600	WESTERN MASS ELECTRIC CO
10677	MA	HAMPDEN	920911	CHICOPEE R	PUTTS BRIDGE	3200	WESTERN MASS ELECTRIC CO
10678	MA	HAMPDEN	920911	CHICOPEE R	INDIAN ORCHARD	3700	WESTERN MASS ELECTRIC CO
11523	MA	HAMPSHIRE	870127	SWIFT R	QUABBIN-WINSOR	1200	MA WATER RESOURCES AUTHORITY
4320	MA	WORCESTER	810724	WARE R	SOUTH BARRE	150	S BARRE HYDROELEC CO INC
3127A	MA	HAMPSHIRE	820212	WARE R	WARE LOWER	320	WARE RIVER POWER
3127B	MA	HAMPSHIRE	820212	WARE R	WARE UPPER		WARE RIVER POWER
9728	MA	WORCESTER	861015	WARE R	POWDER MILL	120	S BARRE HYDROELEC CO INC

Listed are projects exempt from the requirements of Part I of the Federal Power Act. Exemptions may be obtained for projects if generating capacity is being installed or increased; the applicant has all of the real property interests necessary to develop and operate the project; and either the project will be located at pre-1977 dam and have 5 megawatts (MW) or less installed capacity or the project will use the hydropower potential of a manmade conduit used primarily for the purposes other than hydropower and the installed capacity is 15 MW or less (40 MW or less for states and municipalities.) Exemptions are issued in perpetuity, are made subject to mandatory terms and conditions set by federal and state fish and wildlife agencies and by the Commission, and they do not convey the right of eminent domain.

Updated: February 2001

Fig. 29. Waste Water Treatment Plants in the Chicopee River Basin.

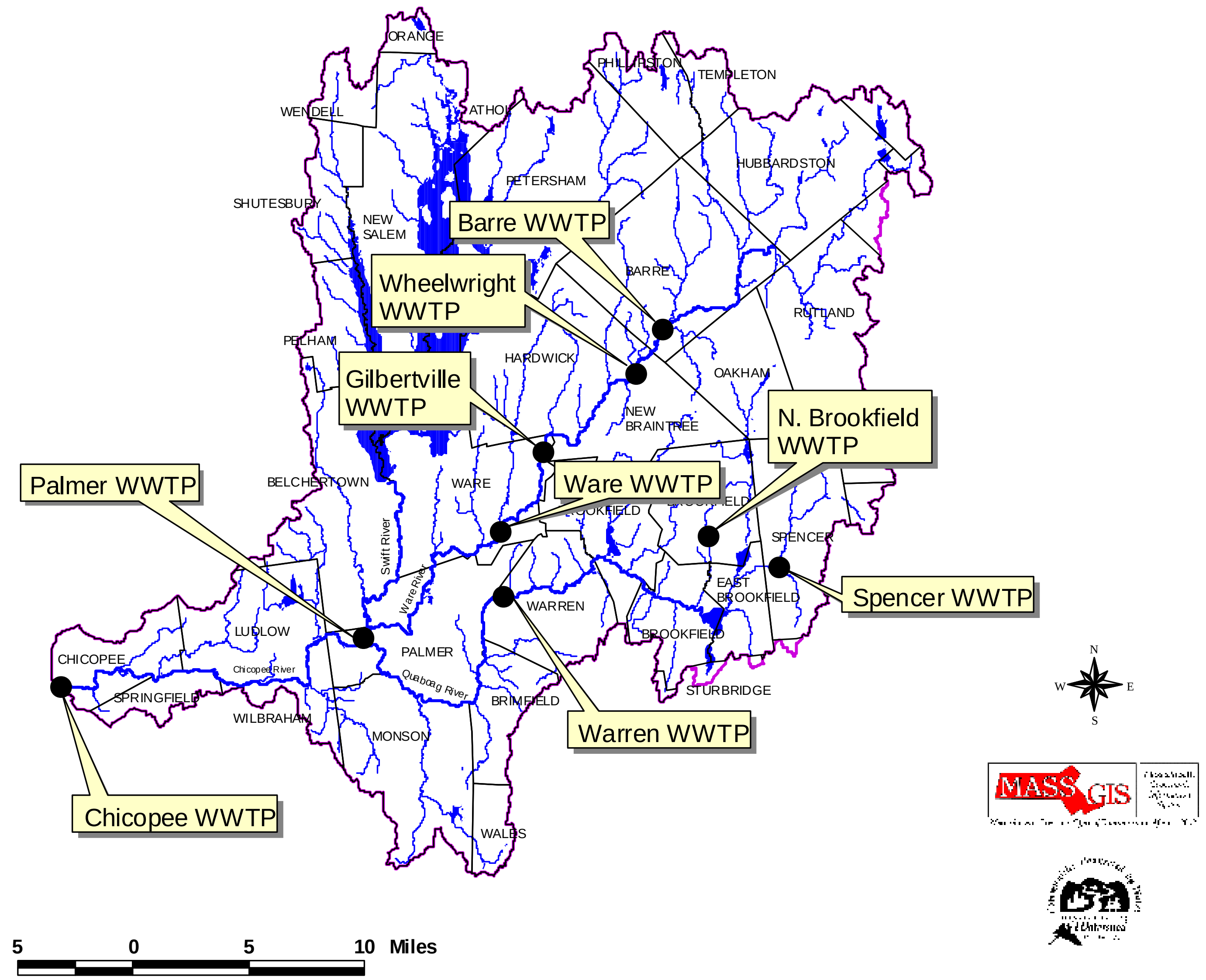


Figure 30. Major Roads in the Chicopee River Basin.

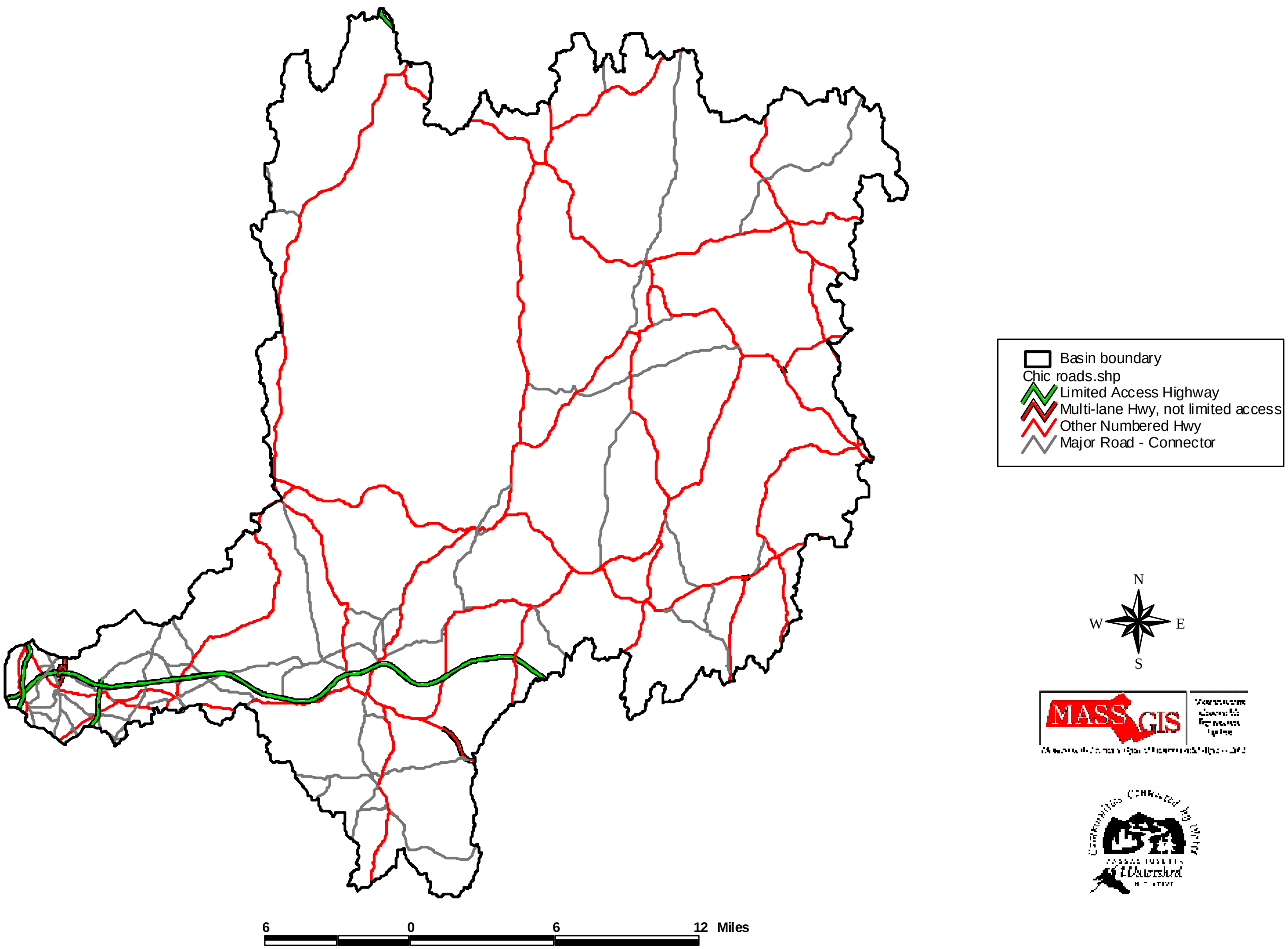


Figure 31. Active Landfills in Chicopee River Basin.

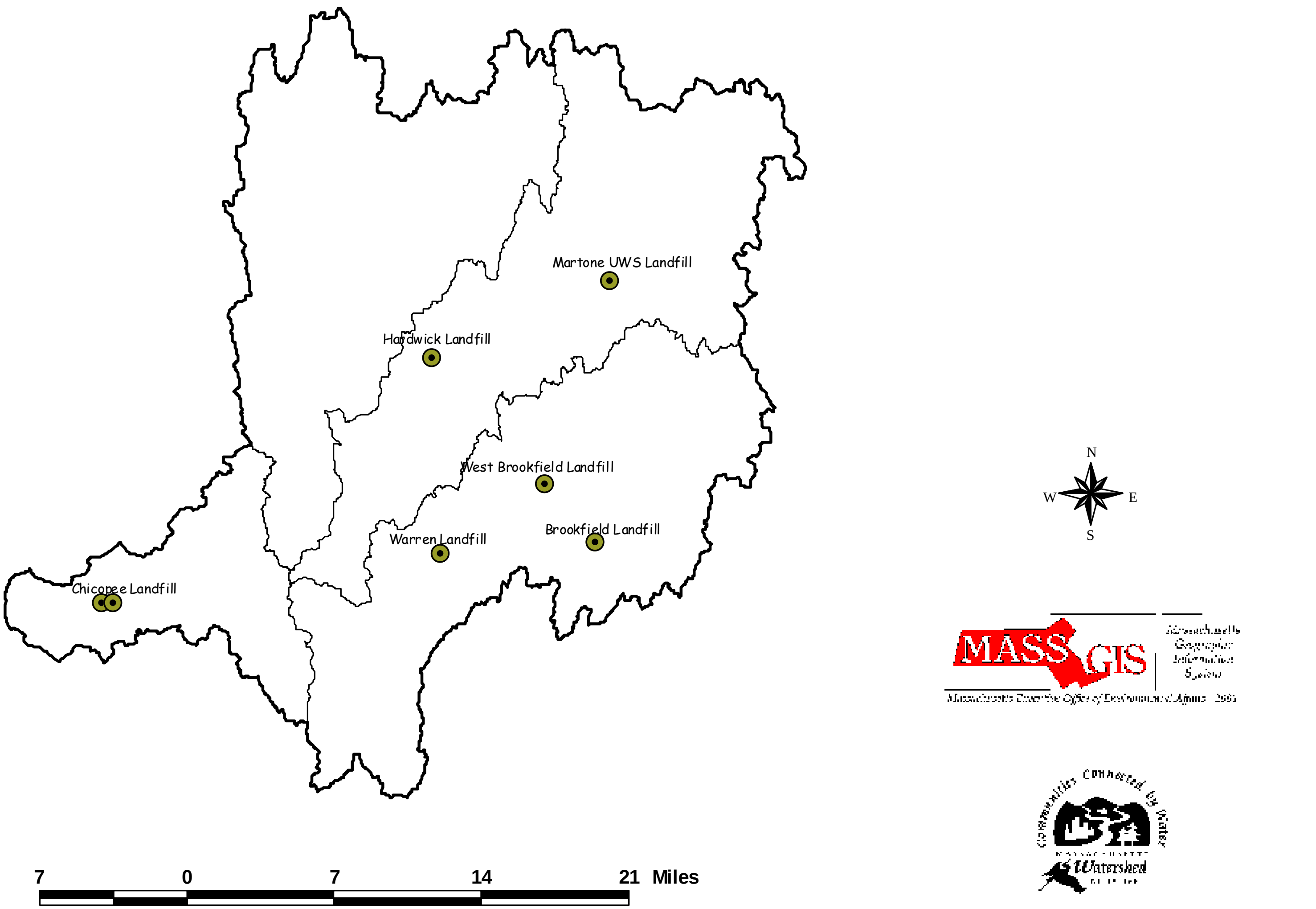
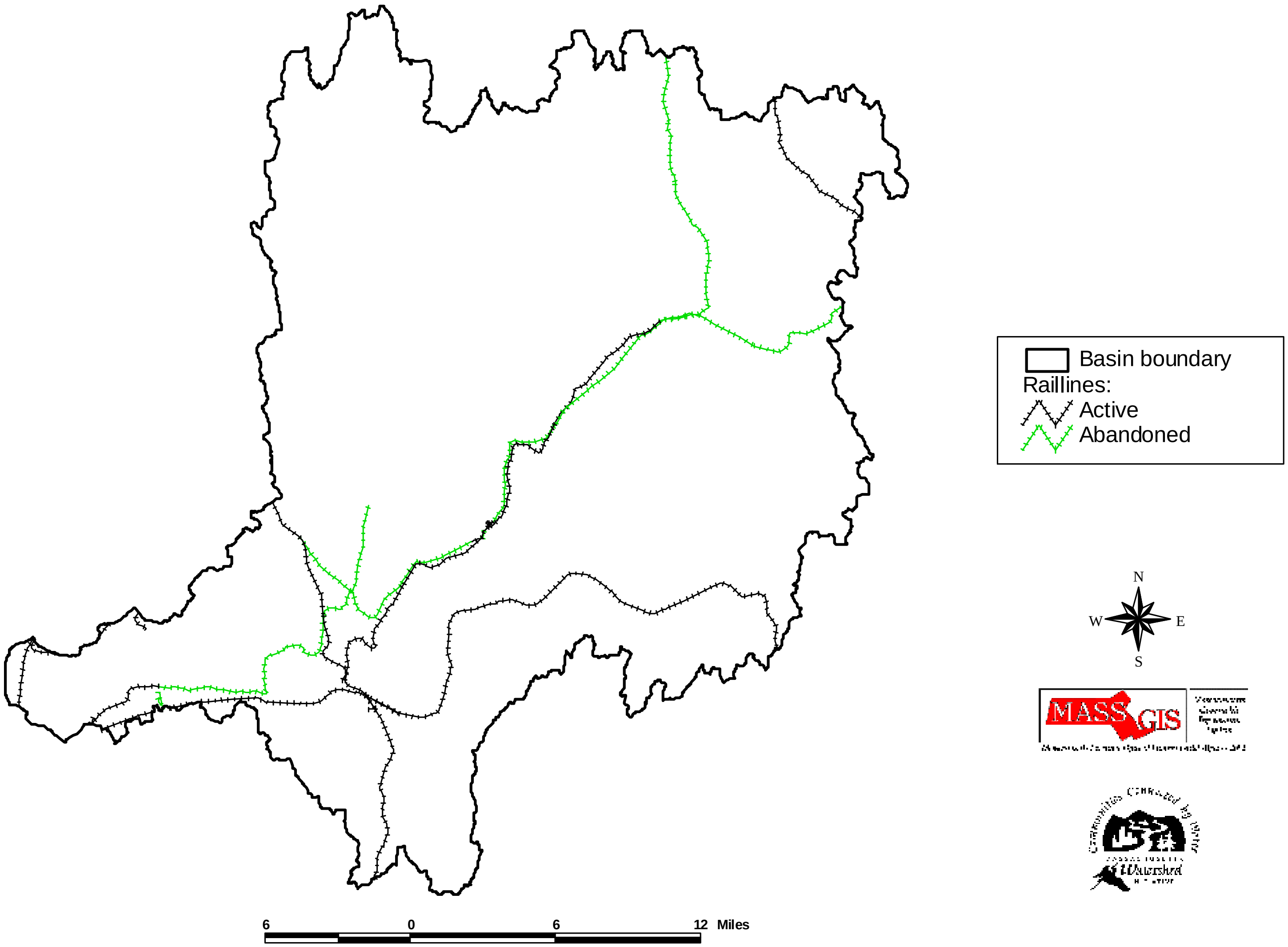


Figure 32. Active and Abandoned Raillines in the Chicopee River Basin.



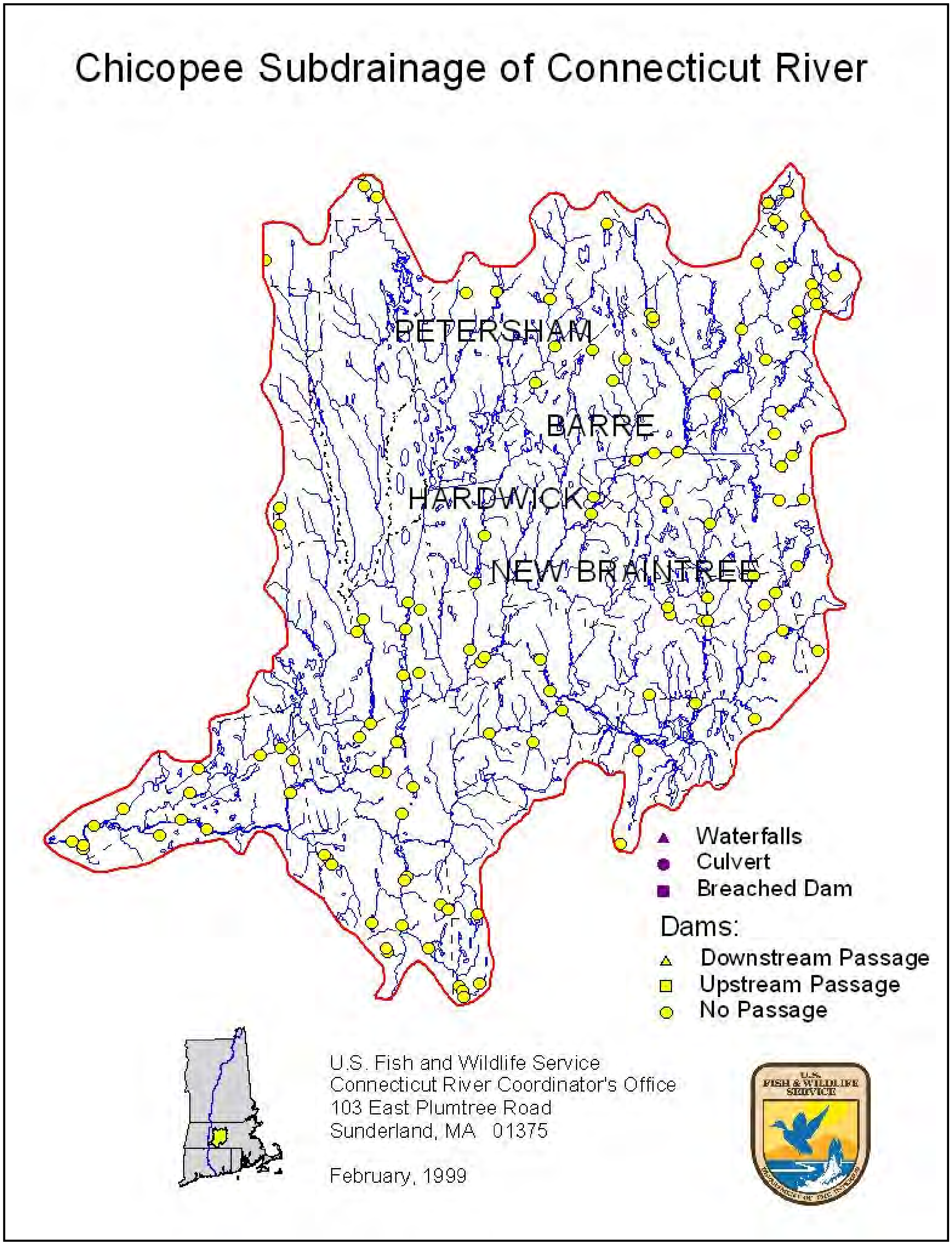


Figure 33. Dams and other barriers to fish passage in the Chicopee River Basin (from USFWS).

Table 19. Impoundments in the Chicopee River Basin (from USEPA)

DAM NAME	Normal STORAGE (acre-feet)	ID #	IMPOUNDMENT NAME
CONANT BROOK DAM	1.0	MA00965	CONANT BROOK RES
	2.0	MA02539	
PULPIT ROCK POND SMALL DAM	3.0	MA00554	PULPIT ROCK POND SMALL
	4.0	MA02597	
UPPER BEMIS POND DAM	5.0	MA00069	BEMIS POND UPPER
LAMBERTON BROOK DAM	7.0	MA00905	LAMBERTON BROOK
	8.0	MA02528	
WOODMAN POND DAM	13.0	MA00529	WOODMAN PONDMA
MOULTON DAM DROPPED	17.0	MA00728	CHICOPEE BROOK
ALDEN POND DAM	20.0	MA00546	ALDEN POND
JUDA DAM	21.0	MA00593	
LOWER BEMIS POND DAM	22.0	MA00531	BEMIS POND LOWER
KITTREDGE DAM	23.0	MA00951	KITTREDGE POND
CALKINS POND LOWER	25.0	MA01003	CALKINS POND
BRADWAY DAM	26.0	MA00556	
GAUCO POND DAM	27.0	MA01302	GAUCO POND
CROSS POND DAM	28.0	MA00666	CROSS PONDMA
WEST WARREN MILL POND DAM	29.0	MA00902	QUOBOAG RIVERMA
DIAMOND INTERNATIONAL CORP LOW	30.0	MA00563	WARE RIVERMA
MONSANTO COMPANY UPPER DAM	34.0	MA00573	PLASTIC PARK PONDMA
BUXTON HILL POND	35.0	MA00776	
HOWE POND DAM	37.0	MA01175	HOWE POND
VINICA POND	38.0	MA00538	VINICA POND
BONDSVILLE LOWER	40.0	MA00561	SWIFT RIVER
STEVENS POND DAM	43.0	MA01301	STEVENS PONDMA
WAX FACTORY POND DAM	49.0	MA00664	WAX FACTORY PONDMA
SAW MILL POND DAM	50.0	MA00098	RICE PONDMA
DEAN POND DAM	51.0	MA00078	DEAN PONDMA
LOWER CANAL DAM	60.0	MA00751	WARE RIVERMA
BEMS POND DAM	64.0	MA00665	BEMS PONDMA
PALMER RESERVOIR UPPER DAM	65.0	MA00557	PALMER RESERVOIRMA
PINE BROOK DAM	70.0	MA00617	PINE HILL BROOKMA
BROWN POND	75.0	MA00652	BROWN PONDMA
NASH HILL RESERVOIR	77.0	MA00550	NASH HILL RESERVOIRMA
WAITE POND DAM	80.0	MA01016	WAITE PONDMA
DOANE POND DAM	81.0	MA00948	DOANE PONDMA
PATRILL HOLLOW POND DAM	83.0	MA00618	PATRILL HOLLOW PONDMA
ADAMS POND DAM	84.0	MA00949	ADAMS PONDMA
BATES POWER RESERVOIR DAM	90.0	MA00650	BATES POWER RESERVOIRMA
COMINS POND DAM	91.0	MA00903	COMINS PONDMA
BRIGHAM POND DAM	96.0	MA00661	BRIGHAM PONDMA
THAYER POND DAM	114.0	MA01249	THAYER PONDMA
SOUTH BARRE MILL POND DAM	115.0	MA00091	SOUTH BARRE MILL POND WAREMA
PULPIT ROCK POND NEW DAM	120.0	MA00552	PULPIT ROCK PONDMA
BARRE RESERVOIR DAM/DIKE	125.0	MA00094	BARRE RESERVOIRMA
BROOKHAVEN LAKE DAM	126.0	MA00980	BROOKHAVEN LAKEMA
CARTER POND DAM	130.0	MA00653	CARTER PONDMA

Table 19 (cont.)

DAM NAME	Normal STORAGE (acre-feet)	ID #	IMPOUNDMENT NAME
WHEELWRIGHT POND DAM	150.0	MA00616	WHEELWRIGHT PONDMA
EDSON POND DAM	152.0	MA00930	EDSON PONDMA
BROWNING POND DAM	176.0	MA00695	BROWNING PONDMA
WILLIAMSVILLE POND DAM	190.0	MA00663	WILLIAMSVILLE PONDMA
WILLIAMSVILLE POND DAM	192.0	MA00662	WILLIAMSVILLE PONDMA
DWIGHT DAM	200.0	MA00721	CHICOPEE RIVERMA
LAKE WHITTEMORE DAM	202.0	MA00699	LAKE WHITTEMOREMA
LOVEWELL POND DAM	210.0	MA00646	LOVEWELL PONDMA
NOYES POND DAM	220.0	MA00643	NOYES PONDMA
DEAN POND DAM	248.0	MA01304	DEAN PONDMA
FOREST LAKE DAM	250.0	MA00559	FOREST LAKEMA
BROOKS POND DAM	260.0	MA00654	BROOKS PONDMA
KNIGHTS POND	270.0	MA00485	KNIGHTS PONDMA
HARDWICK POND DAM	310.0	MA00080	HARDWICK PONDMA
CHICOPEE RESERVOIR	322.0	MA00720	CHICOPEE RESERVOIRMA
MOULTON POND DAM	328.0	MA00931	MOULTON PONDMA
POWDER MILL POND DAM	336.0	MA00092	POWDER MILL POND WARE RIVERMA
DEMOND POND DAM	368.0	MA00991	DEMOND PONDMA
COLD BROOK INTAKE DAM	375.0	MA00093	WARE RIVERMA
	378.0	MA83013	
LAKE MATTAWA SOUTH OUTLET	438.0	MA00502	LAKE MATTAWAMA
QUEEN LAKE DAM	448.0	MA00648	QUEEN LAKEMA
TEXTILE PRINTING COMPANY-UPPER	460.0	MA00560	SWIFT RIVERMA
HORSE POND DAM	650.0	MA00947	HORSE PONDMA
WESTERN MASS ELECTRIC DAM	715.0	MA00724	CHICOPEE RIVERMA
WARE INDUSTRIES MAIN UPPER DAM	746.0	MA00594	WARE RIVERMA
BROOKS POND	760.0	MA00696	BROOKS PONDMA
DIAMOND INTERNATIONAL CORP UPP	780.0	MA00562	WARE RIVERMA
THOMPSONS POND DAM	791.0	MA00697	THOMPSONS PONDMA
	880.0	MA02583	
BEAVER LAKE	930.0	MA00592	BEAVER LAKEMA
SUGDEN RESERVOIR DAM	980.0	MA00698	SUGDEN RESERVOIRMA
INDIAN ORCHARD DAM	1050.0	MA00722	CHICOPEE RIVERMA
LAKE LASHAWAY DAM	1320.0	MA00961	LAKE LASHAWAYMA
BICKFORD POND DAM	3029.0	MA01021	BICKFORD PONDMA
RED BRIDGE DAM	3200.0	MA00723	CHICOPEE RIVERMA
MARE MEADOW RESERVOIR DAM	4849.0	MA01020	MARE MEADOW RESERVOIRMA
LUDLOW DAM	5500.0	MA00547	SPRINGFIELD RESERVOIRMA
CHERRY VALLEY DAM	6150.0	MA00548	SPRINGFIELD RESERVOIRMA
QUABBIN WINSOR DAM	1265200.0	MA00588	QUABBIN RESERVOIRMA
TOTALS	1306587.0	acre feet	
	425947.4	gallons	
	56914929720.0	ft3	

9. Recreational resources: A variety of outdoor recreational resources occur in the Chicopee River basin. Perhaps the most prominent of these is Quabbin Reservation, which constitutes the largest state-owned public land holding in Massachusetts. However, numerous other recreational opportunities exist at state, federal, and privately-owned sites.

a. PAB and other boat launch sites: The state Public Access Board (PAB) has been instrumental in constructing boat launch areas throughout the state, including 15 in the Chicopee River basin (Figure 34 and Table 20). These launch sites provide access to 3 rivers (Ware, Swift, Chicopee), 9 lakes/ponds, and to the Quabbin Reservoir.

b. DEM parks and forests: The former Massachusetts Department of Environmental Management (now DCR) manages a number of lands and facilities in the basin, including 14 state forests, 5 state parks, 3 flood control areas, 2 swimming pools, a state reservation, a boat launch area and one rail trail (Figure 35).

c. MDC lands: The former Metropolitan District Commission (now DCR) controls more than 80,000 acres of watershed lands in the basin, and represents the largest holder of public land in the Chicopee. These lands are in two main blocks – Quabbin Reservation and the Ware River Reservation (Figure 36). Both occur in the upper portions of the Swift and Ware River drainages, respectively, and are managed as public surface water supply watersheds.

d. DFW management areas: The Massachusetts Division of Fisheries and Wildlife (DFW) manages more than 170 parcels in the basin (Figure 37); these include about two dozen Wildlife Management Areas, 5 river access areas, several pond access areas, 2 fish hatcheries, and several other miscellaneous properties.

e. Federal lands: The federal government is represented in the basin in the form of two U.S. Army Corps of Engineer (ACOE) flood control facilities that also provide for public recreational opportunities. These facilities include the Barre Falls project in Barre, Rutland, Hubbardston, and Oakham, and the Conant Brook project in Monson. These facilities provide picnicking, hiking, fishing, hunting, horseback riding and cross-country skiing. Indirectly, the federal government also "provides" for outdoor recreation at the FERC-governed hydroelectric facilities in the basin. As part of their operating permit, dam owners are often required to install and maintain facilities for picnicking, fishing, and boat launching.

f. Local lands: Many recreational resources in the Chicopee River basin are owned and operated by municipalities. For example, numerous small local parks exist throughout the basin. Some communities have larger, more developed recreational facilities (e.g., Szot Park in Chicopee, Spencer Fair Grounds in Spencer). Municipal golf courses, swimming pools or beaches, conservation areas, and various other local facilities provide for a variety of outdoor recreational opportunities.

g. Private facilities: Outdoor recreation in the basin is greatly enhanced by the wide array of opportunities offered by private entities – both non-profit and for-profit. Some excellent hiking, biking, and cross-country skiing is available on some of the lands owned by non-profit conservation organizations such as The Trustees of Reservations, Massachusetts Audubon Society, Harvard Forest and the Norcross Wildlife Sanctuary. The East Quabbin Land Trust has been instrumental in establishing a "canoe route" along the Ware River in Hardwick. Sportsmen's club lands provide for hunting, fishing, and other outdoor pursuits across the basin. The Wachusetts Greenways group is pushing westward with their bikeway construction activity, and has recently entered the easternmost portion of the basin. Future plans call for extension of bike and walkways well into the basin. Private golf courses and campgrounds round out the recreational offerings.

Figure 34. Public Boat Launch Sites in the Chicopee River Basin.

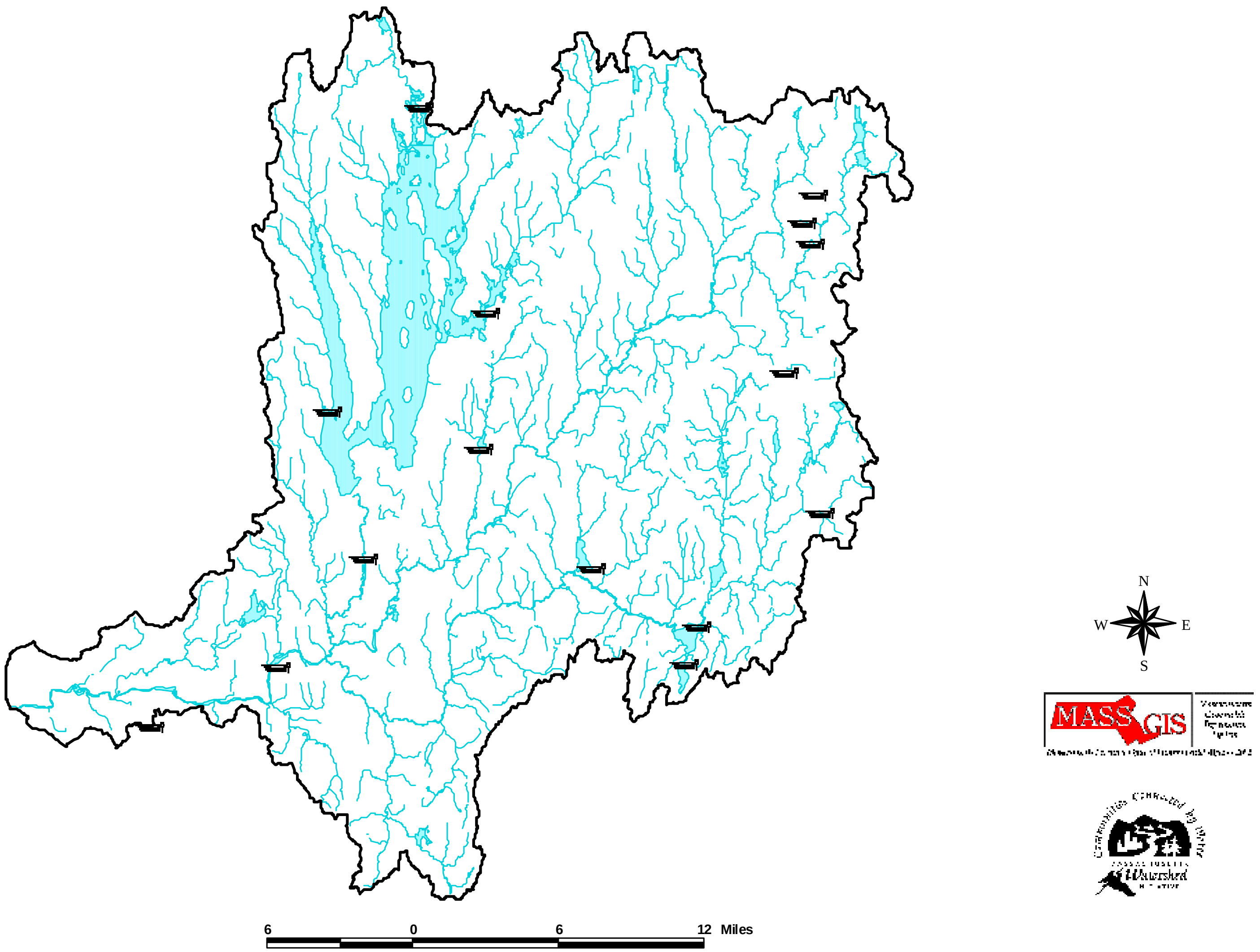


Table 20. Public boat launch information, Chicopee River Basin (data from MassGIS)

Name	Managing Authority	Construction	# Ramps	Parking	Condition	Fee?	Permit?	Restrictions?	Town
QUABBIN RESERVOIR	M.D.C.	CONCRETE	--	--	GOOD	Y	N	Y	NEW SALEM
MOOSEHORN POND	DFWELE:F&W	GRAVEL	1	6	GOOD	N	N	N	HUBBARDSTON
ASNACOMET POND	M.D.C.	CONCRETE	1	40	GOOD	N	N	N	HUBBARDSTON
WARE RIVER-EAST BR.	DFWELE:F&W	GRAVEL	1	6	FAIR	N	N	N	RUTLAND
QUABBIN RESERVOIR	M.D.C.	CONCRETE	--	--	GOOD	Y	N	Y	HARDWICK
LONG POND	DEM DIV. OF FORESTS AND PARKS	CONCRETE	1	25	GOOD	N	N	N	RUTLAND
QUABBIN RESERVOIR	M.D.C.	CONCRETE	--	--	GOOD	Y	N	Y	BELCHERTOWN
HARDWICK POND	PAB	ASPHALT	1	6	GOOD	N	N	N	HARDWICK
SUGDEN RESERVOIR	DFWELE:F&W	GRAVEL	1	10	FAIR	N	N	N	SPENCER
SWIFT RIVER	DFWELE:F&W	CONCRETE	1	20	GOOD	N	N	N	BELCHERTOWN
WICKABOAG POND	TOWN OF WEST BROOKFIELD	CONCRETE	1	6	GOOD	N	N	N	WEST BROOKFIELD
QUABOAG POND	TOWN	ASPHALT	1	50	FAIR	N	N	N	BROOKFIELD
SOUTH POND	TOWN OF BROOKFIELD	CONCRETE	1	12	GOOD	N	N	N	BROOKFIELD
RED BRIDGE LANDING	DEM DIV. OF FORESTS AND PARKS	ASPHALT	1	10	GOOD	N	N	N	WILBRAHAM
FIVE MILE POND	CITY	CONCRETE	1	40	GOOD	N	N	Y	SPRINGFIELD

Figure 35. DEM Lands in Chicopee River Basin.

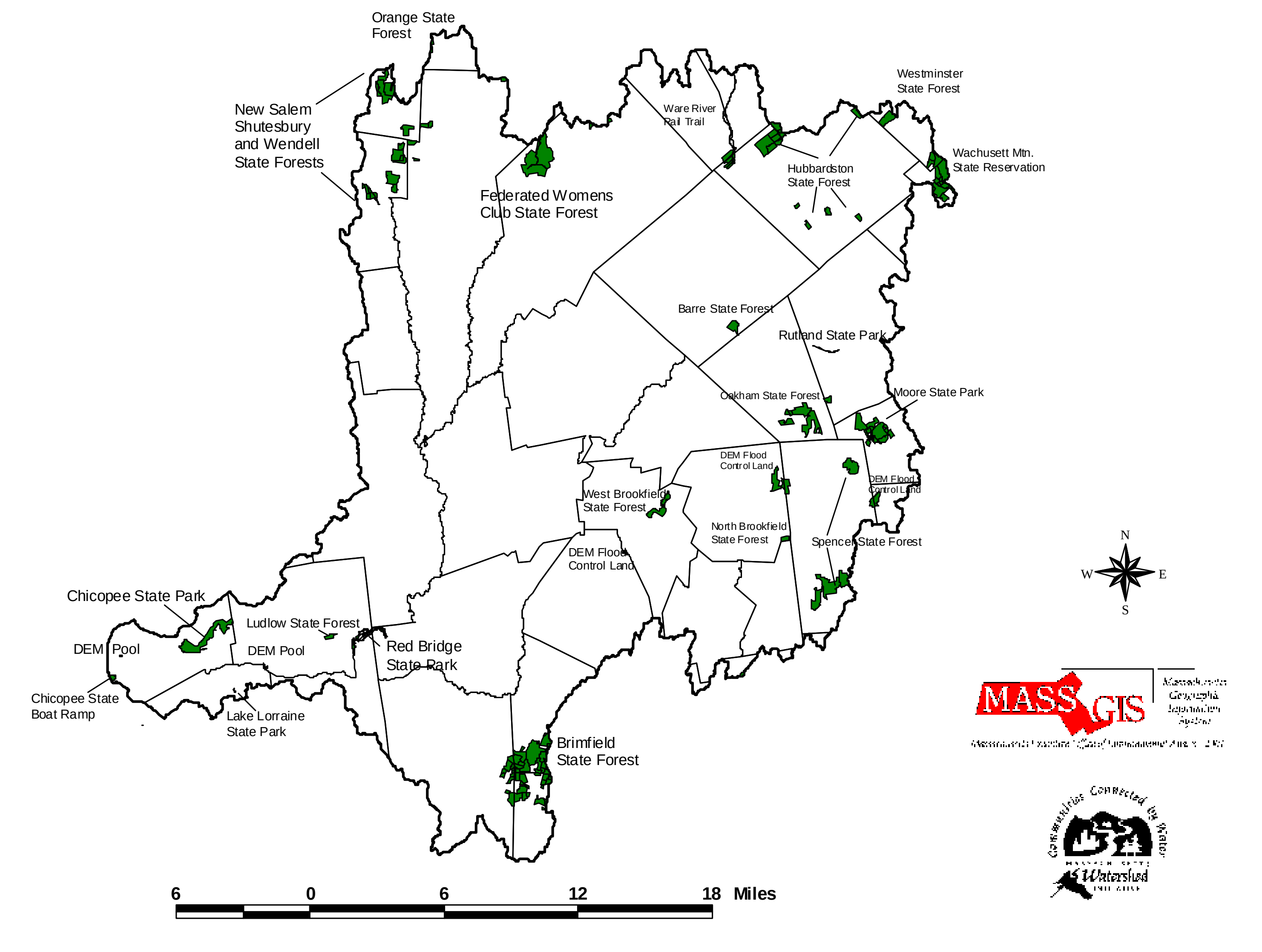


Figure 36. MDC Lands in the Chicopee River Basin.

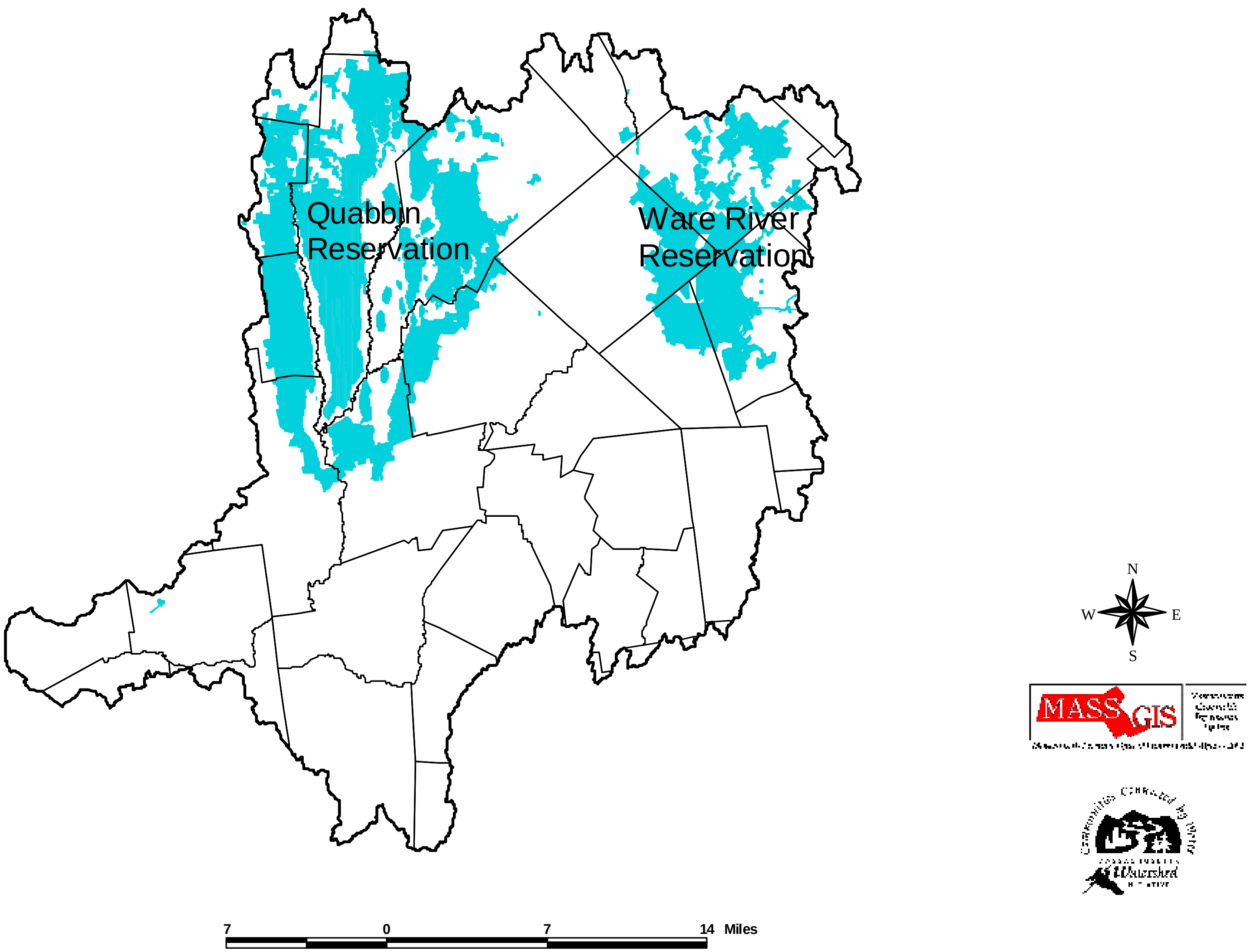
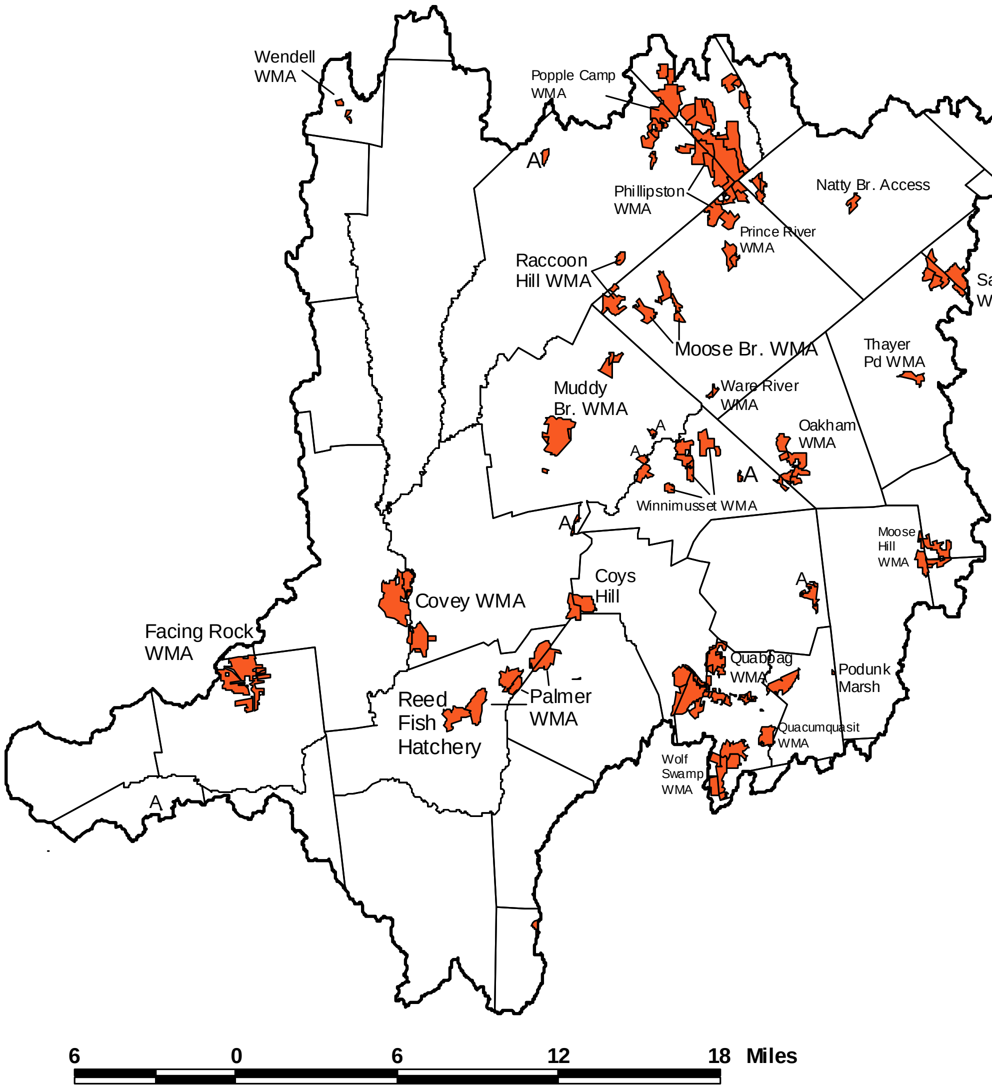


Figure 37. MDFW Lands in Chicopee River Basin.



10. Cultural, historic, and archeological resources: Information from the Massachusetts Historical Commission (through MassGIS) indicates that there are 31 Historic Districts and 47 Historic Places in the Chicopee River basin (Figure 38 and Tables 21 and 22). While these historic sites are found throughout the basin, local concentrations occur along state highway 9 through the Brookfields and Spencer, in Ware, and in the Chicopee/Springfield area. No data could be found on archeological resources in the basin.

11. Scenic resources: In 1981, a Massachusetts Landscape Inventory Project was completed by the former DEM. That inventory identified three "scenic landscapes" in the basin (Figure 39): the area around Quabbin Reservoir, Mt. Wachusetts State Reservation, and the southeast portion of the basin, along Rt. 31 in Spencer. However, much of the basin is considered scenic, in large part due to the presence of numerous small towns and villages, many of which are located along the major rivers and/or in the valleys of those rivers. Many of these small towns still retain much of their "old New England" character. As such, the basin is a major destination for tourists.

IV. Watershed Assessment

The previous section summarized many of the physical characteristics of the Chicopee River basin. In this section, an "assessment" of that information will be made, which will assist in identifying some of the main environmental issues in the basin, as well as some of the gaps in information that might be the focus of future data collection efforts.

The information addressed in this section comes from variety of sources, including data that has been collected over the years by DEP, MDC, other government agencies, municipalities, lake and watershed associations, and others. In addition, recent MWI (former) "priority projects" have served to fill in some of the data gaps that have been identified. For example, recent projects have provided information on water quality conditions, stormwater infrastructure, landuse-based modeling, etc.

In some instances, it was impossible to sort data by watershed boundaries, thus some topics (e.g., population projections and build-out results) are presented for whole communities, even though in some cases, only a small portion of a community may lie within the Chicopee River basin. In most cases however, data is basin-specific.

A. Population projections and build-out analyses

Environmental problems and challenges frequently stem from the needs of growing populations. Thus, an analysis of population levels and rates of growth is an important part of this watershed assessment. Data from several sources has been used for these analyses - U.S. Census data for 1990 and 2000 (see Table 6), population projections from the Massachusetts Institute for Social and Economic Research (MISER), and the results of town by town build-out analyses conducted by EOEA and regional planning agencies.

Census data shows that from 1990 to 2000, Chicopee River basin communities grew by an average of 8.4%. This compares to a statewide average of 9.2%. However, three basin communities experienced greater than 20% growth in population (Belchertown at 22.6%, Rutland at 28.7% and Hubbardston at 39.8%), which put them among the top 11% of growth rates in the state.

MISER projections (Figure 40 and Table 23) suggest that population change from 1990 to 2010 will range from 8.6% (Springfield) to 92.3% (Phillipston) in basin communities, with almost a third exceeding 30% growth, and 8 exceeding 50%. Many factors could affect the accuracy of those projections however, as evidenced from the degree to which the MISER predictions for the year 2000 differed from actual census data in some communities.

Build out analyses provide another measure of the potential for future growth. Such analyses were completed for all basin communities during 2000 and 2001. The results of those analyses again show substantial variability in the potential for growth in basin communities (Appendix D). For example, Springfield is essentially built out, while Petersham could experience more than a 1600% increase in population.

Figure 38. Historic Places and Districts in the Chicopee River Basin.

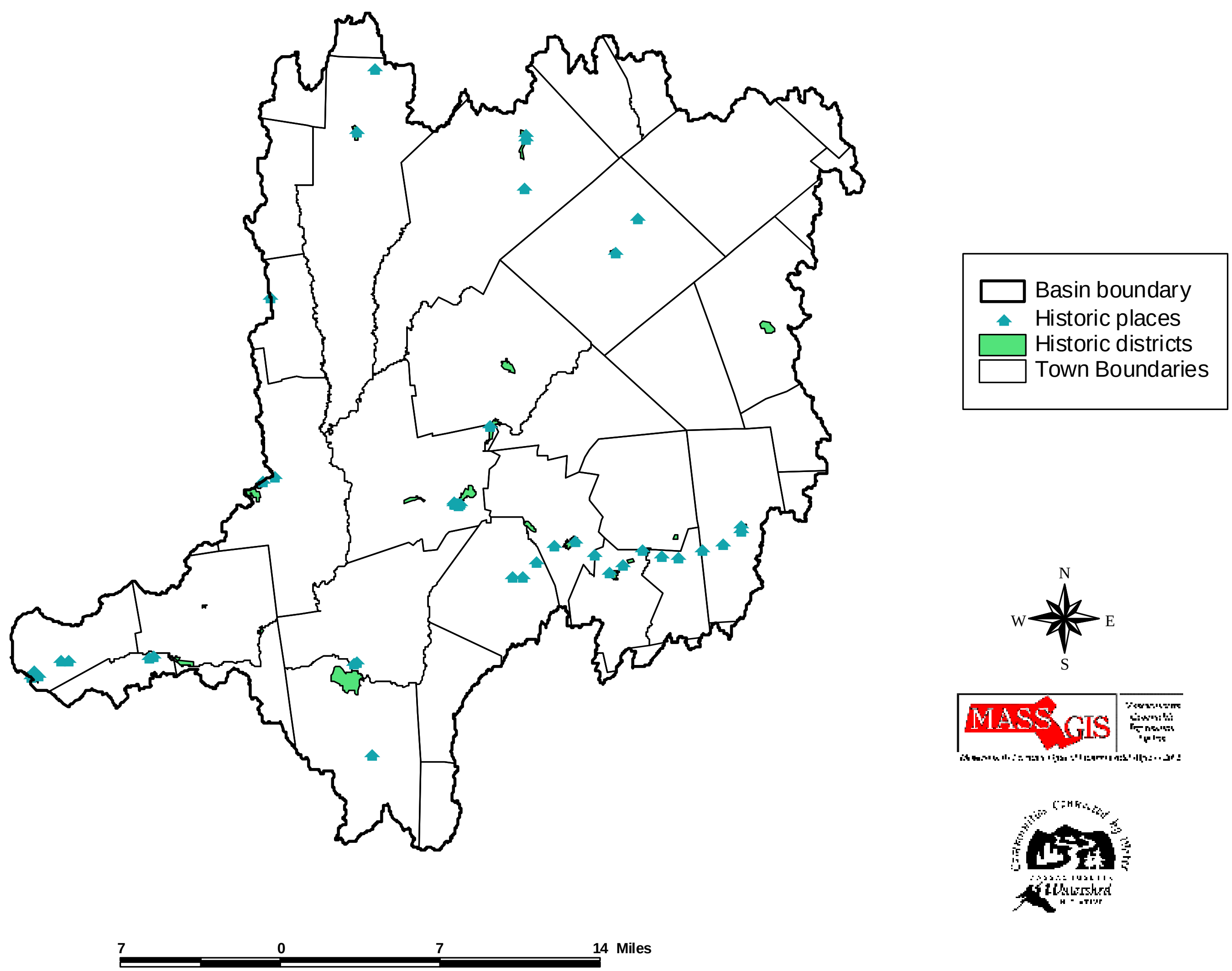


Table 21. Historic districts in the Chicopee River Basin (from MassGIS).

Town	District Name
Barre	Barre Common Historic District
Belchertown	Belchertown State School
Belchertown	Belchertown State School
Belchertown	Belchertown Center Historic District
Brookfield	Elm Hill Farm Historic District
Brookfield	Brookfield Common Historic District
Chicopee	Church Street Historic District
Chicopee	Dwight Manufacturing Company Housing District
Chicopee	Springfield Street Historic District
Hardwick	Hardwick Village Historic District
Hardwick	Gilbertville Historic District
Ludlow	Ludlow Center Historic District
Ludlow	Ludlow Village Historic District
Ludlow	Ludlow Village Historic District
Monson	Monson Developmental Center
Monson	Monson Center Historic District
N. Brookfield	Camp Atwater
New Salem	New Salem Common Historic District
Pelham	Pelham Town Hall Historic District
Petersham	Holland - Towne House
Petersham	Petersham Historic District
Rutland	Putnam
Spencer	Spencer Town Center Historic District
W. Brookfield	Salem Cross Inn
W. Brookfield	West Brookfield Center Historic District
Ware	Church Street Historic District
Ware	Ware Center Historic District
Ware	Ware Millyard Historic District
Wendell	Wendell Town Common Historic District
Wendell	Wendell Town Common Historic District
Wilbraham	Ludlow Village Historic District

Table 22. Historic places in the Chicopee River Basin (from MassGIS)

Town	Historic Place Name	Address
Barre	Barre District #4 School House	Farrington Ave
Barre	Barre Town Hall	Exchange St
Belchertown	Walker - Collis House	1 Stadler St
Belchertown	Clapp Memorial Library	19 South Main St.
Brookfield	Milestone	Rt 9
Brookfield	Milestone	Elm Hill Rd
Brookfield	Milestone	Elm Hill Rd
Chicopee	Polish National Home	136-144 Cabot St.
Chicopee	Valentine School	91-103 Grape St.
Chicopee	Chicopee City Hall	Market Sq.
Chicopee	Page	105 East St.
Chicopee	Bellamy	91-93 Church St.
E. Brookfield	Milestone	Route 9
E. Brookfield	Milestone	North Brookfield Rd
Hardwick	Ware - Hardwick Covered Bridge	
Monson	Memorial Town Hall	Main St.
New Salem	Whitaker - Clary House	Elm St
New Salem	New Salem Academy	South Main St
Palmer	U. S. Post Office - Palmer Main Branch	Park St
Palmer	Union Station	Depot St
Pelham	Pelham Hill Church	
Petersham	Gay Farm	
Petersham	Prescott Town House	MA Route 32
Petersham	Petersham Craft Center	8 North St.
Spencer	Spencer Fire Station	155 Main St.
Spencer	Milestone	Rt. 9
Spencer	Milestone	Rt 9
Spencer	Milestone	Rt 9
Spencer	Spencer District #12 School	23 Grove St.
Springfield	Myrtle Street School	64 Myrtle St.
Springfield	Rieutord Block	146-152 Main St.
W. Brookfield	Milestone	East Main St.
W. Brookfield	Milestone	147 West Main St
W. Brookfield	Milestone	Foster Hill Rd
Ware	Ware - Hardwick Covered Bridge	Old Gilbertville Rd
Ware	Casino Theater	121 Main St.
Ware	Guild Block	66-80 Man St.
Ware	Kaplan Block	85-91 Main St.
Ware	Methodist Episcopal Church	13 Church St.
Ware	Otis Company Mill #1	East Main St
Ware	Otis Company Worker Housing	Otis Ave
Ware	Robinson - Hitchcock Block	112-114 Main St.
Ware	Ware Town Hall	Main St
Ware	Unitarian Church	Main St
Warren	Milestone	

Table 23. MISER population projections for Chicopee River Basin communities				
Municipality	**1990 Census**	**2010 Projection**	**%Change (20 Yr)**	**State Rank**
Athol	11,451	11,641	1.7%	294
Barre	4,546	5,584	22.8%	134
Belchertown	10,579	15,907	50.4%	47
Brimfield	3,001	3,917	30.5%	98
Brookfield	2,968	3,566	20.1%	159
Charlton	9,576	16,655	73.9%	25
Chicopee	56,632	57,041	0.7%	295
East Brookfield	2,033	2,198	8.1%	250
Granby	5,565	6,693	20.3%	157
Hampden	4,709	5,048	7.2%	257
Hardwick	2,385	2,736	14.7%	197
Hubbardston	2,797	5,290	89.1%	15
Leicester	10,191	12,012	17.9%	171
Ludlow	18,820	21,178	12.5%	223
Monson	7,776	8,198	5.4%	273
New Braintree	881	1,152	30.8%	97
New Salem	802	982	22.4%	136
North Brookfield	4,708	5,724	21.6%	144
Oakham	1,503	2,592	72.5%	26
Orange	7,312	8,129	11.2%	233
Palmer	12,054	13,612	12.9%	220
Paxton	4,047	5,026	24.2%	122
Pelham	1,373	1,726	25.7%	115
Petersham	1,131	1,401	23.9%	124
Phillipston	1,485	2,856	92.3%	14
Princeton	3,189	4,103	28.7%	107
Rutland	4,936	7,167	45.2%	60
Shutesbury	1,561	2,937	88.1%	16
Spencer	11,645	12,332	5.9%	270
Springfield	156,983	143,474	-8.6%	334
Sturbridge	7,775	9,091	16.9%	179
Templeton	6,438	7,156	11.2%	234
Wales	1,566	2,350	50.1%	48
Ware	9,808	12,138	23.8%	126
Warren	4,437	6,009	35.4%	76
Wendell	899	1,653	83.9%	20
West Brookfield	3,532	4,163	17.9%	172
Westminster	6,191	7,539	21.8%	141
Wilbraham	12,635	14,041	11.1%	236

Figure 39. Scenic Landscapes in the Chicopee River Basin.

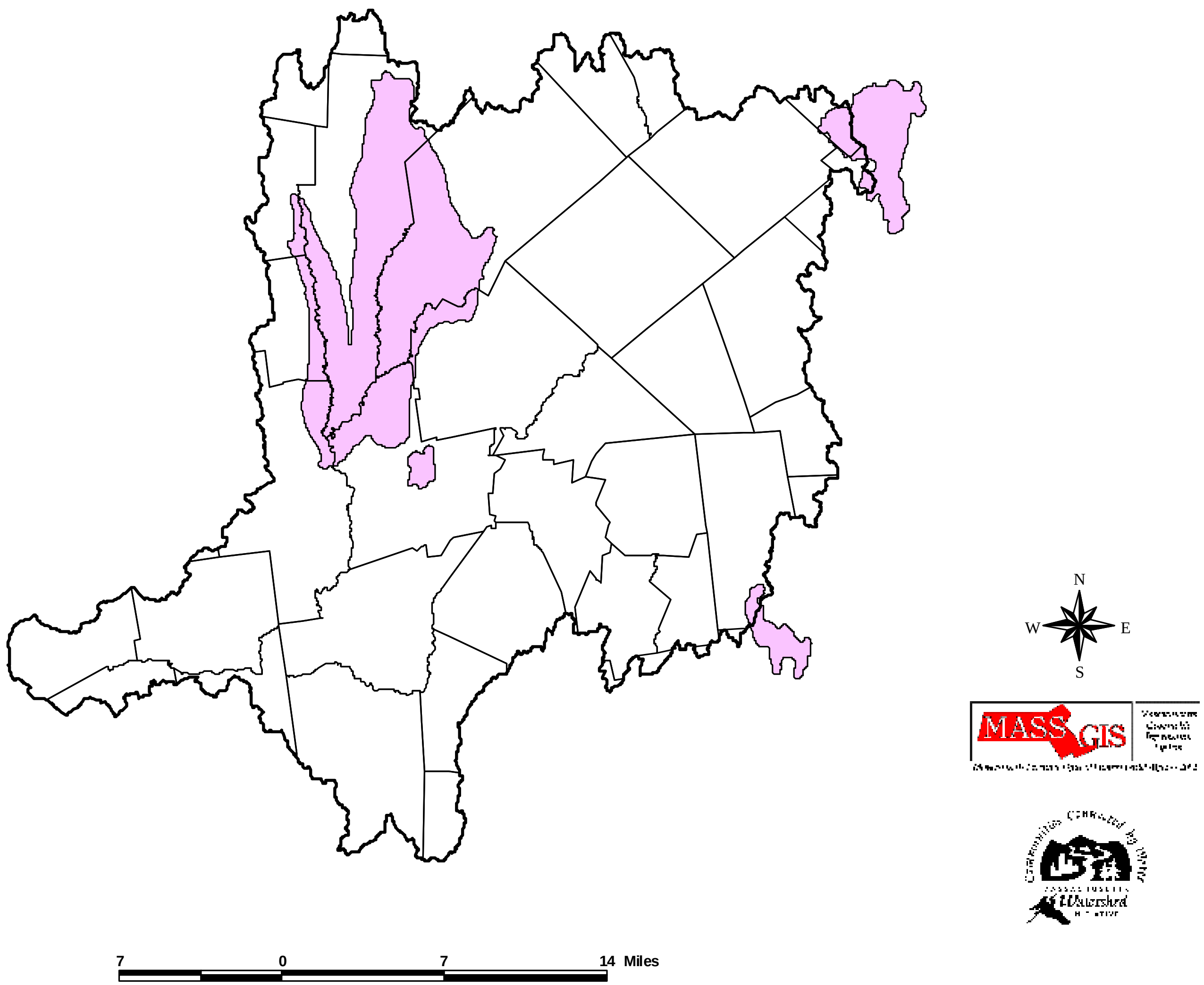
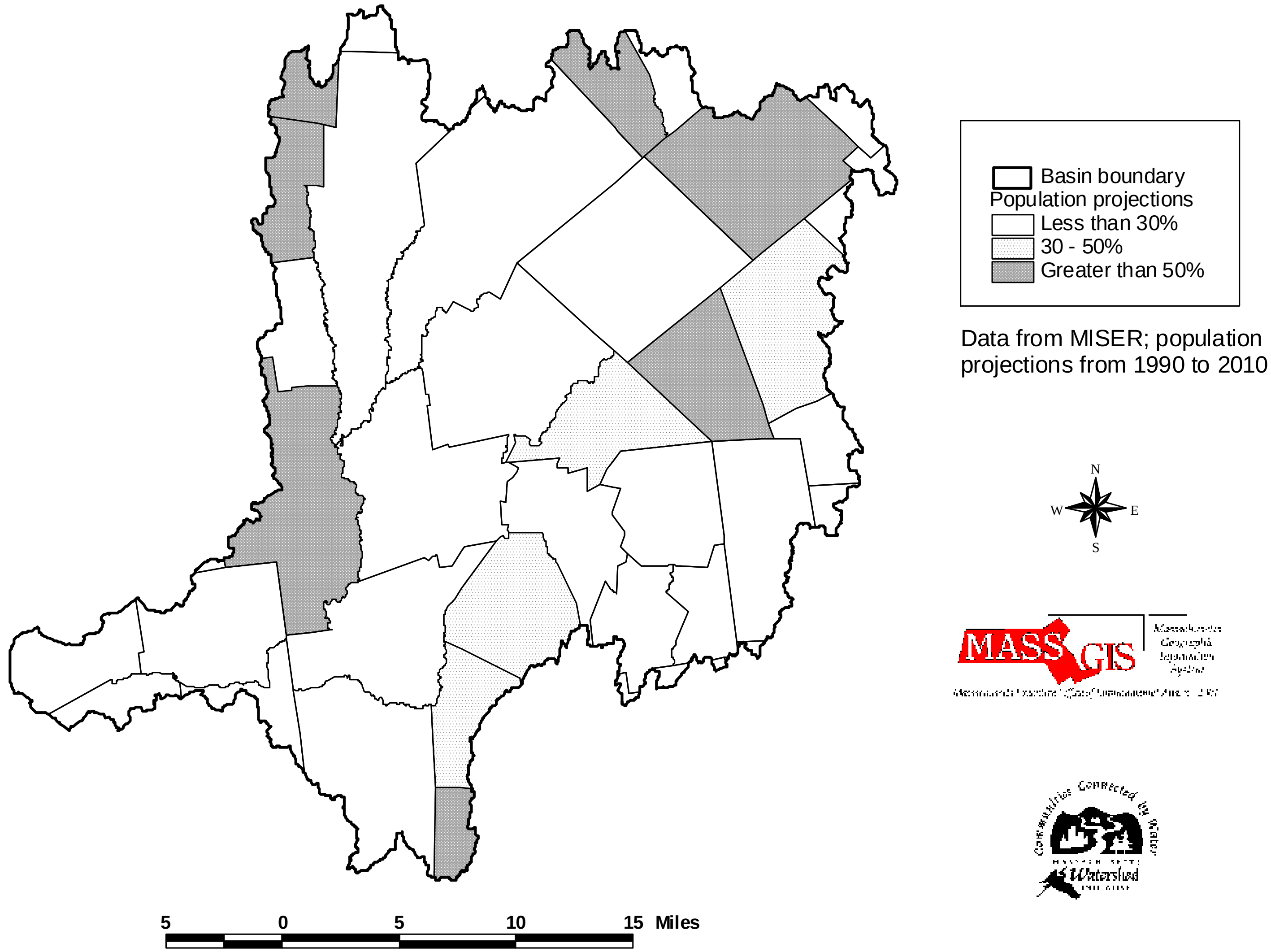


Figure 40. Population Projections in Chicopee River Basin Communities.



Almost half of basin communities could see future population growth exceed 300% (Table 24).

Table 24. Growth potential in basin communities

Growth Potential	Number of Communities	Cumulative Number	Cumulative Percent
<100%	4	4	10.3%
100-200%	9	13	33.3%
200-300%	9	22	56.4%
300-400%	6	28	71.8%
400-500%	4	32	82.1%
500-600%	4	36	92.3%
600-700%	1	37	94.9%
>1000%	2	39	100.0%

For all 39 communities combined, buildout analyses indicate a future growth of more than 130%, with similar increases in student numbers (148%) and households (122%). In terms of infrastructure and space needs, these increases could result in an additional 393,572 acres being developed, almost 57 millions gallons per day of additional water demand, more than 283,000 additional tons/year of solid waste generation, and almost 3,800 miles of additional roadways to serve the 564,000 additional residents.

The rapid growth in some basin communities, plus the potential for significant future growth, means that substantial pressure will likely be put on the natural resources of the basin – particularly water resources – to meet the needs of expanding future populations. This will necessitate careful planning, including the protection of present and potential future water supplies and other significant natural resources.

The Pioneer Valley Planning Commission and the Central Massachusetts Regional Planning Commission have both developed long-range visions and plans for their respective portions of the basin that attempt to balance future population and economic growth in the region with protection of key environmental resources and assets.

B. Water quality

The recent history of water quality conditions in the Chicopee River basin has been typical of other major river systems in the state, which have generally shown substantial improvement over the past several decades as provisions of the federal Clean Water Act have been implemented. Most of the early industrial development and population growth in the basin occurred along the major rivers, especially the Chicopee, which provided the combination of greater flows and relatively steep hydrologic gradients that was so important for early water-powered industries. Further, the rapid growth of metropolitan Boston during the early 20th Century led to the development of the Quabbin Reservoir and the protection of more than 100,000 acres of adjacent watershed lands. As a result, the basin today generally consists of headwater areas with substantial protected land and/or small towns, with much more developed and heavily populated downstream areas. With some notable exceptions (e.g., WWTP discharges along the Ware and Quaboag Rivers), water quality conditions tend to follow the general trend of being good in the "upper" portions of the basin, and much more degraded in the lower portions. The following historical overview of conditions in the basin was taken from a report produced by Environmental Science Services, Inc. (ECS 1996).

Until circa 1974, the quality of water and sediments in the Chicopee River was severely degraded by uncontrolled discharges of municipal sewerage and industrial wastes. A river survey conducted by the U.S. Army Corps of Engineers in the mid-1950s found that the lower reaches of the river were so severely polluted that the river commonly constituted a public nuisance. Data gathered by the Massachusetts Division of Water Pollution Control during the 1960s and early 1970s confirmed this degradation, which was largely due to the discharges of two major industries along the river. Those studies found highly colored and toxic water and contaminated bottom sediments extending far downstream.

Although generally not as serious as the Chicopee River, conditions in the other three major rivers in the basin were also degraded during the mid 20th Century. Discharges from sewage treatment plants and riverside industries resulted in those waters often not meeting Class C criteria. By 1980 however, due to treatment plant upgrades and new limits on industrial discharges, Class B criteria were being met in most locations.

At present, most assessed portions of the basin continue to meet applicable water quality criteria, although the presence of CSOs in several Chicopee River communities still cause serious degradation of river water during storm events. Information on water quality in the Chicopee River basin derives from several sources: sampling data, classifications, and modeling results. Each is discussed in the following sections.

1. Sampling data

Data on water quality conditions in the Chicopee Basin comes from a variety of sources. DEP conducts water testing at 5 "SMART" monitoring stations in the Swift (1 station), Ware (2 stations) and Quaboag (2 stations) Watersheds. The results of that sampling, plus additional water quality testing, is summarized in DEP's 1998 Water Quality Assessment Report (DEP 2001). The Executive Summary of that report is included in Appendix E and available through DEP's web site at: www.state.ma.us/dep/brp/wm/wmpubs.htm.

The DEP assessment report summarizes current information on 37 river segments, totaling 194 river miles, plus 84 lakes, representing approximately 97% of the lake acreage in the basin. For the river segments, insufficient data was available to adequately assess about half of the segments for the four main "uses" evaluated in the report (i.e., aquatic life, primary, and secondary contact recreation, and aesthetics). Of those segments that were assessed, seven were considered to "not support" or only "partially support" one or more designated uses, or were considered to be "threatened" (Table 25).

Eight of the 9 segments in the Swift River Watershed supported all designated uses; insufficient data was available to assess any uses in the 9th segment. Three segments in the Swift River were placed on "Alert Status" for Aquatic Life or Contact Recreation uses, as a result of low dissolved oxygen (DO) or pH readings (in the 2 upper segments), or due to CSO impacts (in the lower segment).

At least one designated use was assessed in all 11 segments of the Ware River, although not all uses could be assessed in 4 segments. At least one use was either not supported, partially supported or threatened in 4 of the 11 segments; 4 others were put on "alert" status due to low DO or pH, high temperatures, low flows, or high bacteria related to CSOs. All together, 8 of the 11 segments in this watershed had issues related to designated use support or were put on alert status. Only one segment supported all designated uses. In the Quaboag River Watershed, lack of data completely precluded the assessment of 7 (of 12) segments. Only 2 segments could be assessed for all 4 uses, and neither of those fully supported all 4 uses. A total of 3 segments included uses that were not, or only partially supported, and one other segment was put on alert status due to CSO impacts.

None of the 5 segments of the Chicopee River were assessed for any designated uses due to lack of data. However, all 4 of the Chicopee River mainstem segments were put on alert status due to CSO impacts and/or hydromodification from the major dams on the river. DEP's river segment assessments also included recommendations, and these are summarized in Table 26. Many of these relate to the need for additional monitoring information to allow for more accurate and complete assessments of river segments in the future. Other recommendations include analysis of MDC's (now DCR) benthic macroinvertebrate data, implementation of DEP's Source Water Assessment Program (SWAP) recommendations, evaluation of flow impacts and issues in several segments, the re-issuance of a number of NPDES permits with updated limits and monitoring

Table 25. DEP Chicopee River Basin: 1998 Water Quality Assessment Report - River Segment Assessment Summary

Watershed	Segment #	River Name	Aquatic Life	1^o Contact	2^o Contact	Aesthetics
Swift River	MA36-29	Cadwell Creek	S	S	S	S
	MA36-30	Atherton Brook	S	S	S	S
	MA36-31	West Br. Swift R.	S	S	S	S
	MA36-32	Hop Brook	S	S	S	S
	MA36-33	Middle Br. Swift R.	S*	S	S	S
	MA36-34	West Br. Fever Br.	S*	S	S	S
	MA36-35	East Br. Swift R.	S	S	S	S
	MA36-09	Swift River	S	S	S	S
	MA36-10	Swift River	NA	NA*	NA*	NA
Ware River	MA36-01	East Br. Ware R.	PS	S	S	S
	MA36-02	West Br. Ware R.	S*	S	S	S
	MA36-36	Canesto Brook	S	S	S	S
	MA36-37	Burnshirt River	S*	S	S	S
	MA36-27	Ware River	PS(1.7)/S(2.9)*	S	S	S
	MA36-03	Ware River	S*	S	S	S
	MA36-04	Ware River	S	NA	NA	NA
	MA36-08	Prince River	NA	NA	NA	S
	MA36-05	Ware River	S(9.1)/T(2.0)	NA	NA	S
	MA36-06	Ware River	S(7.8)/T(1.0)	NS	S*	S
	MA36-07	Ware River	S	NA*	NA*	NA
Quaboag River	MA36-11	Sevenmile River	S	PS	S	S
	MA36-20	Cranberry River	NA	NA	NA	NA
	MA36-12	Sevenmile River	NA	NA	NA	NA
	MA36-13	East Brookfield R.	NA	NA	NA	NA
	MA36-14	Quaboag River	NA	NA	NA	NA
	MA36-18	Forget-Me-Not Br.	S*	NA	NA	S
	MA36-28	Forget-Me-Not Br.	NS	NA	NA	PS
	MA36-19	Dunn Brook	NA	NA	NA	NA
	MA36-15	Quaboag River	S	NA	NA	S
	MA36-16	Quaboag River	S*	NS(4.2)/PS(3.8)	NS(4.2)/S(3.8)	NS(4.2)/S(3.8)
	MA36-17	Quaboag River	NA	NA*	NA*	NA*
	MA36-21	Chicopee Brook	NA	NA	NA	NA
Chicopee River	MA36-22	Chicopee River	NA	NA*	NA*	NA*
	MA36-23	Chicopee River	NA*	NA	NA	NA
	MA36-26	Calkins Brook	NA	NA	NA	NA
	MA36-24	Chicopee River	NA*	NA*	NA*	NA*
	MA36-25	Chicopee River	NA*	NA*	NA*	NA*

Legend: S=Support; NS=Non-support; PS=Partial support; NA=Not assessed; T=Threatened
( ) numbers in parentheses indicate river miles meeting that condition

Table 26. DEP Chicopee River Basin: 1998 Water Quality Assessment Report - River Segment Assessment Recommendations

Watershed	Segment #	River Name	Recommendations
Swift River	MA36-29	Cadwell Creek	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations.
	MA36-30	Atherton Brook	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations.
	MA36-31	West Br. Swift R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Use DEP Biocriteria project data to confirm Aquatic Life Use status; Designate as Cold Water Fishery in next SWQS revision.
	MA36-32	Hop Brook	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Confirm that low DO is result of natural conditions.
	MA36-33	Middle Br. Swift R.	Analyze MDC BMI data and conduct additional biomonitoring to confirm Aquatic Life Use status; Implement SWAP recommendations; Evaluate DEP Biocriteria project data to confirm Aquatic Life Use status; Investigate low DO to determine if naturally occurring or from anthropogenic sources; Designate segment as Cold Water Fishery in next SWQS revision.
	MA36-34	West Br. Fever Br.	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Collect data to confirm low pH and DO as naturally occurring.
	MA36-35	East Br. Swift R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Designate segment as Cold Water Fishery in next SWQS revision.
	MA36-09	Swift River	Protect this valuable resource; Re-issue McLaughlin Fish Hatchery permit with appropriate limits and monitoring requirements; Expand instream monitoring activities to confirm Aquatic Life Use status; Establish "responsible party" to implement dam safety recommendations at Upper Bondsville Mill Dam.
	MA36-10	Swift River	Track and monitor Palmer CSO abatement activities, including fecal coliform data, which will also be used to assess primary and secondary contact uses; Establish "responsible party" to implement dam safety recommendations at Upper Bondsville Mill Dam; Determine need for instream monitoring to assess impacts from Old Bondsville Factory Hazardous Waste Site; Determine need for WMA permit for new Belchertown wells.

Ware River	MA36-01	East Br. Ware R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Conduct habitat and biological assessments related to streamflow; Conduct continuous temperature monitoring at USGS gage; Review Fitchburg Water Dept's compliance with their WMA permit; Evaluate Mare Meadow and Bickford Pond reservoir operations regarding withdrawal practices and minimum flows; Collect additional data on flow, DO and temperature; Evaluate flow management practices at lakes, and relate to elevated in-stream temperatures; Implement SWAP recommendations.
Watershed	Segment #	River Name	Recommendations
	MA36-02	West Br. Ware R.	Analyze MDC BMI data to confirm Aquatic Life Use status; Collect data to confirm that low pH, DO and % saturation are naturally occurring; Evaluate flow management practices at lakes, and relate to elevated temperatures in segment; Implement SWAP recommendations.
	MA36-36	Canesto Brook	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations.
	MA36-37	Burnshirt River	Analyze MDC BMI data to confirm Aquatic Life Use status; Implement SWAP recommendations; Evaluate flow management practices at Queen lake, Stone Bridge and Williamsville Ponds, related to elevated temperatures in Burnshirt River.
	MA36-27	Ware River	Conduct habitat assessment related to streamflow; Conduct BMI and fish population surveys; Conduct continuous temperature monitoring at USGS gage; Collect additional data on flow, DO and temperature; Implement SWAP recommendations.
	MA36-03	Ware River	Conduct habitat assessment related to streamflow; Conduct BMI and fish population surveys; Conduct continuous temperature monitoring at USGS gage; Collect additional data on flow, DO and temperature; Investigate elevated metal concentrations found in NAWQA study; Evaluate USA West Service compliance with stormwater permit at landfill.
	MA36-04	Ware River	Re-issue Barre WWTP permit with appropriate limits and monitoring requirements.
	MA36-08	Prince River	Work with Prince River Stream Team to implement their recommendations, including trash removal; Analyze DWM Biocriteria project data to assess Aquatic Life Use status.
	MA36-05	Ware River	Require Hardwick WPCF (Wheelwright and Gilbertville) to conduct toxicity identification and reduction evalution and reduce testing requirements to one organism; Gilbertville facility should be upgraded to provide adequate treatment of landfill leachate; Re-issue Quabbin Wire & Cable NPDES permit with appropriate limits and monitoring requirements, and screen their effluent for toxicity; Identify source of and reduce sediment inputs near Rt. 32 bridge.

	MA36-06	Ware River	Track progress of Palmer CSO abatement activities and collect bacteria data to evaluate effectiveness; Require Ware WWTP to conduct toxicity testing and reduction, and run Ware River water for dilution.
	MA36-07	Ware River	Track progress of Palmer CSO abatement activities and collect bacteria data to evaluate effectiveness; Use data to assess Primary and Seconday Contact Recreation status.
Quaboag River	MA36-11	Sevenmile River	Investigate sources of bacteria, including failing septic systems; Review Bond Construction Corp. compliance with WMA registration; Evaluate flow management practices of lakes.
	MA36-20	Cranberry River	Conduct upstream/downstream BMI evaluation to evaluate effectiveness of Spencer WWTP dechlorination system, and to assess Aquatic Life Use status; Require Spencer WWTP to run Cranberry River water as dilution water in toxicity tests.
	MA36-12	Sevenmile River	None
	MA36-13	East Brookfield R.	Evaluate East Brookfield Water Dept. compliance with their WMA registration.
Watershed	Segment #	River Name	Recommendations
	MA36-14	Quaboag River	Re-issue Brookfield Wire Co. NPDES permit with appropriate limits and monitoring requirements.
	MA36-18	Forget-Me-Not Br.	Require North Brookfield WWTP to continue to monitor this brook as part of their toxicity testing; Investigate potential for road runoff at multiple East Brookfield road crossings as contributors to instream sedimentation.
	MA36-28	Forget-Me-Not Br.	Make appropriate changes in North Brookfield WWTP NPDES permit; Investigate potential for road runoff at multiple East Brookfield road crossings as contributors to instream sedimentation; Conduct instream monitoring of nutrients and DO upstream and downstream of North Brookfield WWTP to isolate sources of organic enrichment.
	MA36-19	Dunn Brook	None
	MA36-15	Quaboag River	Re-issue Wm. E. Wright NPDES permit with appropriate limits and monitoring requirements; Monitor Warren Water Dept. compliance with their WMA registration.
	MA36-16	Quaboag River	Warren WWTP should implement changes necessary to ensure compliance with TRC and fecal coliform limits, and address color problem, including identifying the industrial user responsible; Remove the CSO designation for this segment in the next SWQS revision; Investigate sources of elevated fecal coliform levels during dry weather conditions.
	MA36-17	Quaboag River	Track progress of Palmer CSO abatement activities, and collect bacteria data to evaluate effectiveness, and to assess Primary and Secondary Contact Recreation status.
	MA36-21	Chicopee Brook	None
Chicopee River	MA36-22	Chicopee River	Track progress of Palmer CSO abatement activities, and collect bacteria data to evaluate effectiveness, and to assess Primary and Secondary Contact Recreation status.

	MA36-23	Chicopee River	Determine if CEEMI installed automated slide gate and if so, effects on flows; Collect data on effects of hydroelectric activities on streamflow and habitat; Address the lack of fish passage at hydropower dams.
	MA36-26	Calkins Brook	None
	MA36-24	Chicopee River	Track progress of Ludlow, Chicopee, and Springfield CSO abatement activities, and collect bacteria data to evaluate their effectiveness and to assess Recreational Uses status; Re-issue Solutia Inc. NPDES permit with appropriate limits and monitoring requirements; Make other appropriate changes to that permit, and to their water usage; Re-issue Chicopee WWTP permit with appropriate limits and monitoring requirements; Terminate the Westover ARB NPDES permit if they receive coverage under their multi-sector general stormwater permit; Issue Hanson Group an NPDES permit with appropriate limits and monitoring requirements; Collect data on effects of hydroelectric activities on streamflow and habitat; Address the lack of fish passage at hydropower dams.
	MA36-25	Chicopee River	Track progress of Chicopee CSO abatement activities, and collect bacteria data to evaluate their effectiveness and to assess Recreational Uses status; Collect data to evaluate effects of hydroelectric activities on streamflow and habitat; Address the lack of fish passage at hydropower dams; Support efforts to install an eel way at Dwight Dam; Determine need for additional instream monitoring to assess possible impacts of former Uniroyal Complex Hazardous Waste Site.

requirements, and the tracking of progress with CSO abatement activities in the lower portion of the basin. Many of these recommendations will guide decisions and actions made by EOEA during coming years.

Lake assessments are summarized in Table 27. Here again, lack of data precluded the assessment of many lakes and ponds, and additional data collection will be an important area of focus for future team actions. Trophic status was assessed for 76 lakes, although it could not be determined definitively for 42 (55.3%) of them. Of the remaining 34, 26 were considered eutrophic, 3 were hypereutrophic, 2 dystrophic, 2 mesotrophic and 1 (Quabbin Reservoir) oligotrophic. Forty-eight lakes were considered impaired for one or more uses. Causes of impairment included non-native and noxious plants, turbidity, mercury, and flow alteration. With the exception of mercury, the causes of impairment may be indicative of enrichment, especially from nutrients resulting from stormwater runoff, failing or substandard sewage disposal systems, and/or agricultural runoff.

Recommendations for lakes in the basin include: additional quality-assured data collection, review and implementation of SWAP recommendations for those lakes that serve as drinking water supplies, “spot treatments” of isolated nuisance plant occurrences as well as programs to handle the more extensive plant infestations, prevention programs to check the future spread of nuisance plants, and investigations of the spread of specific nuisance plants in a number of specific waterbodies.

The MDC (now DCR) conducts extensive water quality monitoring at more than 25 sites in the Quabbin and Ware River drainages, involving both tributary and reservoir sampling. Their data represents the most extensive and intensive assessment of water quality conditions in the basin. As expected, given the high degree of protection afforded the Quabbin watershed, the MDC monitoring results confirm the high quality of the water entering and leaving the reservoir.

Water quality data is also collected by various other agencies and groups in the basin. A number of lake or pond associations sample water quality conditions in their respective waterbodies, and sometimes in their tributaries. Other sampling is, or has been, done by the Chicopee River Watershed Council, the U.S. Army Corps of Engineers (at their Barre Falls and Conant Brook facilities), local schools, conservation commissions, and boards of health. Although these combined activities represents a substantial amount of water quality sampling, most of this sampling is conducted in specific locations, or on irregular schedules. There is no standardization of protocols or coordination of efforts with this sampling.

DEP's SMART represents the best dataset of water quality that is collected at strategic locations on a regular basis. However, at present that program only monitors 5 sites in the entire basin, and all five are located along mainstem sections of major rivers. While such sampling provides useful information, those factors limit the utility of the data for such uses as characterizing conditions throughout the basin, or identifying potential sources of water quality degradation.

In summary, a fair amount of information is available on water quality at various locations in the basin. However, no systematic, basin-wide monitoring program is currently in place in the Chicopee River Watershed.

2. Classifications

Several classifications of water quality in the Chicopee River Basin are available from EPA and DEP. The EPA "Index of Watershed Indicators" web site gives the Chicopee a "score" of 6, which indicates "More Serious Problems; High Vulnerability". This score is based on evaluations of: designated use attainment (less than 20% of all assessed segments support all designated uses); fish consumption advisories (6 advisories in 1998); high levels of population change (1980 to 1990); degree of hydrologic modifications; high numbers of aquatic species at risk; and moderate levels of wetland loss, nitrogen deposition, and both agricultural and urban runoff potential. It should be noted, however, that some of this data may not be basin-specific (e.g., wetland loss figures are statewide) or up to date.

Table 27. Chicopee River Basin Lake Assessments (from DEP Chicopee River Basin 1998 Water Quality Assessment Report)

LAKE, LOCATION	ID #	SIZE (Acres)	TROPHIC STATE	USE ASSESSMENT	CAUSES
Adams Pond, Oakham	MA36001	30	D	1° Contact- P(30) 2° Contact- P(30) Aesthetics- P(30)	Turbidity
Asnacomet Pond,* Hubbardston	MA36005	127	U	2° Contact- S(127) Aesthetics- S(127)	
Beaver Lake, Ware	MA36010	150	U	ALUS- P(150) 2° Contact- S(150) Aesthetics- S(150)	Non-native plants (Mh, Ms)
Bennett Street Pond, Palmer	MA36014	6	E	1° Contact- N(6) 2° Contact- N(6) Aesthetics- N(6)	Noxious plants
Bickford Pond,* Hubbardston/Princeton	MA36015	163	U	2° Contact- S(163) Aesthetics- S(163)	
Brigham Pond*, Hubbardston	MA36020	45	U	2° Contact- S(45) Aesthetics- S(45)	
Brookhaven Lake, West Brookfield	MA36021	34	E	1° Contact- P(34) 2° Contact- P(34) Aesthetics- P(34)	Turbidity
Brooks Pond,* Petersham	MA36022	86	E	1° Contact- N(86) 2° Contact- N(86) Aesthetics- N(86)	Noxious plants
Brooks Pond, North Brookfield/New Braintree/Oakham/Spencer	MA36023	190	U	ALUS- P(190) 2° Contact- S(165); U(25) Aesthetics- S(165); U(25)	Non-native plants (Mh)
Browning Pond, Oakham/Spencer	MA36025	106	E	ALUS- P(106) 1° Contact- N(25); U(81) 2° Contact- S(81); N(25) Aesthetics- S(81); N(25)	Non-native plants (Mh) Noxious plants
Carter Pond,*,Petersham	MA36029	44	U	1° Contact- N(22); U(22) 2° Contact- S(22); N(22) Aesthetics- S(22); N(22)	Noxious plants
Chicopee Brook Pond, Monson	MA36031	9	E	1° Contact-N(7); U(2) 2° Contact- S(2); N(7) Aesthetics- S(2); N(7)	Noxious plants
Chicopee Reservoir, Chicopee	MA36033	22	U	2° Contact- S(22) Aesthetics- S(22)	
Cloverdale Street Pond, Rutland	MA36036	19	E	1° Contact- N(19) 2° Contact- N(19) Aesthetics- N(19)	Noxious plants
Conant Brook Reservoir, Monson	MA36038	4	U	2° Contact- S(4) Aesthetics- S(4)	
Connor Pond,* Petersham	MA36039	22	U	2° Contact- S(22) Aesthetics- S(22)	
Crystal Lake, Palmer	MA36043	16	U	2° Contact- S(16) Aesthetics- S(16)	
Cunningham Pond,* Hubbardston	MA36044	27	E	1° Contact- N(27) 2° Contact- N(27) Aesthetics- N(27)	Noxious plants
Cusky Pond, New Braintree	MA36045	33	E	1° Contact- N(33) 2° Contact- N(33) Aesthetics- N(33)	Noxious plants
Dean Pond, Oakham	MA36050	64	E	1° Contact- P(64) 2° Contact- P(64) Aesthetics- P(64)	Noxious plants Turbidity
Dean Pond, Monson/Brimfield	MA36049	12	U	2° Contact- S(12) Aesthetics- S(12)	
Demond Pond,* Rutland	MA36051	120	M	2° Contact- S(120)	

				Aesthetics- S(120)	
Dimmock Pond, Springfield	MA36053	9.5	E	2° Contact- S(9.5) Aesthetics- S(9.5)	
Doane Pond,* North Brookfield	MA36054	28	H	1° Contact- N(17); U(11) 2° Contact- S(11); N(17) Aesthetics- S(11); N(17)	Noxious plants
Edson Pond,* Rutland	MA36180	36	E	1° Contact- P(7); N(29) 2° Contact- P(7); N(29) Aesthetics- P(7); N(29)	Noxious plants Turbidity
Fivemile Pond, Springfield	MA36061	35.3	U	2° Contact- S(35.3) Aesthetics- S(35.3)	
Fivemile Pond South, Springfield	MA36182	4	E	1° Contact- N(4) 2° Contact- N(4) Aesthetics- N(4)	Noxious plants
Forest Lake, Palmer	MA36063	45	U	ALUS- P(45) 1° Contact- N(11); U(34) 2° Contact- S(34); N(11) Aesthetics- S(34); N(11)	Non-native plants (Ms) Noxious plants
Gaston Pond,* Barre	MA36065	15	U	1° Contact- N(3); U(12) 2° Contact- S(12); N(3) Aesthetics- S(12); N(3)	Noxious plants
Hardwick Pond, Hardwick	MA36066	66	U	ALUS- P(66) 1° Contact- P(66) 2° Contact- P(66) Aesthetics- P(66)	Non-native plants (Cc, Mh) Turbidity
Harris Pond, Ludlow	MA36067	12	E	1° Contact- N(7); U(5) 2° Contact- S(5); N(7) Aesthetics- S(5); N(7)	Noxious plants
Haviland Pond, Ludlow	MA36069	25	U	2° Contact- S(25) Aesthetics- S(25)	
Horse Pond,* North Brookfield	MA36072	63	E	2° Contact- S(63) Aesthetics- S(63)	
Knights Pond,* Belchertown	MA36077	36	U	2° Contact- S(36) Aesthetics- S(36)	
Lake Lashaway, North Brookfield/East Brookfield	MA36079	270	E	ALUS- P(270) 2° Contact- S(270) Aesthetics- S(270)	Non-native plants (Cc)
Lake Lorraine, Springfield	MA36084	28.5	U	ALUS- P(28.5) 2° Contact- S(28.5) Aesthetics- S(28.5)	Non-native plants (Ms)
Lake Whittemore, Spencer	MA36165	52	E	1° Contact- P(52) 2° Contact- P(52) Aesthetics- P(52)	Turbidity
Long Pond,* Rutland	MA36082	168	H	ALUS- P(168) 1° Contact- P(84); N(84) 2° Contact- P(84); N(84) Aesthetics- P(84); N(84)	Non-native plants (Mh) Noxious plants Turbidity
Long Pond, Springfield	MA36083	18	E	1° Contact- N(18) 2° Contact- N(18) Aesthetics- N(18)	Noxious plants
Lovewell Pond,* Hubbardston	MA36085	82	U	1° Contact- N(9); U(73) 2° Contact- S(73); N(9) Aesthetics- S(73); N(9)	Noxious plants
Mare Meadow Reservoir,* Westminister/Hubbardston	MA36090	240	U	2° Contact- S(240) Aesthetics- S(240)	
Mare Meadow Reservoir North,* Westminster	MA36178	38	U	2° Contact- S(38) Aesthetics- S(38)	
Minechoag Pond, Ludlow	MA36093	21	E	1° Contact- N(10); U(11) 2° Contact- S(11); N(10) Aesthetics- S(11); N(10)	Noxious plants
Mona Lake, Springfield	MA36094	11	E	1° Contact- N(7); U(4) 2° Contact- S(4); N(7) Aesthetics- S(4); N(7)	Noxious plants

Moose Hill Reservoir, Spencer/Leicester	MA36179	51	D	1° Contact- P(51) 2° Contact- P(51) Aesthetics- P(51)	Turbidity
Moosehorn Pond,* Hubbardston	MA36097	67	E	ALUS- P(67) 2° Contact- S(67) Aesthetics- S(67)	Non-native plants (Mh)
Muddy Pond,* Oakham/Rutland	MA36102	23	U	1° Contact- P(8); N(15) 2° Contact- P(8); N(15) Aesthetics- P(8); N(15)	Noxious plants Turbidity
Nine Mile Pond, Wilbraham	MA36107	30	U	2° Contact- S(30) Aesthetics- S(30)	
Old Reservoir, Barre	MA36114	37	U	ALUS- N(10); U(27) 1° Contact- P(27); N(10) 2° Contact- P(27); N(10) Aesthetics- P(27); N(10)	Flow alteration Turbidity
Palmer Reservoir,* Palmer	MA36115	8	U	2° Contact- S(8) Aesthetics- S(8)	
Paradise Lake, Monson	MA36116	17	U	2° Contact- S(17) Aesthetics- S(17)	
Pattaquattic Pond, Palmer	MA36117	18	U	2° Contact- S(18) Aesthetics- S(18)	
Peppers Mill Pond, Ware	MA36121	11	U	1° Contact- N(6); U(5) 2° Contact- S(5); N(6) Aesthetics- S(5); N(6)	Noxious plants
Perry Hill Pond, Hubbardston	MA36122	23	U	2° Contact- S(23) Aesthetics- S(23)	
Pottapaug Pond Basin,* (northeast basin Quabbin Reservoir) Petersham/Hardwick	MA36125	568	U	Fish consumption- N(568) 2° Contact- S(40); U(528) Aesthetics- S(40); U(528)	Metals (Hg)
Powder Mill Pond, Barre	MA36126	18	U	Fish consumption- N(18) 2° Contact- S(18) Aesthetics- S(18)	Metals (Hg)
Quabbin Reservoir,* New Salem Shutesbury/Pelham/Hardwick/ Ware /Petersham/Belchertown	MA36129	25000	O	Fish consumption- N(25,000) 2° Contact- S(25,000) Aesthetics- S(25,000)	Metals (Hg)
Quaboag Pond, Brookfield/East Brookfield	MA36130	537	H	ALUS- P(537) Fish consumption- N(537)	Non-native plants (Cc, Mh, Ms) Metals (Hg)
Quacumquasit Pond (South Pond), Brookfield/East Brookfield/ Sturbridge	MA36131	218	U	ALUS- P(218) Fish consumption- N(218) 2° Contact- S(218) Aesthetics- S(218)	Non-native plants (Cc, Ms, Mh) Metals (Hg)
Queen Lake,* Phillipston	MA36132	134	U	2° Contact- S(134) Aesthetics- S(134)	
Red Bridge Impoundment, Ludlow/Wilbraham	MA36171	83	U	2° Contact- S(83) Aesthetics- S(83)	
Shaw Pond,* Leicester	MA36138	64	M	2° Contact- S(64) Aesthetics- S(64)	
South Barre Reservoir, Barre	MA36141	21	U	1° Contact- P(21) 2° Contact- P(21) Aesthetics- P(21)	Turbidity
Spectacle Pond, Wilbraham	MA36142	16	U	1° Contact- N(5); U(11) 2° Contact- S(11); N(5) Aesthetics- S(11); N(5)	Noxious plants
Springfield Reservoir,* Ludlow	MA36145	393	U	2° Contact- S(393) Aesthetics- S(393)	
Stone Bridge Pond,* Templeton	MA36148	32	E	1° Contact- P(4); N(28) 2° Contact- P(4); N(28) Aesthetics- P(4); N(28)	Noxious plants Turbidity
Sugden Reservoir, Spencer	MA36150	83	U	1° Contact- P(83) 2° Contact- P(83) Aesthetics- P(83)	Turbidity
Thayer Pond,* Rutland	MA36181	46	E	1° Contact- N(46)	Noxious plants

				2° Contact- N(46) Aesthetics- N(46)	
Thompson Lake, Palmer	MA36154	32	U	2° Contact- S(32) Aesthetics- S(32)	
Thompsons Pond, Spencer	MA36155	117	U	ALUS- P(117) 1° Contact- P(82); N(35) 2° Contact- P(82); N(35) Aesthetics- P(82); N(35)	Non-native plants (Ms) Noxious plants Turbidity
Town Barn Beaver Pond, Petersham	MA36156	6	E	1° Contact- N(6) 2° Contact- N(6) Aesthetics- N(6)	Noxious plants
Turkey Hill Pond, Rutland/Paxton	MA36157	90	U	ALUS- P(90)	Non-native plants (Mh)
Waite Pond,* Hubbardston	MA36161	34	U	2° Contact- S(34) Aesthetics- S(34)	
Wickaboag Pond, West Brookfield	MA36166	320	E	2° Contact- S(320) Aesthetics- S(320)	
Williamsville Pond,* Hubbardston	MA36167	57	E	1° Contact- N(20); U(37) 2° Contact- N(20); U(37) Aesthetics- N(20); U(37)	Noxious plants

* Indicates Class A (water supply) waterbody; all others are Class B. (Bold indicates 1998 303(d) listed lakes). ID # – Waterbody Identification Code
Trophic State: D = dystrophic, E = eutrophic, H = hypereutrophic, M = mesotrophic, O = oligotrophic, U = undetermined.
Non-native Aquatic Plants: Cc = *Cabomba caroliniana*, Mh = *Myriophyllum heterophyllum*, Ms = *Myriophyllum spicatum*
Use Assessment: Uses (Aquatic Life - ALUS, Fish Consumption, Primary Contact Recreational - 1° Contact, Secondary Contact Recreational - 2° Contact, Aesthetics), Status (S = support, T = threatened, P = partial support, N = non-support, U = undetermined/not assessed)

The Massachusetts Surface Water Quality Standards (SWQS) provide a classification scheme for 24 river segments and drinking water reservoirs in the basin (Table 28). These include 10 Class A Public Water Supplies, 5 Class B Cold Water segments, 7 Class B Warm Water segments, and 2 Class B Warm Water CSO segments. The latter includes all 17.9 miles of the Chicopee River, and one segment of the Quaboag River (which no longer has CSO discharges, and thus should be reclassified when the SWQS are revised). The other main classification of waters in the Chicopee basin is DEP's 303d list of impaired waterbodies. This list, produced under the requirements of section 303d of the federal Clean Water Act, includes 4 rivers and 11 lakes or ponds. Pathogens are the primary cause of impairment for the rivers, and the presence of noxious aquatic plants is the most commonly identified impairment cause for the lakes and ponds (Table 29).

Total Maximum Daily Load (TMDL) analyses were produced for 7 of the waterbodies on the 303d list during 2001. The focus of those TMDLs was phosphorus enrichment, resulting in excessive aquatic plant growth. Two public meetings were held to present and discuss the results of the TMDL models, and to provide recommendations on remedial measures that could be taken to improve the condition of the waterbodies. Several projects are now underway, or in the planning stages, to start addressing those recommendations. The 303d classification process has resulted in a list of waterbodies that may not reflect the true status and remediation needs of the waterbodies in the basin. Thus, it is likely that there will be substantial interest in modifying the list (involving both the removal of presently listed waterbodies, and the addition of new ones) when the opportunity arises.

3. Modeling Results

A number of models are currently available for predicting water quality conditions within specified drainage areas. Two such models have been used in the Chicopee basin to date. Under a former MWI contract administered by the DEP, Environmental Science Services, Inc. (ESS) used the "Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds" (i.e., the "P8" model) to produce estimates of total phosphorus (TP), total Kjeldahl nitrogen (TKN) and total suspended solids (TSS) in 30 drainage areas in the Quaboag sub-basin. Separate analyses were conducted for 1985 conditions (based on the most recent land use data available at the time of the analyses), and for year 2010 conditions (based on projections of population levels and associated land use changes).

Table 28. Water quality classifications of waterbodies in the Chicopee River Basin

Watershed	Name/Location	River Miles	Class	Comments/Restrictions
Swift River	*Swift River* – confluence with Ware River to Winsor Dam	0.0 – 9.8	B	Cold Water
	Swift River – upstream of Winsor Dam	above 9.8	A	Public Water Supply
Ware River	*Ware River* – confluence with Quaboag River to South Barre	0.0 – 27.3	B	Warm Water
	Ware River - South Barre to MDC intake	27.3 – 29.1	B	Cold Water; High Quality water
	Ware River - MDC intake to source	29.1 – 34.0	A	Public Water Supply
	Barre Town Reservoir – source to outlet in Barre, plus tributaries thereto	--	A	Public Water Supply
	Mare Meadow Reservoir – source to outlet in Hubbardston, plus tributaries thereto	--	A	Public Water Supply
	Bickford Pond – source to outlet in Hubbardston, plus tributaries thereto	--	A	Public Water Supply
	Prince River, entire length		B	Cold Water; High Quality water
Quaboag River	*Quaboag River* - confluence with Ware River to Warren POTW	0.0 – 13.1	B	Warm Water; CSO
	Quaboag River - Warren POTW to Rt. 67	13.1 – 19.2	B	Warm Water
	Quaboag River - Rt. 67 to source	19.2 – 24.9	B	Warm Water
	Seven Mile River – confluence with E. Brookfield River to Spencer WWTP	0.0 – 2.4	B	Warm Water
	Seven Mile River – Spencer WWTP to source	2.4 – 8.6	B	Warm Water; High Quality water
	East Brookfield River – entire length	0.0 – 2.2	B	Warm Water
	Dunn Brook – confluence with Quaboag River to N. Brookfield WWTP	0.0 – 3.3	B	Warm Water
	Dunn Brook – N. Brookfield WWTP to source	3.3 – 4.9	B	Cold Water; High Quality water
	Chicopee Brook – entire length	0.0 – 7.0	B	Cold Water
	Doane Pond and Horse Pond – source to outlet in N. Brookfield, plus tributaries thereto	--	A	Public Water Supply
	Palmer Reservoir – source to outlet in Palmer, plus tributaries thereto	--	A	Public Water Supply
	Shaw Pond – source to outlet in Leicester, plus tributaries thereto	--	A	Public Water Supply
Chicopee River	*Chicopee River* – confluence with CT River to confluence with Ware and Quaboag Rivers	0.0 – 17.9	B	Warm Water; CSO
	Springfield Reservoir – source to outlet in Ludlow, plus tributaries thereto	--	A	Public Water Supply
	Nash Hill Reservoir – source to outlet, plus tributaries thereto to Ludlow	--	A	Public Water Supply

Table 29. 1998 303(d) List of Waters, Chicopee River Basin (from DEP 2001)

1998 303(d) Listed Waterbody		Cause of Impairment
Chicopee River	Source to confluence with Connecticut River, Chicopee	Pathogens (fecal coliform bacteria)
Quaboag River	Rte 32 bridge to confluence with Ware River, Palmer	Pathogens (fecal coliform bacteria)
Seven mile River	Confluence with Cranberry River, Spencer to confluence with East Brookfield River, East Brookfield	Pathogens (fecal coliform bacteria)
Cranberry River	Source to confluence with Seven mile River, Spencer	Chlorine
Bemis Pond	Chicopee	Suspended solids
Browning Pond	Oakham/Spencer	Organic enrichment/ low DO, noxious aquatic plants
Dimmock Pond	Springfield	Noxious aquatic plants
Eames Pond	Paxton	Organic enrichment/ low DO, noxious aquatic plants
Long Pond	Springfield	Noxious aquatic plants
Minechoag Pond	Ludlow	Noxious aquatic plants
Mona Lake	Springfield	Noxious aquatic plants
Spectacle Pond	Wilbraham	Noxious aquatic plants
Sugden Reservoir	Spencer	Nutrients, organic enrichment/ low DO
Wickaboag Pond	West Brookfield	Noxious aquatic plants, turbidity
Alden Pond *	Ludlow	Nutrients, noxious aquatic plants

Just over 1/3 of the drainage areas modeled were determined to have unacceptable water quality (using 1985 data), with that fraction predicted to rise to ½ by 2010 (ESS 2001). In addition to the future increase in the number of impacted drainage areas, the modeling also predicted an increase in the degree of impairment in those areas currently considered impacted.

Limited field sampling was also conducted as part of this project. That sampling documented substantial increases in TP and TSS in response to storm events, indicating that NPS pollution is likely to be a major contributor to water quality impairment within the Quaboag sub-basin. Areas suspected of generating significant NPS pollution in the project area include moderate-density residential areas, agricultural lands, urban and commercial areas, golf courses and areas with ongoing construction activities.

The second modeling effort was conducted by the former Chicopee River Watershed Team Leader, using the Watershed Analyst tools available through MassGIS. Those tools provide summaries, estimates, and predictions of land use, percent imperviousness, and annual pollutant loadings (for nitrogen, phosphorus, and TSS) for discrete subwatersheds. This methodology is based on published accounts of the correlations between various land use types and their contributions to imperviousness and pollutant loads.

To facilitate the use of the Watershed Analyst tools, the basin was divided into 44 subwatersheds, ranging in size from approximately one to almost 25 square miles in size (Figure 41). Since it is largely protected and undeveloped, and since the MDC (now DCR) closely monitors the area, the Quabbin Reservoir drainage area was left intact, and not sub-divided for this analysis. The remaining 43 subwatersheds are all direct tributaries to the Chicopee, Swift, Ware, or Quaboag Rivers. In each of those four major watersheds, additional land area that drains directly into the rivers was included in a catch-all "mainstem" category.

Results of the Watershed Analyst modeling showed wide variability in both predicted pollutant loads and imperviousness (Table 30 and Appendix F). Most subwatersheds (38 of 44, or 86%) had estimated imperviousness of less than 5%. Only 4 had greater than 10% imperviousness, although 3 of these exceeded 30%, which is indicative of severely-degraded stream systems.

Pollutant load estimates were converted to pounds per year per square mile to allow for easier comparisons. While no "standards" for pollutants per square mile of drainage area exist, comparisons among subwatersheds are still informative. For example, phosphorus estimates ranged from a low of 74.5 lbs/mi^2/yr in the Parkers Brook subwatershed to 998.3 lbs/mi^2/yr for Abbey Brook. Similarly, nitrogen estimates ranged

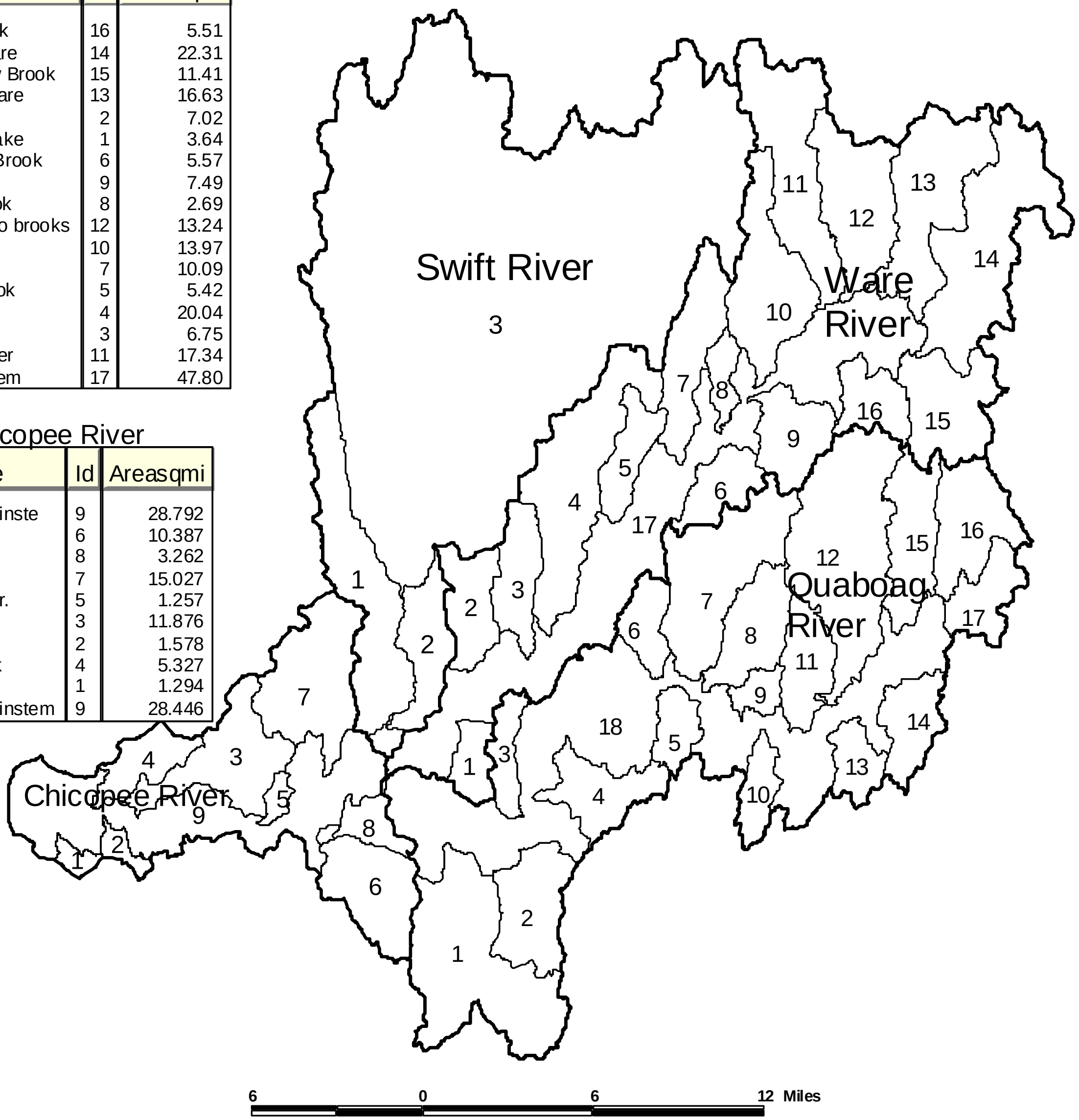
Figure 41. Chicopee River Basin Subwatersheds.

Ware River

Name	Id	Areasqmi
Parkers Brook	16	5.51
E Branch Ware	14	22.31
Longmeadow Brook	15	11.41
W Branch Ware	13	16.63
Penny Brook	2	7.02
Thompson Lake	1	3.64
Winimusset Brook	6	5.57
Pratt Brook	9	7.49
Pine Hill Brook	8	2.69
Natty Canesto brooks	12	13.24
Prince River	10	13.97
Moose Brook	7	10.09
Danforth Brook	5	5.42
Muddy Brook	4	20.04
Flat Brook	3	6.75
Burnshirt River	11	17.34
Ware Mainstem	17	47.80

Chicopee River

Name	Id	Areasqmi
Chicopee Mainste	9	28.792
Twelve Mile	6	10.387
Calkins	8	3.262
Broad Brook	7	15.027
Minechoag Br.	5	1.257
Fuller Brook	3	11.876
Poor Brook	2	1.578
Cooley Brook	4	5.327
Abbey Brook	1	1.294
Chicopee Mainstem	9	28.446



Quaboag River

Name	Id	Areasqmi
Shaw Brook	17	6.033
Turkey Hill Brook	16	10.205
Seven Mile River	15	9.469
Cranberry River	14	6.493
Five Mile River	12	24.883
Great Brook	13	4.193
Dunn Brook	11	6.779
Trout Brook	10	3.968
Willow Brook	9	2.377
Coys Brook	8	8.336
Lake Wickaboag	7	17.728
Naultaug Brook	5	3.891
Lamberton Brook	6	4.542
Kings Brook	3	4.046
Blodgett Mill Br	4	7.712
Foskett Mill Brook	2	9.783
Chicopee Brook	1	24.027
Quaboag Mainstem	18	57.460

Swift River

Name	Id	Areasqmi
Swift below Quabbin	2	7.951
Quabbin Watershed	3	187.516
Jabish Brook	1	18.585
Swift River Mainstem	4	0.960

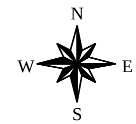


Table 30 – Estimated pollution loads and imperviousness by subwatershed

Watershed	Subwatershed	Acres	Sq.Miles	% Imp.	Estimated gross loads			Estimated loads per sq mi		
					N	P	SS	N	P	SS
Chicopee	12-mile Brook	6647.8	10.4	1.7	20077.3	1573.0	366585.6	1932.9	151.4	35292.1
	Broad Brook	9616.9	15.0	2.3	30523.5	3151.0	903567.8	2031.3	209.7	60132.0
	Calkins Brook	2087.3	3.3	4.4	7167.4	737.1	194178.9	2197.6	226.0	59538.4
	Fuller Brook	7600.4	11.9	6.4	34146.3	4811.5	1313600.1	2875.3	405.2	110613.1
	Minechoag Brook	804.3	1.3	11.3	3990.4	604.0	153672.2	3175.3	480.6	122280.5
	Cooley Brook	3409.0	5.3	31.9	23006.8	4594.5	1421421.8	4319.3	862.6	266855.4
	Abbey Brook	828.2	1.3	35.0	7313.3	1291.8	332281.7	5651.4	998.3	256774.1
	Poor Brook	1009.7	1.6	47.2	8667.5	1569.9	447733.5	5493.9	995.1	283796.6
Swift	Jabish Brook	11894.0	18.6	2.4	37648.2	3573.2	935069.1	2025.8	192.3	50314.8
	Quabbin Res	120002.2	187.5	1.2	321857.6	29052.2	5727611.2	1716.5	154.9	30546.7
	Swift below QR	5087.7	7.9	2.4	16213.6	1560.5	373620.8	2039.6	196.3	46999.1
Ware	Parkers Brook	3525.6	5.5	1.0	9225.0	410.3	90182.0	1674.6	74.5	16370.7
	E. Br. Ware River	14279.9	22.3	1.6	41461.2	3169.5	771005.7	1858.2	142.1	34555.1
	Longmeadow Br.	7304.6	11.4	2.0	22950.9	2073.4	573016.0	2010.9	181.7	50205.4
	W. Br. Ware River	10644.7	16.6	1.7	30441.9	2120.7	485225.1	1830.3	127.5	29173.6
	Penny Brook	4490.8	7.0	2.0	13593.7	1108.7	274889.1	1937.3	158.0	39175.4
	Thompson Lake	2330.5	3.6	3.4	8179.2	896.2	227872.7	2246.2	246.1	62578.2
	Winimusset Brook	3566.7	5.6	1.2	9826.8	940.1	385826.8	1763.3	168.7	69231.8
	Pratt Brook	4794.0	7.5	1.4	13941.0	1211.5	412065.1	1861.1	161.7	55010.8
	Pine Hill Brook	1722.5	2.7	1.2	4896.3	412.6	176285.9	1819.2	153.3	65499.6
	Natty/Canesto	8474.4	13.2	1.9	25286.9	1985.1	530794.3	1909.7	149.9	40086.4
	Prince River	8940.6	14.0	2.0	27391.7	2507.0	846360.9	1960.8	179.5	60585.5
	Moose Brook	6454.4	10.1	1.1	17945.3	1435.9	475563.5	1779.4	142.4	47155.5
	Danforth Brook	3470.7	5.4	1.8	10683.0	1109.9	363318.3	1970.0	204.7	66996.2
	Muddy Brook	12825.7	20.0	1.8	38164.0	3019.6	841253.8	1904.4	150.7	41978.4
	Flat Brook	4318.0	6.7	1.9	13246.3	1193.0	351796.5	1963.3	176.8	52142.1
	Burnshirt River	11099.4	17.3	1.5	31741.2	2123.3	512875.1	1830.2	122.4	29572.8
Quaboag	Shaw Brook	3861.1	6.0	2.0	11937.0	1177.6	338505.7	1978.6	195.2	56109.3
	Turkey Hill Brook	6530.9	10.2	2.7	21931.5	2336.8	638533.7	2149.2	229.0	62573.5

Table 30. (Cont).

Watershed	Subwatershed	Acres	Sq.Miles	% Imp.	Estimated gross loads			Estimated loads per sq mi		
					N	P	SS	N	P	SS
	Seven Mile River	6060.1	9.5	1.6	18123.5	1677.6	505098.9	1914.0	177.2	53342.9
	Cranberry River	4155.4	6.5	2.0	13330.4	1306.8	393123.9	2053.1	201.3	60547.6
	Five Mile River	15924.9	24.9	1.9	47550.9	4619.6	1507681.3	1911.0	185.7	60591.7
Quaboag	Great Brook	2683.6	4.2	1.3	7812.8	577.7	170941.4	1863.2	137.8	40767.1
(cont.)	Dunn Brook	4337.7	6.8	3.2	14176.8	1560.7	472395.8	2091.7	230.3	69699.0
	Trout Brook	2539.3	4.0	2.0	7461.0	583.8	162117.5	1880.5	147.1	40859.8
	Willow Brook	1521.2	2.4	5.2	5420.4	587.2	172779.1	2280.5	247.0	72691.7
	Coys Brook	5334.6	8.3	3.4	19075.4	2397.2	792810.0	2288.5	287.6	95114.6
	Lake Wickaboag	11345.8	17.7	2.1	35138.4	3724.7	1210074.8	1982.1	210.1	68258.6
	Naultaug Brook	2490.3	3.9	1.3	7010.6	548.8	197335.9	1801.7	141.0	50714.8
	Lamberton Brook	2906.9	4.5	1.5	8459.6	714.9	211213.1	1862.5	157.4	46501.9
	Kings Brook	2589.0	4.0	2.1	7238.3	471.3	134777.4	1789.3	116.5	33316.9
	Blodgett Mill Br.	4935.5	7.7	2.6	14777.4	1251.8	358297.9	1916.2	162.3	46461.5
	Foskett Mill Br.	6260.8	9.8	2.2	18324.5	1344.8	340537.7	1873.2	137.5	34810.9
	Chicopee Brook	15376.8	24.0	2.9	51147.3	5139.9	1403862.9	2128.8	213.9	58430.4
OVERALL:		376083.9	587.6		1138502.1	108256.7	28497760.5	1937.4	184.2	48496.0
Mean				4.9				2216.9	240.7	68960.3
Median				2.0				1949.0	178.3	54176.8

from 1674.6 to 5651.4 lbs/mi^2/yr. TSS estimates varied from 16370.7 to 283796.6 lbs/mi^2/yr. As with the estimates of imperviousness, pollutant loads for the majority of subwatersheds were relatively comparable, except for a small number of "outlier" subwatersheds (Figure 42a), especially when graphed against the percent imperviousness of the subwatershed (Figure 42b).

In order to interpret the results of the pollutant loading analyses, and to prioritize subwatersheds for remedial attention, the subwatersheds were "ranked" for each of the 4 main analyses (i.e., % imperviousness, phosphorus, nitrogen & suspended solids) and a cumulative "score" developed for each. The individual rankings (1-44) reflect the pollutant load or % imperviousness estimates, ordered from lowest to highest. The individual rankings were then summed to derive a total "score" for each subwatershed. Thus, a low rank and/or score indicates that a subwatershed had low estimates of pollutant loads and/or imperviousness. As shown in Table 31, the subwatersheds with the highest 5 scores (i.e., most degraded) are all tributaries to the Chicopee. Two subwatersheds in the Quaboag Watershed (i.e. Coys & Willow) also scored high, although the actual pollutant load estimates for those subwatersheds were generally much lower than for the 5 Chicopee tributaries.

The results of both the ESS and the MassGIS modeling will help guide follow-up sampling and/or remediation action in the basin. Specific focus areas for this work will include 5 tributaries of the Chicopee River, and the 2 tributaries of the Quaboag River with the highest scores (see Table 31).

C. Water quantity

Water quantity issues in the Chicopee primarily relate to water withdrawals and transfers in the basin, and the impacts of dams on local flow conditions. The Chicopee has a wealth of surface water bodies, with a total of 174 recognized lakes, ponds, or impoundments covering more than 32,000 acres. Many of these have dams associated with them, and thus have the potential to alter river or stream flows. U.S. Fish & Wildlife Service (USFWS) data indicates that 111 dams that are considered to be barriers to fish movements occur in the basin. In addition, the Chicopee River basin is home to the largest interbasin transfer of drinking water in the state – i.e., the Quabbin Reservoir/Ware River Watershed portion of the MWRA system. Thus, flow issues are of concern in the Chicopee.

Dams occur throughout the basin (see Figure 33), although many of these are small and impound relatively little water. The larger dams in the basin are generally associated with public water supply reservoirs or hydroelectric facilities, and these can have substantial influence on local flow conditions. DEP's 1998 water quality assessment report for the basin (DEP 2001) identified two portions of the basin where dams and/or their associated water withdrawals may have adverse impacts on downstream conditions: 1) the upper Ware River Watershed, where a number of impoundments may be causing alterations in flow, temperature and DO; and 2) the Chicopee River, where large hydroelectric dams may be adversely affecting flow and habitat conditions.

Six hydroelectric dams occur along the Chicopee River, in Wilbraham, Ludlow, Chicopee, and Springfield. Four of these include canal structures (up to 3000 feet long) that divert portions of the river flow to the power stations, and thus reduce flows in the bypass reaches of the river channel.

All 6 hydroelectric facilities along the Chicopee River have exemptions from regular FERC licensing since their power generation levels fall below the thresholds for FERC licensing. However, this does not exempt them from meeting certain operating conditions, including for minimum flows and drawdown limits. Thus, the 4 facilities that deliver water to the powerhouses via canals or tunnels have minimum flows ranging from 237 to 258 cfs, and drawdown limits of 1 or 2 feet (depending on time of year). The 2 run-of-the-river facilities have minimum flow requirements of 332 and 357 cfs. These operating conditions provide some mitigation of the potential impacts of the hydro operations on flow and habitat conditions in the river. Still, USGS gauging station records from the Chicopee River at Indian Orchard show a regular pattern of fluctuation in river stage (Figure 43). Further, the bypass reaches immediately below several of these dams are largely dewatered during dry periods of the year.

Figure 42a. Frequency distributions of pollutant load estimates for the Chicopee River Basin subwatersheds

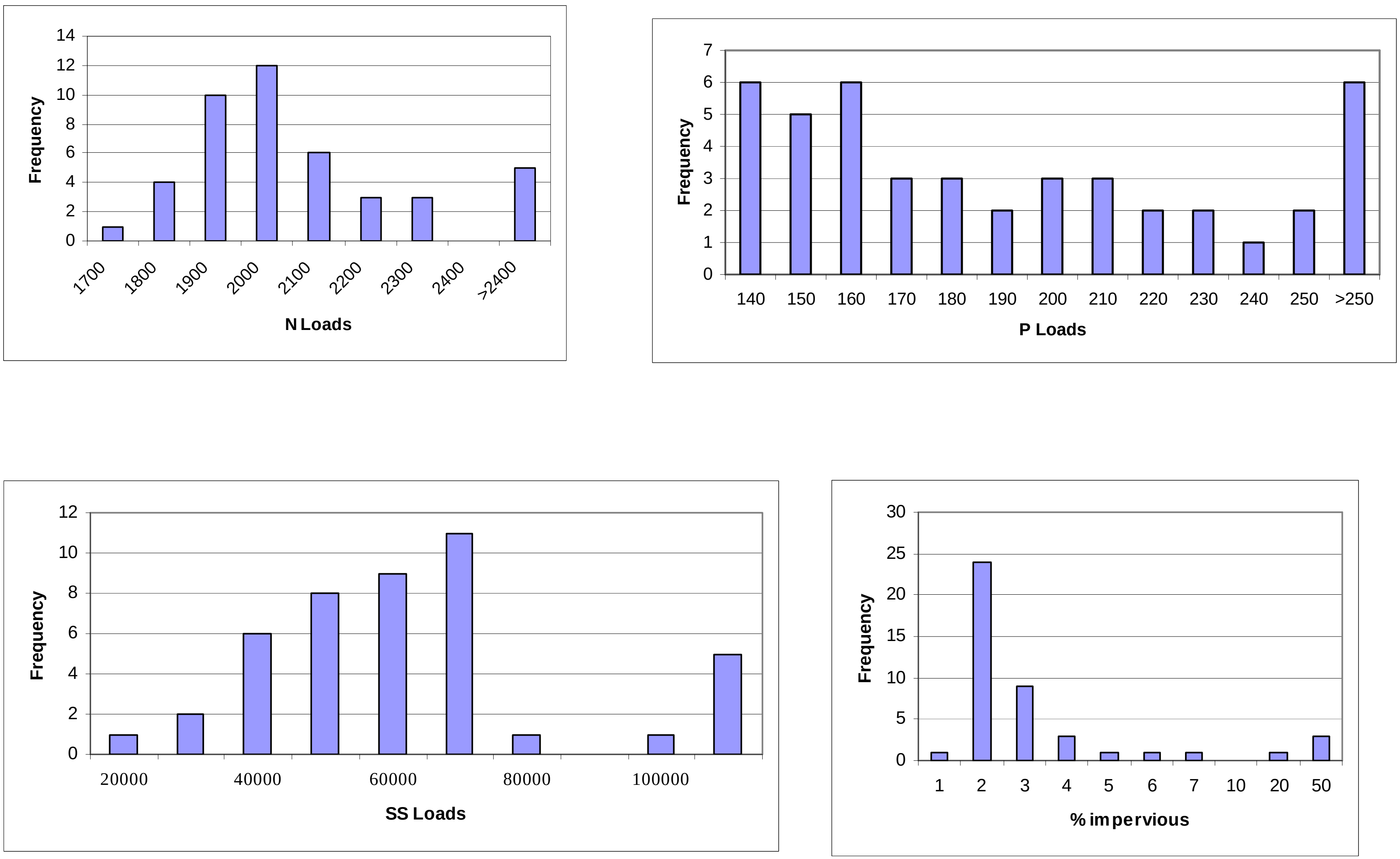
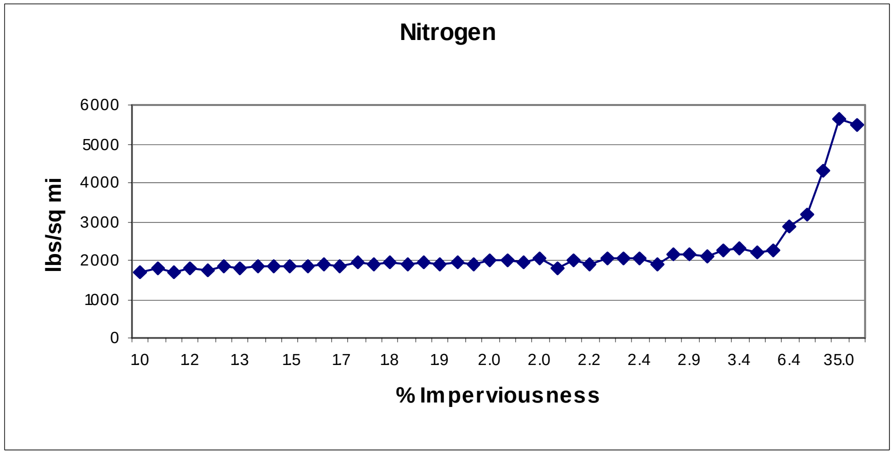
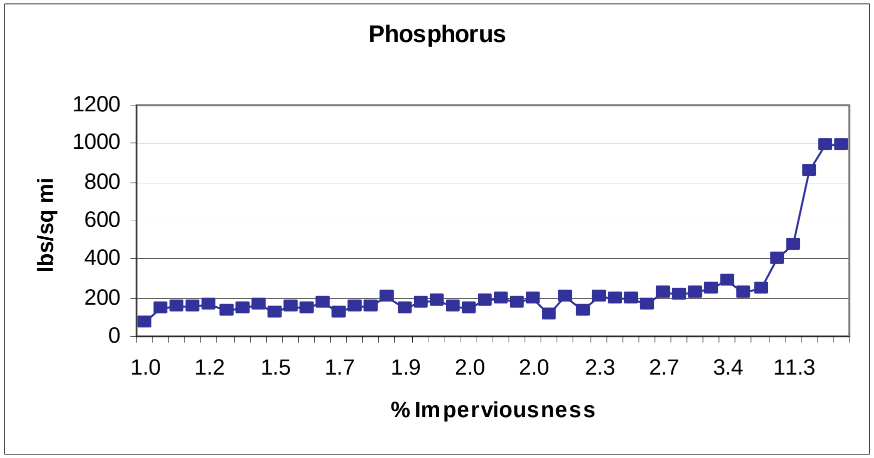


Figure 42b. Estimated subwatershed pollutant loads graphed against percent imperviousness





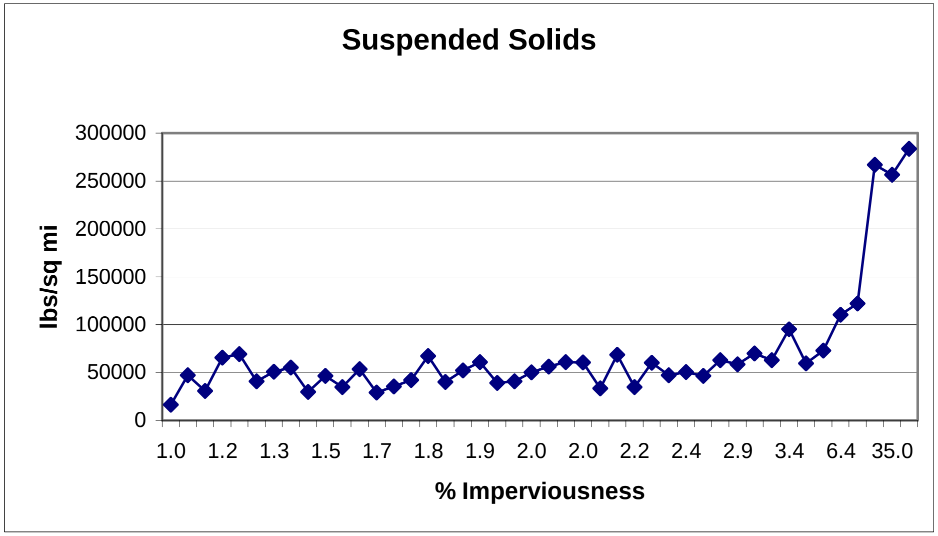
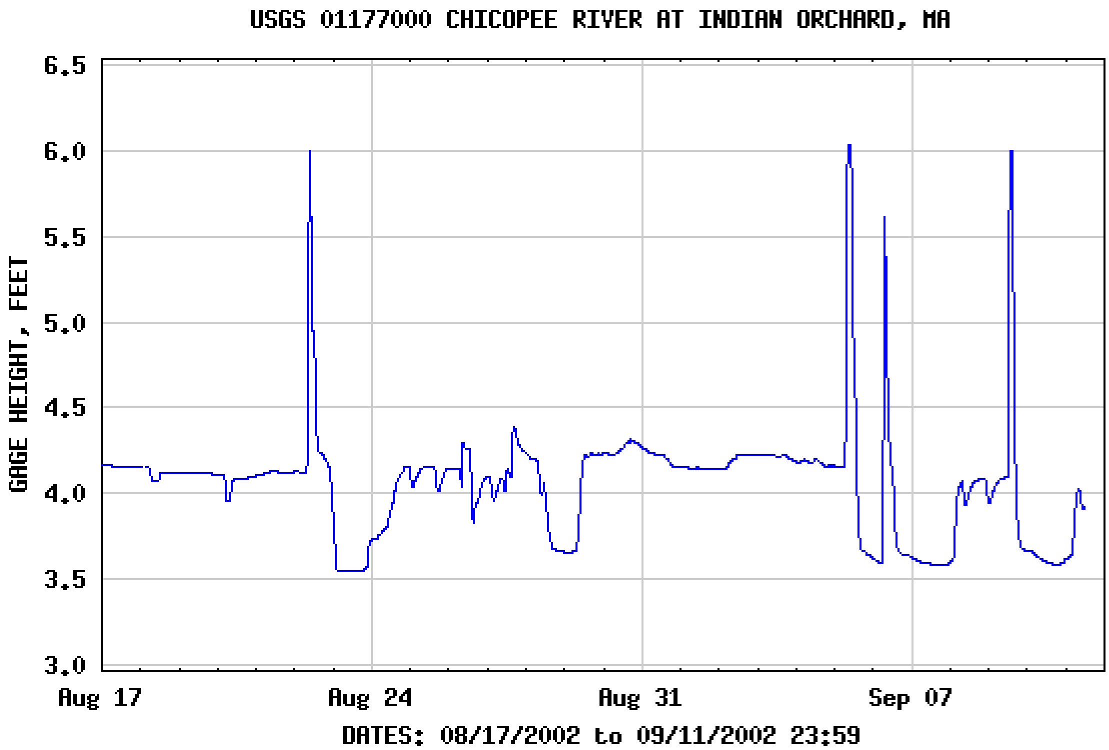
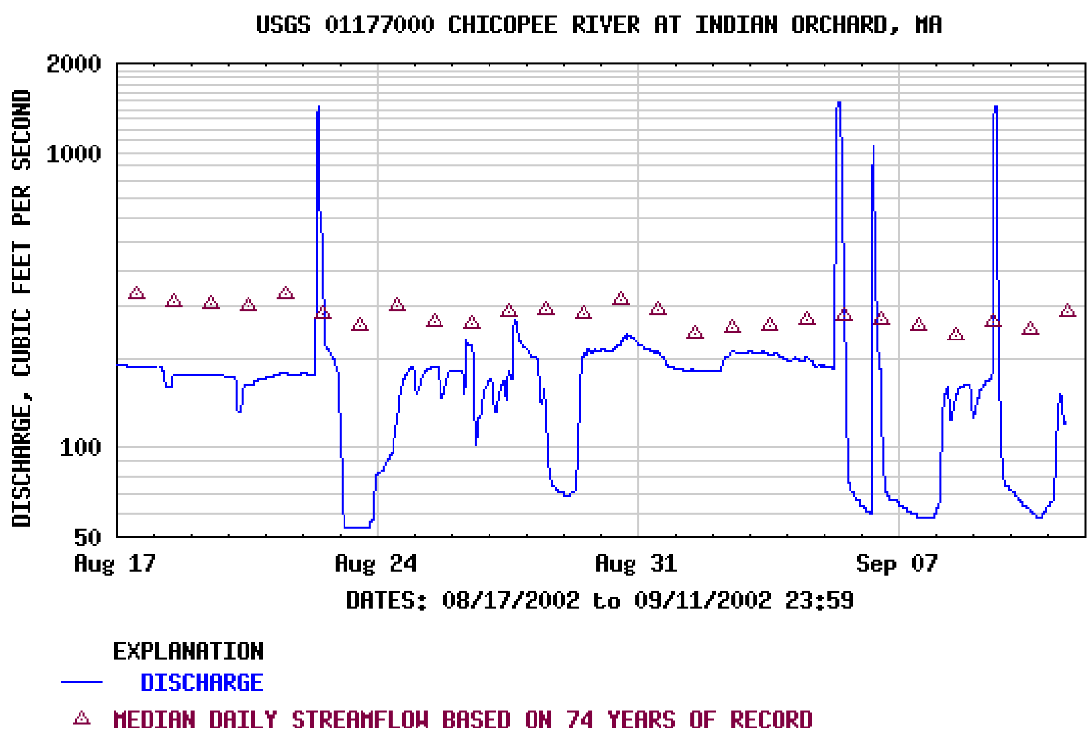


Table 31. Ranking of subwatersheds based on estimated pollution loads
(1=lowest loads or imperviousness; 44=highest)

Subwatershed	Watershed	N	P	TSS	% Imp	Sum of ranks
Parkers Brook	Ware	1	1	1	1	4
Burnshirt River	Ware	8	3	3	9	23
Quabbin Res	Swift	2	15	4	3	24
W. Br. Ware River	Ware	9	4	2	13	28
Moose Brook	Ware	4	9	17	2	32
E. Br. Ware River	Ware	10	8	6	11	35
Great Brook	Quaboag	13	6	11	6	36
Kings Brook	Quaboag	5	2	5	26	38
Naultaug Brook	Quaboag	6	7	20	7	40
Lamberton Brook	Quaboag	12	16	15	10	53
Foskett Mill Br.	Quaboag	14	5	7	28	54
Natty/Canesto	Ware	17	11	10	17	55
12-mile Brook	Chicopee	21	13	8	14	56
Muddy Brook	Ware	16	12	13	15	56
Pine Hill Brook	Ware	7	14	33	4	58
Trout Brook	Quaboag	15	10	12	21	58
Pratt Brook	Ware	11	18	23	8	60
Winimusset Brook	Ware	3	20	36	5	64
Penny Brook	Ware	22	17	9	20	68
Seven Mile River	Quaboag	19	22	22	12	75
Flat Brook	Ware	24	21	21	18	84
Blodgett Mill Br.	Quaboag	20	19	14	32	85
Five Mile River	Quaboag	18	25	30	19	92
Longmeadow Br.	Ware	28	24	18	22	92
Prince River	Ware	23	23	29	25	100
Shaw Brook	Quaboag	26	27	24	23	100
Danforth Brook	Ware	25	30	34	16	105
Jabish Brook	Swift	29	26	19	31	105
Swift below QR	Swift	31	28	16	30	105
Cranberry River	Quaboag	32	29	28	24	113
Broad Brook	Chicopee	30	31	27	29	117
Lake Wickaboag	Quaboag	27	32	35	27	121
Chicopee Brook	Quaboag	34	33	25	34	126
Calkins Brook	Chicopee	36	34	26	38	134
Turkey Hill Brook	Quaboag	35	35	31	33	134
Dunn Brook	Quaboag	33	36	37	35	141
Thompson Lake	Ware	37	37	32	36	142
Willow Brook	Quaboag	38	38	38	39	153
Coys Brook	Quaboag	39	39	39	37	154
Fuller Brook	Chicopee	40	40	40	40	160
Minechoag Brook	Chicopee	41	41	41	41	164
Cooley Brook	Chicopee	42	42	43	42	169
Abbey Brook	Chicopee	44	44	42	43	173
Poor Brook	Chicopee	43	43	44	44	174

Figure 43. Fluctuations in stage and flow of the Chicopee River, as recorded at the USGS gage at Indian Orchard





River profiles, showing the influence of dams along the major rivers in the basin, are presented in Figure 44 and Table 32. The Ware and Chicopee Rivers are the "steepest", with drops of approximately 14 ft/mi. The Quaboag River has an average drop of less than 12 ft/mi; and Swift River (below Quabbin Reservoir) drops just 9 ft/mi.

Table 32. River profile data

River	Length (miles)	Elevation		Total Drop (feet)	Drop (feet/mi.)
		Beginning	End		
Swift (below Quabbin)	8.7	380'	300'	80	9.21
Ware	34.0	742.5'	300'	442.5	13.03
Quaboag	24.8	594'	300'	294	11.83
Chicopee	17.7	300'	50'	250	14.05

The other main sources of variations in flow within the Chicopee River basin are withdrawals and diversions. The DEP lists almost 2-dozen Water Management Act (WMA) registrations in the basin, totaling more than 200 MGD (Table 33). However, the MWRA withdrawal from Quabbin Reservoir and the Ware River accounts for over 92% (187 MGD) of the total. The only other withdrawal greater than 2 MGD is the combined permit for the Palmer and the McLaughlin fish hatcheries operated by MDFW, which is registered at 6.43 MGD.

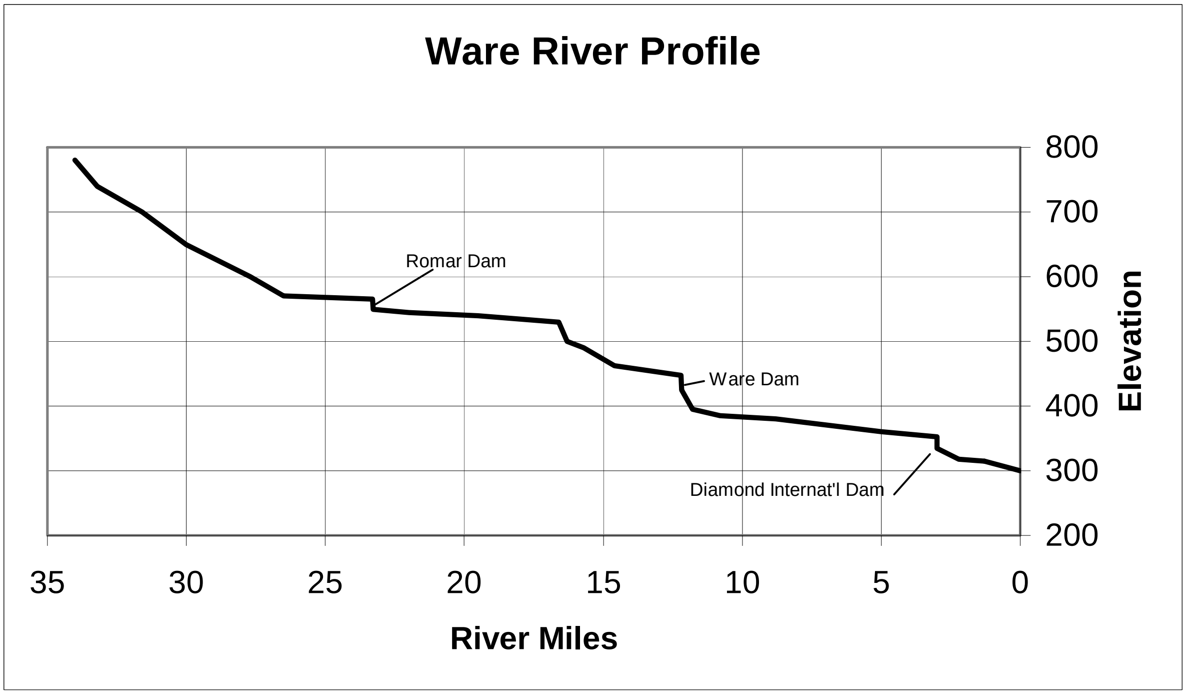
The MWRA withdrawal at Quabbin Reservoir represents a significant interbasin transfer of water. On average, almost 150 MGD is sent from Quabbin (in the Swift River Watershed) eastward into the Nashua River basin. Another 10.6 MGD is transferred from the Swift to the Connecticut River basin through the communities of Chicopee, South Hadley and Wilbraham. Fully ¾ of the water flowing into the Quabbin Reservoir is diverted out-of-basin (approximately 70% to the Nashua through the Quabbin Aqueduct and 5% to the Connecticut via the Chicopee Valley Aqueduct). As discussed previously, these diversions have resulted in significant alterations in the flow regimes of the Swift, Ware, and Chicopee Rivers (see Figures 7 through 10).

As part of the operating requirements for the Quabbin Reservoir, the MWRA is required to release a minimum of 20 MGD to the Swift River on a daily basis. Further, when flows in the Connecticut River drop below certain thresholds, additional releases into the Swift River are required. Since this water originates well below the surface of the reservoir, it remains cool year-round. The net effect is that the Swift River has a relatively constant flow of cool clear water throughout the year – an uncommon condition that is prized by local fishermen. Thus, the potential adverse impacts resulting from the transfer of substantial quantities of water out of basin are somewhat mitigated by the regular, controlled releases into the Swift River, and the beneficial impacts those releases have on the local fishery.

Several other transfers of water or wastewater occur within the basin (i.e., between subwatersheds), or between the Chicopee and other basins (including the Connecticut, Nashua, Blackstone and Millers). Figure 45 shows the approximate locations of these transfers. Most of these are relatively minor, and unlikely to result in significant local impacts. The one possible exception is in the upper reaches of the East Branch of the Ware River, where the Fitchburg Water Department transfers up to 2.26 MGD from the basin via Bickford and Mare Meadow Reservoirs on an annual basis (note: daily withdrawals in 1999 were 3.8 MGD for 145 days from Bickford, and 10.4 MGD for 31 days from Mare Meadow). DEP's Water Quality Assessment Report for the Chicopee identified possible water quality impacts in this region that may be related to these withdrawals (DEP 2001).

Overall, the Chicopee River basin is relatively "water-rich", and water quantity or low flows are generally not of basin-wide concern. However, as described above, impacts of dams, withdrawals and/or diversions have resulted in several significant local concerns.

Figure 44. Profiles of the four major rivers in the Chicopee River Basin (elevations in feet)



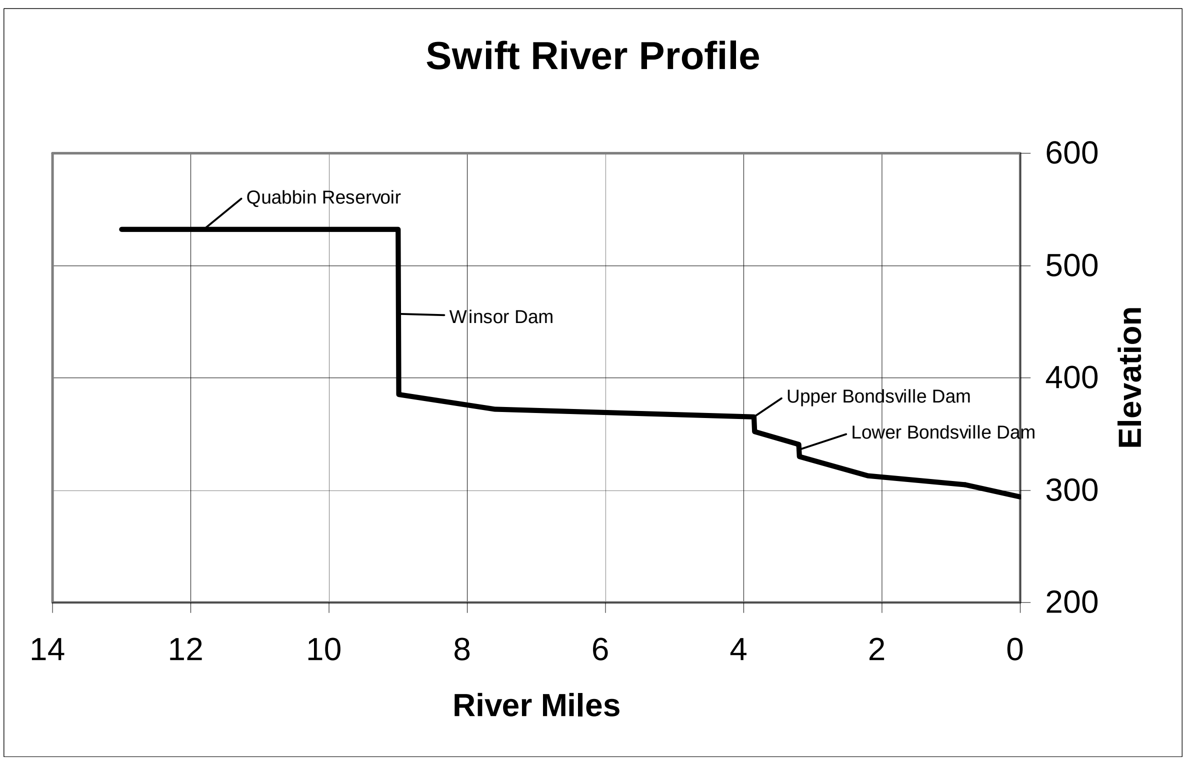
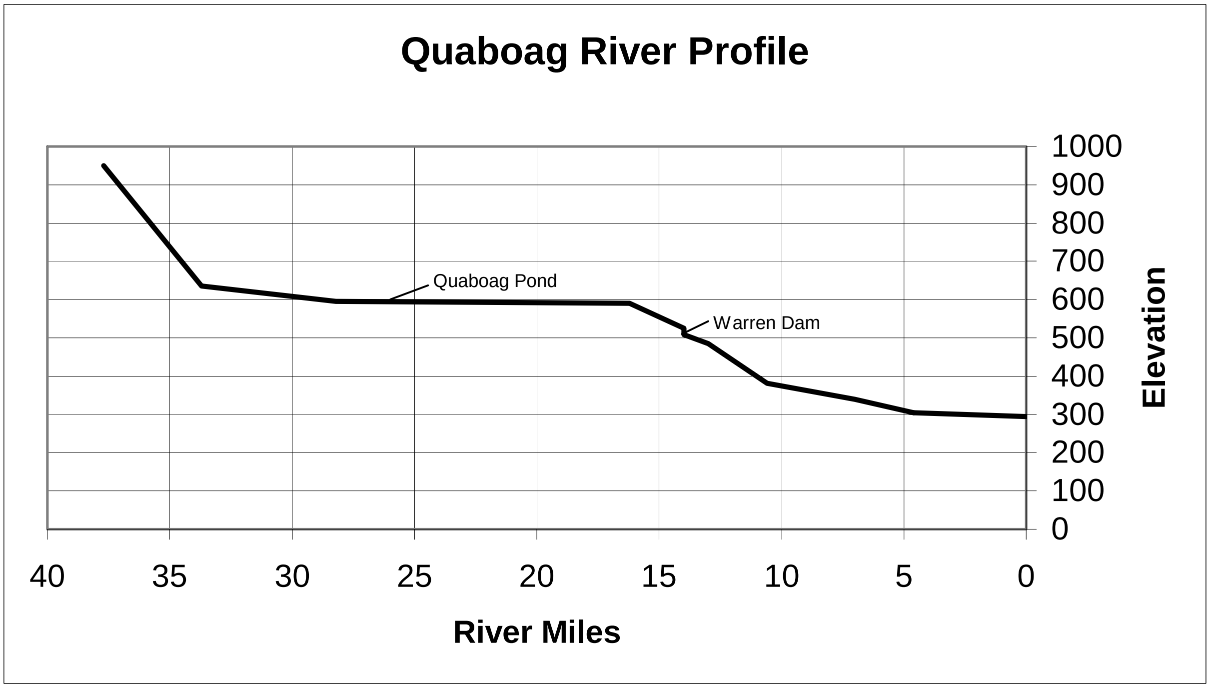


Figure 44 (continued)



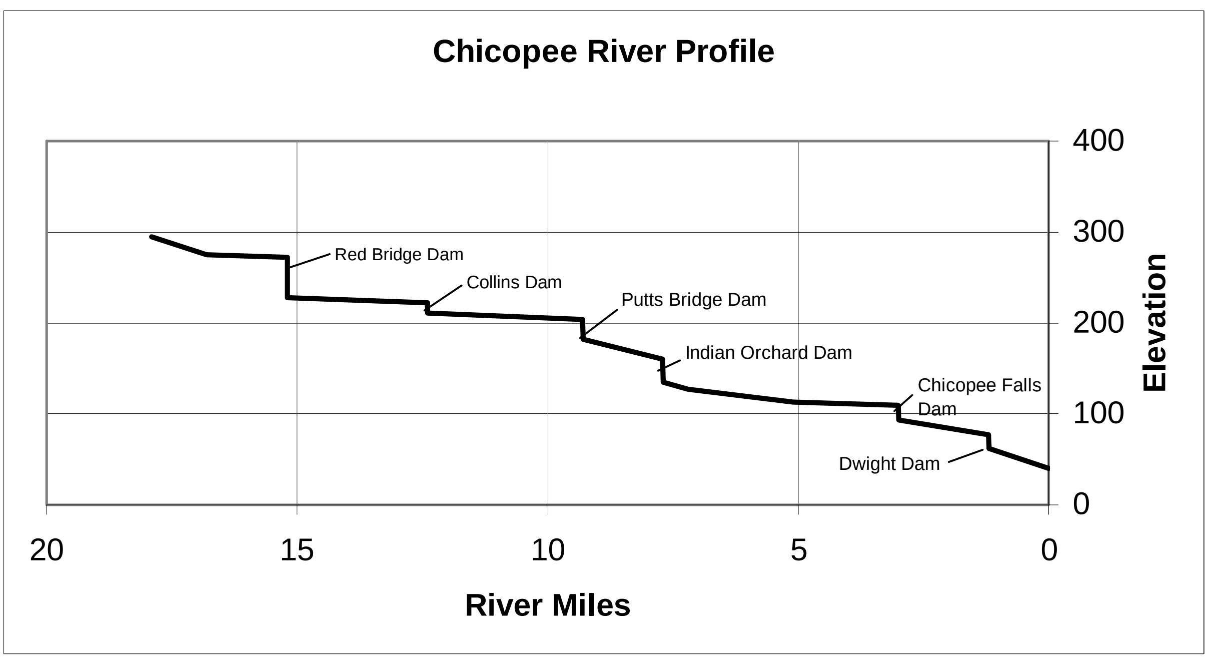


Table 33. List of Water Management Act registered and permitted average annual water withdrawals in the Chicopee River Basin (from DEP 2001)

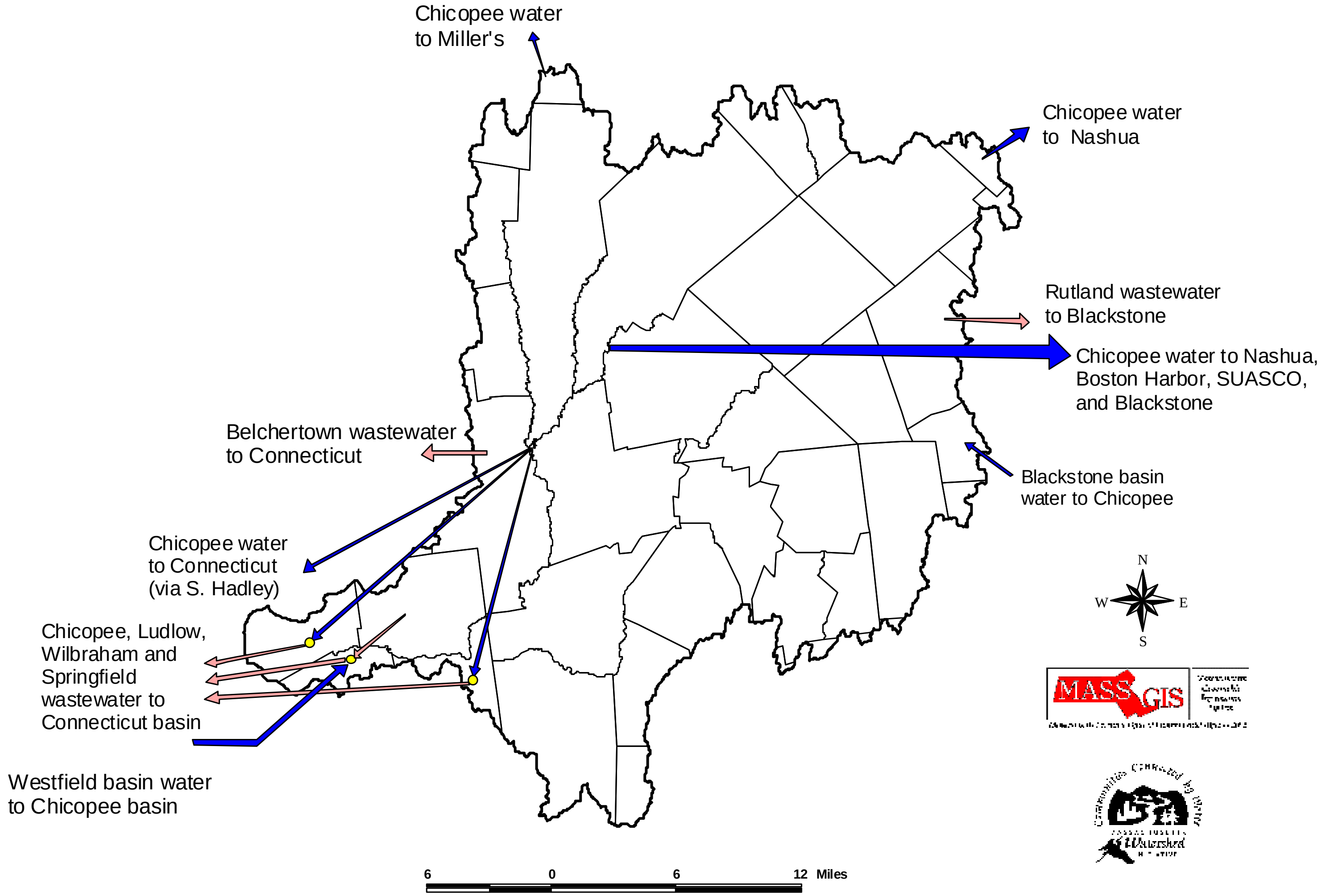
Permit #	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	G or S	Well/Source Name	Withdrawal location
	10802401	1024000	Belchertown Water District	0.19		024-01G	G	Tubular Wells Tap	Belchertown
	10802401	1024000	Belchertown Water District	0.19		024-05G	G	PS-1 (Daigle)	Belchertown
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-01G	G	Well #2	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-01G	G	Well #1	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-01G	G	Well #3	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-03G	G	Dismal Swamp Well	Ware
9P210830903	10806101	1309000	Ware Water Department	0.95	0.44	1309000-02G	G	Well #4	Ware
	10819101	1191000	Monson Water & Sewer Department	0.92		191-02S	S	Conant Pond	Monson
	10819101	1191000	Monson Water & Sewer Department	0.92		191-05G	G	Bunyan Road Well	Monson
	10819101	1191000	Monson Water & Sewer Department	0.92		191-03G	G	Bethany Road Well	Monson
	10819101	1191000	Monson Water & Sewer Department	0.92		191-04G	G	Palmer Road Well	Monson
9P210822701**	10822701	1227003	Three Rivers Fire District	0.4	0	1227003-03G	G	Well #3	Three Rivers
9P210822701**	10822701	1227003	Three Rivers Fire District	0.4	0	1227003-01G	G	Well #1	Three Rivers
	10828101	1161000	Springfield Water&Sewer Commission	1.82		161-01S	S	Ludlow Reservoir	Ludlow
	10822702	1227000	Palmer Water Department	0.65		227-01S	S	Upper Graves Brook Res.	Palmer
	10822702	1227000	Palmer Water Department	0.65		227-02G	G	Gravel Pack Well #2	Palmer
	10822702	1227000	Palmer Water Department	0.65		227-02S	S	Lower Graves Brook Res.	Palmer
	10822704	1227002	Bondsville Water District	0.36		1227002-02G	G	Well #2	S. Belchertown
	10822704	1227002	Bondsville Water District	0.36		1227002-03G	G	Well #3	S. Belchertown
	10822704	1227002	Bondsville Water District	0.36		1227002-01G	G	Well #1	S. Belchertown
	10833901		Dauphinais & Son, Inc*.	0.34					
	20802101	2021000	Barre Water Department	0.26		2021000-01G	G	Well #1	South Barre
	20802101	2021000	Barre Water Department	0.26		2021000-03G	G	South Barre Well	South Barre
	20802101	2021000	Barre Water Department	0.26		2021000-01S	S	Town Reservoir	Barre
	20802101	2021000	Barre Water Department	0.26		2021000-02G	G	Well #2	Barre
	20804501	2045000	Brookfield Water Department	0.09		2045000-02G	G	Quaboag St. Pumping Sta.	East Brookfield
	20808401	2084000	East Brookfield Water Department	0.11		2084000-01G	G	West Street Well	East Brookfield

Table 33. (Cont.)

Permit	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	G or S	Well/Source Name	Withdrawal location
	20821201	2212000	North Brookfield Water Department	0.43		2212000-02S	S	North Pond	North Brookfield
	20828002		Bond Construction Corporation*	0.27					
9P20828001	20828001	2280000	Spencer Water Department	0.48	0.49	280-02G	G	Meadow Rd. Well	Spencer
9P20828001	20828001	2280000	Spencer Water Department	0.48	0.49	280-01G	G	Cranberry Brook Well	Spencer
9P20828001	20828001	2280000	Spencer Water Department	0.48	0.49	280-01S	S	Shaw Pond	Leicester
9P220831101	20831101		Hardwick Knitted Fabrics, Inc	0.23	0.5				
	20832301	2323000	West Brookfield Water Department	0.26		2323000-01G	G	#1 Well	West Brookfield
	20832301	2323000	West Brookfield Water Department	0.26		2323000-02G	G	#2 Well	West Brookfield
	10822705		Cascades Diamond Inc	1.17					
	20831102	2311000	Warren Water District	0.2		311-01G	G	Tub Wells, Comins Pond	Warren
	10830901	MWRA	MDC/MWRA	186.7			S	Ware River Intake	Barre
	10830901	MWRA	MDC/MWRA	186.7			S	Chicopee Valley Aqueduct	Ware
	10830901	MWRA	MDC/MWRA	186.7			S	Quabbin Aqueduct	Hardwick
9P20809701	20809701	2097000	Fitchburg Water Department	0.67	0.11	2097000-06S	S	Mare Meadow Reservoir	Hubbardston
9P20809701		2097000	Fitchburg Water Department		0.11	2097000-09S	S	Bickford Reservoir	Hubbardston
	10802402		DFW	6.43			G	Palmer Hatchery-Well #2	Palmer
	10802402		DFW	6.43			S	McLaughlin Hatchery	Belchertown
	10802402		DFW	6.43			G	McLaughlin Hatchery #3	Ware
	10802402		DFW	6.43			G	McLaughlin Hatchery #2	Belchertown
	10802402		DFW	6.43			S	Palmer Hatchery-Reservoir	Palmer
	10802402		DFW	6.43			G	Palmer Hatchery-Well 1	Palmer
	10802402		DFW	6.43			G	McLaughlin Hatchery #1	Belchertown
9P10802401			DFW	0	1.03		G	McLaughlin Hatchery #4	Belchertown
9P10830901			Ware Fiber Recovery Associates		0.5				
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16		G	PW-1	Belchertown
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16		G	PW-2	Belchertown
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16	1024013-01G	G	PW-3	Belchertown
9P210802402		1024013	Coldspring Golf Course, Inc.		0.16	1024013-02G	G	PW-4	Belchertown

* indicates average withdrawal over less than 365 days, ** permit for new source no change in withdrawal volume, G – ground water, S – surface water, PWS – Public Water Supply

Figure 45. Interbasin transfers in the Chicopee River Basin.



D. Biological resources

The wide variety of habitat types found in the Chicopee River basin, plus the large blocks of undeveloped, mostly-forested habitat and protection provided by the extensive MDC (now DCR) watershed lands, has resulted in substantial richness in the biological resources of the basin. Almost 70% of the basin is classified as forested, with more than 10,000 acres of wetlands and almost 33,000 acres of water. These land cover types provide habitat for a wide variety of both terrestrial and aquatic wildlife species. Further, more than 33,000 acres of agricultural land provides additional habitat for "early-successional" wildlife.

Several efforts to map the state's biological resources have occurred in recent years (e.g., MRIP, GAP, and more recently, BioMap). These programs have used various sources of existing data to identify areas that deserve special attention in land conservation efforts.

The MRIP (Massachusetts Resource Identification Project) was a collaborative effort between MassGIS and the EPA, and was designed to ***identify natural resource areas important to the quality of life and promotion of an ecosystem approach to natural resource management*** in the state. One of the products of the MRIP was a "co-occurrence" map, showing locations where up to 6 important resources overlapped (e.g., estimated rare habitat, outstanding resource water, contiguous natural lands greater than 500 acres, etc.). In theory, areas of multiple resource occurrence should have higher conservation value, and thus be priorities for land protection efforts. The results of the MRIP analysis for the Chicopee River basin (Figure 46) again shows the ecological value of the MDC (now DCR) watershed lands, along with Quaboag Pond and the upper Quaboag River, and several other river valleys in the basin.

The GAP project represents a different approach to assessing the relative condition of biological resources. This method maps natural communities and predicted species distributions (based on current land cover conditions) and compares that information against the existing network of conservation areas, thus showing which species or habitats are not well represented in the network (i.e., where the "gaps" are). For southern New England, the gap identification process has not been completed, although maps of predicted species occurrences for frogs, salamanders, snakes and turtles have been compiled. The dark bands running north-south through the middle part of the state (Figure 47) show the high species richness of these groups of animals that occur in the Chicopee River basin.

Finally, the BioMap project that was recently completed by the Natural Heritage and Endangered Species Program identified and mapped the areas most crucial to protecting the state's biodiversity. These maps were created through a systematic evaluation of over 7,000 site-specific records of rare plants, animals, and natural communities collected over a 22-year period (NHESP 2001). The maps include the most viable rare species habitats and natural communities (i.e., the "core habitat") and large minimally-fragmented "supporting natural landscapes" that safeguard the core habitats. In so doing, ***BioMap identifies those areas of Massachusetts most in need of protection to conserve biodiversity for generations to come*** (NHESP 2001). Significant concentrations of core habitats and supporting natural landscapes in the Chicopee River basin (Figure 48) occur in the Quabbin Reservoir and Ware River Watershed areas, and also near Westover Air Base in Chicopee, near the Springfield Reservoir in Ludlow, around the Norcross Wildlife Sanctuary in Monson, Wales and Brimfield, around Quaboag and Quacumquaset Ponds and the Quaboag River in the southeast portion of the basin, and along the Meadow, Mill and Sucker brooks in New Braintree, North Brookfield and West Brookfield. Additional, smaller (but still significant) core habitat areas occur in other portions of the basin.

In future years, the "AquaMap" project will provide a companion evaluation of aquatic habitats in the state. Further, MDFW will be conducting aquatic habitat surveys in the Chicopee River basin during the 2003 "research" year. Those surveys will provide additional information that will help identify areas of high conservation value in the basin, and prioritize their protection.

Figure 46. Resource co-occurrence in the Chicopee River Basin (MRIP analysis).

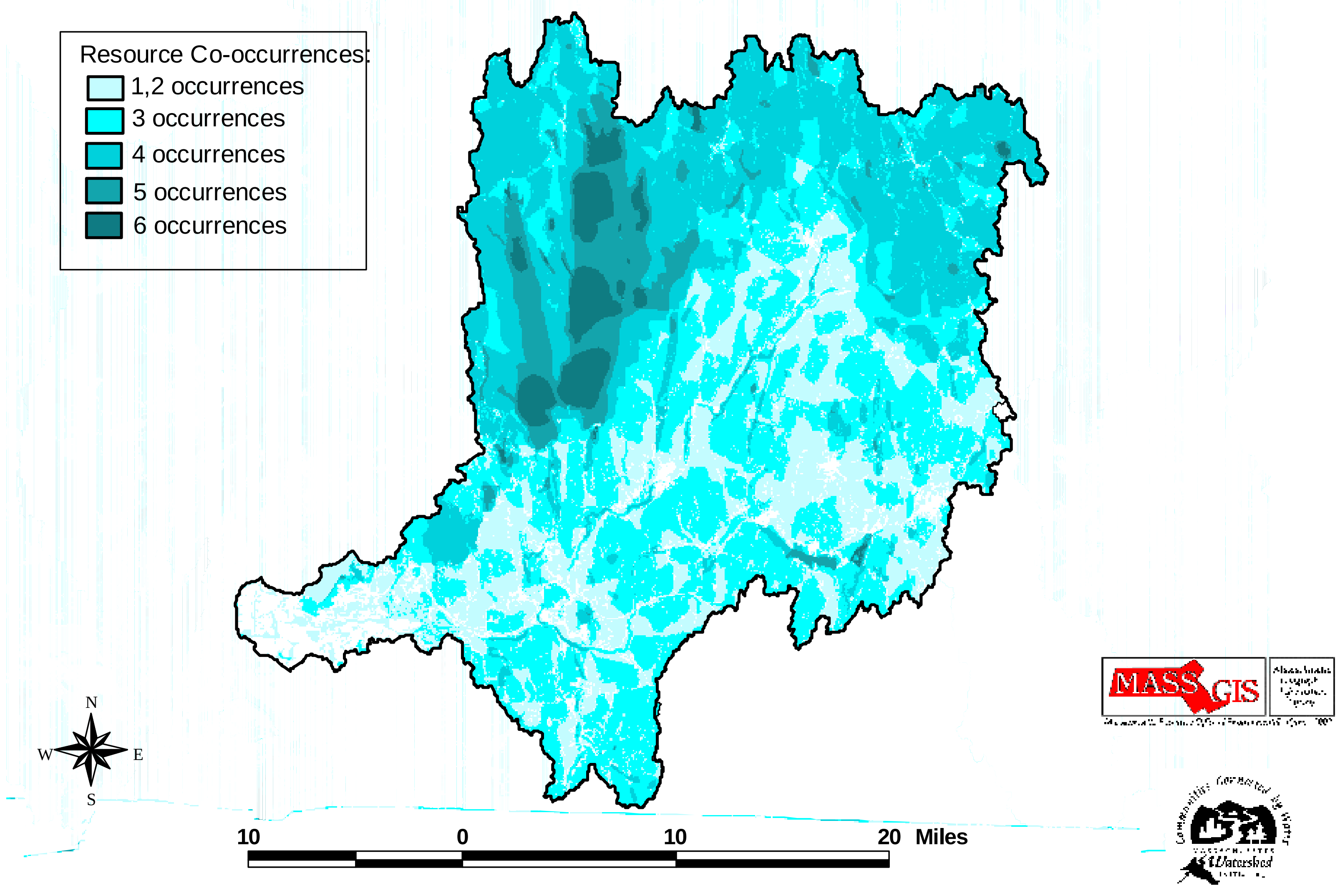


Figure 47. Gap Analysis maps of species richness.

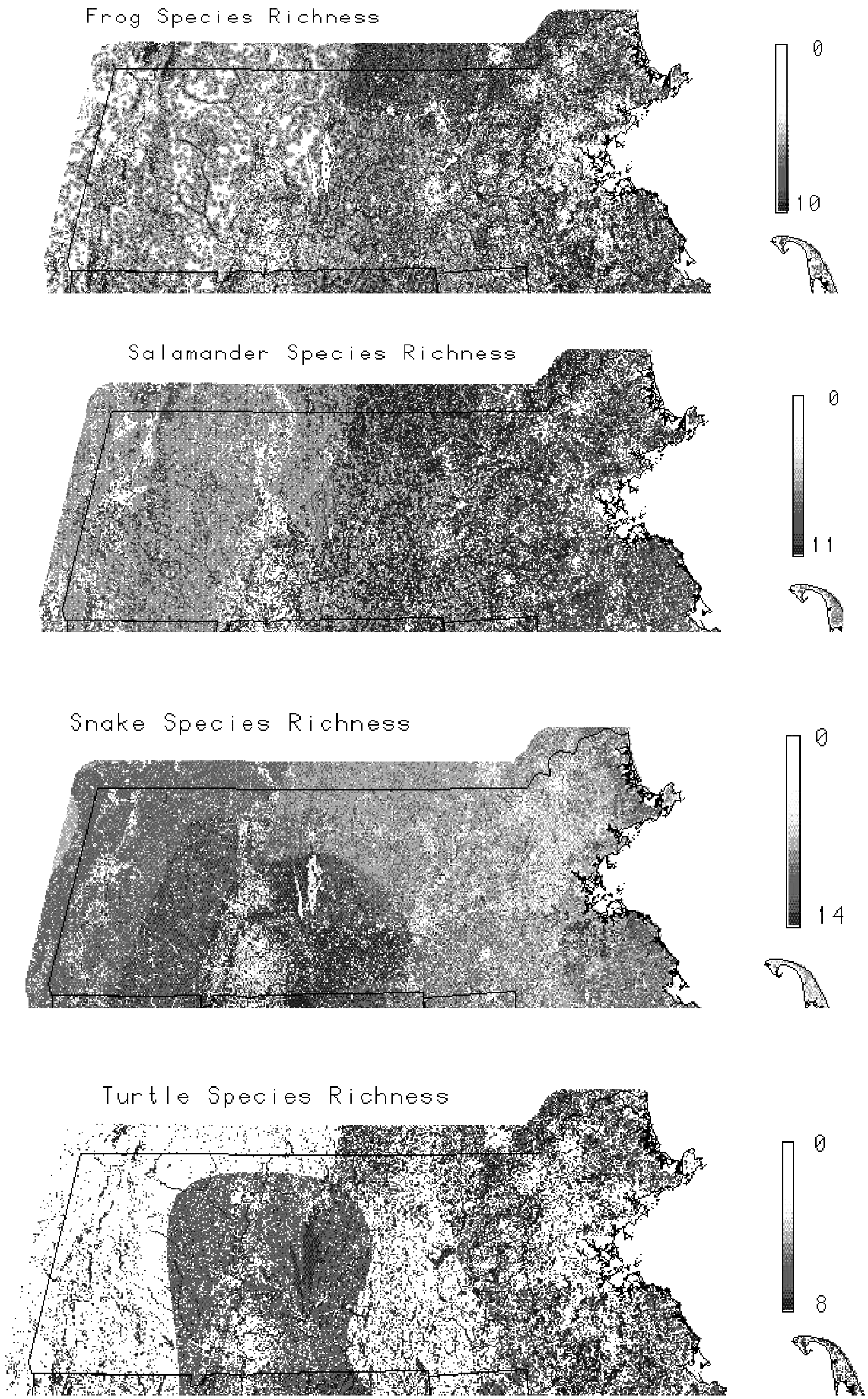
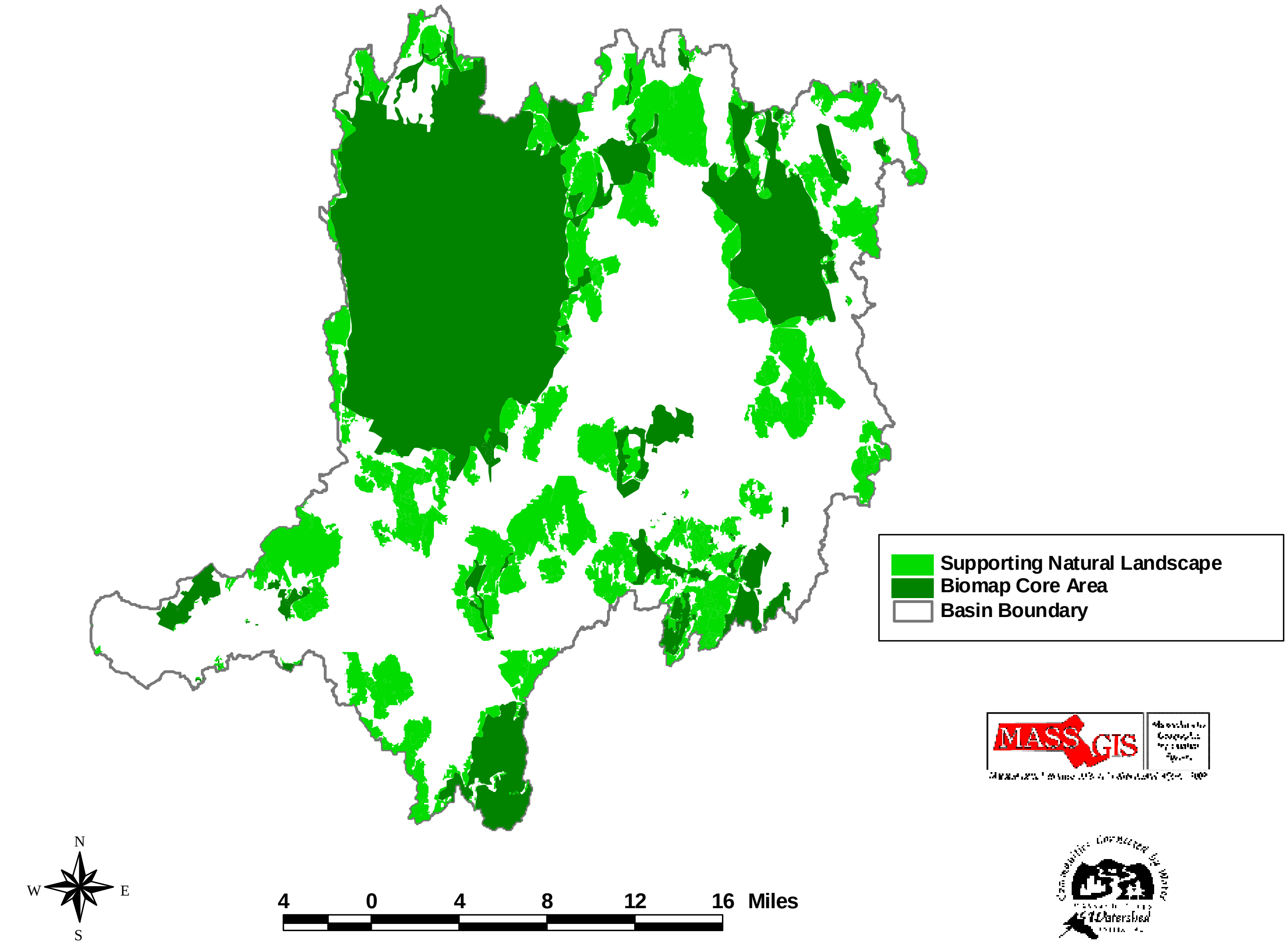


Figure 48. Biomap Core Areas and Supporting Natural Landscapes.



E. Open Space/Growth planning

Efforts to plan for future growth, including protection of open space, have occurred, or are occurring in a number of basin communities. In addition, efforts by government agencies and private conservation organizations have resulted in a substantial amount of protected open space in the basin (Figure 49). Further, land protected by municipalities and private organizations (e.g., sportsmen's clubs, Boy Scouts, etc.), along with Chapter 61 lands account for a substantial amount of additional acreage (Figure 50), although many of these lands are not permanently protected. Overall, almost 289 square miles of the basin are considered "protected open space" (Table 34), representing approximately 40% of the basin.

Table 34. Open space in the Chicopee River basin

Category	Acres	Sq.Miles	% of Total
CH61	9011.2	14.1	4.9%
CH61A	13387.2	20.9	7.2%
CH61B	4727.0	7.4	2.6%
DEM	14183.0	22.2	7.7%
DFWELE	19736.6	30.8	10.7%
MDC	80264.5	125.4	43.4%
FEDERAL	583.5	0.9	0.3%
NON-PROFIT	13693.5	21.4	7.4%
MUNICIPAL	12478.6	19.5	6.7%
PRIVATE	12386.2	19.4	6.7%
MISC. STATE	3320.5	5.2	1.8%
MISC OTHER	1103.0	1.7	0.6%
TOTAL	184874.6	288.9	100.0%

Despite the relatively large percentage of the basin that is considered open space, much of this (more than 43% of the total) is in the large blocks of MDC-controlled (now DCR) watershed lands in the Quabbin and Ware River Watersheds. While there is great value in having such large blocks of protected land, it nonetheless gives a somewhat false impression of the status of open space protection in the basin. As shown in Figure 49, large areas of the basin, including almost all of some basin communities, have little, permanently-protected open space.

In an attempt to remedy this situation, the former watershed team worked to enhance the ability of local communities to protect land by providing assistance in developing or updating their Recreation and Open Space Plans. In 1998, only 28% of the Chicopee basin communities had approved open space plans on file with the state Division of Conservation Services. By spring of 2002, that percentage had increased to 51%, with several other communities in the process of completing their plans (Table 35 and Figure 51). In conjunction with the Massachusetts Watershed Coalition, and The Trustees of Reservations, new plans were developed for Barre, Spencer, Rutland, Hubbardston, and West Brookfield in late 2001 and early 2002. Efforts will continue to encourage additional communities to prepare open space plans, and to assist those communities with approved plans to implement those plans.

Another major effort aimed at assisting communities with growth planning is Executive Order 418 (EO 418), which provides all municipalities in the state with local buildout analyses, and access to up to $30,000 in planning services. This assistance is intended to help cities and towns plan and prepare for future growth through the preparation of a "Community Development Plan" which address such issues as economic development, affordable housing, open space and natural resource protection, and transportation. Presentations

Figure 49. Permanently-protected open space in the Chicopee River Basin.

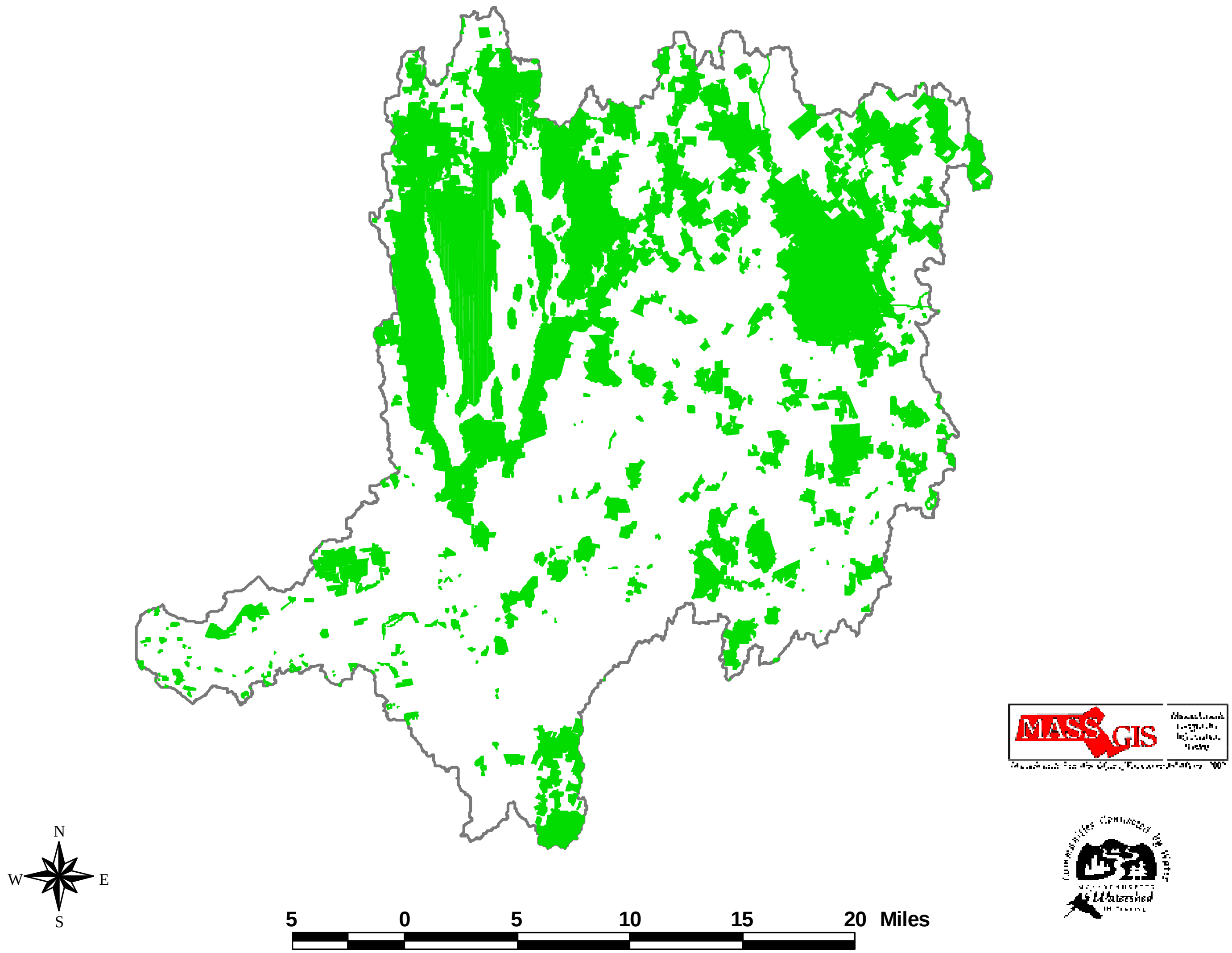


Figure 50. Non-permanent land protection in the Chicopee River Basin.
(Note: Chapter 61 lands not shown for all communities)

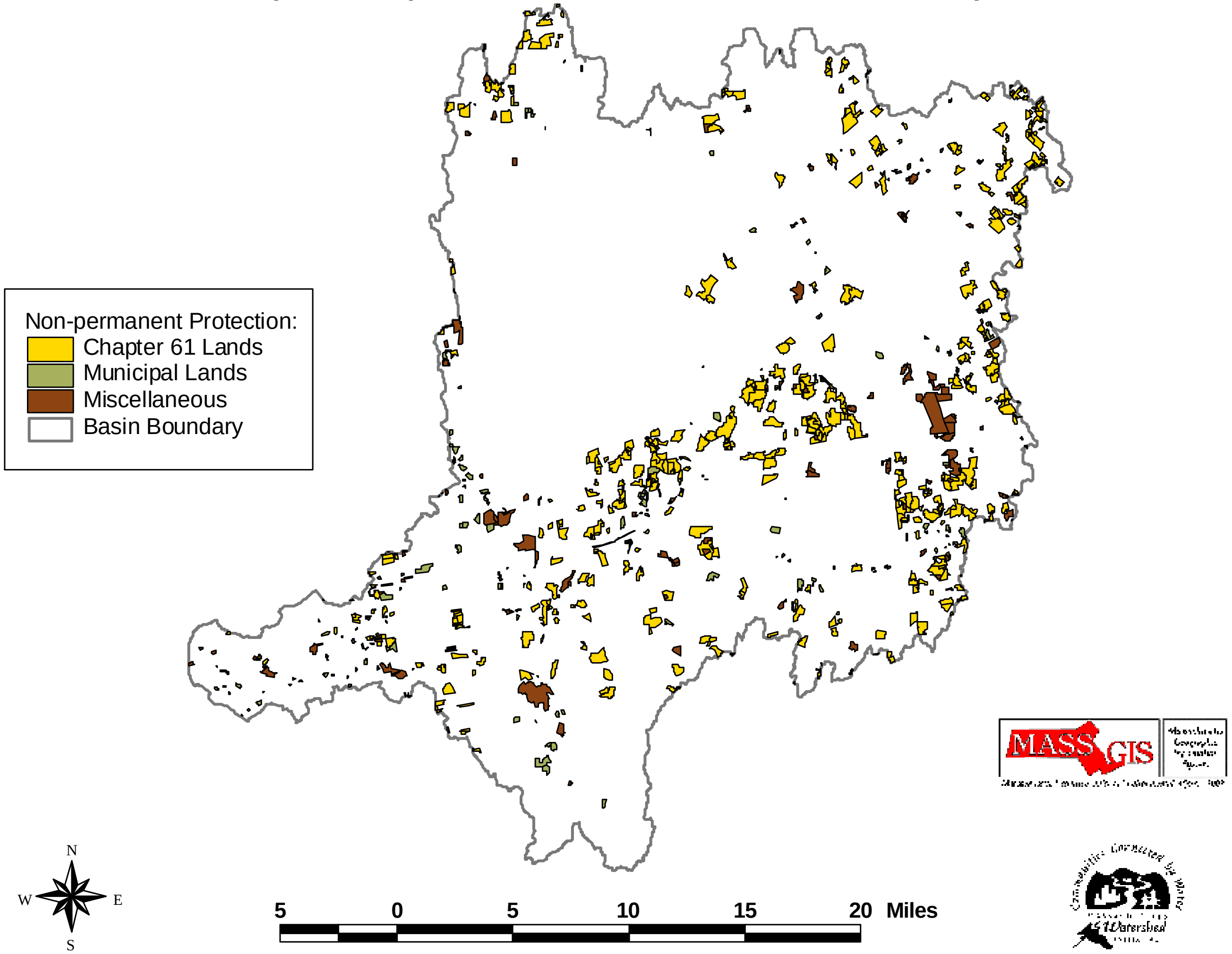
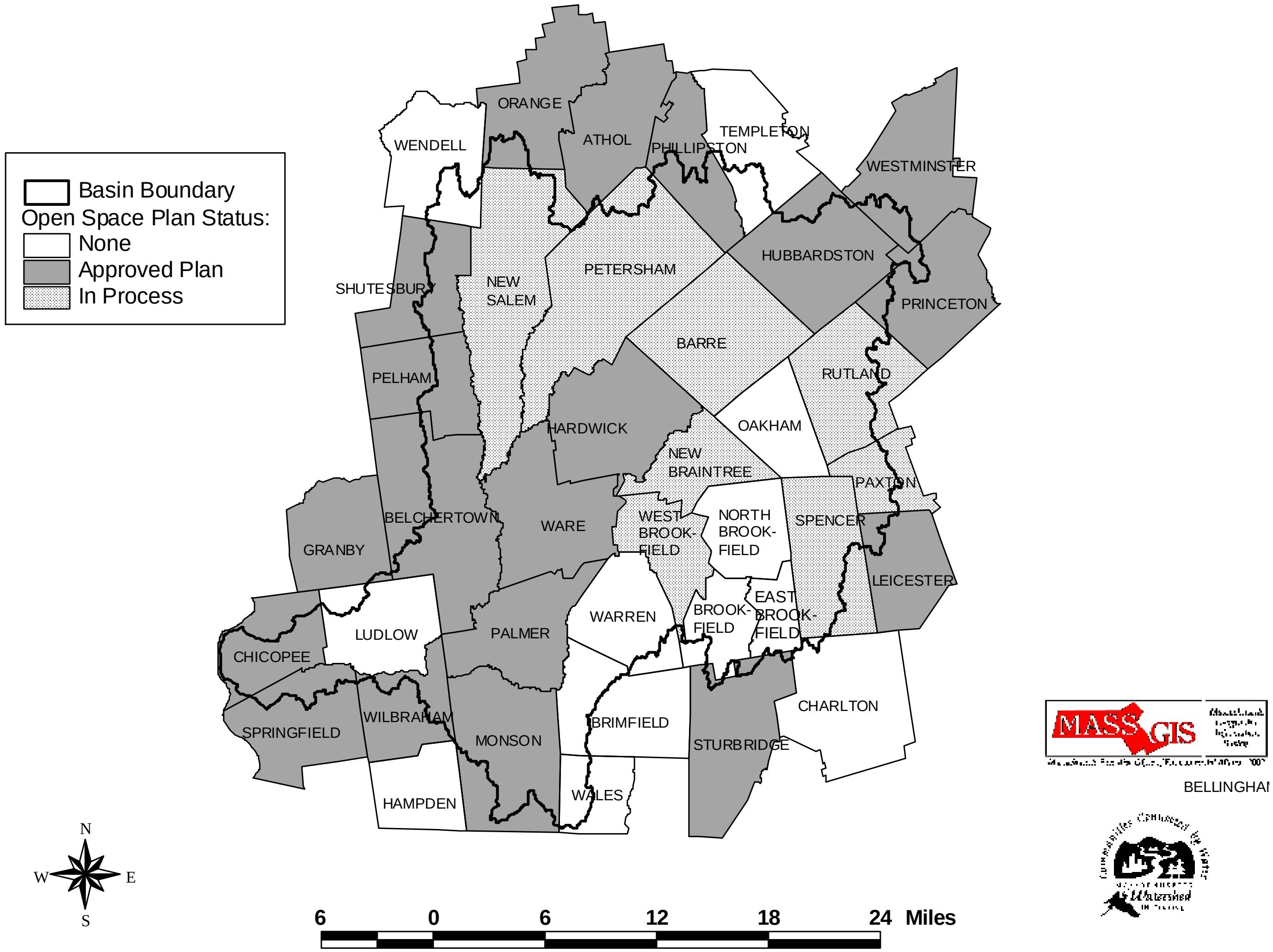


Table 35. Status of open space plans in Chicopee River basin communities (as of 2/02). (20 of 39 (51%) with approved plans or recent drafts)

TOWN	PLAN STATUS	COMMENTS
Athol	Aug-05	
Barre	Expired Plan	updating ?
Belchertown	Jul-06	COND ADA, maps..
Brimfield	Expired Plan	exp 1/95
Brookfield	Expired Plan	no plan
Charlton	Expired Plan	expired 12/01
Chicopee	Jul-2005	COND ADA, inv, maps
E. Brookfield	Expired Plan	no plan
Granby	Jun-02	strong draft 10/24/01
Hampden	Expired Plan	draft 8/00
Hardwick	Feb-02	
Hubbardston	Apr-06	COND ADA, ltrs
Leicester	Aug-2004	
Ludlow	Expired Plan	exp 11/01
Monson	april 2004	
New Braintree	Expired Plan	no plan
New Salem	Expired Plan	exp jun-93
North Brookfield	Expired Plan	expired mar-00
Oakham	Expired Plan	no plan
Orange	Apr-06	
Palmer	Sept-04	
Paxton	Expired Plan	no plan
Pelham	Jun-02	U/R 1/2/02
Petersham	Expired Plan	working?
Phillipston	Mar-2006	
Princeton	Aug-05	
Rutland	Expired Plan	exp 11/01
Shutesbury	May-05	great plan
Spencer	Expired Plan	draft 6/98
Springfield	Oct-02	
Sturbridge	Jul-2004	
Templeton	Expired Plan	exp. may-92
Wales	Expired Plan	no plan
Ware	May-2003	COND
Warren	Expired Plan	no plan
Wendell	Expired Plan	Update in process
West Brookfield	Jun-02	U/R 1/4/02
Westminster	Apr-2004	COND
Wilbraham	Aug-2004	

KEY to PLAN STATUS:
Expired Plan - plans are approved for a 5 year period which has expired
Draft - plan not yet approved; only in draft stage
COND - plan is substantially complete and will be finally approved once outstanding documents are submitted
Date Given - plan expires on the last day of that month

Figure 51. Status of Open Space Plans in Chicopee River Basin communities (as of 2/02).



on the buildout results were delivered during spring and summer of 2001. By January of 2002, 12 communities in the Chicopee River basin had completed the necessary agreements and paperwork to take advantage of the $30,000 in planning services (Belchertown, Brimfield, Granby, Ludlow, Orange, Palmer, Shutesbury, Spencer, Templeton, Wendell, West Brookfield, and Westminster).

Other communities already had current master plans in place, or were in the process of developing or updating them when EO 418 was announced. Those communities were eligible to use the planning resources for implementation of their master plans.

In addition to the above forms of assistance provided for planning in basin communities, the MDC (now DCR) also provides Technical Assistance Grants (TAGs) to municipalities within the Quabbin or Ware River Watersheds for planning. Communities that have received TAGs in recent years include Rutland, Shutesbury, Petersham, Wendell, New Salem, and Paxton. These grants have been used for the development of comprehensive or master plans, open space plans, wastewater planning, and in one case, for the hiring of a planning agent for the town. These grants provide much-needed planning assistance, especially to the smaller communities in the basin, which often lack the staff or resources to develop those plans on their own.

F. Outreach

Outreach to basin communities and residents regarding environmental and watershed issues is presently accomplished in various ways. Former watershed team members and their respective agencies or organizations collectively accomplished much of this outreach, in the form of presentations, displays, newsletters, brochures, websites, field trips, etc. Agencies and organizations that are particularly active with outreach and education include the former MDC, DEP, DFW, and the former DEM as well as the Chicopee River Watershed Council, The Trustees of Reservations, Massachusetts Audubon Society, Norcross Wildlife Sanctuary, the Upper Ware River Watershed Association, and others. The former WTL was also very active with outreach and education in the basin, often meeting with local environmental groups, municipal boards, school groups, and others.

Several recent (former) team activities had enhanced outreach and education in the basin. In FY 01, several thousand dollars worth of outreach materials were purchased, including a portable display board, and various promotional products (e.g., pens, water bottles, litter bags, etc., all with the MWI logo and contact information printed on them). More recently, a former team project has resulted in the purchase of a touch-screen computer monitor that is currently being set up to display the MassGIS watershed analyst tools. This will enable local residents to locate their “place” in the basin, and then follow the path of water flow through the basin from any starting point (e.g., their home).

Another former team project, being done in conjunction with the 4 other former greater Connecticut River WTLs has established a network of middle and high school classes that are interested in environmental monitoring. Training workshops, a project website, an equipment loan program, and a means of data sharing have all been (or are in the process of being) established. That project will greatly enhance outreach and education by providing information, training, and coordination of school-based monitoring of water quality, macroinvertebrates, and invasive species.

Much remains to be done in regards to outreach and education in the basin. For example, contacts and relationships with school groups, local chambers of commerce, businesses, and additional town boards and commissions need to be established and/or strengthened. There is also a need for greater coordination among the various agencies and organizations involved in environmental education in the basin. To facilitate the latter, efforts are currently underway to establish Regional Environmental Education Alliances (REEAs) throughout the state, including one in the eastern portion of the Chicopee basin. The former WTL also met and communicated with existing REEA that serves the western portion of the basin. One possible project that may emerge from that association is the establishment of an environmental education center in the Chicopee River Business Park.

G. Local Capacity Building

Since the inception of the former MWI in the Chicopee River basin in 1998, the need for capacity building among the watershed organizations and municipal boards and commissions in the basin has been clearly articulated. Of the 3 watershed associations that operate in the basin, none has paid staff. All 3 depend on volunteers to run field trips, produce newsletters, maintain mailing lists, and perform the other duties of the organizations. All 3 also operate out of the homes of their directors; none has an office space in which to keep organization records or have a telephone or answering machine.

An analogous situation exists with many municipal boards and commissions in the basin. Almost ¾ of basin communities have fewer than 10,000 residents, and more than half of those have fewer than 5,000 residents. As is the case with many small towns in western and central Massachusetts, town boards and commissions are staffed entirely by volunteers. Few communities in the basin have paid staff to assist with the very important environmental protection work performed by conservation commissions, boards of health, or planning boards.

Capacity-building among the environmental organizations and municipal boards in the basin continues to be a challengey.

H. Recreation

Outdoor recreation is an important part of watershed education and stewardship since it holds the potential for "connecting" people with the outdoor world. Such connections can play an important role in developing a sense of understanding and concern about environmental conditions. A number of outdoor recreational opportunities, as well as needs, have been identified in the Chicopee River Basin.

The abundance of lakes, ponds and waterways in the Chicopee provide for some excellent water-based outdoor recreation opportunities. Further, the large blocks of protected open space, much of which is open to passive recreation, provides additional opportunities. The exceptional fishing, hiking, and wildlife viewing available at the Quabbin Reservation make it one of the most popular outdoor destinations in southern New England. However, many other parts of the basin, including many small local gems of protected open space, also offer superb outdoor recreational opportunities.

Given the large acreages of undeveloped land and the variety of habitat conditions, hunting is a very popular activity in the basin. This activity is greatly enhanced by the numerous wildlife management areas managed by DFW (see Figure 37) and the state forestlands managed by DEM (now DCR) (see Figure 35). The former also provides additional recreational opportunities such as wildlife viewing, hiking, and field trials for hunting dogs. The latter are also popular for hiking, cross-country skiing, and other outdoor activities.

Fishing is also very popular in the Chicopee River Watershed, given the variety of aquatic habitats available (e.g., Quabbin Reservoir reaches depths of 150 feet and has produced landlocked salmon in excess of 20 pounds; the Swift River below the Quabbin Reservoir provides a relatively constant flow of clear cold water year-round, and is thus well-known and well-used as a trout fishery; a number of shallower waterbodies provide excellent warmwater fishing opportunities). Still, fish consumption advisories for Powder Mill Pond, Quabbin Reservoir, Quaboag Pond, and Quacumquasit Pond (in addition to the statewide advisory for mercury) are of concern.

River and lake-based recreation (boating, swimming, etc.) are also popular in the basin, and the 15 public boat launches in the basin (see Figure 34 and Table 20) are well used. These launch areas are mostly on lakes, ponds, or impoundments; however, only 2 provide access to rivers. Although there are many more private or informal access points to the basin's waterways, public access would be greatly enhanced by providing additional developed boat launch sites, especially along rivers and larger streams and brooks.

Swimming occurs in a number of the basin's waterbodies, although the number of state-owned swimming areas is somewhat limited. DEM (now DCR) operates swimming areas at Chicopee State Park, Lake Lorraine State Park and Rutland State Park (in addition to 2 pools), and MDC (now DCR) maintains a swimming beach at Comet Pond in Hubbardston. Most other public swimming occurs at town beaches.

Camping in the basin occurs mainly at private campgrounds. Only one public camping area is located in the basin, and that occurs at an unstaffed site (i.e., the Federated Women's Club State Forest in Petersham). Additional public camping opportunities are desirable.

V. Data Gaps and Assessment of Data Quality

The availability and quality of data used to assess conditions in the Chicopee River basin are variable. In general, and with some exceptions, information on physical and social characteristics is relatively abundant and fairly reliable. Notable exceptions include soils and hydrology data, both of which are lacking somewhat. Soils data for most of the four counties in which the Chicopee is located is available from the Natural Resources Conservation Service (NRCS), but is not yet available through MassGIS (which would allow it to be characterized and summarized for the basin). Good hydrologic data is available for the main rivers in the basin, and for some of their tributaries. However, only limited hydrology data is available for most of the subwatersheds in the basin.

In some cases (e.g., for cultural/historic resources, or for local infrastructure) the information is available, but just needs to be compiled. Much of this data collection and compilation will occur during the next 5-year basin cycle.

Data gaps are most pronounced for certain ecological characteristics, including animal and habitat data, and water quality conditions. The latter is of particular concern since the quality of the water flowing through and out of the basin is often considered to be a reflection of its overall environmental condition or health. Water quality data is collected by a number of organizations and agencies in the Chicopee River basin, but not in a basin-wide coordinated way. Further, no standard sampling protocols are followed by the various entities involved in data collection. Thus, even when data is collected, it cannot always be used for assessment or comparison purposes. As a result, our ability to characterize water quality conditions throughout the basin is limited.

VI. Summary of Priorities, Conclusions, and Next Steps

This report represents the first time that a comprehensive watershed assessment has been conducted for the Chicopee River basin. In addition to compiling significant amounts of information from a variety of sources, it also serves to identify the areas in which additional data collection is necessary. Further, it forms the basis for the 5-year "Watershed Action Plan" (WAP) that will soon be developed for the basin. That WAP constitutes the main "next step" that will follow the release of this assessment report.

Two main conclusions arise from this assessment. First, it is clear that *additional data collection and assessment work are needed in the basin*. However, limitations in state resources that are available to do this additional data collection leads to the second conclusion – i.e., *local organizations and municipal boards must play a greater role in assessing watershed conditions and needs, and ways must be found to increase their capacity to do so*.

Despite the substantial amount of information that is available (and summarized in this report) about the basin, much of it is simply descriptive information about physical or social conditions. Relatively little reliable information is available that allows for a comprehensive assessment, especially of environmental conditions. This is true both basin-wide, and, even more so, for individual subwatersheds. Much of the water quality and hydrology data that is presently collected in the basin is done so along the major rivers (e.g., DEP's SMART monitoring sites are located near USGS gaging stations on the Ware, Swift, and Quaboag Rivers). While this allows for general assessments of conditions in those major drainage areas, they generally do not allow for the assessments of particular problem areas or hot spots.

The subwatershed modeling approach used in this report (see Section IV.B.3) is a first step in providing a "finer resolution" to watershed assessment. However, there are limitations to this method, since it relies on the use of land cover conditions, and generalized relationships between specific land uses and associated water quality produced by those uses. Such analyses are useful in providing a general overview of conditions in the basin, but they should be followed up with actual field data collection, both to verify the model predictions and to help identify the sources of any water quality degradation that is either predicted or documented.

Some of this field data collection is already occurring in the basin, as a result of several priority projects that have been funded by EOEA in the past few years. For example, the University of Massachusetts has been collecting water quality data from 9 sites, along with additional GIS modeling aimed at characterizing the hydrologic processes and the relative influence of various sub-drainages on water quality conditions in the basin. ESS is now conducting their third project in the basin, all of which have, or will, provide water quality data from various locations in the basin. Such data collection will continue to be a priority in future priority project proposals as well.

Efforts must also continue to identify sources of environmental degradation in the basin. The land use based modeling described earlier identified a handful of subwatersheds that are predicted to have high imperviousness and/or pollutant loads. Future fieldwork will focus on these subwatersheds and attempt to identify pollutant sources as well as opportunities for mitigation. Other subwatersheds may not have ranked very high in imperviousness or pollutant loads in the modeling but might still have water quality problems. Thus, data collection efforts should continue throughout the basin.

Stream teams provide a great means of doing initial assessments of subwatersheds as well as promoting local involvement and stewardship.

Additional data collection and assessment work should also be focused on the biological resources of the basin. This work should begin in 2003, when the basin will be in Year 2 of the 5-year basin cycle, and thus DFW will be conducting fish habitat assessments in the Chicopee. Funding is needed for rare species surveys, initially concentrating on rare mussels. The survey work should continue in the future, expanding to other parts of the basin and to other species or groups of organisms. The "AquaMap" project should also provide useful information on the biological resources of the basin.

The second conclusion identified above relates to capacity building among the various environmental groups, organizations, and municipal boards in the basin. Success in moving environmental protection in the basin to the next level will largely depend on the active involvement of those stakeholders in assessment, mitigation, and protection efforts. However, many of these groups do not presently have the resources, training, or other capacity to be active and effective partners in the watershed. New ways of building the capacity of these stakeholders is crucial.

Capacity-building of watershed stakeholders can take various forms. While the ideal goal would be to have strong, well-trained, staffed, and funded organizations and boards, this is unlikely to occur in the foreseeable future. Recent budget cutbacks on the state level have eliminated capacity-building grant programs that were previously available. Also, personnel cutbacks will result in the loss of “circuit rider” positions that are presently providing assistance to conservation commissions in the basin. Thus, it will be important to find other, more creative ways to support and build capacity among watershed partners.

Many watershed organizations successfully operate on a volunteer basis because of the dedication and commitment of their members. The most successful often have one or more leaders who are particularly dedicated and knowledgeable, and possess enough “people skills” to build and maintain a high level of motivation and output from other members. Oftentimes, the best way to build capacity in volunteer organizations is to find and recruit such leaders.

Access to resources is also important for environmental groups, and those resources can take many forms. Sometimes “access to information” is of great value in itself. Such information might be related to grant opportunities, training sessions, technical assistance, or even contact information for people who have been successful in building other organizations, and thus can provide guidance and encouragement. By their very nature, representatives on the former watershed teams represent a wealth of potentially useful information that can be shared, both among former team members and with other watershed stakeholders.

To a limited extent, the former Chicopee team members can provide some basic organizational support to some watershed groups. For example, assistance has been provided to several organizations with newsletter production, mailing lists, map production, and other support services. These options hold particular potential for capacity building since they typically involve outreach and/or education, which can result in greater involvement of existing, or recruitment of new members. The GIS capabilities available to EOEA could be of particular value to certain organizations, and especially to municipal boards and commissions in the basin.

The need for additional data collection and for capacity-building discussed above also represents 2 of the main priorities in the Chicopee River basin. Data collection and assessment should be organized on a subwatershed basis, and focus on water quality conditions, identification of the sources of environmental degradation, and water use and movements in and out of the subwatersheds. Assessments of both the present and long-term infrastructure needs in basin communities should also be a priority. Capacity-building should focus on both environmental organizations (e.g., watershed associations, and lake and pond groups) and municipal boards and commissions (e.g., conservation, health, and planning).

A third priority relates to outreach and education. In general, there should be a continued effort to “***do more outreach, more frequently, and to more people***”. One way to do this is through establishment of watershed newsletters and regular articles in local media. Many of the decisions that affect the quality of the watershed environment are made by the local people. The best decisions are those that are made with the benefit of good information, and providing that information to decision makers in the basin should always be a high priority.

Mitt Romney
Governor

Kerry Healey
Lt. Governor

Ellen Roy Herzfelder
Secretary

Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
Boston, MA 02114

(617) 626-1000
www.state.ma.us/envir

Mr. Fred Ayer, Executive Director
Low Impact Hydropower Institute
34 Providence Street
Portland, ME
04103

RE: Red Bridge Project (FERC No. P-10676)

Dear Mr. Ayer:

The Department of Fish and Game ("DFG") hereby submits the following comments on the Low Impact Hydropower Institute's ("LIHI") Pending Application for the proposed LIHI certification of North American Energy Alliance, LLC's ("NAEA") Red Bridge Project. The project is located on the Chicopee River in the Towns of Wilbraham, Ludlow, Palmer and Belchertown in Hampden and Hampshire Counties, Massachusetts.

DFG is submitting these comments to LIHI in order to fulfill the requirements of the Massachusetts Department of Energy Resources ("DOER") Renewable Energy Portfolio Standard Regulations (225 CMR 14.00; "RPS I" and 225 CMR 15.00; "RPS II"). The RPS I and RPS II regulations were promulgated by DOER on January 1, 2009 and require that any hydroelectric project wishing to qualify as either a RPS I or RPS II generator first obtain LIHI certification. These regulations also require all relevant regulatory agencies to comment on the pending LIHI application.

The Department does not support NAEA's application for LIHI Certification of the Red Bridge Hydroelectric Project for the reasons outlined below.

PROJECT

The project includes a dam with a crest elevation of 272.3' (NGVD), a canal headgate house, a power canal, two operating penstocks, a powerhouse with two generating units, a tailrace channel (normal tailrace elevations 222.7') and appurtenant facilities. The project creates a bypass reach approximately 1,600 feet long.

At normal pond elevation, the Red Bridge Project impoundment extends approximately 1.8 miles upstream of the dam with a maximum surface area is approximately 185 acres at El. 272.3'. Although the permitted storage is approximately 530 acre-feet and the permitted daily drawdown is two feet except during annual energy audits and system emergencies when a drawdown of as much as three feet may be used, the Project uses only one foot of its drawdown and 185 acre-feet of its storage.

The Red Bridge project is situated upstream of five other hydroelectric facilities located on the Chicopee River and downstream of other dams on the Ware, Swift and Quaboag Rivers.

FISH AND WILDLIFE RESOURCES

The Chicopee River is the largest drainage basin in Massachusetts (721 square miles). The River is formed where its three tributaries, the Swift, the Ware, and the Quaboag, meet in Palmer. The Swift River's three branches were impounded in 1938 to form the Quabbin Reservoir. The upper section of the Ware River is also seasonally diverted into the Quabbin Reservoir. Operation of the Quabbin Reservoir has lead to significant flow alteration in the Chicopee River.

The fish of the Chicopee River include microhabitat generalists species such as chain pickerel, bluegill, golden shiner, largemouth bass and smallmouth bass; fluvial species such as white sucker, common shiner; and tessellated darter. The only migratory fish found upstream of the first dam on the system (Dwight dam) is the American eel. Anadromous fish such as American shad, Blueback herring and sea lamprey are present downstream of the Dwight dam. The 2009 publication "Development of Target Fish Community models for Massachusetts Mainstem Rivers" determined that fish species expected to be abundant in the Chicopee river (fallfish, common shiner, blacknose dace, white sucker, and longnose dace) are at low abundance or absent from existing fish survey data.

IMPACTS AND MITIGATION

FLOWS

Run-of-river Operation

The project does not operate as a run-of-river project. The project operated in a "limited pond and release mode" which raises and lowers the impoundment by one foot on a daily basis. This mode of operation also results in unnatural flow variations in the Chicopee River downstream of the project.

Bypass reach

The project's FERC license guarantees that a minimum flow of 237cfs or inflow is released into the project's 1,600 foot long bypass reach. This flow was recommended in 1989 by the USFWS. The flow is either the estimated median August flow and represents 0.36 cfsm (cfs per square mile of drainage area). This flow is not representative of a natural flow regime and is not appropriate as a year round flow requirement.

FISH PASSAGE

The project has no fish passage requirements.

COMMENTS

The Department does not support NAEA's application for LIHI Certification of the Red Bridge Project.

This project, with its daily peaking operations and impoundment, contributes to changes to the nature of the Chicopee River and cannot be described as "Low Impact".

Likewise a minimum flow of 237cfs in a 1,600 foot long section of the Chicopee River cannot be described as “Low Impact”.   Using summer flows for a year round prescription subjects fish and wildlife resources to year round low flow conditions and does not reflect the current state of knowledge for instream flow requirements.

The Department opposes LIHI certification of this project until such time as this project is operated in a significantly more environmentally sensitive manner.

Thank you for this opportunity to comment.

Sincerely,

Caleb Slater, Ph.D.
Anadromous Fish Project Leader

APPENDIX C

Red Bridge Project

Fish Passage and Protection

The Facility is in compliance with mandatory fish passage prescriptions for upstream and downstream passage of anadromous and catadromous fish issued by resource agencies after December 31, 1986.

Section 30(c) of the Federal Power Act and Section 408 of the Energy Security Act require the inclusion in the Red Bridge exemption from licensing, all terms and conditions that are prescribed by state and federal fish and wildlife agencies to prevent loss of, or damage to fish and wildlife resources.

With respect fish passage and protection, the FWS specifically mandated the following conditions:

- The Exemptee agreed to construct, maintain and monitor upstream and downstream fish passage when prescribed by the FWS and/or MDFW. The Exemptee agreed to be responsible for the designs of the fish passage facilities which shall be developed in consultation with, and be approved by, the FWS, MDFW and the Connecticut River Atlantic Salmon Commission (CRASC). Furthermore, the Exemptee agreed to construct and have operational upstream and/or downstream passage facilities within two years after being notified of their need by the FWS and/or the MDFW.

- The Exemptee agreed to develop plans for monitoring, maintaining and operating the upstream and downstream fish passage facilities in consultation with FWS, MDFW and CRASC. Within two years after being notified of the need for passage facilities, these plans shall be finalized and approved.

- The FWS reserved the right to add and/or alter these terms and conditions as appropriate in order to carry out its responsibilities with respect to fish and wildlife resources. The Exemptee agreed, within 30 days of receipt, to file with the Commission any additional or modified mandatory terms and conditions.

- The Exemptee agreed to incorporate the aforementioned fish and wildlife conditions in any conveyance; by lease, sale or otherwise; of its interests so as to legally assure compliance with said conditions for as long as the Project operates under an exemption from licensing.

To date, the Exemptee has not been notified by the FWS[1] and/or MDFW of the need to construct and have operational within two years upstream and/or downstream passage facilities.

Right Side of Ice Sluice

[1] On September 17 and 19, 2011, MDEP and FWS, respectively, were asked if the Project was in compliance with its Fish Passage and Protection. Both entities responded that the Project was in compliance and, despite the fact the agencies could request appropriate passage at any time, there were no pending agency request for passage.


DAVENPORT

FEDERAL ENERGY REGULATORY COMMISSION
Office of Energy Projects
Division of Dam Safety and Inspections – New York Regional Office
19 West 34th Street, Suite 400
New York, NY 10001
Telephone No. (212) 273-5900 **Fax No. (212) 631-8124**

In reply, refer to:

P-10676-MA Red Bridge
NATDAM No. MA00723

Construction Authorization
Canal Wall

October 3, 2012

Mr. Kim C. Marsili
NAEA Energy Massachusetts, LLC
15 Agawam Avenue
West Springfield, MA 01089

Dear Mr. Marsili:

By letter dated September 24, 2012, your Consultant submitted construction documents to raise the canal wall to elevation 287.9 feet. Raising the canal wall was recommended by the Part 12 Consultant to mitigate the results of a potential gatehouse failure by preventing water from flowing along the south embankment groin, jeopardizing the embankment's stability. The following documents were included in your Consultant's submittal:

- Construction Drawings and Specifications.
- Quality Control and Inspection Program (QCIP).
- Soil Erosion and Sediment Control Plan.

According to your Consultant, the existing bridge is owned by the Town of Wilbraham and they have accepted the proposed modifications to the wall as it connects to the bridge foundation. No canal draw down will occur during construction.

Our review of these documents did not find any significant deficiencies or errors that would affect the safety of project structures or adequacy of project works to perform their intended functions. Therefore, you are authorized to proceed with construction at the Red Bridge embankment once you have obtained all necessary permits.

If during the design and construction process, the plans and specifications are revised, it is your responsibility to assure these changes are properly coordinated between the design engineer, the QCIP manager, FERC and yourself. Also, if any changes are made that require a change in operation of the project it is your responsibility to assure these changes are properly coordinated with the FERC-D2SI New York Regional Office. You are reminded that no changes to operation of the project can be made until they are authorized by the Regional Engineer.

Please note within 45 days of completion of construction you are to submit to this office a letter with the following certifications (notarized in accordance with 18 CFR Part 12, Paragraph 12.13 of the Commission's Regulations):

- A certification by the Design Engineer that the project was constructed in accordance with the design intent.
- A certification by the Quality Control Manager that the results of the inspection and testing program results in a conclusion that the project was constructed in accordance with the plans and specifications.
- A certification from the Licensee that the construction fulfills the design intent and was constructed in accordance with the plans and specifications reviewed by FERC.

Within 45 days following completion of construction you must submit a final construction report using the enclosed outline (**Enclosure 1**). Additionally, within 90 days of completion of construction you shall file for Commission approval, with a copy to this office, revised exhibit A, F & G drawings as applicable.

Your continued cooperation is appreciated. In the interim should you have any questions, please contact Mr. Chung-Yao Hsu at (212) 273-5914.

Sincerely,

Gerald L. Cross, P.E.
Regional Engineer

Enclosure No. 1

FINAL CONSTRUCTION REPORTS FROM LICENSEES

The Licensee should submit a final construction report within 90 days from the completion of work. This report should include all information pertinent to the dam safety in a concise form, should be included by the Licensee in the project file and it should be given to the independent consultant for his safety inspection and analyses, if applicable.

As such, the report should contain a summary of information in each of the applicable sections indicated below (the information was previously presented in the monthly reports). Tabular form for test result presentation with indication of applicable standard is recommended for conciseness. If certain sections are not applicable, skip them. Include construction difficulties under sections where it applies.

1. General. Briefly present the reason for construction and description of work with dates of beginning and end of construction. Include reservoir drawdown and filing dates, any findings regarding the original structure.

2. Foundations. Present specifically condition of foundation (faults, etc.) When uncovered, and foundation treatment. Attach foundation mapping.

3. Embankments. Describe the equipment, type of materials used in filters and fills, attach gradation and compaction requirements and all test results.

4. Concrete work. Describe equipment and materials, include all concrete and grout test results, describe surface treatments.

5. Anchors. Present summary of drilling operation including boring logs; results of water pressure tests; anchor design calculations, design loads, specification; results of grout test; results of proof and performance tests; and summary of acceptance criteria.

6. Instrumentation. Present plots of existing instrumentation readings during the construction, if the readings are affected. Include details, compete schedule, plan of calibration/reading of all new instrumentation.

7. Drawings. Attach as-built drawings reduced in size to 8.5"x11" or 11"x17". The drawings should include plan, section and details of the structure affected by the new work. Any new instrumentation should be shown on plan and sections.

Document Content(s)

Essential Power Letter, dated March 22, 2013 is a CEII Protected document. As such, it is referenced here but not attached here. The description the operations of the Red Bridge Project with respect to LIHI issues is accurate; however, since the letter contains dam safety information, the letter is given confidential treatment.

Kleinschmidt

March 26, 2013

VIA E-FILING

Mr. Gerald Cross, Regional Engineer
Federal Energy Regulatory Commission
19 W 34th Street, Suite 400
New York, NY 10001

Red Bridge Hydroelectric Project, FERC No. 10676-001
Canal Wall Extension Project
Post Construction Filing

Dear Mr. Cross:

On behalf of Essential Power Massachusetts, LLC, Kleinschmidt Associates submits to the Federal Energy Regulatory Commission, New York Regional Office (NYRO) the attached notarized Cover Letter, Construction Report, and revised Exhibit F (Sheet 1 of 5) for the Red Bridge Hydroelectric Project (FERC No. 10676-001). The three attachments contain Critical Energy Infrastructure Information and all are labeled as such. Additionally, the revised Exhibit F (Sheet 1 of 5) drawing will be filed with the Secretary, FERC.

As described in previous letter and attachments, and approved by letter from you dated October 3, 2012, Essential Power Massachusetts, LLC has completed construction of a canal wall extension at the Red Bridge Development. In conformance with the guidelines set forth by NYRO, this letter is provided to confirm completion of the above referenced project. With its signatures and attachments it also confirms that construction fulfills the design intent and was constructed according to the approved plans.

Should you have any questions or comments regarding this letter and attachments, please feel free to contact me at (207) 416-1286 or eric.turgeon@kleinschmidtusa.com.

Sincerely,

KLEINSCHMIDT ASSOCIATES

Eric Turgeon
Project Manager

EMT:NC
Attachments: Notarized Cover Letter
Construction Report
Revised Exhibit F (Sheet 1 of 5) - Red Bridge Development

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Document Content(s)

APPENDIX D

Red Bridge Project

Watershed Protection

The Facility is in compliance with both state and federal resource agencies recommendations for a license-approved shoreland management plan regarding protection, mitigation or enhancement of shorelands surrounding the project.

In 1992, Commission staff determined that excavation for the construction of the minimum flow powerhouse could increase the potential for erosion and sedimentation and result in short-term turbidity for the duration of the construction. For these reasons, Article 14[1] was included to ensure that the Exemptee, before engaging in any ground disturbance, would take protective measures to minimize erosion and sedimentation associated with the construction of the minimum flow unit powerhouse.

In 1999, the Exemptee proposed to install an automated slide gate at the spillway instead of a minimum flow generation unit at the spillway. The new slide gate would be capable of releasing the required minimum flow from a single point on the spillway during full and low pond

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[1] Article 14 states that "At least 90 days before the start of any land-disturbing, land-clearing, or spoil-producing activities, the Exemptee shall file with the Commission for approval, and with the New York Regional Office, a plan to control erosion, to control slope instability, and to minimize the quantity of sediment resulting from project construction and operation.

"The plan shall be based on actual site geological, soil, slope, drainage, and groundwater conditions and on project design, and shall include, at a minimum, the following four items: (1) a description of the actual site conditions; (2) measures to control erosion, to prevent slope instability, and to minimize the quantity of sediment resulting from project construction and operation; (3) detailed descriptions, functional design drawings, and topographic map locations of all control measures; and (4) a specific implementation schedule and details of monitoring and maintenance programs for the project construction period and for project operation.

"The Exemptee shall prepare the plan after consultation with the Soil Conservation Service and the Massachusetts Division of Fisheries and Wildlife. The Exemptee shall include with the plan documentation of consultation with the agencies and copies of agency comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the plan accommodates all of the agency comments and recommendations. The Exemptee shall allow a minimum of 30 days for the agencies to comment and make recommendations prior to filing the plan with the Commission. If the Exemptee does not adopt a recommendation, the filing shall include the Exemptee's reasons, based on geological, soil, and groundwater conditions at the site.

"The Commission reserves the right to require changes to the plan. No land-disturbing or land-clearing activities shall begin until the Exemptee is notified by the Commission that the plan is approved. Upon Commission approval, the Exemptee shall implement the plan, including any changes required by the Commission."

conditions. CEEI indicated in its December 6, 1999 letter that the use of a new slide gate at the spillway was also acceptable to both the FWS and the MADFW. Since the proposed automatic slide gate was not authorized by the subject order, CEEI was required to fulfill the measures delineated by Article 14 before proceeding with its proposed installation. These measures required CEEI to file, for Commission approval, an erosion control plan[2] before the start of any land-disturbing, land-clearing or spoil-producing activities at the project. In addition, the development and implementation of the erosion control plan minimized any adverse impacts of slide gate installation on water quality and fishery resources.

[2] Although no explicit FERC approval of an erosion control plan could be found in the Essential Power, FERC or MHC files, a Soil Erosion and Sedimentation Control Plan was located on pages 197 to 201 of Appendix D-1. Since the Soil Erosion and Sedimentation Control Plan was incorporated into the bid document for the installation of the automated slide gate, it can be inferred that the plan would have been complied with during the construction of the automated slide gate.

Kleinschmidt

Energy & Water Resource Consultants

FILED
OFFICE OF THE SECRETARY
01 MAR 22 PM 12:02
FEDERAL ENERGY
REGULATORY
COMMISSION

March 19, 2001

Mr. Anton Sidoti
Federal Energy Regulatory Commission
New York Regional Office
19th West 34th Street – Suite 400
New York, NY 10001

FERC - NYRO
RECEIVED
MAR 20 2001
NEW YORK, NY

FERC Project No. 10676 - Mass.
Red Bridge Project
Installation of a Minimum Flow Gate

Dear Mr. Sidoti:

Consolidated Edison Energy Massachusetts, Inc. (CEEMI) owns and operates the Red Bridge Hydroelectric Project (FERC No. 10676) located on the Chicopee River in Ludlow, Massachusetts. The project is required to supply a continuous flow release into the bypassed river reach of 237 cubic-feet-per-second (cfs) (or inflow) to protect fisheries and other aquatic resources. The Massachusetts Division of Fish and Wildlife (MDFW) and the US Fish and Wildlife Service (USFWS) have stated that the current method of flow release is unacceptable due to the variance in the actual amount released over the spillway. To address the MDFW and USFWS concerns, CEEMI proposes to install an automated vertical slide gate at the Red Bridge Dam. CEEMI has consulted with the MDFW, USFWS and the Massachusetts Historical Commission (MHC) regarding the gate's design and function. The MDFW electronically (copy of email attached) indicated that they had no comments regarding the proposed gate. A copy of the comments received from the USFWS is attached. The MHC has not completed their review and we will forward their comments when they are received.

Article 12 of the project's exemption requires CEEMI to obtain approval from the Federal Energy Regulatory Commission (FERC) prior to commencement of construction activities of the project. In accordance with Article 12 of the exemption order, please find enclosed three (3) copies of the proposed construction information for your approval. A temporary emergency action plan (TEAP), soil erosion and sediment control plan, and a quality control inspection plan (QCIP) (including resumes) are included in the documents.

The USFWS does not object to the structure but has concerns with the gate discharge and operation. In summary the USFWS expressed concern that the proposed operation would not provide sufficient discharge during all pond levels and the more frequent gate adjustments may be warranted. We concur with the USFWS that the discharge rate needs to be conservative to reasonably ensure that the minimum discharge is provided under all pond levels. CEEMI's calculated discharge and proposed operation is based on test data from the Army Corp of Engineers (ACOE) (attached) for gate discharge coefficients, rather than on generic vendor based coefficients used during the USFWS review. Due to the relatively small change in the discharge rate at the various pond levels, CEEMI proposed to operate the gate based on 6-inch increments of pond level change. As pond levels drop to the bottom of each 6-inch increment

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75 Main Street, P.O. Box 576 • Pittsfield, ME 04967 • Phone: 207-487-3328 • Fax: 207-487-3124 • www.KleinschmidtUSA.com
– Offices Nationwide –

the gate opening would be increased to pass the required 237cfs. Conversely, when pond levels rise to the next 6-inch increment, the gate opening would be decreased to pass 237 cfs. This 6-inch increment appears to be a reasonable balance between passing excess minimum flow and constant gate operation. CEEMI intends to discuss the USFWS' gate discharge and operational concerns prior to operation of the gate. Since the gate will be controlled through a programmable logic controller (PLC), adjustment to the gate operation can occur after installation.

The USFWS requested that CEEMI provide monthly summaries of the gate operation for the first six months of operation. The USFWS also requested a mechanism to visually verify gate discharge. CEEMI intends to provide the requested monthly summaries and associated rating curve to the USFWS and MDFW. We will also work with the USFWS and MDFW to determine appropriate visual aids in the bypass area.

Construction is anticipated to be undertaken in a de-watered area behind a temporary wood and steel box cofferdam. The temporary cofferdam would be installed along the upstream face of the existing spillway by use of a shore-based crane and divers. A temporary timber diversion wall would also be placed parallel to the flow along the upper spillway face to divert water away from work areas. The cofferdam and diversion wall will be removed at the completion of installation and testing of the new gate system. We will file for approval the cofferdam scheme and details upon receipt from the selected contractor.

The construction is anticipated to occur over a period of approximately three months, weather permitting. Construction of the sluice gate will consist of mechanical removal of dam materials (concrete) to accommodate the new structure and the consequent installation of the gate. Removal will be accomplished through small equipment mounted or hand held hydraulic or air hammers. After completion of removal the new cast-in-place concrete sill and piers will be installed. Gate and operator installation would follow installation of the new concrete sill and piers.

CEEMI is soliciting installation costs for the project and state permits concurrent with this filing. The work, if approved, is anticipated to occur in the summer to early fall period. If you have any questions or need additional information, please call me at (207) 487-3328 (email: AL.Nash@KleinschmidtUSA.com).

Sincerely,
KLEINSCHMIDT ASSOCIATES

Alfred Nash, P.E.
Project Engineer

AJN:mas
Enclosure
cc (letters only): J. Warner (USFWS), C. Slater (MDFW), J. Labiak (CEEMI), K. Marsili (CEEMI), C. Molongoski (CEEMI), F. Szufnarowski (Kleinschmidt)

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10,676
Moss

HYDRAULIC DESIGN CRITERIA

SHEET 320-1

CONTROL GATES

DISCHARGE COEFFICIENTS

1. General. The accompanying Hydraulic Design Chart 320-1 represents test data on the discharge coefficients applicable to partial openings of both slide and tractor gates. The basic orifice equation is expressed as follows:

H' = ΔH - CG₀
G₀ = GATE OPENING HT. (IN FT.)
B = GATE WIDTH (FEET)
g = 32.2 FT/SEC

$$Q = C\,G_o\,B\sqrt{2gH'}$$

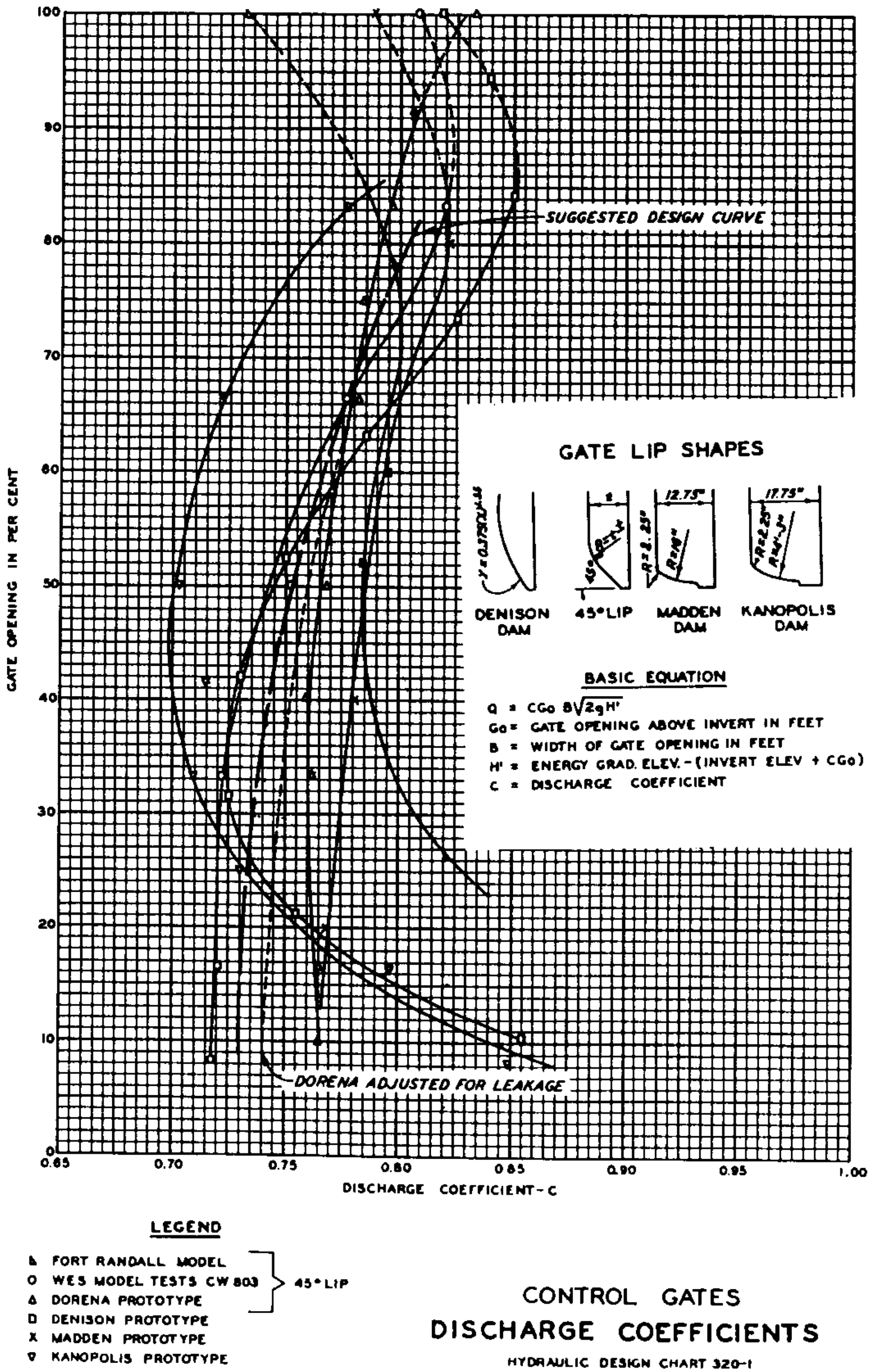
The coefficient C is actually a contraction coefficient if the gate is located near the tunnel entrance and the entrance energy loss is neglected. When the gate is located near the conduit entrance the head (H') is measured from the reservoir water surface to the top of the vena contracta. However, when the gate is located a considerable distance downstream of the conduit entrance, H' should be measured from the energy gradient just upstream of the gate to the top of the vena contracta because of appreciable losses upstream of the gate. The evaluation of H' requires successive approximation in the analysis of test data. However, the determination of H' in preparation of a rating curve can be easily accomplished by referring to the chart for C.

2. Discharge Coefficients. Discharge coefficients for tractor and slide gates are sensitive to the shape of the gate lip. Also, coefficients for small gate openings are materially affected by leakage over and around the gate. Chart 320-1 presents discharge coefficients determined from tests on model and prototype structures having various gate clearances and lip shapes. The points plotted on the 100 per cent opening are not affected by the gate but rather by friction and other loss factors in the conduit. For this reason the curves are shown by dashed lines above 85 per cent gate opening.

3. Suggested Criteria. Model and prototype tests prove that the 45° gate lip is hydraulically superior to other gate lip shapes. Therefore, the 45° gate lip has been recommended for high head structures. In the 1949 model tests leakage over the gate was reduced to a minimum. Correction of the Dorena Dam data for leakage results in a discharge coefficient curve that is in close agreement with the 1949 curve. The average of these two curves shown on Chart 320-1 is the suggested design curve. For small gate openings special allowances should be made by the designer for any expected excessive intake friction losses and gate leakage.

4. Values from the suggested design curve are tabulated below for the convenience of the designer.

Gate Opening, Per Cent	Discharge Coefficient
10	0.73
20	0.73
30	0.74
40	0.74
50	0.75
60	0.77
70	0.78
80	0.80



CONTROL GATES
DISCHARGE COEFFICIENTS
HYDRAULIC DESIGN CHART 320-1

WES 4-1-53

Consolidated Edison Energy Massachusetts, Inc.

RED BRIDGE MINIMUM FLOW GATE

Pond Elevation	Head on Gate	Minimum Gate Opening Gate Opening	% Open	Coefficient	H'	Q (cfs)
272.24	7.5	2.25	30%	0.735	6.375	235
272	7.26	2.33	32%	0.736	6.095	238
271.75	7.01	2.42	35%	0.739	5.8	242
271.5	6.76	2.42	36%	0.74	5.55	237
271.25	6.51	2.5	38%	0.74	5.26	238
271	6.26	2.58	41%	0.743	4.97	240
270.75	6.01	2.67	44%	0.746	4.675	242
270.5	5.76	2.67	46%	0.748	4.425	236
270.24	5.5	2.75	50%	0.753	4.125	236

Coefficient derived from ACOE Hydraulic Design Criteria Sheet 320-1

Gate Width 7
Gate Sill 264.74

Pond Elevation	Head on Gate	Adjusted Gate Opening Gate Opening	% Open	Coefficient	H'	Q (cfs)	Final Gate Opening
272.24	7.5	2.33	31%	0.735	6.335	242	2'-4"
272	7.26	2.33	32%	0.736	6.095	238	2'-4"
272	7.26	2.42	33%	0.736	6.05	246	2'-5"
271.75	7.01	2.42	35%	0.739	5.8	242	2'-5"
271.5	6.76	2.42	36%	0.74	5.55	237	2'-5"
271.5	6.76	2.58	38%	0.74	5.47	251	2'-7"
271.25	6.51	2.58	40%	0.74	5.22	245	2'-7"
271	6.26	2.58	41%	0.743	4.97	240	2'-7"
271	6.26	2.67	43%	0.743	4.925	247	2'-8"
270.75	6.01	2.67	44%	0.746	4.675	242	2'-8"
270.5	5.76	2.67	46%	0.748	4.425	236	2'-8"
270.5	5.76	2.75	48%	0.748	4.385	242	2'-10"
270.24	5.5	2.75	50%	0.753	4.125	236	2'-10"

Coefficient derived from ACOE Hydraulic Design Criteria Sheet 320-1

Gate Width 7
Gate Sill 264.74

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-0104

REF: FERC No. 10676
Red Bridge Hydroelectric Project

March 13, 2001

Alfred Nash, P.E.
Kleinschmidt Associates
75 Main Street, P.O. Box 576
Pittsfield, ME 04967

Dear Mr. Nash:

This responds to your January 24, 2001 letter regarding installing a minimum flow gate at the Red Bridge Project, located on the Chicopee River in Massachusetts. The vertical slide gate will be used to pass the required 237 cfs bypass flow. Presently the minimum flow is passed via uniform spill across the crest of the dam.

Based on the information contained in your letter, the accompanying design plans, and additional information furnished at our request, our understanding of the slide gate system is as follows:

- The slide gate is 7.5-ft. high and 7-ft. wide. The invert is at elevation 264.74, and the dam crest is at elevation 272.24.

- The automated slide gate will be tied into a headpond level sensor system. The Programmable Logic Control (PLC) system will adjust the gate for every six inches of pond level change to ensure 237 cfs always discharges into the bypass.

We have no objection to the proposed structure itself, but do have several concerns regarding the operation of the gate (please refer to the attached memorandum from Curt Orvis of our Regional Office/Engineering Division).

Our first concern pertains to the coefficient of discharge (C_d) used in the gate opening calculations. The amount of discharge released is determined by gate position, which in turn is based on the C_d used. For a given head and gate opening, using a higher C_d results in a higher calculated discharge through the gate. We are uncertain that using a higher C_d value is appropriate. Therefore, if a C_d value higher than 0.7 is to be used, we request that a rating of the discharge be made at an appropriate location in the bypass channel using standard USGS gaging techniques to verify that the gate opening is passing the required flow.

We are also concerned that the 6-inch increment for gate adjustment is too coarse. If a finer increment is not practical due to excessive wear-and-tear on the gate, we request that the gate openings be conservative, such that the discharge through the opening will provide for a minimum of 237 cfs over the range of within-increment pond elevations (i.e., flow is at least 237 cfs at elevation 271.76 as well as at elevation 272.24). The enclosed spreadsheet shows what gate openings should be used at different pond levels (using the Rodney Hunt coefficient of 0.7). We recommend that the automatic gate be set using these numbers.

We request that you maintain records for the first six months of gate operation to verify that the slide gate is operating as anticipated. Monthly summaries should be provided to this office and to the Massachusetts Division of Fish and Wildlife. Also, a rating curve or table showing the relationship between slide gate opening, pond level and discharge should be developed and included in the summaries.

Lastly, to facilitate verification of compliance with the mandated bypass flow, we request that a staff gage or other marking system be placed in an easily viewed location within the bypass. The mark should indicate the water level at a bypass flow of 237 cfs.

Thank you for this opportunity to comment. If you have any questions, please contact Melissa Grader of this office at (603) 223-2541.

Sincerely,

William J. Neidermyer

William Neidermyer
Assistant Supervisor
Federal Activities
New England Field Office

Enclosure

cc: FERC/DHAC
John Labiak, CEEMI
111 Broadway, 16th Floor
New York, NY 10006
Caleb Slater, MADFW
Curt Orvis, RO/EN
Reading File
es: MGrader:dw:3/13/01:(603)223-2541

UNITED STATES GOVERNMENT
U.S. FISH AND WILDLIFE SERVICE
300 WESTGATE CENTER DRIVE
DIVISION OF ENGINEERING
HADLEY, MASSACHUSETTS 01035-9589

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FISH & WILDLIFE SERVICE
MAR 1 - 2001
NEW ENGLAND FIELD OFFICE
CONCORD, NH

DATE: March 1, 2001

MEMORANDUM

TO: Supervisor, NEFO (ES), Concord, N.H.
Attention: Melissa Grader, Energy Projects

FROM: Curt Orvis, Hydraulic Engineer

SUBJECT: Review of the Minimum Flow Discharge Structure Red Bridge Hydroelectric Project (FERC# 10676) on the Chicopee River in Massachusetts (Tributary to the Connecticut River).

Reference is made to the Kleinschmidt Associates letter to the Massachusetts Historical Commission dated January 24, 2001 with attached drawings on Sheets RB1 through RB4 showing the proposed 7-foot wide gate structure to release 237 cfs.

For a crest of the dam at elevation 272.24 and an invert on the proposed gate sill at elevation 264.74, the gate structure has the hydraulic capacity to pass in excess of the required 237 cfs discharge.

Our main concern is the operation of the gate to ensure that the minimum of 237 cfs is maintained in the channel downstream. To check the estimated discharge computation, the orifice equation was used: Q=c*a*sqrt(2*g*h). From measured data (Brater and King 1976), the discharge coefficient, c, can range from 0.615 to as high as 0.91. A local gate manufacturer, Rodney Hunt, has provided the attached literature for estimating discharge which recommends use of a coefficient of discharge equal 0.7 as being conservative. For a gate opening of 2-feet 2-inches (2.17'), an estimated discharge of 216 cfs would be computed for the 7-foot wide gate using a coefficient of 0.7 in the orifice equation. Back calculating to determine what discharge coefficient KA designers could have used, results in a c value of 0.77. Although the computed coefficient is not unreasonable, the flow could be less than expected in the downstream channel. Using a coefficient of 0.7, a gate opening of 2.4 feet would be needed to provide the required discharge. Thus, as is the case for all minimum flow release structures, we recommend that a rating of the discharge be made at and appropriate location in the bypass channel using standard USGS techniques.

It is our understanding that the headpond can be lowered to elevation 270.24 during operations, and gate changes can be made in 6-inch increments. In order to estimate the impact the coefficient and lowering of the headpond would have on the discharge to be released, a spread sheet was developed to calculate the needed increase in gate opening at lower headpond water levels. The spread sheet shows that at the water surface elevation of 270.24, a gate opening of 3.02 feet would be needed to pass 237 cfs.

Another question was raised from the email message from Mr. Nash. An open gate at water levels below 265 will not provide the required 237 cfs discharge. Back calculation for hydraulic depth, using the weir equation with a weir coefficient of 3.32 over the 7-foot width, results in a required depth of 4.74 feet over the invert at elevation 264.74. Thus, the estimated minimum water surface for the proposed opening to pass 237 feet is about 269.5.

We appreciate the opportunity to comment on the designs.

Attachments

References

Brater, E. F. and H. W. King, 1976, *Handbook of Hydraulics*, McGraw-Hill Book Company, New York.

Discharge Computation for Orifice Opening

Q=c*A*sqrt (2*g*h)

Coefficient	Depth Open (feet)	Area (sq. ft.)	h=7.5-d/2 (feet)	Discharge (cfs)
0.61	2.17	15.19	6.42	188
0.62	2.17	15.19	6.42	191
0.63	2.17	15.19	6.42	195
0.64	2.17	15.19	6.42	198
0.65	2.17	15.19	6.42	201
0.66	2.17	15.19	6.42	204
0.67	2.17	15.19	6.42	207
0.68	2.17	15.19	6.42	210
0.69	2.17	15.19	6.42	213
→ 0.70	2.17	15.19	6.42	216
0.71	2.17	15.19	6.42	219
0.72	2.17	15.19	6.42	222
0.73	2.17	15.19	6.42	225
0.74	2.17	15.19	6.42	228
0.75	2.17	15.19	6.42	232
0.76	2.17	15.19	6.42	235
KA USED → 0.77	2.17	15.19	6.42	238
0.78	2.17	15.19	6.42	241
0.79	2.17	15.19	6.42	244
0.80	2.17	15.19	6.42	247
0.81	2.17	15.19	6.42	250
Coefficient	**Opening**	**Area**	**h=7.5-d/2**	**Discharge**
0.70	2.00	14.00	6.50	201
0.70	2.10	14.70	6.45	210
0.70	2.20	15.40	6.40	219
0.70	2.30	16.10	6.35	228
0.70	2.40	16.80	6.30	237
0.70	2.50	17.50	6.25	246
0.70	2.60	18.20	6.20	255

FOR CREST

Discharge Computation for Orifice Opening

Q=c*A*sqrt (2*g*h)

WS EL (feet)	Coefficient	Depth Open (feet)	Area (sq. ft.)	h=WSEL-264.74-d/2 (feet)	Discharge (cfs)
270.24	0.70	3.02	21.14	3.99	237
270.74	0.70	2.81	19.67	4.60	237
271.24	0.70	2.65	18.55	5.18	237
271.74	0.70	2.52	17.64	5.74	237
272.24	0.70	2.40	16.80	6.30	237 • CREST
272.74	0.70	2.30	16.10	6.85	237
273.00	0.70	2.26	15.82	7.13	237
270.24	0.70	3.02	21.14	3.99	237
270.74	0.70	3.02	21.14	4.49	252
270.74	0.70	2.81	19.67	4.60	237
271.24	0.70	2.81	19.67	5.10	249
271.24	0.70	2.65	18.55	5.18	237
271.74	0.70	2.65	18.55	5.68	248
272.24	0.70	2.40	16.80	6.30	237
272.74	0.70	2.40	16.80	6.80	246
272.74	0.70	2.30	16.10	6.85	237
273.00	0.70	2.30	16.10	7.11	241

DISCH. COEFF .70 RECOMMENDED BY RODNEY HUNT.

GATE WIDTH 7.0 ft.

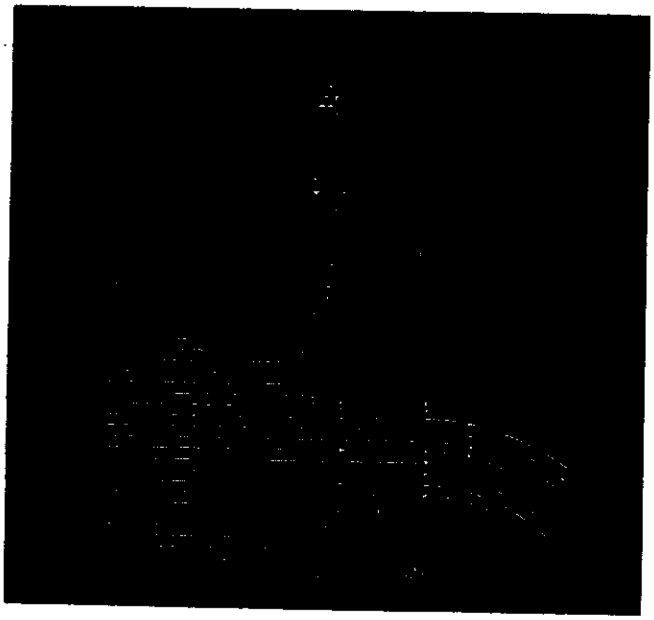
ASSUMES FREE FLOW (NO SUBMERGENCE)

Determining the Size of Sluice Gates

The size of a sluice gate usually depends on the amount of flow to be passed through the gate and the head on the gate. The method of determining a sluice gate size for three different types of applications is explained in the following pages. A simplified treatment of pipe flow has been used and is, therefore, not as precise as a more exhaustive treatment. If more precise treatments are justified, a hydraulics handbook, such as King and Brater, should be used.

CASE I

Free Flow

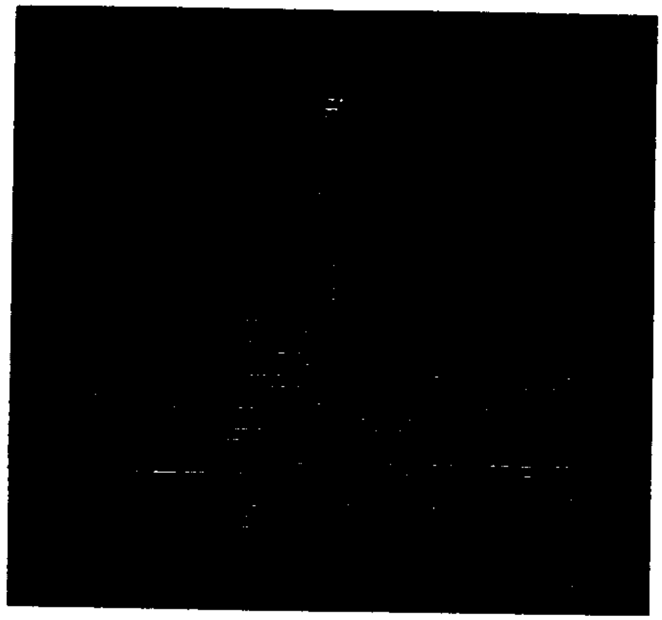


Free flow occurs when water is discharged through a gate into the atmosphere as shown above. "H" is the head or distance in feet from the surface of the water to the center of the gate opening. Using Chart 1, connect the known values of "Flow" and "Head" with a straight line. At the point where this straight line intersects the "Area" scale, read the required area of gate opening in square feet.

Example: Suppose the discharge "Q" is to be 200 cubic feet per second and the head "H" is 20 feet. By laying a straight edge on Chart 1, we find that the area of gate opening required is 8.1 square feet. The area of opening for various sizes of sluice gates is shown on Table 3. The solution of this typical problem is shown on Chart 1.

CASE II

Submerged Flow



Submerged flow occurs when water is discharged through a submerged gate as shown above. There is water on both sides of the opening, but the water on one side is "H" feet higher than on the other. The solution is identical with Case I except that differential head "H" is used instead of the distance from the water surface to the gate center line. Chart 1 is used in the same manner as for Case I.

The required opening area may also be computed for either Case I or Case II by rearranging the formula

$$Q = C_d A \sqrt{2gH}$$

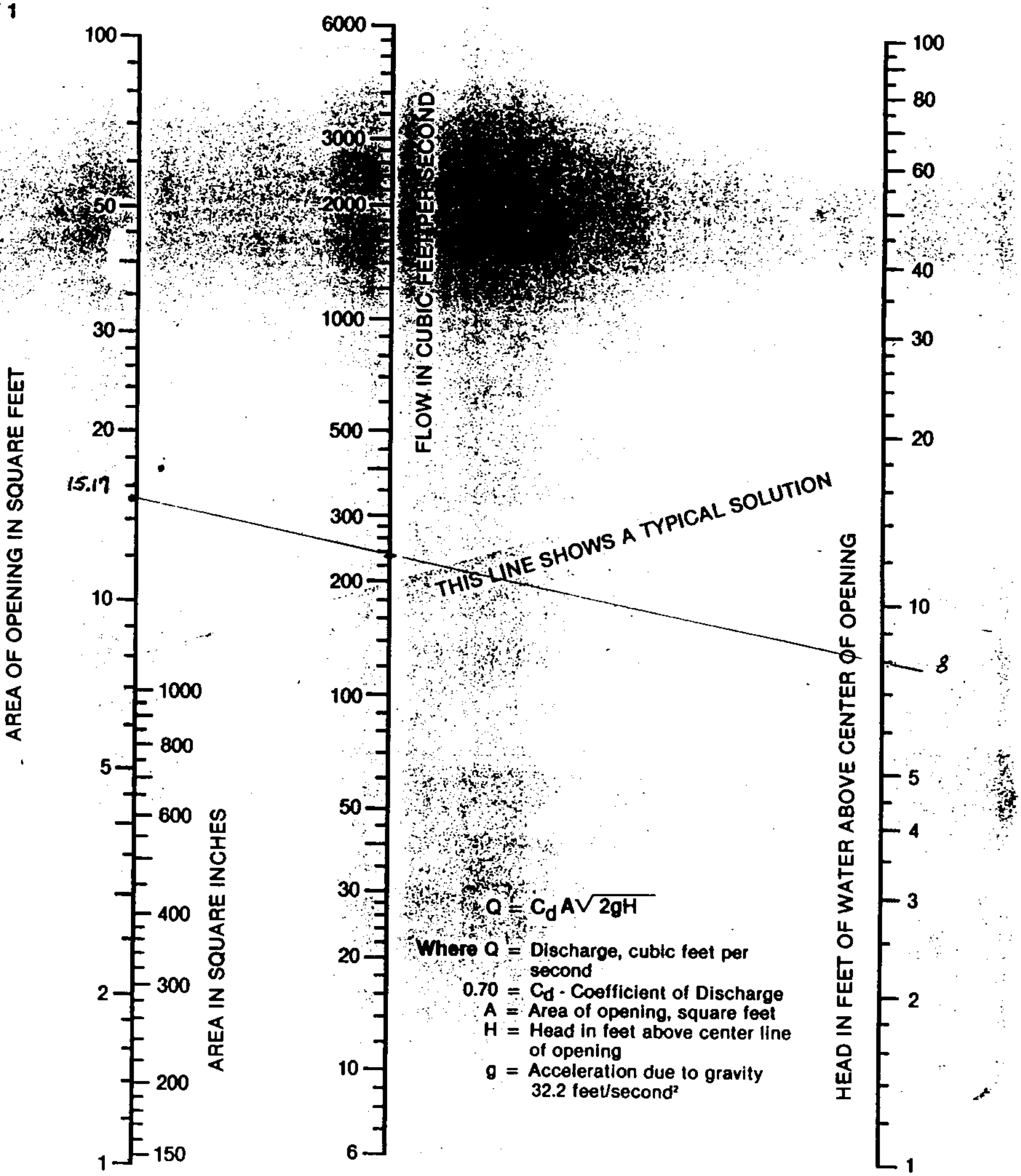
to the form

$$A = \frac{Q}{C_d \sqrt{2gH}}$$

Where "Q" is the discharge or flow in cubic feet per second; "H" is the differential head; "A" is the gate area in square feet; "g" is the acceleration due to gravity, and "C_d" is the coefficient of discharge. A coefficient of discharge of 0.7 was used in making Chart 1 and is considered to be conservative based on available tests and knowledge.

The nomograph below shows the relationship between the area of the opening, the head of water above the centerline of the opening and the flow through the opening in cubic feet per second. If any two of these factors are known, the third can be readily determined.

CHART 1



$$Q = C_d A \sqrt{2gH}$$

Where Q = Discharge, cubic feet per second

0.70 = C_d - Coefficient of Discharge

A = Area of opening, square feet

H = Head in feet above center line of opening

g = Acceleration due to gravity 32.2 feet/second^2

Al Nash

From: Slater, Caleb (FWE) [Caleb.Slater@state.ma.us]
Sent: Tuesday, March 13, 2001 11:23 AM
To: Al.Nash@KleinschmidtUSA.com
Subject: FERC reports

Al,

I just looked through the Gardners Falls and Red Bridge updates and they look fine.

Caleb

....

Caleb Slater, PhD
Anadromous Fish Project Leader
MA Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581
(508)792-7270 x133

10,676 [illegible]

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

West Springfield, Massachusetts

RED BRIDGE MINIMUM FLOW GATE PROJECT

PROJECT MANUAL

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NEW YORK, NY

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REGULATORY
COMMISSION

February 2001

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

CONSOLIDATED EDISON ENERGY
MASSACHUSETTS, INC.
West Springfield, Massachusetts

RED BRIDGE MINIMUM FLOW GATE PROJECT

PROJECT MANUAL

February 2001

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.
West Springfield, Massachusetts

RED BRIDGE MINIMUM FLOW GATE PROJECT

Table of Contents

INVITATION FOR BID
CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

RED BRIDGE MINIMUM FLOW GATE PROJECT

Sealed bids for Construction of the Red Bridge Minimum Flow Gate Project, will be received at the office of John Labiak at 111 Broadway, 16th Floor, New York, NY 10006, until the end of business on Wednesday, March 28, 2001, prevailing time, at which time they will privately open and read. A copy of the bid shall be provided to the office of Alfred Nash at Kleinschmidt, 75 Main Street, P.O. Box 576, Pittsfield, ME 04967. Faxed bids are acceptable provided that a hard copy is provided by the next business day after the bid due date.

The Minimum Flow Gate Construction Project will be a complete installation that includes, but is not necessarily limited to;

Fabrication and installation of the gate, embedded guides, and walkway
Temporary site improvements for access to the construction area
Removal of portions of the existing masonry dam
Provide concrete, reinforcing, and embedded items
Provide the gate operator and power supply
Provide the gate instrumentation/control system and gate guide heater
Testing of the completed gate installation

A mandatory pre-bid conference will be held Thursday, March 8, 2001, at 9:30a.m. at the project site. Directions may be obtained at the office of Charlie Molongoski, (413) 730-4789 (email: MolongoskiC@conedenergy.com).

Specifications and Information for Bidders may be obtained at the Office of John Labiak, 212-267-5280.

The successful bidder shall also furnish a 100% Performance Bond and a 100% Payment Bond.

Consolidated Edison Energy Massachusetts, Inc., (CEEMI) reserves the right to reject any or all bids, in whole or part, to award any item, group of items, or total bid, and waive any informality in the bids received if it deems it to be in the best interest of CEEMI to do so.

No Bidder may withdraw their bid within 45 days after the actual date of the opening thereof.

All bids must be submitted in a sealed envelope bearing the bidder's name and the project name.

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

RED BRIDGE MINIMUM FLOW GATE PROJECT

INSTRUCTIONS TO BIDDERS

1. Introduction

Consolidated Edison Energy Massachusetts, Inc. (CEEMI), a wholly owned subsidiary of ConEd Development, hereafter referred to as the "Owner", owns and operates the Red Bridge hydroelectric power station on the Chicopee River in Massachusetts. The Owner has retained the services of Kleinschmidt Associates (Kleinschmidt) Consulting Engineers, hereafter referred to as the "Engineer," to assist with the project.

The Owner is soliciting bids for providing an automatically controlled vertical slide gate at the Red Bridge hydroelectric project. The gate shall be used to pass a constant flow into the bypass reach. The Contractor shall provide all necessary services and fabrications for the new gate system. The bidder is responsible to verify all dimensions and mechanical parameters to ensure that the work is compatible with the existing facility.

Appendix A of the Project Manual contains a list of the contract drawings. The Owner is not responsible for any errors or omissions contained on the drawings.

Appendix B contains product information for new equipment.

2. Defined Terms

Terms used in these Instructions to Bidders, which are defined in the Contractor Agreement, have the meanings assigned to them in the Contractor Agreement and Specifications. The term "Bidder" means one who submits a Bid directly to the Owner, as distinct from a sub-bidder, who submits a bid to a Bidder. The term "Successful Bidder" means the Bidder to whom the Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award. The term "Bidding Documents" includes the Invitation to Bid, Instructions to Bidders, the Bid Form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

Title to all materials and equipment shall pass to the Owner upon completion of the work.

3. Copies of Bidding Documents

Complete sets of the Bidding Documents may be obtained from the Owner. To obtain Bidding Documents contact:

John Labiak
Consolidated Edison Energy Massachusetts, Inc
111 Broadway, 16th Floor
New York, NY 10006
(212) 267-5280

Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

Owner and Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

4. Qualifications of Bidders

Each Bid must contain evidence of Bidder's qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the contract.

This work requires the contractor to be sensitive to environmental constraints working within U.S. waters and conditions established by the various permitting agencies. The Bidder performing this work shall have completed three projects of similar nature in the last six years.

5. Interpretations and Addenda

All questions about the meaning or intent of the Contract Documents shall be directed to Engineer. All questions about the meaning or intent of a contractual nature shall be directed to the Owner. Interpretations or clarifications considered necessary by the Engineer or Owner in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the Owner as having received the Bidding Documents. Questions received less than three days prior to the date for opening of Bids may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

Addenda may also be issued to modify the Bidding Documents as deemed advisable by the Owner or Engineer.

Requests for additional Commercial Information should be directed to:

John Labiak
Consolidated Edison Energy Massachusetts, Inc
111 Broadway, 16th Floor
New York, NY 10006
(212) 267-5280 [fax 385-8693]
(email: LabiakJ@conedenergy.com)

Request for additional Technical Information should be directed to:

Alfred Nash
Kleinschmidt Associates
75 Main Street
Pittsfield, ME 04967
(207) 487-3328 x231 [fax 487-3124]
(email: AL.Nash@KleinschmidtUSA.com)

6. Contract Time

The number of days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the Contract Time) are set forth in the Bid Form.

7. Bidder Qualifications

The Bidder shall submit the following as part of the Bid Package.

a. Bidder's organizational chart.
b. Resumes of key personnel.
c. List of projects of similar magnitude and nature along with contact for reference.
d. List of proposed Sub-Contractors.
e. Proposed project schedule.
f. Safety records for previous 2 years (OSHA 200 log).

8. Bid Form

The Bid Form is included with the Bidding Documents; additional copies may be obtained from the Owner.

All blanks on the Bid Form must be completed in ink or by typewriter.

Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

All names must be typed or printed below the signature.

The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

The address and telephone number for communications regarding the Bid must be shown.

9. Site Visits

The Bidder must attend the pre-bid meeting indicated in the Invitation to Bidders. The Owner encourages Bidders to visit the Project prior to submission of bids. Site visits may be arranged with:

Charlie Molongoski
Hydro Manager
Consolidated Edison Energy Massachusetts, Inc
15 Agawam Ave
West Springfield, MA 01089
(413) 730-4789
(email: MolongoskiC@conedenergy.com)

Bidders must satisfy themselves of the location of the work and of the accuracy of the information provided. After bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of work or the nature of the work to be done. Conditional or qualified bids will not be accepted.

10. Submission of Bids

Bids shall be submitted at the time and place indicated in the Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the Project title (and, if applicable, the designated portion of the project for which the Bid is submitted) and name and address of the Bidder and accompanied by the Bid Security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

One (1) original and one (1) copy of the bid shall be submitted to Owner and an additional (1) copy to Engineer.

11. Bid Security

A bid security is not required for the bid.

12. Insurance

A valid, current certificate of Insurance, with coverage limits as defined by Article 37 (Insurance) of the Standard Terms and Conditions of Construction Contracts, shall be required by all suppliers and subcontractors present at the job site. Copies shall be presented to the Owner prior to the start of work. Insurance coverage shall be valid up to and including the day of Final Inspection.

A Workman's Compensation Certificate, covering any work which may be performed on site or work performed elsewhere for the duration of the contract, shall be submitted to the Owner prior to the start of work and not later than 28 days after the Notice to Proceed.

13. Award of Contract

The Owner reserves the right to reject any and all Bids, to waive any and all informalities not involving price, time or changes in the Work and to negotiate contract terms with the Successful Bidder, and the right to disregard all nonconforming, non-responsible, unbalanced or conditional Bids. Also, the Owner reserves the right to reject the Bid of any Bidder if the Owner believes that it would not be in the best interest of the Project to make an award to that the

Bidder, (*i.e.*, the Bid is not responsible or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by the Owner). Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

The Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted.

The Owner may conduct such investigations as the Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to the Owner's satisfaction within the prescribed time.

If the contract is to be awarded, the Owner will give the Successful Bidder a written Notice to Proceed within forty-five (45) days after the day of the Bid opening.

BID FORM

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

RED BRIDGE MINIMUM FLOW GATE PROJECT

BID FORM

PROJECT IDENTIFICATION:

Red Bridge Minimum Flow Gate Project

THIS BID IS SUBMITTED TO: Consolidated Edison Energy Massachusetts, Inc.
West Springfield, Massachusetts

1. The undersigned BIDDER proposes and agrees, if this bid is accepted, to enter into an agreement with the OWNER in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for forty-five days after the day of Bid opening. BIDDER will sign and submit the Contractor Agreement with the bonds and other documents required by the Bidding Requirements within fifteen days after the date of OWNER's Notice of Award.

3. In submitting this bid, BIDDER represents, as more fully set forth in the Agreement, that:

   a. BIDDER has examined copies of all the Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledged):

Date	Number
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________

   b. BIDDER has familiarized itself with the nature and extent of the Contract Documents, Work, Project site, Locality, and all local Conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the work.

   c. BIDDER has given the ENGINEER written notice of all conflicts, errors, or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by the ENGINEER is acceptable to the BIDDER.

d. The BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and the BIDDER has not sought by collusion to obtain for itself any advantage over any other Bidder or over the OWNER.

4. BIDDER will complete the Work for the price(s) stated in the bid schedule.

5. BIDDER agrees that the Work will be substantially complete on or before September 30, 2001 and completed and ready for final payment on or before October 27, 2001. Bidder may submit a separate alternate bid with differing completion dates.

6. Communications concerning this bid shall be addressed to:

Mr. John Labiak
Consolidated Edison Energy Massachusetts, Inc.
111 Broadway, 16th Floor
New York, NY 10006
Tel. No. 212-267-5280
e-mail: LABIAKJ @ CONEDENERGY.COM

A copy of all communications shall be provided to:

Alfred Nash
Kleinschmidt Associates
75 Main Street
Pittsfield, ME 04967
Tel. No. 207-487-3328
e-mail: AL.Nash@KleinschmidtUSA.com

7. The terms used in this Bid which are defined in the Standard Terms and Conditions of the Construction Contract included as part of the Contract Documents have the meanings assigned to them in the Standard Terms and Conditions.

SUBMITTED ON ____________________, 20____.

BY: ______________________________________ (insert Contractor name here).

RED BRIDGE MINIMUM FLOW GATE - ITEMIZED BID SCHEDULE

Item	Description	Unit	Est. Qty.	Unit Price	Est. Price	Total Lump Sum Price
1.	Mobilization (including submittal of all Owner required paperwork for the project, temporary facilities, initial site survey and verification of field conditions).	L.S.				$________
2.	Environmental Management (including turbidity curtains and silt fencing).	L.S.				$________
3.	Design, construct, maintain and remove any and all temporary access roads, cofferdams, and diversion berms necessary to access and dewater the work area(s) (including related clearing, earthwork and site dewatering as required).	L.S.				$________
4.	Partial Dam Removal	L.S.				$________
5.	New concrete (including embedded metals)	L.S.				$________
6.	New access walkway and platform.	L.S.				$________
7.	New gate leaf including installation.	L.S.				$________
8.	Install complete operator system (including heaters, electrical controls and testing).	L.S.				$________
9.	Demobilization including final survey, site cleanup, fencing and gate installation and submittal of all owner required closeout documents.	L.S.				$________

Total Estimated Contract Price (Items 1 through 9) <u>Base Bid</u> $__________

Words:____

Projected Number of Weeks for Project Work: ________ weeks

Anticipated Start Date:____________________

The BIDDER shall list and provide details (on an attached sheet) of work for which the BIDDER failed to complete or the contract was terminated prior to completion for projects within the last five (5) years.

Statement if None:____

The BIDDER shall list and provide details (on an attached sheet) of any judgements, claims, arbitration proceedings or suits pending or outstanding against the BIDDER or its officers.

Statement if None:____

The BIDDER shall provide its Workers Compensation insurance - experience modification rate for the last three (3) rating periods.

	Policy Year	Modification Rate
Most Recent Policy Year		
1 Year Previously		
2 Years Previously		

Are the above rates interstate or intrastate?________________

If intrastate, which state?______________________________

The BIDDER shall list the following references:

Trade Reference:

Bank Reference:

Surety:

The BIDDER shall also provide written evidence of capacity to provide sufficient personnel and equipment to perform the work on schedule.

If BIDDER is:

An Individual

By____(SEAL)
(Individual's Name)

doing business as____

Business Address:____

____

Phone No.:____

A Partnership

By____(SEAL)
(Firm Name)

____
(General Partner)

Business Address____

____

Phone No.:____

A Corporation

By____
(Corporation Name)

____
(State of Incorporation)

By____
(Name of Person Authorized to Sign)

____
(Title)

(Corporate Seal)

Attest____

Business Address:____

Phone No.:______________________________

A Joint Venture

By______________________________

(Name)

____

(Address)

By______________________________

(Name)

____

(Address)

(Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above.

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

STANDARD TERMS AND CONDITIONS

of

CONSTRUCTION CONTRACTS

August 19, 1999

TABLE OF CONTENTS

1. Definitions. For purposes of these Standard Terms and Conditions, the following definitions shall apply:

CEEMI	-	Consolidated Edison Energy Massachusetts, Inc.
Contractor	-	The contractor named in the agreement into which these terms and conditions are incorporated.
Contract	-	The contract between CEEMI and Contractor consisting of: for performance of the Work, including (a) the written agreement executed by CEEMI and Contractor, (b) these Standard Terms and Conditions, and any all plans, schedules, specifications, addenda, drawings and other documents, to the extent that they are directly or indirectly incorporated by reference by (a) or (b) above. The words "hereof," "herein," "hereto" and "hereunder" as used in these Standard Terms and Conditions all refer to the Contract.
Work	-	The project contemplated by the Contract and all labor and supervision; construction materials, equipment, tools and other aids to construction; equipment, materials and structures to be installed; and other things of any nature necessary or proper for the completion of the project, whether or not expressly specified herein.
Subcontractor	-	Any company or person, other than an employee of Contractor, that furnishes any of the Work on behalf of Contractor.

2. Contract Formation. A legally enforceable contract shall arise upon CEEMI and the Contractor signing the written agreement referenced above in the definition of "Contract."

3. Specifications, Plans, and Drawings

A. The Work shall be performed in strict accordance with the Contract specifications, plans, and drawings. No deviation is permitted unless approved in advance in writing by CEEMI. The specifications, plans, and drawings and all other documents which are part of the Contract are supplementary to each other. Anything called for by any one of such documents shall be required to the same extent as if called for by all of them, and the Work shall be completed in every detail whether or not every item is specifically mentioned. If there should be a conflict between the drawings and the writings that comprise the plans and specifications, the writings shall govern unless upon notice thereof CEEMI directs otherwise in writing.

Contractor shall carefully review all of the contract documents. Contractor shall promptly submit in writing to CEEMI whenever discovered, whether before or after award, any inconsistency, ambiguity, or error between documents or within a document. Contractor shall abide by the written direction of CEEMI's authorized representative with respect to such matters, which direction shall be final and binding.

Contractor waives any claim for extra compensation based on an inconsistency, ambiguity, or error which the Contractor could have discovered by reasonable diligence and prudence.

B. CEEMI may furnish to Contractor any additional plans, drawings, specifications or other documents which it considers necessary to illustrate or explain the Work in further detail, and Contractor shall comply with the requirements of all such documents.

C. Contractor shall, throughout the time during which the Work is being performed, keep at the construction site available for inspection by CEEMI one complete and current set of the Contract documents, including, but not limited to, the Contract plans, specifications, and drawings, any additional documents furnished by CEEMI, and all shop and work drawings approved by CEEMI.

4. Price and Payment

A. Unless expressly stated to the contrary herein, all prices are firm and not subject to increase. All payment periods, including discount periods, shall begin upon receipt by CEEMI of acceptable invoices at the following address: Consolidated Edison Energy Massachusetts, Inc., c/o Consolidated Edison Energy, Inc., 111 Broadway, 16th Floor, New York, NY 10006, Attention: Project Manager. Invoices shall be submitted in such detail and with such supporting documentation as required by the Contract or as may reasonably be required by CEEMI for tax, regulatory, or other reasons. Unless otherwise specified in the Contract, payment shall be made within 30 days of receipt of each invoice.

Payments by mail shall be deemed made when deposited in the mail.

B. For unit price Work involving layouts, Contractor shall submit invoices upon completion of layouts or layout parts. For other unit price Work, invoices shall be submitted monthly. For all unit price Work, the judgment of CEEMI as to the quantity of Work completed and whether or not it is acceptable shall be conclusive.

C. For lump sum Work, Contractor shall render progress payment invoices monthly unless stated otherwise in the Contract. Each invoice shall be based on an estimate, certified by Contractor and approved by CEEMI, of the physical Work performed during the period stated in the Contract or, if none is stated, during the preceding calendar month. In preparing estimates, Contractor shall include up to 75% of the cost of conforming materials delivered onto the site but not yet physically incorporated into the Work. As additional security for the proper performance of the Contract, CEEMI will retain ten percent (10%) of the amount of each invoice until fifty percent (50%) of the Work is completed. Thereafter, if the Work is progressing satisfactorily and on schedule, CEEMI shall pay the remaining progress payments in full. The amount previously retained will be paid to Contractor following completion and acceptance of the entire Work. The judgment of CEEMI as to the value of the Work completed, whether it is on schedule and whether it is acceptable shall be conclusive.

D. CEEMI shall have the right at any time to withhold from any payment which may be or become due under the Contract such amount as may reasonably appear necessary to it to compensate CEEMI for any actual or prospective loss due to Work which is defective or does not conform to Contract requirements, actual or prospective failure of Contractor to complete performance of the Work, or any other failure of Contractor to perform any of its obligations under the Contract or when it reasonably appears to CEEMI that the Contractor has previously been overpaid. CEEMI shall be entitled to retain any and all amounts so withheld until Contractor has, in CEEMI's judgment, either performed the obligation or obligations in question or furnished security which CEEMI deems adequate for such performance or, in the case of withholding for overpayment, until an audit of Contractor's work or documentation is completed and the proper payment is determined.

E. CEEMI at any time may, after notifying Contractor in writing, pay directly any unpaid claims against Contractor based on the Work, and in so doing CEEMI shall be conclusively deemed to be acting as Contractor's agent. Any payment made by CEEMI to discharge a claim against Contractor shall be treated as a payment made under the Contract from CEEMI to the Contractor.

F. CEEMI shall not be liable to contractor for interest on any late payments unless expressly provided for herein. If for any reason CEEMI is in arrears in payment(s) hereunder, payment(s) made shall be applied by Contractor to any and all principal sum(s) due before being applied to any interest that may be due thereon pursuant to any express provision therefor in the Contract or otherwise.

G. Except to the extent specified in a written reservation of rights, the acceptance by Contractor of final payment shall be and shall operate as a release of all claims against CEEMI and of all liability of CEEMI to Contractor for things done or furnished in connection with the Work and for every act and neglect of CEEMI and others for whom CEEMI may be responsible relating to or arising out of the Work. However, no payment, final or otherwise, shall operate to release Contractor or its sureties from the obligations under this Contract or any performance or payment bond.

5. Time for Completion. Time is of the essence of this Contract and of each and every portion thereof for which a certain length of time is fixed for performance. Unless otherwise specified, Contractor shall start the Work at the construction site within ten (10) days after it receives a written Notice to Proceed from CEEMI and shall complete the Work and the various parts thereof within the time or times specified in the Contract schedule. Contractor shall prosecute the Work regularly, diligently and without interruption at such rate of progress as will ensure completion within the specified time, and shall furnish properly skilled workmen and materials, tools, and equipment in numbers and amounts sufficient to accomplish this. Contractor agrees that the time or times specified for completion of the Work and of any part thereof are reasonable, taking into consideration all facts and circumstances. Work specified by the Contract to be performed after regular hours or on Saturdays, Sundays or legal holidays and Work performed at such times as a result of conditions in a permit or because of local regulations or to adhere to or regain the rate of progress required by CEEMI shall be performed without additional expense to CEEMI. If, in the opinion of CEEMI, Contractor falls behind schedule, CEEMI shall have the right to require contractor, at no additional cost to CEEMI, to increase its labor

force or days or hours of work, to work overtime or increase the number of shifts, to use additional equipment or other construction aids, or to take such other steps as may be necessary to ensure completion of the Work on schedule. Receipt and acceptance by CEEMI of revised schedules from the Contractor during the Work shall not be deemed a waiver of the schedule initially approved.

6. Excusable Delay. Contractor shall be excused any delay in completion of the Work arising from a cause beyond its control which it could not with the exercise of due diligence have either foreseen or avoided, including act of governmental authority, act of God, extraordinary weather conditions, flood, accident such as fire or explosion not due to the negligence of Contractor, strike which is not the result of an unfair labor practice by the Contractor, riot, failure of public transportation facilities, inability of CEEMI to provide access due to plant malfunctions, and inability to perform caused solely by CEEMI's act or failure to act in breach of an express obligation under the Contract. Delay in Contractor's receipt of subcontracted supplies or services for reasons beyond the control of the Subcontractor shall not be excusable delay hereunder to the extent that the supplies or services are available to Contractor from another source. Contractor shall give written notice and full particulars of the cause of any delay within 48 hours after its occurrence. The time for performance in any such instance shall be extended by a period equal to the time lost by reason of the excusable delay. CEEMI shall not be liable for any additional costs incurred as a result of such delay.

7. Safeguards in Work

A. The Contractor shall provide and maintain at its own expense safe and sufficient entrance and exit ways, walkways, platforms, barricades, warning lights, scaffolds, ladders, runways for concrete carriers, hoists and all equipment, apparatus and appliances necessary or proper for carrying on the Work safely; shall not load any of the foregoing items or any part of any structure or equipment with a weight that will make it unsafe; shall make and keep the place of Work and the ways and approaches thereto well lighted, safe and free from avoidable danger, taking into account, without limitation, local conditions; and shall mark any faulty items "unsafe" until repaired or replaced.

B. Contractor shall provide all permanent and temporary shoring, anchoring and bracing required by the nature of the Work to make all parts absolutely stable and rigid, even when such shoring, anchoring and bracing are not explicitly called for. Contractor shall support and protect all buildings, bridges, roadways, conduits, wires, water pipes, gas pipes, sewers, pavements, curbing, sidewalks, fixtures and other public or private property that may be encountered or endangered in the prosecution of the Work.

C. In accordance with the rest of this Article 7 and without limitation thereof, the Contractor shall test all areas, excavations, openings, manholes, vaults and boxes, for an adequate supply of oxygen and for any and all toxic, harmful or combustible gases or fumes or other dangerous substances before and during the course of the Work and shall provide all the necessary equipment, including, but not limited to, all oxygen deficiency and gas testing apparatus required for such tests.

D. Contractor shall strictly observe safety requirements of applicable federal, state and municipal laws and regulations, including, without limitation, the Federal Occupational Safety and Health Act. The Contractor shall cause all equipment and structures, the place of Work and the ways and approaches thereto to meet the requirements of all public authorities. The Contractor shall comply with the requirements of and recommendation in the latest edition of the "Manual of Accident Prevention in Construction," published by The Associated General Contractors of America, to the extent that such provisions are not inconsistent with other provisions of the Contract or applicable laws or regulations. The Contractor shall maintain an accurate record of all cases of death, occupational disease or injury requiring medical attention or causing loss of time from work arising in connection with performance of the Work.

E. If in the opinion of CEEMI's authorized representative the Contractor's work practices or conditions created by the Contractor are unsafe or fail to comply with applicable laws or regulations, CEEMI may halt the work until such practices and conditions are corrected. The Contractor shall not be entitled to any additional costs or time for performance due to such work stoppage. If, when CEEMI's authorized representative is not present at the site, a CEEMI employee directs the Contractor to discontinue an operation because it may be unsafe or illegal, the Contractor shall immediately halt the questioned operation and, if the Contractor disagrees with the employee, shall contact CEEMI's authorized representative for instructions. The Contractor shall obtain the employee's name and employee identification number and report this information to CEEMI's authorized representative.

F. The Contractor shall be responsible for any failure or neglect on its or its Subcontractor's part to perform the obligations contained in this article, and shall defend and indemnify CEEMI against any liability resulting in whole or in part from such failure or neglect.

G. If the Work involves pipeline facilities for the transportation of gas, hazardous liquids or carbon dioxide or a liquefied natural gas facility subject to Part 192, 193 or 195 of Title 49 of the Code of Federal Regulations (CFR), the Contractor shall comply, and shall require its employees to comply, with the drug and alcohol testing requirements of 49 CFR Part 199. The Contractor shall maintain and follow written anti-drug and alcohol misuse plans and shall provide the testing, education, and training required by the Regulations. The Contractor shall allow access to its property and records concerning the plans and their implementation to CEEMI, to the Department of Transportation Administrator, and to representatives of federal or state authorities having jurisdiction for the purposes of monitoring compliance with these requirements.

8. Knowledge of Work Conditions and Requirements. Contractor represents that it has visited and examined the site of the Work and satisfied itself as to the general and local conditions, particularly those relating to transportation, handling and storage of materials, availability of labor, water, drainage, power, roads, weather, ground and other physical conditions at the site, and as to all other matters which could affect the Work or the cost thereof. Contractor also acknowledges that it has examined the specifications, drawings, and other Contract documents and has satisfied itself as to the requirements of the Work, and has seen or had an opportunity to ask about all conditions which may affect the Work, including equipment or structures in place or to be in place, or work being or to be performed, which could interfere with the uninterrupted performance of the Work. Contractor agrees that its entry into the Contract has not been induced either wholly or in part by any promises, representations or statements on behalf of CEEMI other than those set forth in the Contract, and that any failure of Contractor to examine the Work site, Contract documents or all other available information shall be at its own risk. Contractor further represents that the price set forth in the Contract has been determined with due regard by the Contractor to all such conditions and requirements affecting the Work, as well as the difficulties and delays incident to work of the nature contemplated hereby, and agrees that no claim

for any increase in such price shall be made except as specifically provided in the Contract.

9. <u>Contractor's Performance</u>

A. Contractor shall perform in good workmanlike manner and in accordance with best accepted practices in the industry all the Work specified or reasonably implied in the Contract, in accordance with its terms and the directions of CEEMI as any may be given from time to time. Contractor's performance shall include, except as otherwise specifically stated in the Contract, everything requisite and necessary to complete the Work properly, notwithstanding the fact that not every item involved is specifically mentioned, including, but not limited to all materials, labor, tools, equipment, apparatus, water, lighting, power, transportation, superintendence, temporary construction, and all other services and facilities of every nature necessary or appropriate for the execution of the Work on schedule. Details which are not specified in the Contract shall be performed by Contractor at no extra cost if such details are within the general description of the Work.

B. Contractor shall provide a full time on-site representative who shall be deemed to have full authority to act for Contractor. The representative must be able to effectively communicate with the persons performing the Work for the Contractor in the language or languages spoken by those persons. The continuance of this individual in that role will be subject to the continuing approval of CEEMI.

C. Contractor shall perform the Work in accordance with the following:

(a) All equipment, tools, other construction aids and materials utilized by Contractor shall be of high quality and in good working order. Contractor shall submit material safety data sheets (MSDS) for all chemical and hazardous substances used in the Work. If, in the opinion of CEEMI, any of Contractor's equipment, supplies, tools, other construction aids or materials are unsafe or inadequate, Contractor shall remove such items from the site immediately and replace them with safe and adequate substitutes at Contractor's expense. Contractor shall be fully and solely responsible for and shall safeguard its equipment, tools, supplies, other construction aids and materials at all times. Contractor shall provide adequate storage for all such items used in connection with the Work.

(b) The use of public roadways and properties for the parking of employee vehicles, construction equipment, receiving and placement shall be in accordance with the applicable laws and ordinances. Access to all underground facilities, as for example through CEEMI, municipal and telephone company manholes, shall be maintained and allowed during the entire performance of the Work. Adjacent private properties shall not be entered or used for any such purpose without the written consent of the property owners.

(c) Fire hydrants and stop valves adjacent to the Work shall be kept clear and readily accessible to fire apparatus, and no material or other obstruction shall be placed, parked or stored within fifteen (15) feet of any hydrant or stop valve (or a greater distance if required by local law, rule or regulation). Contractor shall comply fully with all local rules and regulations relative to fire protection, shall keep the structure and premises free from burnable trash and debris, and shall exercise every precaution against fire. This shall include, but not be limited to, posting a fire watch, with appropriate fire fighting equipment, during all welding, burning, stress relief and other heating operations. Contractor shall assure that the fire watch is informed of the site fire control procedures and remains posted during breakfast, lunch and dinner periods and until one hour after such heating operations have stopped.

10. <u>CEEMI's Authority</u>

A. CEEMI shall have the authority to decide any and all questions which arise in connection with the Work, and CEEMI's decisions shall be conclusive and final. CEEMI shall be the final judge of the meaning and intent of the Contract and all provisions thereof. CEEMI shall have the authority to conclusively resolve any disagreements which may arise between Contractor and any other contractor.

B. CEEMI shall have the right to maintain a representative at the construction site. Such representative may, on request, give

Contractor reasonable assistance in interpreting the Contract drawings, specifications and plans, but such assistance shall not relieve Contractor of any duties (including, without limitation, those of giving notice to or securing the approval of CEEMI) arising under the Contract.

11. Estimated Quantities. Whenever estimated quantities of Work to be done on a unit-price basis are shown in the Contract, differences between the actual number of units of Work encountered and the estimated quantities of units shall not result in an increase or decrease in the unit prices or provide the basis for any claim against CEEMI by Contractor.

12. Warranties

A. Contractor warrants the Work for a period of one (1) year from the date of completion and acceptance of all Work, unless a longer period is specified elsewhere in the Contract or in an applicable municipal code or regulation, in which case the longer period shall apply:

(a) as to services, that they shall be rendered competently and by qualified personnel in accordance with the best accepted practices in the industry, and

(b) as to materials, equipment, structures and other things, that they shall be new and free from defects in title, material, workmanship and design, conform strictly to all applicable specifications, and be suitable for their intended use. Contractor further warrants that the Work shall meet any and all tests and comply with all performance requirements contained in the Contract. The warranty of good title shall be unlimited in time.

B. In the event any part or all of the Work fails to satisfy any of these warranties, upon written notice thereof from CEEMI, Contractor shall, at no cost to CEEMI, promptly repair, replace, or reperform the defective Work, as directed by CEEMI, and do whatever else is necessary to cause the Work to satisfy all of the aforesaid warranties. All work repaired, replaced or reperformed under the provisions of this Article shall be subject anew to this Article with the warranty period commencing upon completion of the repair, replacement, or reperformance. If Contractor fails to correct any defective Work as aforesaid promptly after being notified thereof by CEEMI, then CEEMI may, at its option, either correct the defective work and charge Contractor for the costs and expenses it occurs in so doing or secure an equitable reduction in the Contract price based on its retention of the defective Work. Any defective parts removed in connection with repair or replacement shall be disposed of by Contractor at its expense.

C. In addition to making the foregoing warranties, Contractor agrees to obtain, for the benefit of CEEMI, from any and all Subcontractors hereunder, the same warranties as those required of Contractor under this Article and not to accept any warranties which are inferior in any respect to those required under this Article.

13. <u>Changes (Including Extra Work)</u>

A. CEEMI shall have the right at any time, by written notice to Contractor and without notice to any of Contractor's sureties, to direct changes in the Work, including direction to do extra work or work outside of normal hours (when such work is not already the responsibility of the Contractor under the Contract) or to delete part of the Work. If any such change causes an increase or decrease in the cost or time required for performance hereunder, an equitable adjustment shall be made in the Contract price or schedule, or both, as follows: If the change involves work of the kind for which unit prices are contained in the Contract, such work shall be paid for at those prices unless CEEMI at its discretion determines not to use such unit prices and so notifies the Contractor prior to the start of the changed work. For work for which no unit price is established or for which CEEMI has determined not to apply the unit prices, the parties shall endeavor to agree on a lump sum price for the change. If the change is not defined well enough for a fixed price, or if there is not enough time to negotiate one, or if the parties do not agree on one, the Contractor shall perform the change on a time-and-materials basis at rates for labor, equipment and materials approved by CEEMI. In the case of deletion of any portion of the work for which no unit price is established, the Contract price shall be reduced by the decrease in the Contractor's cost of performance and profit thereon.

B. The following time and materials rates are approved by CEEMI for Work performed on a time and materials (T & M) basis:

(a) Labor

The Contractor will be compensated for each hour performed at the straight and premium time rates (as applicable) specified in the Consolidated Edison Company of New York, Inc. schedule of rates entitled "New York City and Westchester County Labor Rates for Time and Materials Work" or "Maintenance Agreement Labor Rates -- New York City and Westchester County," as applicable, in effect at the time the Work is performed, except that an additional 10% will be paid for the straight time portion of labor performed by an approved Subcontractor. The labor of superintendents, non-working foremen, timekeepers and clerical employees is not compensable.

(b) Materials

The Contractor will be compensated for all materials used for the Work at the actual net cost plus ten percent.

(c) Equipment

The Contractor will be compensated for equipment employed in the Work at 70% of the rates, including operating costs, in effect at the time the Work is performed, in the "Rental Rate Blue Book for Construction Equipment" or the "Rental Rate Blue Book for Older Construction Equipment," whichever is applicable.

All rates are based on 8 hours per day, 40 hours per week, 176 hours per month and 22 working days per 30 day period. The rate resulting in the lowest cost to CEEMI for the employment of the equipment in the Work will be used. Operating costs will only be paid for hours during which equipment is actually being used in the performance of the Work.

Each unit of equipment or tool with a value at the time of use of less than $500 will be considered included in the labor rate and will not be separately compensable.

C. Contractor shall not perform any changes in the Work, including extra work, except pursuant to written direction from CEEMI's representative authorized to make changes expressly and unmistakably indicating his intention to change the Work. In the event adjustments for such changes are not agreed upon promptly, Contractor shall nevertheless proceed diligently to effect the changes at the time it is directed to do so by CEEMI.

D. In the absence of a written direction described in the preceding paragraph C, if Contractor deems any directive, whether oral or written, by CEEMI's authorized representative to be a change in the Work, Contractor shall nevertheless comply therewith but shall within five days give written notice as described in Article 16, Claims, and comply with the requirements thereof.

E. Any price increase or decrease or extension or acceleration of time for performance shall not be binding on CEEMI unless evidenced by a Contract modification or change order signed and issued by CEEMI. Contractor shall not have the right to make changes in the Work without the prior written approval of CEEMI.

F. Prices agreed upon for, or applicable to, changes (including extra work), include all impacts of the changes on the Work, including, but not limited to, delay, loss of productivity, demobilization, remobilization and idle time, and Contractor shall have no other claim for other effects on the Work due to such changes.

14. Labor

A. Contractor shall, unless otherwise specifically stated herein, provide all labor required to fully complete the Work. This shall include all crafts that are required by the nature of the Work, or by local, contractual, or other rules or regulations. Unless otherwise specifically provided herein, the costs of all labor, including supporting crafts, are included in the Contract price. Contractor will employ on Work at the construction site only union labor from building trades locals having jurisdiction over the Work, to the extent such labor is available. Whenever Contractor knows or believes that any actual or potential labor dispute is delaying or threatening to delay the timely performance of the Work, Contractor shall immediately give CEEMI notice thereof, including all relevant information with respect thereto. If such notice is given orally, Contractor shall confirm it in writing within 24 hours. In the event of any labor dispute which adversely affects the timely and efficient performance of the Work, including, but not limited to, a jurisdictional dispute, the Contractor shall exercise all rights and avail itself of all remedies and under collective bargaining agreements and the federal and state labor laws to resolve the dispute and end the adverse effect on the Work, including, but not limited to, the filing of an unfair labor practice charge with the National Labor Relations Board and the seeking of an injunction.

B. The Immigration Reform and Control Act of 1986 Pub. L. No. 99-603 (the "Act") makes it illegal for an employer to hire or employ an illegal alien. The Act also makes it a legal requirement for employers to establish an employment verification system which includes the employer's checking specified documents to establish both an individual's identity and legal authorization to work. Contractor represents and covenants that Contractor has complied and will comply with all the requirements of the Act with respect to all persons assigned or employed by Contractor in the performance of the Work. Contractor agrees to defend, save harmless and indemnify CEEMI, its trustees, officers, agents and employees against any and all liability under the Act arising in any way out of services performed by or CEEMI's use of persons furnished by Contractor.

15. <u>Time and Material and Cost Reimbursable Work</u>

A. CEEMI shall have the right to generally supervise, direct, control and approve the extent and character of work done on a time and material or other cost reimbursable basis.

B. Work performed on the basis of time and material shall not be performed either in whole or in part on a premium time basis (including overtime, Saturdays, Sundays and holidays) unless the Contractor obtains the prior written consent of CEEMI's duly authorized representative.

If the Contractor should perform work on a premium time basis without obtaining such consent then all cost relating to the premium time portion shall be borne solely by the Contractor without recourse to CEEMI.

C. For time and material work Contractor shall submit reports which shall list the time and trades used, material consumed and types of equipment used on site and operating hours indicated. The reports shall be submitted by the end of the next working day for each shift worked. These reports are to be submitted to the CEEMI site representative for approval (subject to future audit and adjustment if found to be in error). CEEMI shall make payment within 30 days after receipt of a proper invoice with required supporting documentation.

D. All work performed on a time and material basis shall be subject to the warranties provision of Article 12 above.

E. The hourly rates for time and material and cost reimbursable contracts include profit and all indirect costs such as, but not limited to, field overhead, home office costs, engineering and all other off-site costs.

16. Claims

A. The only claims that may be made by the Contractor are claims for (i) providing services or materials beyond the scope of the Contract that are not covered by a written and signed change order (hereafter "Non-Contract Work"), and (ii) the increased cost of performing Contract Work caused by CEEMI's breach of the Contract (hereafter "Increased Costs").

B. For each claim for Non-Contract Work, as defined in (A)(i), the Contractor must give written notice to CEEMI's designated representative within 5 days of when the Contractor began to perform such work. The notice must identify such work with particularity, the date such work was begun, the reason such work was performed, the estimated cost and duration of the work, the anticipated schedule impact, and the name of any CEEMI representative alleged to have ordered such work. For each claim for Increased Cost, as defined in (A)(ii), the Contractor must give written notice to CEEMI's designated representative within 5 days of Contractor's discovery of CEEMI's breach. The notice must identify the breach with the following particularity: for an act of CEEMI identify the act, the location of the act, the individual who performed the act, and the date of the act; for an omission by CEEMI, identify the specific action Contractor believes CEEMI should have taken, the date the action should have been taken, and the date the action was taken, if ever; for a misrepresentation by CEEMI, identify the representation alleged to be incorrect by document, page, section, and clause, describe the fact or condition misrepresented, and provide the date the Contractor learned of the misrepresentation.

C. For claims for which Contractor has given timely notice, Contractor must segregate and maintain, on a weekly basis, all costs associated with the claim. Documentation of all such costs shall be maintained and be made available to CEEMI upon request. Ten days after submitting the notice required by paragraph (B) of this Article, the Contractor must begin submitting weekly detailed itemizations of such costs to CEEMI. For each claim for Non-Contract Work, as defined in (A)(i), these detailed records shall include:

(1) The name, title, trade, local, and number of each worker employed in such work, the dates and hours each worker was employed in such work, and the tasks performed, and

(2) The nature and quantity of any materials, plant and equipment furnished or used in connection with the performance of such work and from whom purchased or rented.

For each claim for Increased Costs, as defined in (A)(ii), these detailed records must include:

(1) The date the Increased Costs were incurred,

(2) The name, title, trade local, and number of the workers who performed the work whose costs were increased,

(3) The price in the Contractor's bid for the performance of the work that had its cost increased, the actual cost to the Contractor to perform such work, and the amount of the Increased Costs that the Contractor claims CEEMI is responsible for.

(4) The nature and quantity of any materials, plant, and equipment whose cost was increased by CEEMI's act, omission, or misrepresentation.

D. Contractor's failure to provide timely notice of a claim, as required by paragraph (B), or to collect, segregate, maintain, and make available to CEEMI documentation of all costs sought in the claim, as required in paragraph (C), or to timely submit such costs on a weekly basis, as required by paragraph (C), shall be deemed a conclusive and binding determination by the Contractor that neither the Contractor nor any of its subcontractors have provided any services or materials beyond the scope of the Contract not covered by a written and signed change order and that neither the Contractor nor any of its subcontractors have had their costs increased by a breach of the Contract by CEEMI, and such failure shall be deemed a waiver of the claim.

17. Permits, Codes, Laws and Regulations. Contractor shall obtain and pay for all permits and licenses required for the Work except those which can be obtained only by CEEMI and those which the Contract specifically requires CEEMI to obtain. Contractor shall comply with all federal state, and local laws, executive orders, regulations, ordinances, rules, and safety codes insofar as they relate to the Work (including but not limited to the giving of notices and the payment of fees) and shall defend, save harmless and indemnify CEEMI, its trustees, officers, agents and employees against all liability arising out of Contractor's failure to do so. Contractor shall promptly examine all Contract documents and notify CEEMI in writing if it appears that any of them may fail to conform to any such code, law, ordinance, rule or regulation. Contractor shall provide CEEMI with the original or a copy of permits, certificates, receipts and other evidence establishing its compliance with the obligations imposed by this Article. Without limiting the generality of the foregoing, Contractor agrees to comply with the Fair Labor Standards Act.

18. Quality Assurance/Quality Control. Contractor shall establish and maintain a quality assurance/quality control program which shall include procedures for continuous control of all construction and comprehensive inspection and testing of all items of Work, including any Work performed by Subcontractors, so as to ensure complete conformance to the Contract with respect to materials, workmanship, construction, finish, functional performance, and identification. The program established by Contractor shall comply with any quality assurance/quality control requirements incorporated in the Contract.

19. Protection of Persons, Work and Property

A. The risk of loss or damage to the Work prior to full completion of all Work hereunder and final acceptance thereof by CEEMI shall be borne by Contractor.

B. In the course of performing the Contract, Contractor shall at all times exercise every reasonable precaution to protect persons and property and items of Work. Contractor shall at its own expense design, furnish, and erect such barricades, fences and railings, give such warnings, display such lights, signals and signs, exercise such precautions against fire, adopt and enforce such rules and regulations, and take such other precautions as may be necessary, desirable or proper, or as may be directed by CEEMI. Contractor shall provide and maintain in good working order at all times an adequate, approved system for promptly extinguishing fires. Fire alarms, extinguishing equipment and water lines shall be continually inspected by Contractor and shall at all times be accessible and ready for immediate use.

C. Contractor shall, while on or about the site of Work, observe and comply with all fire, safety, hazard, "No Smoking", and all other rules and regulations heretofore or hereafter prescribed by CEEMI. Safety hats shall be worn at all times in the Work area by Contractor's employees.

D. Contractor shall, at no additional cost to CEEMI, comply with all reasonable requests of CEEMI to enclose or specially protect Work, property or persons. If CEEMI determines that Work, property or persons are not adequately protected after any such requests, then it may, without prejudice to any other rights it may have hereunder or under applicable law, order an immediate suspension of the Work or take such steps as it deems necessary to protect Work, property or persons. The cost of such steps shall be charged to Contractor and may be deducted from any payments due Contractor, and Contractor shall not be entitled to be compensated for any costs of its own arising from such suspension.

E. Contractor shall promptly report in writing to CEEMI all accidents whatsoever arising out of or in connection with the performance of the Contract, whether on or adjacent to the construction site, which result in death, injury or property damage, giving full details and statements of witnesses. In addition, if death or serious injury or serious damage is caused, Contractor shall immediately report the accident by telephone to CEEMI.

F. Contractor shall provide at the construction site such equipment and medical facilities as are necessary to supply first aid service to any persons who may be injured in the course of performance of the Work and shall have standing arrangements for the removal and hospital treatment of such persons. If any claim is made by any person against Contractor or any other contractor on account of any accident, Contractor shall promptly report it in writing to CEEMI, giving full details of the claim.

G. If in the reasonable opinion of Contractor greater precautions than those required herein or directed by CEEMI are advisable, Contractor shall implement such precautions and advise CEEMI thereof. In the event of an emergency threatening injury to persons or damage to property the Contractor shall take all necessary action immediately and shall promptly notify CEEMI thereof.

20. Vehicle Spills Contractor is required to assure that all vehicles, including those of subcontractors and suppliers, used in the performance of work for CEEMI are maintained in good working condition and are not leaking any fluids. Particular attention is to be paid, without limitation, to hydraulic systems on each vehicle.

The driver must immediately notify a CEEMI authorized representative in the event of a leak or spill from a vehicle or container carried on a vehicle while at the job site. The driver must wait for instructions before moving the vehicle unless field conditions require it, and then, only to the nearest safe point.

The driver will be required to eliminate the leak or spill before leaving the job site. Contractor shall be required to reimburse CEEMI for all costs associated with the cleanup of leaks and spills.

21. Maintenance of Work Site. Contractor shall, at its own expense, store its apparatus, material, supplies and equipment in such orderly fashion as will not interfere with the progress of the Work or the work of any other contractors; clean up and remove on a daily basis and more frequently if directed by the CEEMI representative all refuse, rubbish, scrap materials, and debris so that at all times the Work site shall present a neat, orderly and workmanlike appearance; and, before final payment, remove all surplus material, falsework, and temporary structures, including any foundations thereof. If, in the opinion of CEEMI, Contractor has failed to comply with any provisions of this Article, CEEMI may order any or all of the Work suspended until the conditions is corrected, and all costs associated therewith shall be borne by Contractor.

22. Subsurface Conditions Found Different. CEEMI shall not be obliged to show any subsurface conditions on any drawing, plans or specifications it furnishes Contractor, and if none are shown that is not to be interpreted as indicating that there are none of significance to the Work. Should Contractor encounter subsurface conditions at the site materially different from any that are shown on the drawings, plans or specifications, it shall immediately give notice to CEEMI of such conditions before the conditions are disturbed. CEEMI

will thereupon promptly investigate the conditions, and if it finds that they materially differ from those shown on the plans or indicated in the specifications it will make any changes necessary. Any increase or decrease in the cost of or time required for performance resulting from such changes shall be dealt with in accordance with the provisions of Article 13, Changes.

23. Inspection and Tests and Correction of Defects

A. All parts of the Work shall, throughout the time of performance of the Contract, be subject to inspection by CEEMI. CEEMI shall be the final judge of the quality and acceptability of the Work, the materials used therein, and the processes of manufacture and methods of construction employed in connection therewith. Contractor shall provide CEEMI's representatives with safe and proper facilities for access to and inspection of the Work, both at the construction site and at any plant or other source of supply where any equipment, material, or part may be located. CEEMI shall have the right to witness any test Contractor or any third party acting on behalf of Contractor conducts relating to the Work, and Contractor shall give CEEMI advance written notice thereof. CEEMI shall have the right to require Contractor to perform additional tests at reasonable times and places. The cost of any additional tests required by CEEMI shall be borne by CEEMI unless they disclose a defect or nonconformity in the Work, in which case the cost shall be borne by Contractor.

B. No inspection, failure to inspect, or waiver of inspection on the part of CEEMI or anyone acting on its behalf shall relieve Contractor of its duty to complete the Work in full accordance with the requirements of the Contract.

C. Should it appear to CEEMI at any time prior to the completion and acceptance of the entire Work, whether as a result of the aforementioned inspections and tests or otherwise, that any part of the Work is not suitable or of good quality or fails to conform to Contract requirements, CEEMI shall have the option to :

(a) halt the continuation of such Work; and

(b) require Contractor, at Contractor's sole expense and within such reasonable time as may be fixed by CEEMI, to reconstruct, replace or correct the applicable Work and remedy any damage to property of CEEMI and others occasioned by such Work or the materials, methods or processes employed in connection therewith; or

(c) perform or have performed by another all tasks stated in section (b) and withhold or recover the cost thereof from Contractor; or

(d) accept the unsuitable or nonconforming Work and reduce the Contract price by an amount CEEMI deems equitable.

In any event, Contractor shall reimburse CEEMI for all costs attributable to delays in the Work or additional work performed by other contractors to the extent they arise from Contractor's unacceptable Work.

24. Effect of CEEMI Approval. Contractor's obligations under this Contract shall not be affected by the grant to, or the exercise or non-exercise by, CEEMI of rights to inspect, test, review or approve the Contractor's performance of the Work, including, without limitation, documents such as drawings, written procedures or daily reports. Any approval by CEEMI of any materials, workmanship, equipment, documents or other act or thing done or furnished or proposed by Contractor shall be construed merely as indicating that at the time of the approval CEEMI was not aware of any reason for objecting, and no such approval shall release Contractor from full responsibility for the accurate and complete performance of the Contract in accordance with its terms.

25. Subcontracting

A. Contractor shall not subcontract all or any portion of the performance to be rendered hereunder without the express written approval of CEEMI as to the tasks to be subcontracted and the Subcontractor; provided, however, that this limitation shall not apply to the purchase of standard commercial supplies or raw materials. The Contractor may utilize the services of specialty Subcontractors if they are customarily used in the industry on the work subcontracted, provided CEEMI has first approved the proposed Subcontractor. The Contractor shall, as soon as practicable after execution of the Contract, notify CEEMI in writing of any Subcontractor proposed to be employed on the Work. Contractor shall not be relieved of any obligations hereunder by reason of any such approved subcontracting.

B. Contractor, shall, notwithstanding CEEMI's approval, be as fully responsible for the acts and omissions of its Subcontractors and their agents as it is for its own acts and omission. Should any approved Subcontractor fail to perform to the satisfaction of CEEMI, CEEMI shall have the right to rescind its approval and to require the Work subcontracted to be performed by Contractor or by another approved Subcontractor. Nothing contained herein shall create any contractual rights in any Subcontractor against CEEMI. Contractor shall cause all subcontracts applicable to the Work to contain provisions which require the Subcontractor to provide the same insurance coverage as is required of the Contractor naming both CEEMI and contractor as additional insureds. Subcontracts shall provide for the Contractor the same rights against the Subcontractor as CEEMI has hereunder against the Contractor and shall expressly state that such provisions shall also be for the benefit of CEEMI.

26. Title to Materials and Completed Work. Contractor shall obtain and maintain title to all materials, equipment and structures to be installed by it in the Work, free from all liens, claims and encumbrances. Title to all Work completed or in the course of construction and to all materials, equipment and structures as to which any payment has been made by CEEMI shall be in CEEMI, but this shall not affect CEEMI's right to require the correction of defective or non-conforming Work nor relieve Contractor of any other obligation arising under the Contract.

27. Audit. In the event the contact now provides or in the future is modified to provide that the Work or any part thereof shall be done on a cost-reimbursable basis (whether or not a fee has, in addition, been fixed by the parties), time-and-materials basis or similar basis, or if payment on such basis is to be made under Article 32, Suspension or Article 33. Termination for Convenience, Contractor shall maintain, and in the event there are subcontracts on any of such bases shall cause the Subcontractor(s) to maintain detailed books, records and accounts covering costs incurred in connection with such Work or, as applicable, time spent and materials used. Contractor shall make or cause to be made said books, records and accounts available for inspection and audit by CEEMI and its authorized representatives during the term of this Contract and for a period of six (6) years after final payment hereunder. If audit discloses that CEEMI has paid Contractor for any costs which were not in fact incurred or for any time spent or materials used which were not in fact spent or used, Contractor shall refund to CEEMI an amount equal to such payment.

28. CEEMI's Performance. CEEMI shall perform any action required of it by the Contract in order to enable the Contractor to perform hereunder. Failure by CEEMI to substantially perform any such obligation shall not give rise to an action for damages by Contractor, in contract or in tort, or entitle Contractor to

cancel or rescind the Contract or abandon performance hereunder. Unexcused nonperformance by CEEMI shall, however, relieve Contractor of its obligation to perform hereunder to the extent that it prevents Contractor from performing. Nonperformance by CEEMI shall be excused where caused by an act or omission of the Contractor.

29. Liens. Contractor shall save harmless and indemnify CEEMI against all claims, liens or attachments growing out of the demands of Subcontractors, mechanics, workmen, materialmen, laborers and furnishers of services, machinery, equipment, tools, materials or supplies, including commissary, in connection with the Work. Contractor shall deliver the Work to CEEMI free and clear of all liens, claims, and encumbrances, and shall furnish CEEMI a certificate to that effect upon request. Contractor shall furnish CEEMI a Waiver of Liens in full with the presentation of Contractor's final invoice for payment. Neither the final payment, nor payment of any part of the retained percentage shall become due until Contractor furnishes a Waiver of Lien. Contractor may, if any of its Subcontractors or suppliers refuse to furnish a Waiver of Lien, furnish a bond satisfactory to CEEMI indemnifying CEEMI against any lien. If required by CEEMI, Contractor shall furnish CEEMI, in addition to the Waiver of Lien, an affidavit that so far as Contractor has knowledge, the Waiver of Lien includes all labor and material for which a lien could be filed. CEEMI may withhold from payment an amount sufficient to protect CEEMI against any claims, liens or attachments. If any lien remains unsatisfied after final payment has been made to the Contractor, Contractor shall refund to CEEMI all monies that CEEMI may be compelled to pay in discharging such lien, including all costs and attorneys' fees.

30. Bonds. Contractor shall furnish performance or payment bonds, or both, that may be required by law or requested at any time by CEEMI. Any and all such bonds shall be in a form and in an amount, and shall have a surety or sureties, acceptable to any governmental authority having jurisdiction and to CEEMI. The premiums for all such bonds which are required by law or which have been requested by CEEMI prior to the time of the execution of the Contract or which are required by the Contract itself shall be deemed to be included in the Contract price, and no additional compensation shall be payable to Contractor with respect to such bonds. If a bond is required by CEEMI after the Contract is executed, Contractor shall be reimbursed the cost thereof, if it has been previously approved by CEEMI, upon submission by Contractor of satisfactory evidence of payment therefor. No change order, extension of the time for completion, failure to enforce any rights arising under the Contract, or other act or forbearance of CEEMI shall operate to release or discharge any surety or sureties under any such bonds, and such bonds shall so provide.

31. Other Contractors

A. Contractor shall fully cooperate with other contractors and any CEEMI employees at or near the site of the Work and carefully coordinate its own work with that performed by them. Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor or by CEEMI.

B. If any other contractor or any Subcontractor shall suffer loss or damage through acts or neglect on the part of Contractor, Contractor shall use its best efforts to settle the matter with such other contractor or Subcontractor. If such other contractor or Subcontractor asserts any claim against CEEMI based on such loss or damage, CEEMI shall notify Contractor, and Contractor shall indemnify and save CEEMI harmless against any such claim and any loss or liability arising therefrom.

C. Contractor and its Subcontractors shall keep informed of the progress and the details of work of other CEEMI contractors at the Work site (and of CEEMI) and shall notify CEEMI immediately of lack of progress or defective workmanship on the part of any of them (or of CEEMI). Failure by Contractor to keep informed of other work in progress at the site or to give notice of lack of progress or defective workmanship by others shall be deemed an acceptance by the Contractor of such other work insofar as it relates to or affects its own Work.

32. Suspension. CEEMI shall have the right, for its convenience, to suspend all or part of the Contractor's performance hereunder at any time by written notice. Contractor shall, as soon as possible, resume any suspended Work when so directed by CEEMI. The time for performance shall be extended for a period equal to the delay caused by such suspension. If such suspension continues beyond a reasonable period, Contractor shall be entitled to be reimbursed for any out-of-pocket costs (exclusive of field and home office overhead or costs resulting from loss of efficiency or Work done out of sequence) which it establishes to the reasonable satisfaction of CEEMI (obtained through audit if required by CEEMI) were incurred by it thereafter solely by reason of such suspension, provided, however, that such entitlement is conditioned upon Contractor's notifying CEEMI in writing within fifteen (15) days after the beginning of such suspension that additional costs will or may be incurred thereby and upon Contractor's making claim therefor in writing within thirty (30) days after CEEMI's notice to resume work. In no event shall Contractor be entitled to a profit on such costs.

33. <u>Termination for Convenience</u>

A. CEEMI may, for any reason whatsoever, including its own convenience, terminate the Contract, in whole or in part, upon ten (10) days' written notice to Contractor without liability except as stated in this article. Upon receipt of such termination notice, Contractor shall: (1) cease performance of the Work to the extent specified by CEEMI in the notice of termination and thereafter do only such Work with respect to the terminated portion of the Contract as may be necessary to preserve and protect Work already performed or in progress; (2) place no further orders or subcontracts for services, materials or equipment, except as may be necessary for completion of such portion of the Work as is not terminated; and (3) procure cancellation of all existing orders and subcontracts to the extent they relate to the performance of Work terminated.

B. In the event of such termination, CEEMI shall, in full discharge of all its obligations to Contractor, pay termination charges as follows: With respect to lump sum contracts, a percentage of the Contract price reflecting the percentage of Work performed prior to the effective date of the termination; with respect to cost reimbursable contracts, allowable costs incurred prior to the effective date of termination plus an equitable portion of any fixed fee provided for in the Contract; with respect to time-and-materials contracts, for time expended and materials purchased and paid for prior to the effective date of the termination at the Contract rates; and with respect to unit price contracts, for units of Work completed prior to the effective date of termination at Contract rates. In addition, regardless of the type of contract, CEEMI shall reimburse Contractor any unavoidable out-of-pocket costs of cancellation payments to Subcontractors resulting directly from the termination which CEEMI agrees in writing were not taken account of in the aforementioned payments. Contractor shall not be entitled to be compensated for any other costs arising from the termination, direct or indirect (including, without limitation, field and home office overhead and accountants' or attorneys' fees), whether or not based on Work performed prior to the effective date of termination. All termination payments shall be less (a) prior amounts paid on account of the Contract price and (b) the value of any salvage available to the Contractor with respect to any material, structures or equipment purchased or manufactured prior to cancellation. Contractor shall use its best efforts to minimize termination charges. All termination charges shall be subject to audit by CEEMI.

C. If payments on account of the Contract price made prior to the effective date of termination exceed the above termination charges, the excess shall be refunded to CEEMI. Except as agreed in writing, termination shall not relieve either party of any obligation which may arise out of Work performed prior to termination. In no event shall CEEMI be liable to Contractor for damages of any kind whatsoever arising out of the termination, whether based on lost profit, unrecovered or increased home office or other overhead resulting from termination-related reductions in workload or in direct costs, lost opportunities to obtain other jobs, or otherwise.

34. Confidentiality. All specifications, plans, drawings, and other technical information furnished to Contractor or prepared by Contractor in connection with the Work shall, at the written request of CEEMI or if the documents are so marked, be held confidential by Contractor, be used by the Contractor only in connection with the performance of the Work, and be delivered to CEEMI upon completion of Contractor's performance.

35. Patents, Etc. If Contractor, in performing this Contract employs, constructs or provides any design, process, material, tool or equipment covered by a patent, copyright, trademark or other proprietary right, Contractor shall, if it does not itself own such right, at its own expense secure permission prior to its use hereunder by securing a suitable agreement from the owner of such right. Contractor shall indemnify and hold CEEMI harmless against any claim, suit or proceeding for infringement of any patent, copyright, trademark or other proprietary right brought against CEEMI, and any liability arising therefrom, arising out of the use or manufacture of any designs, processes, materials, tools or equipment provided to CEEMI or employed in the performance of the Work. Contractor shall provide for the defense of any such claim, suit or proceeding, and shall pay all costs and expenses in connection therewith, including compensation of experts and counsel, and all damages and costs awarded against CEEMI. CEEMI shall notify Contractor of any such claim, suit or proceeding in writing and give Contractor authority, information and assistance (at Contractor's expense) for the defense thereof. In the event that the use of anything furnished or constructed hereunder is enjoined, Contractor shall promptly, at its own expense and at its option, either (a) procure for CEEMI the right to continue using it or (b) with the approval of CEEMI, (i) replace it with a noninfringing equivalent or (ii) modify it so it becomes noninfringing.

36. Indemnification. To the fullest extent allowed by law, Contractor agrees to defend, indemnify and save CEEMI, its directors, officers, employees and agents harmless from all claims, damage, loss and liability, including costs and expenses, legal and otherwise, for injury to or the death of persons, or damage to property, including the property of CEEMI, or statutory or administrative fines, penalties or forfeitures resulting in whole or in part from, or connected with, the performance of the Work by Contractor, any subcontractor, their agents, servants and employees, and including claims, loss, damage and liability arising from the partial or sole negligence of CEEMI or non-parties to this Contract. To the fullest extent permitted by law, the Contractor expressly agrees that CEEMI may pursue claims for contribution and indemnification against the Contractor in connection with claims against CEEMI for injury and/or death to Contractor's employees notwithstanding any provisions of any applicable workers' compensation or similar law limiting such claims for contribution and indemnification against employers, and Contractor hereby waives any such limitations on contribution and indemnity claims against employers insofar as such claims are asserted by CEEMI against the Contractor.

37. Insurance. Contractor shall procure and maintain the following insurance at its own expense until completion and acceptance of performance hereunder, and thereafter to the extent stated below, with at least the monetary limits specified. The insurance shall be in policy forms which contain an "occurrence" and not a "claims made" determinant of coverage and shall be placed with insurance companies acceptable to CEEMI.

A. Employment related insurance.

(a) Workers' Compensation Insurance as required by law.

(b) Employer's Liability Insurance, including accidents (with a limit of $1,000,000 per accident) and occupation diseases (with a imit of $1,000,000 per employee).

(c) Where applicable, insurance required by the United States Longshoremen's and harbor Workers' Act, the Federal Employers' Liability Act, and the Jones Act.

B. Comprehensive (also called Commercial) General Liability Insurance, including Contractual Liability, with limits of $5,000,000 per occurrence for bodily injury or death and $1,000,000 per occurrence for property damage or a combined single limit of $5,000,000 per occurrence and, for at least one year after completion of performance hereunder, Products/Completed Operations Liability Insurance with similar but separate and independent limits. Policy deductibles shall be subject to CEEMI's approval. The insurance shall contain no exclusions for explosion, collapse of a building or structure, or underground hazards. The insurance policy or policies shall name CEEMI (Consolidated Edison Energy Massachusetts, Inc. an additional insured. There shall be no exclusion for claims by Contractor employees against CEEMI based on injury to Contractor's employees.

C. Comprehensive Automobile Liability Insurance, covering all owned, non-owned and hired automobiles used by the Contractor or any subcontractors, with limits of $1,000,000 per occurrence for bodily injury or death and $500,000 per occurrence for property damage or a combined single limit of $1,000,000 per occurrence.

D. Where the Work involves the use of aircraft, Aircraft Liability Insurance, covering all owned, non-owned and hired aircraft, including helicopters, used by the Contractor or any Subcontractors, with a combined single limit of $5,000,000 for bodily injury or death and property damage. The insurance policy shall name CEEMI as an additional insured.

E. For the asbestos abatement portion and the lead abatement portion of the Work, Asbestos Abatement General Liability

Insurance and Lead Abatement Liability Insurance, as applicable, each with a combined single limit of $5,000,000 for bodily injury or death and property damage. Each insurance policy shall name CEEMI as an additional insured. Where the abatement work is to be performed by a subcontractor, the Contractor shall require the subcontractor to name both the Contractor and CEEMI as additional insureds and to submit copies of the policies to CEEMI.

Contractor shall cause all insurance carried hereunder to be endorsed by the insurer to require that the insurer furnish CEEMI with at least ten (10) days' written notice prior to the effective date of cancellation of the insurance or of any changes in policy limits or scope of coverage. All coverage of additional insureds shall be primary coverage as to the additional insureds.

At least three days prior to commencing work at the site, Contractor shall furnish CEEMI with copies of the policies specified in paragraphs B and E above and Certificate(s) of Insurance covering all required insurance and signed by the insurer or its authorized representative certifying that the required insurance has been obtained and will not be canceled or altered without at least ten (10) days' prior written notice to CEEMI. Such certificates shall state that the policies have been issued and are effective, show their expiration dates, and state that CEEMI is an additional insured with respect to all coverages enumerated in paragraphs B, D and E above. Such certificates shall not contain a disclaimer of liability of the insurer for failure to provide CEEMI with notice of cancellation or substantial alteration. CEEMI shall have the right to require the Contractor to furnish CEEMI, upon request, with a copy of the insurance policy or policies required under paragraphs A. C, and D hereunder. The Contractor agrees that this is an insured contract. The insurance required herein is intended to cover CEEMI for its own liability for negligence or any other cause of action in any claim or lawsuit for bodily injury or property damage arising out of the Work.

For purposes of interpretation or determination of coverage of any policy of insurance or endorsement thereto, Contractor shall be deemed to have assumed tort liability for any injury to any employee of Contractor or CEEMI arising out of the performance of the Work, including injury caused by the partial or sole negligence of CEEMI and notwithstanding any statutory prohibition or limitation of the Contractor's indemnification obligation hereunder.

Certificates of Insurance identifying the Contract shall be sent to:

Consolidated Edison Energy Massachusetts, Inc.
c/o Consolidated Edison Energy, Inc.
111 Broadway, 16th Floor

New York, NY 10006
Attention: Project Manager

38. Taxes. The Contract price includes all federal, state and local sales, use, excise, occupational, franchise, property, gross receipts, privilege and other taxes that may be applicable to the Work, and all federal, state and local taxes, contributions, and premiums imposed upon or measured by Contractor's and any Subcontractor's payrolls.

39. Amendments. No modification of or amendment to the Contract shall be valid or binding unless in writing and signed by an authorized representative of CEEMI.

40. Assignment. Contractor shall not assign the Contract or any or all of its rights under the Contract without the written consent of CEEMI, and any assignment made without such consent shall be void. If Contractor assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause to the effect that the right of the assignee to any monies due or to become due to Contractor shall be subject to any and all claims based on services rendered or omitted or materials supplied or not supplied in the performance of the Work.

41. Cancellation for Default. In the event Contractor is in default of any of its obligations under the Contract, CEEMI shall have the right, on written notice to Contractor and any sureties, to cancel the Contract for default. Contractor shall be deemed to be in default hereunder if it is in default of any of its obligations under the Contract or makes any statement or performs any act indicating that it will not perform one or more of such obligations (whether or not the time has yet arrived for performance thereof) or ceases to pay its debts promptly or becomes insolvent or commences or has commenced against it any insolvency proceeding or finds its affairs placed in the hands of a receiver, trustee, or assignee for the benefit of creditors. In the event of cancellation for default hereunder, Article 33, "Termination for Convenience" shall not apply and CEEMI shall have all rights and remedies provided by law and the Contract. In addition, in such event CEEMI shall have the right, at its election and without prejudice to any other remedies, to take possession for the purpose of completing the Work of all materials, tools, equipment and appliances at the construction site and to either complete or employ another to complete the Work and hold the Contractor liable for any additional cost occasioned thereby. Following cancellation, Contractor shall not be entitled to any further payment until the work has been fully completed and accepted, and CEEMI may retain from any money otherwise due Contractor for services rendered prior to cancellation an amount which CEEMI determines is adequate to cover all damage resulting from Contractor's default. In the event that Contractor

demonstrates that a cancellation of the Contract for default is erroneous, the cancellation shall, at CEEMI's option, be withdrawn or be deemed to have been issued as a termination for convenience pursuant to Article 33, and the rights and obligations of the parties hereto shall in such event be governed accordingly.

42. Relationship of Parties. Contractor shall be an independent contractor in the performance of the Work. No right of supervision, requirement of approval or other provision of the Contract and no conduct of the parties shall be construed to create a relationship of principal and agent, partners or joint venturers between the parties, or joint employers of Contractor's employees.

43. No Third Party Rights. Unless specifically provided elsewhere herein, nothing contained in this Contract is intended for the benefit of any third parties.

44. Waiver. Neither the acceptance of the Work or any part thereof nor any payment therefor nor any order or certificate issued under the Contract nor any performance by CEEMI of any of Contractor's duties or obligations nor any failure by CEEMI to insist on strict performance by Contractor of any of the Contract terms or to otherwise assert its rights shall be deemed to be a waiver of any provision of the Contract or of any rights or remedies to which CEEMI may be entitled because of any breach hereof. No cancellation or rescission hereof in whole or as to any part of the Work because of breach hereof shall be deemed a waiver of any money damages to which CEEMI may be entitled because of such breach. No waiver shall be effective against CEEMI unless in writing and signed by CEEMI's authorized representative, and any such waiver shall be effective only with respect to the particular event to which it specifically refers.

45. Set-Off. CEEMI shall have the right to set off against any sums due Contractor hereunder any claims CEEMI may have against Contractor under the Contract or any other contract between CEEMI and the Contractor without prejudice to the rights of the parties in respect of such claims.

46. Conflicting Contract Documents. To the extent, if any, that the specifications, plans, drawings and other documents that may be incorporated herein conflict with the provisions of the written agreement or any special conditions incorporated by such written agreement or the Standard Terms and Conditions of which this clause is a part, the written agreement, such special conditions and these Standard Terms and Conditions shall take precedence and govern. In any instance where there is a conflict or inconsistency among the written agreement, the special conditions incorporated by the written agreement and these Standard Terms and Conditions, these Standard Terms

and Conditions shall take precedence and govern unless the written agreement or any special conditions incorporated by such written agreement expressly refers by number and title to the conflicting or inconsistent clause, in which case the provision in the written agreement or the special conditions, as applicable, shall take precedence and govern. In the event that any terms of Contractor's proposal are expressly referred to in the Contract, in any instance where such terms are in conflict or inconsistent with other provisions of the Contract, unless there is a clear statement to the contrary herein said other provisions shall take precedence and govern. All rights and remedies provided by the Contract shall, unless otherwise specified herein, be deemed to be cumulative so as to exist in addition to one another and to any other rights and remedies provided by law. The titles of the articles of this Contract are for convenience only and shall not be construed to limit or qualify the meaning of any article or section thereof.

47. Notices. All notices required or permitted to be given under the Contract shall be in writing and given by either party by personal delivery or by depositing the notice in the United States Mail, enclosed in a sealed envelope with first class postage thereon, addressed to the other at the address shown in the Contract. The address of either party may be changed by written notice to the other.

48. Entire Agreement. The Contract, as it may be amended in accordance with Article 39 hereof, Amendments, contains the entire agreement between CEEMI and Contractor. If any article or provision of the Contract is or becomes legally invalid or unenforceable, the remainder of the article and the Contract shall not be affected thereby. Any prior or contemporaneous oral or written understandings or agreements relating to the subject matter of the Contract are merged herein.

49. Applicable Law. The Contract shall be interpreted and the rights and liabilities of the parties hereto determined in accordance with the laws of the State of New York without recourse to such state's choice of law rules.

50. Waiver of Trial by Jury. Contractor hereby waives trial by jury in any action, proceeding or counterclaim brought by either party against the other on all matters whatsoever arising out of or in any way connected with the Contract or any claim of damage resulting from any act or omission of the parties in any way connected with the Contract.

51. Submission to Jurisdiction/Choice of Forum

A. Contractor hereby irrevocably submits to the jurisdiction of the courts of the State of New York with regard to any controversy arising out of or relating to the Contract. Contractor agrees that service of process on Contractor in relation to such jurisdiction may be made, at the option of CEEMI, either by registered or certified mail addressed to Contractor at the address shown in the Contract or at the address of any office actually maintained by Contractor, or by actual personal delivery to Contractor. Such service shall be deemed to be sufficient when jurisdiction would not lie because of the lack of a basis to serve process in the manner otherwise provided by law. In any case, however, process may be served as stated above whether or not it may be properly served in a different manner.

B. Contractor consents to the selection of the New York State and United States courts situated within the City of New York or Westchester County as the exclusive forums for any legal proceeding arising out of or relating to the Contract. Contractor also agrees that all discovery in any proceeding will take place in the City of New York or Westchester County.

52. Limitation on Time to Sue. No action shall be brought by Contractor based on any controversy or claim arising out of or related to the Contract, or any breach thereof, more than two years after accrual of the cause of action.

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

RED BRIDGE MINIMUM FLOW GATE PROJECT

SPECIAL CONDITIONS

1.0 GENERAL

Except as and to the extent otherwise expressly specified in the Standard Terms and Conditions of Construction Contracts, the following Special Conditions shall be applicable to and constitute a part of the Contract. If there is a conflict between the Standard Terms and Conditions of Construction Contracts and these Special Conditions of the Contract, the Special Conditions shall govern.

2.0 CONTRACT DOCUMENTS

The intent of the Contract is to include all labor, materials, appliances and services of every kind necessary for the proper execution of the work, and the terms and conditions of payment therefore. The Contract Documents are to be considered as one, and whatever is called for by any one of the Documents shall be as binding as if called for by all.

3.0 ARTICLE 4 (Price and Payment) of the Standard Terms and Conditions of Construction shall be modified as follows: All invoices shall be submitted to Engineer at

Kleinschmidt Associates
PO Box 576
Main Street
Pittsfield, ME 04967
Attn: Alfred Nash

Engineer will review and submit to CEEMI.

4.0 ARTICLE 7 (Safeguards in Work) of the Standard Terms and Conditions of Construction Contracts shall add the following:

H. The Contractor's safety personnel or supervisor shall meet with Owner representatives to review CEEMI's Contractor Safety Work Rules and shall provide Signature of Understanding and Compliance. Signature shall be completed prior to the commence of work on Owner's property.

I. The Contractor shall be responsible for job site safety and enforcement of safety related acts or laws. The Owner or his Representative will provide periodic inspections to inspect the quality of work. The Owner or his representative reserves the privilege to intercede in Contractor's operation for specific individual circumstances which are brought to this attention without assuming responsibility for all other Contractor operations and personnel. Failure of the Owner or his

Representative to determine or identify unsafe practices shall in no way relieve the Contractor of his responsibility to provide a safe work environment.

5.0 ARTICLE 14 (Labor) of the Standard Terms and Conditions of Construction Contracts shall be modified as follows:

Non-union labor may be employed in the work.

6.0 ARTICLE 17 (Permits, Codes, Laws and Regulations) of the Standard Terms and Conditions of Construction Contracts shall be modified as follows.

The Owner has applied for the following permit:

State of Massachusetts, Department of Environmental Protection, Waterways License or Permit.

The method of construction and quantities listed on the permit application are general in nature and should not be construed as actual quantities or method of construction or intended to define or limit the Contractor or Contractor's proposed techniques.

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CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

RED BRIDGE
MINIMUM FLOW GATE PROJECT

CONTRACTOR SAFETY WORK RULES

1. Introduction

   A. These work-rules govern the way that contractors and their staff conduct business at Fossil/Hydro facilities belonging to Consolidated Edison Energy Massachusetts, Inc. (CEEMI). These rules are meant to convey CEEMI's expectations for the safe and environmentally correct safe practices to be used at each station and may exceed the requirements of OSHA or other regulatory agencies. They reference CEEMI policies and programs such as the fitness-for-duty program, and other rules relating to the use of facility equipment. Contractors are responsible for supplying competent supervision and employees who are qualified and trained for the type of work that they will perform, providing all applicable training and safety instructions, and assuring that safe practices are followed. This includes verifying that the employees reporting to work are physically able to do all aspects of their jobs when they start work on the project.

   B. Contractors and their employees are expected to abide by these work-rules and discipline those who do not abide by them. In addition, contractors must inform all of their employees of CEEMI policies, practices, and rules, including these work-rules, to be followed while on CEEMI properties and projects.

   C. CEEMI will assign a qualified individual who has demonstrated a sufficient level of experience and training to act as liaison for each contractor. The contractor must provide the CEEMI liaison with up-to-date lists of the employees on site. Any questions or concerns regarding these work-rules should be directed to the liaison or the liaison's designee.

2. Emergencies

   A. EMERGENCY NUMBER
   413-730-4745

   B. Plant operations staff handles all emergencies and coordinates all activities, such as, medical, fire, and hazardous emergencies. The phone number to contact them is 413-730-4745 - Plant operations staff notifies fire, police and rescue agencies when necessary.

   C. When reporting an emergency, you must clearly state what the emergency is, where you are located, and any other information to allow the appropriate response action. This includes requesting fire or ambulance equipment if needed. You must also stand by in a safe area to allow the responders to identify the area of the emergency as soon as possible and to provide them with first hand information when they arrive.

D. Contractors must provide their employees with awareness and informational training concerning bloodborne pathogens. Training must comply with OSHA Section 29 CFR 1910.1030. In the case of a biological spill, contractors must coordinate with CEEMI liaison to ensure an appropriate response.

E. Contractors should be equipped with their own first aid kits and other medical supplies, however, first aid kits are available on-site for minor injuries if necessary. Contractors are responsible for transporting employees to receive medical treatment for minor injuries, if required.

F. Each station has a "PLAN FOR EMERGENCY EVACUATION" which is posted in a prominent location. The contractor must assure that their personnel are familiar with this plan and the location of the exits. Some locations have emergency evacuation warning tones which may be tested monthly and early in the outage periods following a general announcement of the test over the P.A. system.

3. Safety

A. General Safety Rules

All contractors and their employees are responsible for safety. This includes following all regulatory required safety and environmental rules and regulations, (including the latest version of OSHA Sections, 29CFR 1910 and 1926 in effect at the time of the work or those that may take effect during the work), CEEMI rules and procedures, site specific rules, and safe work practices. Failure to comply is just cause for expulsion from CEEMI properties.

1. All contractors must supply qualified employees who are knowledgeable and skilled in the areas to which they are assigned. Appropriate documentation on employees performing tasks or jobs requiring special training and medical and physical qualifications for fork truck or crane operation, rigging, welding, asbestos removal, etc., must be available at all times for review by the CEEMI liaison. Contractors must evaluate all work to determine the appropriate PPE requirements, such as respiratory protection, eye protection and other protective measures as needed, beyond the station's general requirements, and they must require that such protection be used. All contractor personnel using respirators must be clean shaven and have satisfactory up-to-date respirator fit tests and medical clearances on file with their employer.

2. Contractors must conduct pre-job safety briefings ("tailboards") with their employees at the start of each individual work assignment or shift and whenever workscope changes warrant, as required by OSHA Section 29 CFR 1910.269(c). The CEEMI liaison can help to identify hazards (boiler ash, chemicals, etc.) that exist within each station and also provide MSDS sheets for hazards.

3. Contractors must report all injuries, work related illnesses and near misses to the CEEMI liaison as soon as possible. Incident documentation is required on-site. CEEMI requires that all injury and illness reports be promptly submitted to the CEEMI liaison. CEEMI also requires that all injuries, illnesses, and near misses be promptly investigated with documented investigation reports submitted to the CEEMI liaison within one week, unless other arrangements with CEEMI liaison have been made, but not to exceed two weeks.

4. No alcoholic beverages, controlled drugs (other than prescribed drugs), or firearms are allowed on CEEMI property nor shall any worker under the influence of alcohol and/or drugs be allowed on CEEMI property. The sale or use of alcohol and/or drugs on CEEMI property is strictly prohibited. Fighting, stealing and gambling is also prohibited and strictly enforced. Reference to the CEEMI Fitness For Duty policy which states:

    - Maintaining an alcohol and drug free workplace that is free from the effects of such substances.

    - Ensuring that employees perform their work assignments in a reliable, trustworthy manner and not impaired by mental or emotional problems, fatigue, or stress.

    - Provide reasonable measures for early detection of individuals who are not fit to perform their duties.

5. The use of personal radios, such as "walkman" style cassette or CD players, etc., and walkie talkies are either restricted or prohibited on most CEEMI properties. Permission to use equipment of this type must be obtained through your CEEMI liaison.

6. Smoking is prohibited in most areas of each station. Signs are posted where a fire or explosion hazard might exist. See the CEEMI liaison or the site specifics for the details of the smoking policy at this work location.

B. Personal Protective Equipment and Tools

1. All contractors are required to supply their own tools, safety equipment and personal protective equipment (PPE). Tools and equipment shall have all required guards, safety features as determined by site specific requirements and applicable standards (ANSI.UL, etc.) and be in safe working condition at all times. ALL PPE shall be worn as designed. Damaged tools and equipment shall be removed from service and properly identified to prevent accidental use. CEEMI will not lend tools or safety equipment to contractors except in special or unusual situations. Tools and equipment borrowed from CEEMI must be approved through the CEEMI liaison and the contractor must return them in good condition or replace them. Contractors must evaluate all work to determine the

appropriate PPE requirements, such as respiratory protection, eye protection and other protective measures as needed, beyond the station's general requirements, and they must require that such protection be used. All contractor personnel using respirators must be clean shaven and have satisfactory up-to-date respirator fit tests and medical clearances on file with their employer.

2. Class B hard hats and safety glasses with rigid side shields are required at all times in the work area, and while walking through the work areas while work is in progress or hazards present. PPE is usually not required in office areas or some other areas as outlined in the station specifics.

3. Hearing protection is required in designated areas in CEEMI facilities and during activities that may exceed 85 dB. See the station specifics for details at your work location.

4. Foot wear and clothing appropriate for the job is required at all times. Hazard assessments of CEEMI facilities have shown that steel toed work shoes or boots are required in many areas for some tasks or jobs. Shirts and long pants are required in all areas, and long sleeve shirts are required around hot piping or equipment. Disposable coveralls are not permitted where welding, cutting, burning or heat/flame are in use because of the risk of combustion. Disposable fire retardant coveralls are permitted where welding, cutting, burning or heat/flame are in use if in a dirty or potentially contaminated environment.

5. Fire resistant clothing and other accessories are required for certain electrical work. All employees exposed to electrical sources greater than 50 volts AC or DC utilized in the generation, transmission, or distribution of electricity must wear 100% natural fiber clothing and /or Fire Resistant clothing. Disposable fire/flame retardant coveralls are permitted over the appropriate welding, cutting, brazing, burning or heat/flame clothing consisting of wool or leather materials to protect from. heat and sparks. The necessary head, ear face, eye, hand and foot personal protective equipment would also be in addition to the above clothing requirement.

C. Equipment Isolation for Maintenance Work

The CEEMI Fossil/Hydro Production stations use the applicable Lockout/Tagout or Hazardous Energy Control Procedures (reference Accident Prevention Manuals) for the implementation of isolating the associated energy source from the equipment or machine in an inoperative mode before servicing or maintenance is performed. The rules in this procedure must be complied with at all times. Failure to comply with these rules could result in serious injury and violations will not be tolerated. Only qualified CEEMI personnel shall hang or remove tags. Manipulation of switches, controls, breakers, valves, etc. will be performed by CEEMI qualified personnel, unless previously agreed not to. To request a tagging clearance, contact the CEEMI liaison. Every worker should be aware of the requirement to sign-on/off of each assigned job through the use of a Master Clearance Sheet or the appropriate tags. The contractor supervisor is responsible for collecting all workers' signatures. The contractor supervisor must provide a copy of the sign-on sheet for his workers to the CEEMI liaison before the job begins and sign-off sheet before the clearance is canceled at the end of the job. The CEEMI liaison can provide more information on the details of this safety requirement and provide a copy of the current version of the tagging manual.

D. Electrical Awareness

1. Training shall be performed as per 1910.269 to provide the level of electrical awareness to all contractors/employees to allow them to safely walk through or perform non-electrical activities outside the unqualified clearances in an area such as a power plant or substation, containing exposed energized lines or parts of equipment. This training must demonstrate proficiency in recognizing exposed energized parts and be documented in writing. All questions regarding proper electrical clearances shall be referred to the CEEMI liaison as required.

E. Housekeeping

1. Work and walking areas shall be free from tripping hazards like extension cords, welding leads, air & water hoses, etc. These hoses and cords shall be run either overhead or in a manner that does not result in tripping hazards. The contractor must supply cones or other warning devices to highlight the dangers in areas where tripping hazards unavoidably interfere with walkways. Contractors must assure that unused cords, hoses, cables, etc. are periodically retrieved to eliminate unnecessary hazards and housekeeping problems.

2. Walkways must be kept free of debris and materials and maintained at least three feet wide where possible. Slipping hazards such as dust, oil, or water must be promptly contained and cleaned up. Stairwells, ladders, electrical and fire protection equipment must be kept clear for easy access and use during emergencies. Do not block exits.

3. All contractor work and break areas must be kept picked up, clean and tidy by contractor employees.

F. Welding, Cutting and Burning

1. Oxy-fuel welding, burning and cutting in CEEMI facilities must be done in a safe manner. Oxygen, acetylene and other combustible fuel bottle(s), whether full or "empty", must be stored vertically and secured at all times and keeping a 20 ft. separation between oxygen bottle(s) and acetylene or other combustible fuel bottle(s). Some fuel gasses are not allowed in certain CEEMI facilities. The restrictions will be addressed in station specific instructions. Compressed gas cylinders must be transported by approved dolly or carriers, with valve protectors in place. All unused or empty cylinders must be returned to the designated storage areas as soon as possible.

2. A fire-watch is required on tasks involving welding, burning, cutting or grinding or with any other open flame or spark producing activity. The fire-watch must be properly trained and observe all areas affected, extinguish small fires and notify the control room of any and all fires. The fire-watch employee can still perform other tasks or work in the immediate area while on fire-watch. Fire-watches must be maintained for a period of 30 minutes following the completion of hot work. Precautions to avoid fires must include removing all combustibles from the work area, using protective fire retardant cloth to lay over grating, and having the fire extinguishers immediately available. The CEEMI liaison may be able to provide fire extinguishers that are used only for fire-watch situations. These extinguishers must be properly stored and labeled "empty" after use. This practice will ensure that extinguishers will always be available in the normal hanging storage locations around the station. The CEEMI liaison will provide details on the requirements of this section as it pertains to each contractor.

3. All necessary precautions must be taken to protect personnel and equipment from weld flashes, welding curtains and shielding over grating is required whenever welding is performed.

4. Welding, cutting, and burning may require additional permits or precautions, depending on the location of the work. See your CEEMI liaison before beginning these activities to insure that all notification requirements are met and that all precautions are taken.

G. Scaffolding, Ladder, Climbing Stacks and Fall Protection/Restraint

1. Scaffold erecting and dismantling shall be conducted under the direction of a "competent person ". These activities shall be performed only by experienced and trained employees selected for such work by the competent person. Fall protection shall be required to be worn by the employees erecting and dismantling of supported scaffolds. Personal fall arrest systems shall be attached by a lanyard to a vertical lifeline or horizontal lifeline at a fixed safe point of anchorage and shall be independent of the scaffold. The scaffold and the associated structures must not restrict travel in the walkways. The installation of fabricated decking or planking, toeboards, mid-rails and hand rails shall be at each work level. Proper barricading and signage shall be installed to protect and warn personnel from potential falling objects. Scaffold tags shall be placed at the scaffold access to indicate the condition of the scaffold, e.g. "OK to use" (green in color) or "Unsafe do not use." (Red in color).

2. Ladders used by contractors must be provided by contractors unless other arrangements are made through the CEEMI liaison. CEEMI ladders are for CEEMI use only and are located throughout each station for emergency and maintenance and must not be moved or used by contractors. Ladders used by contractors must be made of wood or fiberglass and meet all applicable standards. The use of aluminum or other metal ladders is prohibited at CEEMI locations. Use of any ladder

will be in accordance with CEEMI safety rules. All required safety inspections of ladders must be performed and recorded by the contractor. Any use of rolling stairs must be approved by the CEEMI liaison.

3. Climbing stacks and towers requires 100% fall protection to be worn.

4. Fall protection or restraints are required when working at a height of 6' or more. Only approved safety harnesses shall be used for fall protection when engineering controls can not be used. Approved safety belts may only be used for fall restraint in limited situations.

H. Hazard Communications/Respiratory Protection

1. All contractor supplied hazardous materials and chemicals must be approved by CEEMI prior to use and entry on CEEMI property. All MSDS and associated instruction sheets must be provided to the CEEMI liaison far enough in advance of the time of intended use or the materials or chemicals may not enter CEEMI property. The contractor must also have a copy of its "Hazard Communications" program available. Any containers used to handle chemical, fluid, or hazardous material must be labeled. Hazardous materials transferred from their original containers must be placed in containers approved for their use, e.g., proper construction with closed top. Minimum label requirements: product name, manufacturer or distributor, hazardous warnings.

2. The CEEMI liaison can help to identify hazards (boiler ash, chemicals, etc.) that exist within each station and also provide MSDS sheets for hazards.

3. Any chemical, fluid or hazardous materials brought on CEEMI properties must be properly disposed of after use. Containers must be labeled and removed with the approval of the CEEMI liaison. Spent material must be disposed of in pre-labeled DOT approved barrels. The placement of such barrels requires permission of the CEEMI liaison. Waste chemicals, fluids, or hazardous materials must not be mixed with other substances and drums containing waste must not be left open. Disposal or removal of spent chemicals, fluids or hazardous materials may be the responsibility of the contractor; therefore, see your CEEMI liaison for clarification.

4. The proper disposal of batteries, aerosol cans, paint cans and light bulbs are carefully controlled through a recycling process on CEEMI' properties that must be coordinated through the CEEMI liaison. Trash disposal procedures will be identified by the CEEMI liaison.

5. Asbestos is present throughout many of the CEEMI Facilities. Asbestos removal activities are frequently undertaken to reduce the quantity of asbestos containing materials within its facilities. Boiler, pipe and surfacing insulation along with other building materials should be considered to contain asbestos unless it can be identified as non-asbestos insulation. Plastic tents, glove bags, and proper demarcation surrounding

the removal process protect workers in other areas of the facility. Without proper authorization and training workers may not enter asbestos work areas. The contractor should contact the CEEMI liaison for help in identifying possible asbestos containing materials in its work area.

6. Lead containing materials and lead -based paints are present throughout many of the CEEMI facilities. Special care and precautions shall be taken by the contractor in working with lead containing materials and/or lead based paints and the removal of the same. All potential lead containing materials must be identified. For all operations involving lead containing materials and/ or lead based paints where there is potential to exceed the action level, as stated within OSHA's 29 CFR 1926.62, appropriate engineering and administrative controls per 1926.62 must be implemented.

I. Confined Spaces

1. Contractor employees frequently work in areas such as boilers, precipitators, air ducts, and condensers which are considered to be confined spaces. These work areas require a pre-work evaluation as determined in the FHEO Confined Space Policy. As confined spaces, they require special precautions. In some instances, energy isolation (tagging) and initial atmospheric testing for oxygen, and combustibles, a physical hazard assessment, i.e., overhead hazards, fall greater than 6', noise, may be sufficient to re-classify the space as a non-permitted confined space and allow entry. However, as conditions change or work progresses, new hazards may be introduced (or potentially introduced) which will require re-evaluation of the confined space. This re-evaluation , including any atmospheric monitoring, is the responsibility of the contractor. See your CEEMI liaison for details.

2. Welding, burning, cutting, painting, and solvent or chemical use inside a confined space may require additional precautions. Fumes or dust from boiler ash or welding and grinding activities will usually require respiratory protection. See B. Personal Protective Equipment and Tools, paragraph I on page 3. Prior to beginning work, the CEEMI liaison and contractor will review the job, including any known or potential hazards.

J. Electro-Magnetic Forces (EMF) and Pacemakers

1. Increasing numbers of people with a variety of heart conditions rely on implanted cardiac devices (Pacemakers and Defribulators). The equipment used for the generation and transmission of electricity can produce electric and magnetic fields of sufficient strength to possibly interfere with the proper functioning of implanted cardiac medical devices. It is the contractors' responsibility to inform its employees of the potential created by EMF.

K. Trenching or Excavation

1. Trenching or excavation shall be conducted through the CEEMI liaison and the proper authorities will be contacted before beginning the excavation process. Before trenching or excavation please call in:

   - Connecticut "Call Before You Dig" 1-800-922-4455
   - Massachusetts "Dig Safe" 1-888-DIG-SAFE
   - New Hampshire "Dig Safe" 1-800-225-4977

2. Trenching and excavation requirements will be reviewed with the CEEMI liaison.

L. Diving

1. All diving activities shall be done according to 1910.401. The diving safety manual procedures shall be reviewed and coordinated by the CEEMI liaison.

M. Vehicles

1. Occupants of all vehicles must wear seat belts while on CEEMI property.

2. All drivers must observe posted speed limits at all times while on CEEMI property.

3. Back vehicles into spaces where practical.

4. Contractor vehicles are allowed limited access to CEEMI properties. Station specifics detail the conditions under which contractors may bring vehicles on site and the designated parking areas for contractor employees' vehicles.

N. Facilities

1. At most CEEMI sites, shower, locker and lunchroom facilities are not available to contractors. Contractors may also have to provide portable toilets for their employees and subcontractors. The CEEMI liaison or the station specifics at the work location provide these details.

Instructions: Remove and sign this sheet in the presence of your liaison.

As an authorized representative of my company, I have reviewed the CONSOLIDATED ENERGY MASSACHUSETTS INC. CONTRACTOR WORK RULES and agree to work in conformance with them. Any questions I had pertaining to these rules have been answered by my liaison or a Consolidated Energy Massachusetts Inc., company representative.

(Contract Company or Organization Represented)

(Print Name) (Sign Name) (Date)

Witness:

(Liaison/Representative) (Date)

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.
West Springfield, Massachusetts

TECHNICAL SPECIFICATIONS
FOR THE
RED BRIDGE MINIMUM FLOW GATE PROJECT

Table of Contents

SECTION 01010 – SUMMARY OF WORK

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Terms and Conditions and other Specification sections, apply to work of this section.

1.1 PROJECT IDENTIFICATION:

A.	GENERAL:	Owner:	Consolidated Edison Energy Massachusetts, Inc.
		Title:	Red Bridge Minimum Flow Gate Project
		Location:	City of Ludlow, Massachusetts
		Design Engineer:	Kleinschmidt Associates Pittsfield, Maine

1.2 CONTRACT DOCUMENTS

A. Contract Documents include the Project Manual and the Drawings. The documents define the scope of work of the contract including the related requirements and conditions.

B. Summary by References: Work of the Contract can be summarized by references to the Contract, Standard Terms and Conditions, Special Conditions, Specification Sections, Drawings, addenda and modifications of the contract documents issued subsequent to the initial printing of this project manual and including, but not necessarily limited to, printed material referenced by any of these. It is recognized that work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon including weather conditions and other forces outside the contract documents.

C. Abbreviated Written Summary: Briefly and without force and effect upon the contract documents, the work of the contract can be summarized as follows:

D. The site work for the project consists of, but is not limited to, providing mobilization, demobilization, utilities and service, care of water, measures required for security, traffic control, and landscaping as required for the successful completion of the project. The contractor shall provide all labor, supervision, equipment, and material for the complete installation of the minimum flow gate assembly, walkway, fencing/gate, operators, controls, and associated hardware and equipment.

1.3 JOB CONDITIONS

A. Station Operation: It is intended that the plant operations will **not** be discontinued during the work. Contractor's work plan and schedule shall indicate any anticipated duration of interruption to operations. Unit operation at this unmanned project is by automatic float control. Pond level changes will occur to maintain project operation terms and conditions established by the resource agencies.

B. Minimum Flow Release: Owner is required to pass a continuous minimum flow of 237 cfs into the bypass reach. The flow is discharged over the entire spillway crest and the impoundment is typically fluctuated between 3" to 8" above the spillway crest. This flow must be maintained throughout the project period (except for pre-demolition survey discussed in Section 02060). Contractor shall protect his work area from spillway flow.

C. Work Hours: Contractor shall limit his activities to the hours between 7:00 a.m. and 9:00 p.m. daily. Activities beyond these hours shall be for emergency conditions or for equipment which must be continuously operation (*i.e.*, dewatering pumps). Contractor shall minimize to the extent possible noise during non-work hours.

D. Material Safety Data Sheets (MSDS): The Owner is required to maintain strict environmental emission levels. Contractor shall submit for acceptance MSDS to Owner, prior to use, for all chemicals to be used during or to become a part of the permanent work. In specific, MSDS sheets shall be submitted for concrete additives, form coatings, and root killing products.

E. Emergency Phone: Contractor shall provide phone(s) or radio(s) for emergencies. Phone numbers of state police and local police, fire and hospital as well as key contractor and Owner personnel (office and home) shall be prominently displayed at all times in an area readily seen from within and outside the work area.

F. Construction Access: It is anticipated that access to the work will be from the earth embankment side. In addition, the area downstream of the earth embankment may be used for the Contractor's laydown area. The Contractor shall limit activities to the immediate work area. Personnel vehicles may be parked in the powerhouse drive. Contractor and personnel vehicles shall at no time block Owner access to the station and shall not block public use of the boat launch area. The Contractor is responsible for creating, upgrading, and maintaining the condition of all access roads and embankments and to restore the roads and embankments to an acceptable condition and, in no event, less than their initial condition upon completion of the work. Contractor shall consult with Owner on acceptable areas and extent of Owner's property. Access by and use of areas other than that of the lands indicated above shall be Contractor's responsibility.

G. Temporary Facilities: The Contractor shall provide sanitary and other facilities for the construction personnel, as needed or required. The Contractor shall provide drip pans under all motorized equipment, and in temporary storage areas for construction chemicals and supplies.

H. Temporary Offices: Temporary offices shall be established on the job site where directed by the Owner, adequately furnished, and maintained in a clean, orderly condition by the Contractor. Instructions received there from the Owner shall be considered as delivered to the Contractor.

I. Security/Protection Provisions: The types of temporary security and protection provisions required, include, but not by way of limitation, fire protection (including fire watches while using propane, acetylene, or other fire ignited systems), smoke detectors, barricades, warning signs/lights, site enclosure fence, building enclosure/lockup, personnel security program (theft prevention), environmental protection, and similar provisions intended to minimize property losses, personal injuries and claims for damages at project site.

J. Local Complaints: If local citizens protest or have a complaint regarding the project, the contractor shall immediately notify the Owner's local manager, Kim Marsili at (413) 730-4721. The Owner's representative will be responsible to review the matter. The Owner's representative will notify the Contractor of discussion results prior to any actions or recommendations.

K. Powerhouse and gatehouse access: Access to the powerhouse and canal gatehouse shall be limited to emergencies or for new work requiring access into these facilities. Access shall be coordinated through Owner's local Manager, Kim Marsili at (413) 730-4721 or his designee. Contractor shall minimize his time in these facilities and shall at no time interfere or hinder Owner's staff or project operation.

1.4 DISPOSAL OF MATERIALS

A. Trash: Remove and dispose of all trash, rubbish and other burnable materials OFF-SITE. On-site burning of trash and burnable materials will not be allowed. Disposal of materials shall use methods conforming to local governing regulations.

B. Concrete: Concrete removed from the structure shall be disposed of off-site. Disposal of material in a manner acceptable to regulating authorities.

   a. Do not allow any concrete or wash water from concrete trucks or pumps to enter the waterways. If said materials enter waterways, all costs associated with the cleanup and any ensuing fines shall be borne by the Contractor.

   b. All fresh waste concrete shall be disposed of off-site in a manner conforming to local governing regulations.

C. Stone and Masonry: Stone and masonry removed from the work site shall be disposed of off-site.

1.5 BID SUBMITTALS

The Contractor shall submit the information listed in the Instruction to Bidders and:

1. Current labor and equipment billing rates (including overhead and profit) of all trades required to complete all items of work.

2. The Contractor shall submit a detailed construction work plan to include but not be limited to a description of his proposed method of performing all aspects of the work including his method of cofferdamming, water diversion, access, construction methods, erection sequence, major equipment, manpower loading, anticipated working hours, interruption to generation if necessary, and the proposed on-site superintendent's name and resume/lists of other jobs.

1.6 OWNER COSTS

It is anticipated the Owner will provide a part-time Resident Engineer which will result in Owner costs. The Contractor shall provide the projected number of weeks to perform the work.

PART 2 - PRODUCTS - Not Applicable

PART 3 - EXECUTION - Not Applicable

END OF SECTION

SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Terms and Conditions other Specification Sections, apply to work of this section.

A. Definitions: See Specification Section 01068 for definition and explanation of the words: "provide", "furnish", and "install".

1.2 DESCRIPTION OF REQUIREMENTS

A. Definition of Payment Items: Work under this contract shall be paid as described in Section 4 of the Standard Terms and Conditions of Construction Contracts. Payment of work shall be full compensation for costs incurred by the Contractor in providing the work as described in the Contract Documents.

a. When lump sum prices are contained in the Payment Schedule, the Contractor shall provide a detailed breakdown of the lump sum costs, acceptable to the Engineer, which will be used for estimating progress payment requests unless otherwise specified herein.

B. Undefined and Contractual Costs: Costs for work not specifically mentioned which are incidental to the overall conduct of the work, shall be included in the Contractor's Bid distributed into the actual Bid item as deemed appropriate. Examples of these types of costs are, but not limited to, the following:

Bonds	Temporary Facilities & Utilities
Insurances	Safety and Security Items
Construction Permits and Licenses	

C. Measurements: All measurements taken for payment shall be taken by Contractor and reviewed by the Owner.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

3.0 UNIT PRICES

Unit prices are for changes in Contract Documents and shall include additions or deletions in scope of work. Measurement and payment will be for changes in quantities or for additional work that is not included in Contract Documents. All unit prices shall remain constant and shall not be increased or decreased in value, regardless of actual quantities determined in field. Final payment will be based on quoted net prices and actual quantities measured.

3.1 FIXED SCOPE WORK

A. Lump Sum Work: For items indicated in the bid schedule to be lump sum, payment shall be as follows. The scope of work shall be for providing all material, labor and equipment required to construct the facilities as defined elsewhere in these specifications.

   a. Measurement of work is not required.

   b. Payment shall be lump sum bid and made in monthly payments in proportion to the percent of work completed for each task in the bid schedule. Exceptions are mobilization and demobilization listed elsewhere.

B. Mobilization: Scope of work for this item includes all costs related to moving the Contractor's materials, equipment and support facilities onto the site and establishing appropriate temporary and support facilities. Mobilization shall include the purchase of Contract bonds and all necessary permits; transportation of all personnel, equipment, and operating supplies to the site; establishment of offices, buildings, sanitary facilities; and other necessary facilities at the site; construction and maintenance of temporary access roads and other preparatory work at the site.

   This item covers mobilization for work required by the Contract at the time of award. If additional mobilization costs are incurred during performance of the Contract as a result of changed or added items of work for which the Contractor is entitled to an adjustment in Contract price, compensation for such costs will be included in the price adjustment for the items of work changed or added.

   a. Measurement of work is not required.

   b. Payment for work shall be lump sum. One-half of the lump sum amount will be paid under the first payment request and the second half of the lump sum will be paid when the project is 50% completed, equal to 50% of the lump sum amount.

C. Demobilization: Scope of work shall include removal of all unused material and equipment including field offices. All work shall be neatly cleaned upon completion according to the Owner's direction and be left in a neat and orderly condition. Any salvaged material not specified to be disposed of otherwise shall become the property of the Contractor and shall be removed from the site. All trash shall be removed as directed by the Owner and disposed of according to local regulations. Work shall also include submittal of all Owner required close out documentation and record drawings.

a. Measurement of work is not required.

b. Payment for work shall be lump sum. One-half of the lump sum amount will be paid after substantial completion and the second half of the lump sum shall be paid under the final payment request.

3.2 OWNER COSTS

A. The Contractor shall be subject to a damages charge should the actual number of project weeks exceed the stipulated completion date. The amount of damage cost shall be Five Thousand dollars ($5,000) per full week.

a. Measurement shall be by Owner's logs and calculated to the lowest full week.

b. Payment shall be subtracted from the Contractor's final payment request.

END OF SECTION

SECTION 01068 - DEFINITIONS

PART 1 - GENERAL

1.0 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including Terms and Conditions, Instructions to Bidders, and other Specification sections, apply to work of this section.

1.1 DEFINITIONS:

A. General Explanation: A substantial amount of specification language constitutes definitions for terms found in other contract documents, including drawings which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in contract documents are defined generally in this article. Definitions and explanations of this section are not necessarily complete or exclusive. They apply to the work to the extent that more explicit information is not contained elsewhere in the contract documents.

B. General Requirements: The provisions or requirements of General Requirements apply to entire work of Contract and, where so indicated, to other elements of work which are included in the project.

C. Indicated: The term "Indicated" is a cross-reference to graphics, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in the contract documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

D. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted", mean "directed by Owner", "requested" by Owner", etc. However, no such implied meaning will be interpreted to extend Owner's responsibility into Contractor's area of construction supervision.

E. Approve: Where used in conjunction with Owner's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations of Owner's responsibilities and duties as specified in Standard Terms and Conditions of a Construction Contracts. In no case will "approval" by Owner be interpreted as a release of Contractor from responsibilities to fulfill requirements of the contract documents.

F. Project Site: The space available to Contractor for performance of the work, either exclusively or in conjunction with others performing other work as part of the project. The extent of project site is shown on the drawings, and may or may not be identical with description of the land upon which project is to be built.

G. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

H. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, storing, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, disposal of materials, and similar operations, as applicable in each instance.

I. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

J. Installer: The entity (person or firm) engaged by Contractor or its subcontractor or sub-subcontractor for the performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

K. Substantial completion: The work has progressed to the point where, in the opinion of the Owner, the project is completed and can be used for it's intended purpose. Some work of a minor nature may extend past the date of substantial completion. Seeding may be done the following spring if the earth slopes are properly protected from erosion, by temporary measures such as heavy mulching or jute matting.

L. Testing Laboratory: An independent entity engaged to perform specific inspections or tests of the work, either at project site or elsewhere: and to report and (if required) interpret results of those inspections or tests.

M. Engineer: Kleinschmidt Associates, Pittsfield, Maine

N. Resident Engineer: Resident is Engineer's agent at the site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding Resident Engineer's actions. Resident Engineer's dealings in matters pertaining to the on-site work shall in general be with Engineer and Contractor keeping Owner advised as necessary. Resident Engineer's dealing with subcontractors shall only be through or with the full knowledge and approval of Contractor. Resident Engineer shall generally communicate with Owner with the knowledge of and under the direction of Engineer.

O. Competent Person: Competent person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 01340 - SUBMITTALS

PART 1 - GENERAL

1.0 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including Terms and Conditions and other Specification sections, apply to work of this section.

1.1 DESCRIPTION OF REQUIREMENTS:

The types of submittal requirements specified in this section include shop drawings, product data, samples and miscellaneous work-related submittals. Individual submittal requirements are specified in applicable sections for each unit of work. Refer to other Specification sections and other contract documents for requirements of administrative submittals.

A. Definitions: Work-related submittals of this section are categorized for convenience as follows:

a. Shop Drawings include specially-prepared technical data for this project, including fabrication and installation drawings, diagrams, performance curves, data sheets, design mix formulas, schedules, templates, patterns, reports, calculations, instruction, measurements and similar information not in standard printed form for general application to several projects. Standard information prepared without specific reference to a project is not considered to be shop drawings.

b. Product Data include standard printed information on materials, products and systems; not specially-prepared for this project, other than the designation of selections from among available choices printed therein.

c. Miscellaneous submittals related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurements data, operating and maintenance materials, overrun stock, keys and other security protection devices, and similar information, devices and materials applicable to the work and not processed as shop drawings, product data or samples.

1.2 GENERAL SUBMITTAL REQUIREMENTS:

A. Progress Scheduling:

a. Bar-Chart Schedule: Submit a bar-chart type progress schedule not more than 7 days after date established for "commencement of the work". On the schedule, indicate a time bar for each major category or unit of work to be performed at the site, properly sequenced and coordinated with other elements of work. Show completion of the work sufficiently in advance of the date established for substantial completion of the work. Revise and resubmit schedule weekly.

b. Distribution: Following initial submittal to and response by Owner, print and distribute progress schedule to Engineer, Owner's Project Manager, John Labiak (2 copies), Owner's Local Manager, Kim Marsili, separate contractors (if any), principal subcontractors and suppliers or fabricators, and others with a need-to-know schedule-compliance requirement.

B. Listing: Prepare a separate listing, organized by related specification section number sequence, showing principal work-related submittals and their initial submittal dates as required for coordination of the work. Submit listing within 10 days of date of commencement of the work.

The following list is provided to show the intent of this section and is not to be considered complete nor does it relieve the Contractor from compliance with these Contract Documents. Individual submittal requirements are specified in applicable sections for each unit of work.

Item	Ref.
List of Proposed Subcontractors	Instruction to Bidders
Proposed Project Schedule	Instruction to Bidders
Insurance Polices	Standard Terms and Conditions
Waiver of Liens	Standard Terms and Conditions
Materials Safety Data Sheets (MSDS)	Specification 01010
Labor & Equipment Billing Rates	Specification 01010
Work Plan	Specification 01010
Record Drawings	Specification 01340
Soil Erosion and Sediment Control	Specification 01590
Cofferdam Design	Specification 02300
Gate Fabrication Drawings	Specification 15000

C. Review Time: Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary. Advise the Engineer on each submittal, as to whether processing time is critical to the progress of the work, and if the work would be expedited if processing time could be shortened.

Allow two weeks for the Engineer's initial processing of each submittal. Allow a longer time period where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

D. Procedure:

Submittals will be submitted by the Contractor or vendor as follows:

1. Two (2) prints and one (1) reproducible of shop drawings, or four (4) copies of submittals which are reproducible by photocopier to:

   Mr. Alfred J. Nash
   Kleinschmidt Associates
   75 Main Street
   Pittsfield, Maine 04967

2. One (1) copy of the transmittal letter and one (1) print to Owner's Project Manager:

   John Labiak
   Consolidated Edison Energy Massachusetts, Inc.
   111 Broadway, 16th Floor
   New York, NY 10006

3. One (1) copy of the transmittal letter and one (1) print to Owner's Local Manager:

   Mr. Kim Marsili
   Consolidated Edison Energy Massachusetts, Inc.
   15 Agawam Avenue
   West Springfield, MA 01089

After review, copies will be distributed as follows:

1. One print retained for KA files
2. One print sent to John Labiak, CEEMI
3. One print sent to Mr. Kim Marsili, CEEMI
4. One print returned to Contractor or vendor

1.3 SPECIFIC-CATEGORY SUBMITTAL REQUIREMENTS:

A. Shop Drawings: Provide newly-prepared information, on reproducible sheets not less than 8 1/2" x 11" (except for actual pattern or template type drawings), with graphic information at accurate scale (except as otherwise indicated), with name of preparer indicated (firm name). The maximum sheet size shall be 24" x 36". Show dimensions and provide special notation of dimensions which are based on field measurement. Highlight, encircle or otherwise indicate deviations from the contract documents on the shop drawings. Identify materials and products in the work shown. Indicate compliance with standards, and special coordination requirements. Do not allow shop drawings copies without appropriate final "Action" markings by Engineer to be used in connection with the work. Provide a space not less than 20 sq. in. beside the title block for marking the record of the review process and the Engineer's "Action" marking. Do not reproduce contract documents or copy standard printed information as the basis of shop drawings.

B. Product Data: Collect required data into one submittal for each unit of work or system; and mark each copy to show which choices and options are applicable to project. Include manufacture's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked, and special coordination requirements. Maintain one set of product data (for each submittal) at project site, available for reference by Engineer and others.

a. Submittals: Do not submit product data, or allow its use on the project, until compliance with requirements of contract documents has been confirmed by Contractor. Submittal is for information and record, unless otherwise indicated. Submit 2 copies, plus 2 additional copies (which will be returned) where required for maintenance manuals.

b. Installer's Copy: Do not proceed with installation of materials, products or systems until final copy of applicable product data is in possession of Installer.

C. Warranties: In addition to copies desired for Contractor's use, furnish 2 executed copies, except furnish 2 additional (conformed) copies where required for maintenance manuals.

D. Survey Data: Refer to 1.2D (procedures) section for specific general requirements on property surveys, field measurements, quantitative records of actual work, damage surveys, photographs and similar data required by individual work sections of these specifications. None of specified copies will be returned.

a. Survey Copies: Furnish 2 copies of survey data, except furnish 10 copies of final property survey (if any).

E. Closeout Submittals: Refer to individual work sections and to "closeout" sections for specific requirements on submittal of closeout information, materials, tools and similar items.

a. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings provide 2 photographic copies of marked-up drawings, which, at the Contractor's option, may be reduced to not less than half size.

1.4 ACTIONS ON SUBMITTALS:

A. Engineer's Action: Where action and return is required or requested, Engineer will review each submittal, mark with "Action", and where possible return within 2 weeks of receipt. Where submittal must be held for coordination, Contractor will be so advised by Engineer without delay.

B. Action Stamp: Engineer's action stamp, for use on submittals to be returned to the Contractor. Explanation of action stamp markings are as follows:

a. No Exceptions Taken: Work may proceed, provided it complies with Contract Documents, when submittal is returned with the following: "No Exceptions Taken."

b. Make Corrections Noted: Work may proceed, provided it complies with the notations and corrections on submittal and with Contract Documents when submittal is returned with the following: "Make Corrections Noted."

c. Amend and Resubmit: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the work: "Amend and Resubmit."

d. Rejected - See Remarks: Where submittal is returned for other reasons, as explained thereon, it will be marked as follows: "Rejected - See Remarks." Revise drawing and resubmit.

PART 2 - PRODUCTS

(not applicable)

PART 3 - EXECUTION

(not applicable)

END OF SECTION

SECTION 01450 - SAFETY

PART 1 - GENERAL

1.0 SUMMARY

The following information is provided to the Contractor by the Owner with the understanding that these guidelines for safe work practices while working on the Owner's property are not intended in any way to be all-inclusive or to relieve the Contractor of any part of the responsibility for the safe performance of the work. The information shall be used in concert with the Contractors Safety Work Rules contained elsewhere in the manual. If discrepancies exist between the sections or federal guidelines, the most stringent criteria shall govern.

1.1 RELATED DOCUMENTS

Drawings and General Provisions of the Contract apply to work in this section.
Reference Section 02300 - Cofferdams.
Reference Article 7 – Standard Terms and Conditions of Construction Contracts

PART 2 - PRODUCTS

2.0 All safety related equipment including items such as cables, lanyards, and harnesses shall meet all applicable OSHA requirements and be in good working condition.

PART 3 - EXECUTION

3.0 DESIGNATION OF CONTRACTOR SITE SAFETY COORDINATOR

The Contractor shall designate a specific competent member of its management organization at the job site as its Safety Coordinator. The designee's duty shall be the prevention of accidents and other job losses and must have control of and be familiar with day-to-day construction activities of the Contractor. This person shall be responsible for initiating, maintaining, and supervising all safety and loss prevention programs and procedures in connection with the Work.

3.1 REGULATORY COMPLIANCE

All work must be completed in compliance with all applicable occupational and environmental safety and health laws, regulations, standards, ordinances, codes and other similar requirements. Such requirements shall serve as minimum guidelines for all actives of the Contractor in connection with the Work.

3.2 REPORTING AND INVESTIGATION OF OCCUPATIONAL INJURIES AND ILLNESSES

The Contractor shall require that all of its employees, all of its Subcontractors employees and all Third Parties report all occupational injuries and illnesses relating to the Work immediately to the Contractor.

The Contractor shall report all such cases to the Owner on a daily basis. Serious injuries and illnesses, fatalities or any cases involving any Owner personnel or property must be reported immediately to the Owner.

3.3 PERSONAL PROTECTIVE EQUIPMENT

All employees of the Contractor and other persons entering onto Owner's property in connection with the Work shall wear appropriate protective equipment at all times. Special personal protective devices and/or equipment must be used where needed for the hazards of the Work. Such equipment shall be provided by the Contractor for all Contractor, Subcontractor, and any Third Party employee, including, but not limited to:

1. Hearing protection.
2. Respirator protection devices.
3. Fall protection devices.
4. Temperature protection equipment.
5. Full-face protection devices.
6. Hand protection equipment.
7. Life-lines and safety belts/harnesses.
8. Personal floatation device.
9. Any other special equipment/devices necessary to provide appropriate protection in their work.

Contractor, Subcontractor, or any Third Party is not only obligated to provide appropriate personal protective equipment to its employees, but is further obligated to stop the Work of any employee that fails to use the personal protective equipment properly.

All personal protective equipment shall meet the applicable requirements of NIOSH, OSHA, ANSI, and/or other applicable regulations, standards, or codes.

3.4 VESSEL OR CONFINED SPACE ENTRY

During the Work, it may be necessary for Contractor employees to enter vessels or confined spaces (areas of limited access or egress). The Contractor must have a written, enforced policy to assure the safety of all personnel under its supervision or control who enter any confined space or vessel in the performance of the Work. Such policies and procedures must comply with all applicable safety and health regulations.

The Contractor's procedure for safe entry and Work in vessels and in other confined spaces must include at least specific provisions on:

1. Employee education and training.
2. Use of a permit system.
3. Atmosphere testing and appropriate ventilation.
4. Use of appropriate respiratory protection.
5. Use of safety belts and lanyards.
6. Use of outside observer at all times.
7. Emergency action provisions.

3.5 WORK ABOVE GROUND LEVEL

Whenever Work is to be done above ground level or above walking or working areas which may present a hazard to personnel or property below, all necessary action shall be taken by the Contractor to prevent falls from elevated Work areas and to protect personnel and equipment below from falling materials, tools, or other objects. This action shall include, without limitations, roping of the area and posting of warning signs to caution personnel below from falling materials. If necessary, a flagman shall be stationed below to warn persons in the area. All such barriers and signs shall be removed as soon as the Work is completed.

All personnel under Contractor supervision or control, who could fall from elevated Work areas, shall be protected by guardrails, safety belts and lanyards, safety nets or other effective means which comply with applicable Federal, State and Local regulations.

3.6 LADDERS

The Contractor shall provide employees with ladders that are constructed from non-conductive materials such as fiberglass. Ladders shall be equipped with anti-slip shoes and secured as required. As a minimum, the ladder must extend three feet above the upper floor landing.

3.7 RIGGING EQUIPMENT

Rigging equipment for material handling shall be inspected prior to use on each shift and as necessary during use to ensure that it is safe.

3.8 SCAFFOLDING

Scaffolds shall be erected in accordance with requirements of OSHA standards, 29 CFR 1926.451 - Scaffolding.

3.9 CRANE OR DERRICK SUSPENDED WORK PLATFORMS

Contractor owned or leased platforms suspended from lifting cranes or derricks for work to be performed at elevations that cannot normally be reached by other types of scaffolds or aerial work platforms, shall be designed and/or approved by a qualified engineer, periodically inspected for soundness and adequately maintained according to applicable Federal, State, and/or Local standards. Personnel on the work platforms shall adhere to Federal, State and/or Local safety work performance standards.

3.10 VEHICLE MOUNTED ELEVATING/ROTATING WORK PLATFORMS

Operation of vehicle mounted aerial platform devices shall be restricted to only those individuals that have been trained and are familiar with the vehicle's operation and emergency procedures.

Safe operation of aerial devices may require the presence of two or more persons, depending on the type of work being performed and the vehicular traffic in the area. As a minimum, a safety watch on the ground is required during welding or burning performed in the aerial device.

Aerial devices, unless specifically designed for and certified for such Work, shall not be used to work on energized electrical equipment.

Signs shall be posted and barricades erected in the area directly under the work area so that personnel cannot enter the Work area.

Employees working in the bucket shall keep BOTH feet on the floor of the bucket and be tied off to the bucket with an approved safety belt.

3.11 EXCAVATIONS

The Contractors shall have an enforced written policy requiring barrier protection for all excavations, pits, or open holes.

The Contractor's procedure for guarding excavations, pits, and holes must include as a minimum, specific provisions for:

1. Employee training.
2. Adequate barrier protection (*e.g.*, shoring, sloping).
3. Posting of signs warning of the hazard.

3.12 CHEMICAL SAFETY AND INDUSTRIAL HYGIENE

The Contractor shall obtain all information necessary to be fully aware of all potential exposures to hazardous materials and physical or biological agents in the performance of the Work. The Contractor shall provide to its employees, Subcontractors and Third Parties, all information and training on the nature of these potential hazards as required by Federal, State or Local Laws or Regulations, regardless of the source of such hazards.

The Contractor's program must include as a minimum, specific provisions for:

1. The location of potential hazards.
2. The potential adverse health effects posted by such hazards.
3. Proper safe work practices to prevent or reduce potential exposure.
4. Proper protective measures and equipment required.
5. Proper use of protective equipment.
6. Proper response to exposure incidents.

The Contractor shall provide all personal protective equipment to its employees required by the nature of the hazard. Such protective equipment must include at least the following items:

1. NIOSH-approved respirator protection equipment (for dusts, mists, fumes, gasses, etc.).
2. Hearing protection (plugs, muffs, etc.).
3. Protective clothing (chemical goggles, gloves, resistant clothing, etc.).

Certain chemical and physical agents (*i.e.*, asbestos, PCB's, radiation sources, etc.), are specifically regulated by Federal, State and/or Local agencies. When the Work involves a potential exposure to any such hazards, the Contractor shall assure compliance with all of those specific regulations. If spills, releases, disposal or exposure occur which may require reporting to regulator agencies, the Contractor shall notify the Owner immediately of the nature of the incident.

3.13 CHEMICALS/"RIGHT TO KNOW" LAWS

The Contractor shall provide to the Owner the manufacturer's current and complete MSDS for every chemical that the Contractor will be bringing onto the site before the chemical comes onto the site.

The safety requirements on the MSDS will be followed by the Contractor, and he assumes sole responsibility and liability for compliance with such requirements.

Small portions of material which may be used on a daily basis will be handled in accordance with all applicable laws and disposed of and/or removed from the site at the end of each work day. Small buckets or personal containers that by law do not have to be labeled when used by one person on their shift will not be left on site with residue in them.

Upon completion of the work, the Contractor will be responsible for the proper clean-up, removal, and/or disposal of chemicals. Disposal methods and locations must be licensed for applicable chemical.

3.14 WELDING, BURNING AND FIRE SAFETY

The Contractor shall take all necessary precautions to prevent fire or other injury or damage relative to welding, burning or other spark or flame producing processes and procedures. Contractors shall also establish procedures for storage, handling and use of flammable or combustible materials which comply with all applicable laws, regulations and fire codes.

The Contractor shall assure that its employees and all Third Parties are familiar with fire protection and fire alarm systems in the area of the Work. The Contractor shall also be responsible for fire alarm systems in the area of the Work. The Contractor shall also be responsible for supplying and maintaining a sufficient number of the appropriate type of fire extinguishers to support the Work involved. As a minimum, all employees of the Contractor, Subcontractor, and other Third Parties must be trained by the Contractor on:

1. Proper operation of fire extinguishers or other fire apparatus.
2. Emergency evacuation routes and procedures.

All fires and other emergencies are to be reported immediately by the Contractor to the Owner. The Contractor shall also report all impairments in fire detection or suppression systems occurring in the course of the Work to the Owner in advance of such impairment and the contractor shall establish alternate methods of detection or suppression, as may be necessary during the impairment to adequately safeguard personnel and property.

At any time during the Work where spark or flame producing operations are conducted (such as welding, cutting, or burning), a fire watch shall be established by the Contractor during and after such operations (for at least 30 minutes) to assure that fires do not ignite. The Contractor shall assure that fire watch personnel are trained in fire fighting and are aware of procedures for sounding alarms and making notifications in the event of a fire.

The Contractor shall take all action required to prevent fire on the site from any sources associated with the Work. Smoking control is particularly important. Personnel shall not smoke in areas which are not specifically designated smoking areas.

3.15 HOUSEKEEPING

The Contractor shall keep the Work site clean and orderly at all times. All material must be stored in locations and in such a manner that it will not interfere with operations or constitute any hazard to personnel or equipment. All paper, wood, chemicals or other scrap or Work material must be cleaned up regularly by the Contractor and removed from the Work site and disposed of in a lawful, safe and environmentally sound manner. Upon completion of the Work, the entire Work site must be cleaned by the Contractor, removing all chemicals, scrap, materials, tools, equipment, temporary structures or other items not intended as part of the finished project.

3.16 HEAVY EQUIPMENT OPERATION

No machinery or heavy equipment shall commence operation without undergoing a safety inspection. All machinery and heavy equipment shall be operated only by trained and qualified operators.

All mobile equipment shall be equipped with warning lights and/or audible alarms to indicate when the machinery is operating in reverse or when the line of site is limited.

Cranes shall be equipped with a proximity warning device, or equivalent, to warn the operator and other workers when the crane boom is brought near electrically charged equipment.

Contractors, Subcontractors, and all Third parties shall maintain records covering operator qualifications, and hands-on mobile equipment testing. Machinery and equipment inspection records shall be maintained in accordance with OSHA regulatory requirements and be made available for inspection by the Owner upon request.

3.17 GROUND FAULT PROTECTION

It shall be the Contractor's responsibility to provide the necessary equipment for ground fault protection or the implementation of an assured equipment grounding conductor program in connection with the use of portable power tools.

3.18 MEDICAL AND FIRST AID FACILITIES

The Contractor shall make provisions for adequate first aid and other medical treatment for occupational injuries and illnesses which may occur to employees of the Contractor, Subcontractor, or to Third Parties.

3.19 DRUG & ALCOHOL POLICY

A. Drugs

To the use, possession, transfer, sale or purchase or any drug or illegal or controlled substance on or off the Owner's property or job sites, other than possession of over-the-counter drugs and prescription medications for which the employee has a valid prescription, by the Contractor employees is prohibited. In addition, Contractor employees are prohibited from using or being impaired by any drug or substance of whatever type or legality that interferes with the person's ability to perform the job in a safe manner. Possession of paraphernalia used in connection with any drug or substance subject to this rule shall be a violation of this rule.

B. Alcohol

The use, possession or transportation of alcoholic beverages during working hours, (including regular or overtime or emergency call out),on Owner's property of job sites by Contractor employees is prohibited. In addition, no Contractor employee shall report to work impaired by alcoholic beverages.

3.20 CONDUCT OF CONTRACTOR'S EMPLOYEES

The following is a list of prohibited actives which is not intended to be all inclusive. If employees of Contractors engage in any of these activities, it shall constitute a default under the contract which may result in removal of the Contractor from the work site or barring the employee from the work site in addition to any other remedy available to the Owner. Failure by the Owner to discover or act on any such default shall not constitute an excuse for or a waiver of such default.

1. Willful violations of project safety or security rules.
2. Acts of sabotage to project or plant property, equipment, machinery or systems.
3. Sleeping on the job.
4. Engaging in horseplay or fighting. (Horseplay or fighting is defined as, but not limited to pushing, slapping, hitting, tripping, or any physical contact or other action which may cause or result in injury or bodily harm to any individual).
5. Use or possession of firearms or ammunition on the job site.
6. Suspected use, possession, and/or working under the influence of alcoholic beverages or drugs on Owner's property.
7. Failure to use sanitary facilities.
8. Failure to report accidents, job related injuries, and/or fires to supervision.
9. Removal of equipment safety devices, *e.g.*, alarms, guards, etc.

3.21 EMERGENCIES

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto the Contractor, without special instruction or authorization from Owner, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give Owner immediate notification of any and all emergencies. Contractor shall give Owner prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby.

END OF SECTION

SECTION 01590 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.0 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including Terms and Conditions and other Specification Sections apply to work of this section.

1.1 DESCRIPTION OF WORK:

The work consists of providing sedimentation basin, silt fences, hay bale dikes, erosion control facilities and/or other approved measures necessary to prevent brook or canal water contamination or disturbance of sediments.

1.2 QUALITY ASSURANCE:

Codes and Standards: Comply with permits and local, state and federal governing regulations regarding water quality and disposal of river (brook) dredged material.

PART 2 - PRODUCTS

2.0 SILT FENCE:

Provide silt fence conforming to the following:

A. Equivalent opening size of a U.S. standard sieve size of 40 (max.), 70 (min.).

B. Mullen Burst Strength - 200 psi.

C. Grab strength - 120 lbs. min.

D. Spun-Bonded nylon fabric reinforced with polyester netting, or polypropylene fabric with 2" x 4" 12 Ga. woven wire backing fence.

E. Acceptable Manufacturer: Subject to compliance with requirements, provide silt fences from one of the following:

Harris Silt Fence, By Amoco Fabrics and Fibers

MIRAFI 100X, by Celanese

2.1 SUPPORT POSTS

Six inch minimum in length, spaced 6' o.c. max.

2.2 HAY BALE DIKE

Provide clean, seed free hay bales which are locally available.

2.3 SEDIMENTATION BASIN

Sediment laden water shall not be released into any waterway. Contractor shall provide appropriately sized sedimentation basin or other approved sediment removal devices for his dewatering or water diversion activities.

Location and details of sedimentation basin or other devices shall be submitted to Owner for his approval prior to dewatering activities.

2.4 TURBIDITY CURTAIN

Provide a pre-manufactured turbidity curtain of continuous construction for the project site. The turbidity curtain shall consist of an impervious membrane, with an integral foam filled billet flotation system and a continuous integral weight system to prevent movement of the curtain base. The curtain shall be capable of withstanding the flow velocity of the brook during the annual flood event without sustaining a blow-by of the contained sediment laden water.

A. Acceptable Manufacturer: Subject to compliance with requirements, provide turbidity curtain from available manufacturers:

   Cormier Turbidity Curtain - A.H. Harris
   Lagoon Baffles - Slickbar Products Corp. - Seymour, CT.

PART 3 - EXECUTION

3.0 INSTALLATION

A. Silt Fence/Hay Bale Dike: Install in accordance with manufacturers recommendations prior to beginning clearing operations in the affected areas.

   a. Maintenance - The Contractor shall remove accumulated sediment from the silt fence when the accumulation reaches 30% of the capacity of the fence. The hay bale dike shall be removed/replaced when deterioration of the effluent quality is evident. The silt fence or hay bale dike shall be maintained until project completion.

B. Construct haybale dikes or silt fences at toe of slope upon commencement of grading operations as shown on drawings.

C. Turbidity Curtain: Install in accordance with manufacturer's recommendations. Remove site debris which may puncture membrane during installation process.

Do not drag membrane along ground. Provide adequate anchorage at either end of membrane to prevent movement from intended location.

3.1 INSPECTION

Contractor shall inspect all soil erosion and sediment control measures at least once per week and immediately following rainstorms or other periods of heavy runoff.

Contractor shall provide one individual to inspect soil erosion and sediment control measures.

Contractor shall have adequate men, equipment, and extra materials at the site to facilitate immediate repairs during rainstorms to the specified soil erosion and sediment control measures.

The Contractor shall maintain a weekly log of the condition of the soil erosion and sediment control measures noting deficiencies, additional repair/replacement work necessary, and dates and times of inspection. If corrective work is required, the weekly log shall indicate dates of observance and completion of corrective work. Upon completion of Contractor's activities, Contractor shall provide the weekly log to the Owner and the log shall become the property of the Owner.

END OF SECTION

SECTION 02060 - DEMOLITION

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Terms and Conditions and Specification sections, apply to work specified in this section.

1.1 DESCRIPTION OF WORK

Extent of demolition work is shown on drawings.

A. Demolition Work

Demolition requires chipping and removal of masonry spillway section. Work is as shown on the Contract Drawings and generally described in Section 01010 - Summary of Work.

1.2 SUBMITTALS

A. Schedule

Submit schedule indicating proposed methods and sequence of operations for selective demolition work to Owner's Representative for review prior to commencement of work.

1.3 JOB CONDITIONS

A. Condition of Structures

Owner assumes no responsibility for actual condition of items to be demolished. Contractor shall employ demolition methods which minimize impacts to the structure beyond the immediate work area. Methods resulting in joint cracking or dislodgement to areas beyond the demolition limits shall not be employed.

B. Protections

Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.

Protect from damage existing structures that is to remain in place and becomes exposed during demolition operations.

C. Damages

Cease operations immediately if adjacent structures appear to be in damage. Notify Owner. Promptly repair damages caused by demolition work at no cost to Owner.

D. Explosives

Use of explosives will not be permitted.

E. Environmental Controls

Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.0 INSPECTION

Prior to commencement of selective demolition work, inspect areas in which work will be performed in the presence of the Owner's Engineer. Photograph existing conditions to structure surfaces, leakage/seepage rates, equipment or surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work. Inspection shall occur with the pond at or below the spillway crest. Since the inspection will result in an interruption of the minimum flow release, the inspection will require coordination with the resource agencies. Owner's Engineer will be responsible for coordination of the inspection with contractor. Notification of inspection readiness shall be provided a minimum of 1 (one) week prior to the inspection.

A. Demolition

Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

If unanticipated mechanical, electrical or structural elements are encountered, investigate and measure both nature and extent. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without delay.

B. Disposal of Demolished Materials

Remove debris, rubbish and other materials resulting from demolition operations. Transport and legally dispose of off site.

Repair, by methods approved by the Owner, demolition performed in excess of that required. Return structures and surfaces to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 02300 - COFFERDAMS

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, and Instructions to Bidders, apply to work of this section.

Reference Section 01010 Summary of Work for Job Conditions.

Reference Section 01590 - Soil Erosion and Sediment Control.

1.1 DESCRIPTION OF WORK

The work includes designing, installing, maintaining, and later removing temporary cofferdams.

Earthen cofferdams are not permitted on this project.

The purpose of the cofferdam is to allow construction of project structures under dry conditions which might otherwise be submerged. All construction work which forms a part of the permanent project structures shall be done in areas free from water unless otherwise authorized in writing by the Owner.

When no longer required for the intended purposes, the Contractor shall remove all temporary cofferdams, construction, and equipment and shall leave the work areas in a neat and orderly condition. All materials and equipment removed shall be disposed of off the Owner's property. No temporary construction materials will be permitted to remain or be spoiled in the bottom of any body of water.

Owner shall be informed prior to installation of any cofferdam. Cofferdam removal shall not begin until Owner's approval and testing of the competed work is obtained.

Included in this section is information on water surface elevations for given flow conditions and other hydrologic information for the use of the Contractor in the design of the cofferdams. The Owner does not guarantee the completeness, reliability, or accuracy of any to this dam.

1.2 COFFERDAM HEIGHT

The minimum cofferdam levels required by this contract are elevation 275.00 ft upstream and 2.0 ft along spillway surface. Minimum levels in no way assures adequacy against overtopping and Contractor shall determine appropriate height above minimum levels to avoid overtopping.

1.3 RESPONSIBILITY FOR COFFERDAMS

The contractor shall be fully and solely responsible for design, adequacy, safe construction, and maintenance, repair, removal and disposal of all cofferdams and related facilities required for protecting the work. If the elevations increase to the extent that the cofferdams are overtopped and construction areas are flooded, the Owner will assume no responsibility for flooding.

The Owner is not aware of the water intrusion integrity of the masonry dam or the effects of the Contractor's demolition activities. The Contractor shall be solely responsible for stopping or otherwise controlling water seepage or leakage into the work area. Methods to stop or control water seepage or leakage into the work area shall be reviewed by the Owner's Engineer. Methods deemed to be potentially detrimental to the work's integrity shall not be used. Owner will assume no responsibility for costs or delays associated with water intrusion.

1.4 EMERGENCY ACTION PLAN AND WARNING SYSTEM

The Contractor must plan, install, and rehearse a Temporary Emergency Action Plan (TEAP). Minimum requirements for the TEAP are contained in the Appendices.

Warning signals for evacuation of employees in case of an emergency shall be developed and posted.

Any construction personnel working around water will be required to wear life jackets and fall protection equipment. Life rings will be located immediately downstream of the cofferdam and will remain in place for the duration of the construction period. The life rings will be used only in the event of an emergency situation.

The Contractor will be required to hold an informational meeting, prior to initiating any construction activity, to inform workers of the actions to be followed should any evacuation be required. The workers will be instructed to exit the work area via one of several ladders (minimum of two) extending into the work area, and will be informed of the safe areas which are areas providing maximum safety for workers.

In case of an emergency, the construction superintendent will be responsible for immediately notifying the Owner.

A specific competent individual shall be responsible for coordinating the safety program and rescue operations.

Other State, or Federal OSHA-required equipment, or any equipment or procedures which will enhance and improve the overall safety of the Contractor's or the Owner's personnel.

None of the above shall be construed to imply that the Owner or Engineer assume responsibility for Contractor's safety measures.

1.5 COFFERDAMMING SCHEME SUBMITTAL

A. Bid Submittal: The bid cofferdamming scheme must address the proposed design of cofferdams, including approximate lengths, width, materials, height, construction materials, and stability.

B. Construction Submittal: prior to start of cofferdam construction, the Contractor shall submit to the Engineer for review the details of the cofferdam systems including calculations for the Engineer's review. Plans shall be in sufficient detail to permit review by the Engineer of hydraulic conditions and stability of structures, including the stability of overtopped. Plans shall show the method and equipment proposed for dewatering and maintaining the cofferdammed areas dry. Review by the Engineer of the Contractor's plans and/or comments on them will in no way relieve the Contractor of responsibility as stated above.

C. Backup Pumps: During the construction period, sufficient reserve pumping systems shall be available for immediate use in the event that water flows exceed the anticipated volumes and/or the primary system breaks down. It is mandatory that pumping be adequate at all times and that no delays occur during the construction. In the event that backup systems be put into use, those pumps should then be considered part of the primary system and a new backup system established.

D. The cofferdam arrangement shown in the permit application is for permitting and approval purposes. Any modifications in the cofferdam arrangement by the Contractor may require additional approvals and/or permits, and are the Contractor's responsibility.

1.6 SITE HYDROLOGIC AND HYDRAULIC DATA

Typical river flows are included below for the use of the Contractor in the design of the cofferdams. The data was obtained from USGS Gage No. 01177000 Chicopee River at Indian Orchard, Massachusetts, period of record 1929-1997.

Month	Average Daily Flow (cfs)	Maximum Average Daily Flow (cfs)	Minimum Average Flow (cfs)
June	797	1802	329
July	474	1018	194
August	446	1338	153
September	464	1514	150
October	531	1140	222

1.7 STATION HYDRAULIC CAPACITY:

Maximum 1230 CFS/Unit
Presently two units are operational

END OF SECTION

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SECTION 02800 - SEEDING AND MULCHING

PART 1 - GENERAL

This work shall consist of furnishing of all labor, equipment, and materials, and performing all operations in connection with seedbed preparation, liming, fertilizing, seeding and mulching of all areas disturbed during construction.

PART 2 - MATERIALS

2.0 GENERAL

The Contractor shall furnish all materials to be used in performing the work under this Contract. Prior to use, the Contractor shall be required to furnish to the engineer:

1. Copies of delivery tickets showing the net weight delivered to the job site.

2. Certification from the suppliers of ground limestone showing:

    Magnesium oxide content
    Total calcium oxide neutralizing equivalent
    Gradation of the ground limestone

3. Certification that fertilizer meets the chemical analysis of this specification and the requirements of the State of Massachusetts laws.

4. The bag tag for each variety of mix and bag of seed showing test results and date of test.

2.1 LIME

Standard ground limestone is to be used and is defined as ground limestone, which will analyze at least 90 percent calcium carbonate equivalent, 90 percent of which will pass through a 20 mesh sieve, with a minimum of 40 percent passing a 100 mesh sieve, and which contains all fine materials produced in grinding. Magnesium oxides will be given a weight of 1.30 when converting to calcium oxide equivalent.

2.2 SEED

The seeds shall conform to the requirements of the Massachusetts Department of Transportation Standard Specifications for roads, bridges and incidental construction. All seeds shall be furnished fully tagged and bagged. The minimum percentage of weight of pure live seed in each lot shall not be less than 90 percent. All germination tests shall have been made not more than 6 months prior to the date of planting. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. At the discretion of the Engineer, all materials shall be subject to additional sampling and testing.

Mixture	Percent by Weight
Creeping Red Fescue	35%
Kentucky Bluegrass	25%
Alsike Clover	5%
K-31 Tall Fescue	30%
Perennial Ryegrass	5%

2.3 MULCH

Only hay or straw shall be used. The materials shall not be musty, moldy, caked, or of otherwise low quality.

PART 3 - EXECUTION

3.1 SEEDING SEASON

All disturbed soil areas shall be seeded before October 15.

3.2 SEEDED PREPARATION

Seed will be applied to a well conditioned smooth firm seedbed, prepared to a depth of three (3) inches. Clods or other obstructions generally larger than two (2) inches in diameter or thickness that will prevent uniform seeding shall be removed or reduced in size. If the seedbed becomes hard or caked, it must be reconditioned before seed is applied. Care must be taken by the Contractor to see that ruts or ridges are not created on the graded areas.

3.3 LIMING, FERTILIZING AND SEEDING

Lime, fertilizer and seed may be applied by either of the following methods. The rates of application shall not be less than:

Fertilizer	-	1,000 pounds per acre
Seed Mixture	-	140 pounds per acre
Mulch	-	2 tons per acre
Lime	-	1.5 tons per acre

A. Method 1 - Hydraulic Spray Method

The hydraulic spray method of sowing seed may be used where approved by the Engineer. This work shall be done with an approved machine operated by a competent crew. Seed and fertilizing material shall be mixed with water in the tank of the machine and kept thoroughly agitated so the materials are uniformly mixed and suspended in the water at all times during operation. The spraying equipment must be designed and operated to distribute seed and fertilizing materials evenly and uniformly on the designated areas at the required rates. If the Engineer finds the application uneven or otherwise unsatisfactory, he may require the hydraulic spray method to be abandoned and the balance of the work done as specified under another method.

B. Method 2 - Mechanical Method

Fertilizing and liming shall be done when the soil is in a moist condition and at least 24 hours before sowing the seed. The fertilizer and lime shall be applied to the soil by means of a mechanical spreader or other approved method capable of maintaining a uniform rate of application and shall be thoroughly harrowed, raked or otherwise mixed with the soil to a depth of not less than 1 inch. The fertilizer and lime shall not be applied together unless applied hydraulically.

Grass seed of the required mixture and quality shall be sown by a mechanical seeder or other method which will sow the seed uniformly at the required rate over the entire area to be seeded. The mechanical seeder shall be capable of being operated to avoid the growth of grass in rows and shall be so operated.

C. Mulching

Immediately after the area has been seeded, it shall be uniformly covered by a mulch of hay or straw at the rate of two (2) tons per acre.

Mulch Binder: Promptly after placing the mulch, it shall be anchored by either Type SS-1 emulsified asphalt meeting the standards of ASTM D-977-57, or adhesive mulch stabilizer and be applied at the rate of 250 gallons per acre. Application temperature shall be 75-120 degrees Fahrenheit. The asphaltic emulsion shall not have been frozen and must not be allowed to freeze at any time prior to application. Adhesive mulch stabilizer shall be uniformly applied at the rate of 50 pounds per 1,000 gallons of water per acre using power spray equipment. Adhesive mulch stabilizer shall be used immediately after mixing.

END OF SECTION

SECTION 03310 - CAST-IN-PLACE CONCRETE

PART I - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Terms and Conditions and other Specification Sections.

1.2 DESCRIPTION OF WORK

A. Scope of work is for providing concrete. Also included in this section is surface preparation, curing, finishing, grouting, formwork, and reinforcing steel.

B. Extent of work is indicated in the Contract Documents and shown on drawings.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are specified.

ACI 211.1	-	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
ACI 214	-	Recommended Practice for Evaluation of Strength Test Results of Concrete.
ACI 301	-	Specifications for Structural Concrete for buildings.
ACI 304	-	Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
ACI 305	-	Hot Weather Concreting.
ACI 306	-	Cold Weather Concreting
ACI 309	-	Consolidation of Concrete.
ACI 318	-	Building Code Requirements for Reinforced Concrete.
ACI 347	-	Recommended Practice for Concrete Formwork.
ASTM C 31	-	Standard Method of Making and Curing Concrete Test Specimens in the Field.
ASTM C 33	-	Standard Specifications for Concrete Aggregates.

ASTM C 42	-	Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 70	-	Test for Surface Moisture in Fine Aggregate.
ASTM C 94	-	Standard Specification for Ready-Mixed Concrete.
ASTM C 109	-	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars using 2-in. or 50 mm cube specimens.
ASTM C 143	-	Standard Test Method for Slump of Portland Cement Concrete.
ASTM C 150	-	Standard Specifications for Portland Cement.
ASTM C 172	-	Standard Method of Sampling Fresh Concrete.
ASTM C 231	-	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
ASTM C 260	-	Standard Specification for Air-Entraining Admixtures for Concrete.
ASTM C 494	-	Standard Specification for Chemical Admixtures for Concrete.

B. Batch plants shall have NRMCA - Batch Plant Certification.

C. Materials: Materials used in producing the concrete shall be from the same source for the duration of the project. Change of source for cement admixture or fine and coarse aggregate constitutes a new mix design and will require resubmittal of all data and laboratory tests. Any costs associated with resubmittals shall be borne by Contractor at no charge to Owner.

D. Tolerances - The tolerances for finished cast-in-place concrete shall conform to ACI-347.

1.4 CONCRETE TESTING

General: Concrete materials and operations will be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Engineer for final acceptance.

1.5 SUBMITTALS

A. Product Data: Submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, and others if requested by Engineer.

B. Reference Paragraph 2.5.B for the required mix report submittals.

C. Submit full data on concrete production facilities including certifications of batch plants by National Ready Mixed Concrete Association.

1.6 PROJECT CONDITIONS

Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 2" to surface. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II.

1. Use one brand of cement throughout project, unless otherwise acceptable

to Engineer.

B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Do not use fine or coarse aggregates containing spalling-causing deleterious substances:

a. Use source of aggregate with documented service records of satisfactory performance regarding alkali reactivity.

b. Where service records of field performance do not exist, Owner may require the Contractor to submit results of laboratory tests demonstrating the suitability of the aggregate in regards to alkali reactivity. Testing shall be in accordance with ASTM C 227, C 289 and C 586 or as otherwise directed by the Owner.

2. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Engineer.

3. Preferred coarse is 1-1/2" aggregate per ASTM C 33, minimum is 3/4" size if available.

4. Aggregate material to be quartzite quartz, limestone, dolomite, granite, feldspar, or other low shrinkage rock.

C. Water: Potable

D. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Air-Tite," Cormix.
"Air-Mix" or "Perma-Air," Euclid Chemical Co.
"Darex AEA" of "Daravair," W.R. Grace & Co.
"MB-VR" or "Micro-Air," Master Builders, Inc.
"Sealtight AEA," W.R. Meadows, Inc.
"Sika AER" Sika Corp.

E. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"WRDA"; W.R. Grace
"PSI N"; Cormix
"Eucon WR-75"; Euclid Chemical Co.
"Pozzolith Normal or Polyheed"; Master Builders.
"Plastocrete 161"; Sika Chemical Corp.
"Chemtard"; Chem-Masters Corp.
"ProKrete-N"; Prokrete Industries, Inc.

F. Hydration Stabilizer Admixture: ASTM C-494, Type B or Type D, and containing not more than 0.1 percent chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Recover"; W.R. Grace

G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G and containing not more than 0.1 percent chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"WRDA 19" or "Daracem"; W.R. Grace
"PSP"; Prokrete Industries Inc.
"Super P"; Anti-Hydro Co., Inc.
"Sikament 300"; Sika Chemical Corp.
"Eucon 37"; Euclid Chemical Co.
"PSI Super"; Cormix
"Rheobuild"; Master Builders

H. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.

2.4 RELATED MATERIALS

A. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

100 Non-Shrink Grout (Non-Metallic); Conspec, Inc
Supreme Grout; Cormix, Inc.
Sure Grip Grout; Dayton Superior.
Euco N.S.; Euclid Chemical Co.
Crystex; L & M Construction Chemicals, Inc.
Masterflow 713; Master Builders.
Sealtight 588 Grout; W.R. Meadows.
Propak; Protex Industries, Inc.

Set Non-Shrink; Set Products, Inc.
Five Star Grout; U.S. Grout Corp.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

Waterproof paper
Polyethylene film
Polyethylene-coated burlap

C. Liquid-Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"A-H 3 Way Sealer"; Anti-Hydro Co., Inc.
"Spartan-Cote," The Burke Co.
"Conspec #1," Conspec Marketing & Mfg. Co.
"Hardtop," Cormix.
"Day-Chem Cure and Seal," Dayton Superior Corp.
"Eucocure," Euclid Chemical Co.
"Horn Clear Seal," A.C. Horn, Inc.
"L&M Cure," L&M Construction Chemicals, Inc.
"Masterkure," Master Builders, Inc.
"CS-309," W.R. Meadows, Inc.
"LR-151," Prokrete Industries.
"Kure-N-Seal," Sonneborn-Rexnord.

D. Polymer Modified Concrete: A polymer-modified cementitious patching mortar with a high bond strength and with a coefficient of thermal expansion compatible with concrete.

1. Vertical and overhead patches less than 1 inch thick-use Sikatop 123, Fosroc Renderoc HB or approved equivalent.

2. All horizontal surfaces and vertical and overhead patches greater than 1 inch thick (formed and placed)-use Sikatop 122, Fosroc Renderoc SD or approved equivalent. For patches greater than 5 inches deep or larger areas, extend concrete with 3/8 inch aggregate.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs.

B. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Engineer.

C. Design mixes to provide normal weight concrete with the following properties:

4000 psi 28-day compressive strength; W/C ratio, 0.42 maximum by weight.
Air Entrainment 5% to 7%

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.

E. Admixtures:

1. May use water-reducing admixture and High Range Water-Reducing (HRWR) admixture (super plasticizer) in concrete as required for placement and workability.

2. Use air-entraining admixture in concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content of 5 to 7 percent.

3. Use admixtures for water-reducing in strict compliance with manufacturer's directions.

4. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement: To conform to approved mix design. It is expected that these will be approximately:

a. Without HRWR 3", plus or minus 1".

b. Concrete containing HRWR admixture (super-plasticizer): Not more than 7" after addition of HRWR to site-verified 1-1/2" (plus - or minus - 1/2") slump concrete.

2.6 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

2. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Job-Site Mixing:

1. Shall conform to ASTM C94.

2. Shall Meet or exceed the National Ready Mixed Concrete Associations On-Site Batch Plant Certification Specifications.

3. Mix materials for concrete in appropriated drum-type batch machine mixer. For mixers of one cu. yd. Or smaller capacity, continue mixing at least 1 minute, after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum mixing time by 15 seconds for each additional cu. yd. or fraction thereof.

4. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the placement of forms, reinforcing steel, and concrete inspection of the work with the Engineer.

B. Notification: Twenty-four hours notice shall be given to the Engineer prior to each concrete placement.

C. No concrete shall be placed without prior inspection of the forms and embedments and release by the Engineer.

3.2 FORMS

A. Design, erect, support, brace, and maintain form work to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain form work construction tolerances complying with ACI 347.

B. Design form work to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures.

Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of form work is inaccessible for clean-out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer all exposed corners and edges with a 3/4 inch chamfer. Use wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.3 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars"; for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by form work, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operation. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Support dowels through spacers, bar supports or similar devices to maintain even coverage of surrounding grout material during dowel grouting operations.

3.4 JOINTS

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Engineer.

B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

C. Waterstops: Provide waterstops in construction joints where shown on drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

D. Clean all joints to remove laitance and loose material from substrate, acid cleaning is prohibited.

E. Saturate joint 2 hours prior and immediately proceeding placement of fresh concrete. Remove all standing water.

3.5 INSTALLATION OF EMBEDDED ITEMS

A. General:

Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by Cast-in-Place Concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be embedded.

3.6 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel form work is not acceptable.

3.7 CONCRETE PLACEMENT

A. Preplacement Inspection: Before placing concrete, inspect and complete form work installation and reinforcing steel.

B. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation, maximum free drop of concrete shall be five feet.

C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

D. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

E. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 deg. F (4 deg. C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg. F (10 deg. C), and not more than 80 deg. F (27 deg. C) at point of placement. Air entrainment admixture amount will vary with concrete temperatures.

G. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

H. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

I. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

J. Cool ingredients before mixing to maintain concrete temperature at time of placement below 80 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

K. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

L. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.8 FINISH OF VERTICAL SURFACES

A. All vertical concrete formed surfaces shall receive a "Smooth Form Finish".

Smooth Form Finish: Provide as-cast smooth form finish for all formed concrete surfaces.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas, with fins or other projections completely removed and smoothed, and any holes filled.

3.9 FINISH OF HORIZONTAL SURFACES

A. Trowel Finish: Apply mag trowel finish to all horizontal concrete surfaces to be used as walking surfaces.

B. After Screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge placed on surface at not less than 2 different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.

C. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces ringing sound as trowel is moved over surface.

D. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge.

E. Non-Slip Broom Finish: Apply non-slip broom finish to all horizontal surfaces. Immediately after trowel finishing, slightly roughen concrete surface by brooming in direction perpendicular to main traffic route. Coordinate final finish with Engineer before application.

3.10 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 7 days.

2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by one of the following methods.

a. Keep concrete surface continuously wet by covering with water.

b. Continuous water-fog spray.

c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:

a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

b. Provide curing and sealing compound as follows:

c. Apply specified curing and sealing compound to concrete slabs within 2 hours of completing the final finishing operation and after surface water sheen has disappeared.

d. Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

C. Curing formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, and other flat surfaces by application of appropriate curing method.

3.11 POLYMER CONCRETE

The application of the polymer modified cementitious mortar is to follow the manufacturers recommended procedures.

3.12 REMOVAL OF FORMS

Form work not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Form work, including bracing supporting new work, shall not be removed prior to cumulatively curing at not less than 50° F (10° C) for 96 hours after concrete placement, unless otherwise approved by Engineer.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas in a manner acceptable to the Owner.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean and dampen with water the area to be patched.

C. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

D. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent. Dry packed mortar shall be placed in layers about 3/8 inch thick under saturated surface dry conditions.

E. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

F. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

G. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.

H. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

1. Repairs utilizing epoxy materials shall be done according to ACI 503-1, ACI 503.2, and ACI 503.4.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Owner or the Owner's testing laboratory shall perform the concrete tests and to submit test reports.

Notification: Notify Owner and Engineer twenty-four (24) working hours prior to each concrete placement, or as directed by Engineer. No placements shall be made unless testing personnel are available and present.

Owner shall not be held responsible for cost incurred by delays associated with the unavailability of the test personnel.

B. Sampling and testing for quality control during placement of concrete shall include the following, as directed by Engineer or Owner.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

2. Slump: ASTM C 143; one test at point of discharge for truckload of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one test for each set of compression test specimen.

4. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 deg C) and above; and each time a set of compression test specimens are required.

5. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

6. Compressive Strength Tests: ASTM C 39; one set for each day's pour plus additional sets for each 50 cu. yds. over and above the first 75 cu. yds. of concrete placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen tested at 56 days or retained in reserve for later testing if required by Engineer.

   a. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

   b. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

   c. Contractor or Contractor's concrete supplier shall provide cure box and cylinder mold, unless otherwise agreed to by the testing laboratory.

   d. Contractor shall assist testing personnel through providing incidental equipment or materials.

   e. Test results shall be reported in writing to Owner, Engineer and Contractor within 3 days after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; weight of concrete in pounds per cubic foot; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

f. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

g. Additional Tests: The testing service will make additional tests of in-place concrete, as requested by Engineer, when test results indicate specified concrete strengths and other characteristics have not been attained in the structure. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION

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SECTION 15000 - FABRICATED GATE AND GUIDES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Terms and Conditions of this Section apply to this work.

1.2 DESCRIPTION OF WORK

This section includes providing gate, lifting system, gate guides, electrical power, instrumentation, controls, and appurtenances. A vendor designed gate may also be submitted for approval as an alternate. The Owner shall determine if any alternate vendor gate design is acceptable.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".

2. AWS D1.1 "Structural Welding Code".

B. Qualifications for Welding: Use only prequalified welded joints and welding procedures. Welders and welding operators to be AWS qualified.

C. The Owner reserves the right to make shop inspections during the course of the work. The fabricator will periodically notify the Owner and Engineer as to the progress of the work so that inspections can be scheduled. Do not apply paint and coatings until Owner and Engineer has been notified and has indicated whether a shop inspection will be made prior to coating application.

1.4 SUBMITTALS

A. Submit shop drawings of the gate and all fabricated items, and gate design calculations, if a vendor designed gate is proposed as an alternative.

1.5 STORAGE, DELIVERY, AND HANDLING

A. Storage: Store materials to permit easy access for inspection and identification. Keep members off the ground. Protect from corrosion and deterioration.

Do not store materials or fabrications in a manner that might cause distortion or damage.

B. Deliver in ample time not to delay work. All necessary attaching bolts will be stainless steel and furnished by the slide gate manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Plates, Bars: ASTM A36, except as otherwise noted.

B. Structural Steel Shapes: ASTM A572.

C. Stainless Steel Plates, Bars: Type 304.

D. Threaded Fasteners: All threaded fasteners, nuts and washers used in the fabrication of gate shall be A325.

E. UHMW Plastic: "GAR-DUR", as manufactured by Garland Manufacturing Company, Saco, Maine.

F. Neoprene Seals: 1500psi tensile Strength, durometer hardness 55-60.

G. Strap Anchors: M1020 hot rolled.

H. Welding Electrodes: A36-E7OXX; carbon to stainless use E309; 304SS use E308; also comply with AWS D1-1 code where applicable.

I. Rubber Seals: Seal shall be as manufactured by "Buckhorn Rubber Products" or equivalent and be a molded, natural rubber or a butadiene and styrene copolymer and shall have the following physical properties:

1. Shore A Durometer 65±5.

2. Minimum elongation, 450 percent.

3. Minimum ultimate strength, 2750 psi.

4. The rubber shall not absorb more than 5 percent, by weight, of water in a 48 hours test. The tensile strength of the test specimen, after being subjected to an accelerated aging test for 48 hours in oxygen at 160° F and 300 psi pressure, shall not be less than 80 percent of the strength of the test specimen before aging.

5. Corners shall be factory vulcanized.

J. Galvanizing

1. Structural steel shapes, plates, and bars for the gate, guides, walkway,

grating, and handrail shall be hot dipped galvanized, after fabrication, per ASTM A-123. Provisions shall be made to treat stainless steel rub bar surface with a bleed through marker or other means prior to galvanizing to keep the stainless steel rub surface free of galvanizing. The finished surface of the rub bar shall be smooth and free of any scratches, burrs, and gouges. Fabricator shall inspect areas of gate and gate guides interfaces after galvanizing and remove any excess galvanizing as necessary. Galvanizing may be touched up with a cold galvanizing paint, CRC, or Engineer approved equal.

2. Bolts, nuts, washers and hardware shall be hot dipped galvanized per ASTM A-153

K. Caulking - Sikaflex 1A or equal.

L. Gate Heaters:

1. General: Provide mineral-insulated heating cables, as indicated on drawings and as follows:

   Wattage: 480W
   Voltage: 120V
   Heater Length: 8 ft
   Cold Lead: 12 ft
   type: Mineral Insulated

2. Manufacturer: Chromalox

3. Ordering Specification: D/25S2/8/480/120/12/14X

4. Supplier; Leo C. Pelkus, Inc., 170 Worcester St., PO Box 349, Wellesley Hill, MA 02181, (617) 235-8040.

5. Controls

   General: Provide pressure and temperature controls and accessories as indicated on drawings and as specified herein:

   Temperature controller: Chromalox PIT-15, temperature range 0-150 degrees.

M. Gate Hoists:

1. The gate operating system shall conform to the AWWA C-540 Specification.

2. Provide single screw-stem electric gate hoist system. Design and provide stems, hoist, interconnecting attachments and brackets, base plates and

fasteners.

3. Design lifting force to lift gate at maximum pond is 6,000 lbs. Gate hoist system shall develop an allowable lifting force of at least 7,000 lbs.

4. The design closing force for the gate is 5,000 lbs. All components of the hoist system, including stem, shall be capable of developing and supporting the design closing force.

5. Gate stems shall be A276 Type 3901 stainless steel with Acme Type threads, a minimum of 2-1/2" diameter.

6. Operator control: The motor operator shall be provided with a local and remote operating capabilities and have a mechanical gate position indicator. A handwheel shall be provided and shall be capable of being locked against unauthorized use.

7. Operator, including all lubrication, shall be suitable for a long term outdoor exposure to all ambient weather conditions, including temperature range from –60⁄F+ 120⁄F. Use grease such as Beacon 325 or Bardahl low temperature. Electrical enclosures shall be NEMA 4 (weatherproof).

8. Benchstand hoist shall be sized to permit operation of the gate under the full operating head with a maximum effort of 40 pounds on the crank or handwheel. It is the operator manufacturer's responsibility to specify and ensure that when maximum operator torque is imposed that the stem and gate will withstand this torque without damage.

   The hoist nut shall be manganese bronze conforming to ASTM B584 C86500. The hoist nut shall be supported on roller bearings. The hoist nut shall be removable from the top of the operator, without requiring removal of the operator from the gate. A lubrication fitting shall be provided for lubrication of the hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter. The direction of handwheel or crank rotation to open the gate shall be clearly and permanently marked on the hoist.

   The entire operating mechanism shall be designed to withstand any shock resulting from operation with improper setting of limit or torque switches or with foreign matter lodged in the gate. The operator shall be capable of closing or opening the gate against maximum unbalanced operating pressure and maximum flow.

N. Electrical

All electrical and control devices shall be sized and installed per latest edition of NEC. Devices shall operate using the existing 208 volt 3 phase power (available at the gatehouse). Conduit shall be galvanized steel or aluminum ridged metal suitable for outdoor use.

All electrical enclosures shall be lockable NEMA 4 (weatherproof).

O. Instrumentation and Control System

The PLC system shall control and continuously record pond level and gate position. Local operation shall permit the manual operations of the gate without the need to reset the controls. Gate position shall be automatically adjusted based on input signal of pond level to maintain a discharge of 2' – 2" through the gate. The PLC shall fully open the gate at pond levels below El. 265.0' and above El. 273.0'. PLC shall cease all operations and send alarm in the event of electric surge, loss of power, motor torque trip or no change in leaf travel after 10 seconds of operation. The PLC shall have a minimum 2 extra I/O slots and a power reversing contact.

P. Motor Operator Requirements: The gate operator motor shall be equipped with the following devices:

- Motor space heater
- Local and remote control capabilities
- Manual and auto control selector switch
- 3 push button operator – open/close/stop
- Local indication of % gate open
- Adjustable torque limit trips
- Overload breaker

PART 3 - EXECUTION

3.1 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies, including seals, in shop to greatest extent possible. While assembled, the gate to be checked for dimensions, clearances, tolerances, and accuracy of alignment. Fabricate items of structural steel in accordance with AISC specifications and as indicated on final shop drawings.

1. Assemble and weld built-up sections by methods which will minimize heat distortion and warpage.

2. After the entire gate has been completely welded and before any galvanizing, the gate shall be completely assembled in the shop. The gate and guide assembly will be fully inspected by Owner and Installation Contractor for dimensions, clearances, tolerances, accuracy of alignment, and quality of welding and machining. Notify Owner when gate is ready for inspection.

3. Complete welded assembly prior to galvanizing.

B. All members shall be continuously welded. Nominal size seal welds may be placed between structural skip welds.

3.2 TOLERANCES

These are for the installed gate and guide including both shop and field work.

A. Overall length and width ±1/4".

B. Seal mounting surfaces: flat from a true plane of ±1/16" overall and ±1/16" in any two-foot length. This tolerance also applies to the gate guide sealing surface after installation.

C. Unspecified tolerances to be ±1/8".

3.3 FIELD INSTALLATION

A. Provide temporary support of embedded items, during concrete placement, as necessary to insure that gate will operate without binding and without unnecessary drag after installation.

B. The Contractor shall be responsible for the quality of work performed by his welding organization. No production work shall be undertaken until both the welding procedure and the welding operators have been qualified to the satisfaction of the Owner. All welding shall be done by the shielded metal-arc process, except where otherwise specifically permitted by the erection engineer from the supplier. All welding rods shall be furnished by the Contractor. Welds shall be made as specified on the Drawings and in accordance with the conventional welding symbols of the American Welding Society.

C. Qualification of Welding Operators - Only qualified welding operators shall be assigned to the work. Operators shall have been qualified in accordance with Part II of the Standard Qualification Procedure of he American Welding Society from AWS D1.1 Structural Welding Code. Welding operator's period of effectiveness shall conform to the provisions therefore contained in the code. If in the opinion of the Owner the work of any operator appears questionable, requalification of the operator in accordance with the code will be required. The Contractor shall furnish all test plates and welding rods for such requalification and shall bear all expense of the required tests.

D. Inspection of Welds - All welds may be inspected by the Owner. All welds not meeting the criteria of AWS D1-1 will be reworked, until they are in conformance.

E. Installation of the steel gate shall include (but not be limited to):

- Field welding if necessary
- Attaching necessary hardware such as seals
- Rub strips
- Adjusting seals
- Galvanizing all field welded and abraded areas

F. Provide rigid temporary support of embedded items as necessary to ensure that gate will operate without binding and without unnecessary drag after installation. Install piano wires and take measurements before and during concrete placement to monitor position and tolerance. Demonstrate to Owner's field representative that guides are in correct position prior to concrete placement. Assure guide rub surfaces and guides are plumb straight and level to the following tolerances after installation is complete:

Seal rub surfaces and seal mounting surface

±1/32" in any 2 ft length
±1/4" in length or width of gate

Guides

straightness ±1/4" in length
±1/32" in any 2 ft length

G. If bulb type seal is used, gate seals shall be installed with 1/8" bulb compression.

H. Gate inspection procedure.

The sluice gate and guides will be independently inspected by the Owner, or his representative, and Contractor for position, straightness, square and alignment. As a minimum, inspect after completion of fabrication and prior to shipping, and the after the guides have been installed and checked by the Contractor, but prior to placing guide embedment concrete.

1. Install 2 piano wires, tightly stretched. Vertical plumb line at inside edge of vertical stainless steel rub plate, one horizontally placed in front of the top channel and 5 more horizontally and equally spaced down the face of the 3/8" steel plate. Dimensions will be measured at random at 1 to 2 ft intervals along the height of the gate guides. Note that all these S.S. surfaces are required to be flat within ± 1/16 inch.

2. The overall guide width dimension will be checked.

3. The diagonal dimensions will be measured and shall match.

3.4 GATE TESTING

A. General

1. The Contractor shall test, under normal operating conditions, all components of each gate provided or installed by the Contractor, make adjustments and correction of defects, replace inoperative equipment, seal leaks and retest as necessary.

2. The Contractor shall arrange gate testing before removal of the cofferdam, by flooding the cofferdam, to enable dewatering if corrective measures are necessary.

3. The Contractor shall arrange schedule and operations involving the release of water into or from the project with the Owner.

4. Tests specified herein must be made in the presence of the Owner and Owner's Representative as a prerequisite to final acceptance. Incidental tests may be made by the Contractor as needed to satisfy that a component operates properly prior to requesting the Owner and Engineer presence.

5. After completion of testing, check and adjust all anchor bolts; replace any damaged or worn components; retop reservoirs to the fill level.

6. Only after completion of testing shall remaining cofferdams be removed.

B. Execution:

1. Schedule operations well in advance with Owner. Do not test components involving release of water without Owner's permission.

2. Clean all debris, sediment and foreign matter from areas where the release of water would cause this debris to be carried into the river.

3. Do not remove the stoplogs and/or cofferdam until all dry and wet testing is complete and the Owner has accepted the gate operation in writing.

4. Operate the gate by raising and lowering both under dry and wet conditions. Test the lifting system through full operational range for at least 5 complete cycles under both dry and full pond condition (total 10 cycles).

5. Adjust seals on gate to stop all leakage under full pond conditions. Inspect the dewatered side of the gate when under full pond conditions.

6. Repairs and adjustments shall be made by the Contractor until each unit operates satisfactorily, in the opinion of the Owner.

C. Leakage: Maximum allowable leakage for gates shall be 0.1 gallons-per-minute per foot of wetted periphery, regardless of the direction of unbalanced head.

D. Heater Tube Test:

General: After assembly, heater chamber shall be shop and field tested for leakage of water. Testing shall be conducted as follows:

Shop: After final shop assembly of the gate guide/heater, all welds within the heater pressure vessel will be checked by charging the system to 20 psi, and check all joints for water tightness. Shop to reweld as required to prevent leakage. Assembly shall be retested and rewelded\ (if required) until no leakage is detected.

Field: After all field-made joints (threaded, flanged or sweated) to the heater system have been completed, they will be checked for leakage. Contractor to repair joints as required to prevent leakage. Assembly shall be retested and repairs made (if required) until no leakage is detected.

Notify: Engineer shall be notified and will be present when final shop and field testing of the heater pressure vessel will be conducted. Notify Engineer sufficiently in advance of the scheduled test to allow for Engineer's presence.

END OF SECTION

APPENDIX A

LIST OF CONTRACT DOCUMENTS AND DRAWINGS

CONSOLIDATES EDISON ENERGY MASSACHUSETTS, INC.
West Springfield, Massachusetts

RED BRIDIGE MINIMUM FLOW GATE PROJECT

LIST OF CONTRACT DOCUMENTS AND DRAWINGS

The Contract Documents which comprise the entire agreement between Consolidated Edison Energy Massachusetts, Inc. and Contractor concerning the work consist of the following:

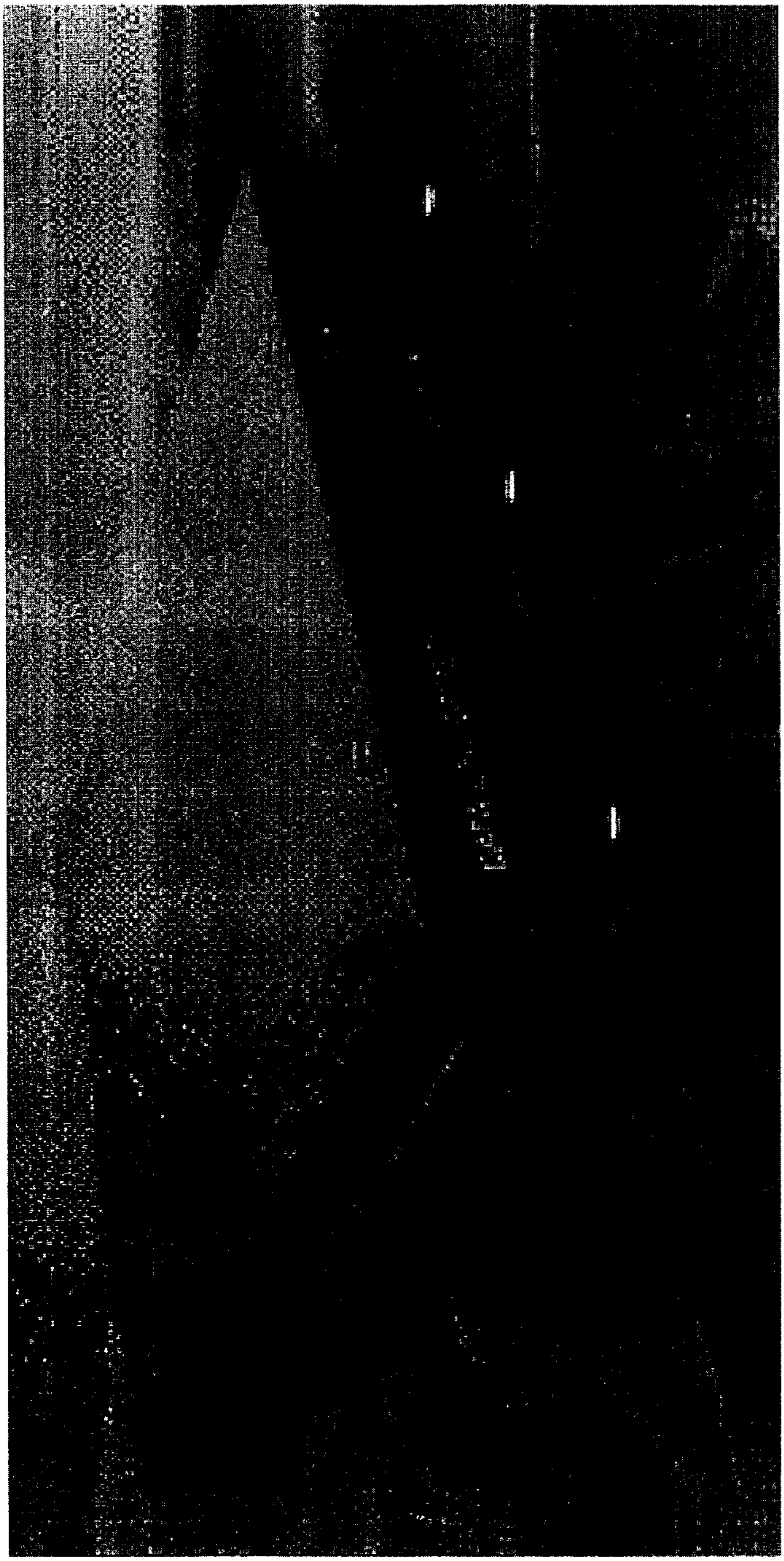
Performance and Payment Bond (Required by Invitation for Bids)
Standard Terms and Conditions of Construction Contracts
Contractor Safety Work Rules
Special Conditions

Drawings
RB - 1. General Arrangement and Section
RB - 2. Concrete Sections and Notes
RB - 3. Guide and Access Platform Details
RB - 4. Gate Leaf Details
RB – 5. Miscellaneous Details

Specifications contained herein including Appendices

APPENDIX B

EQUIPMENT DATA

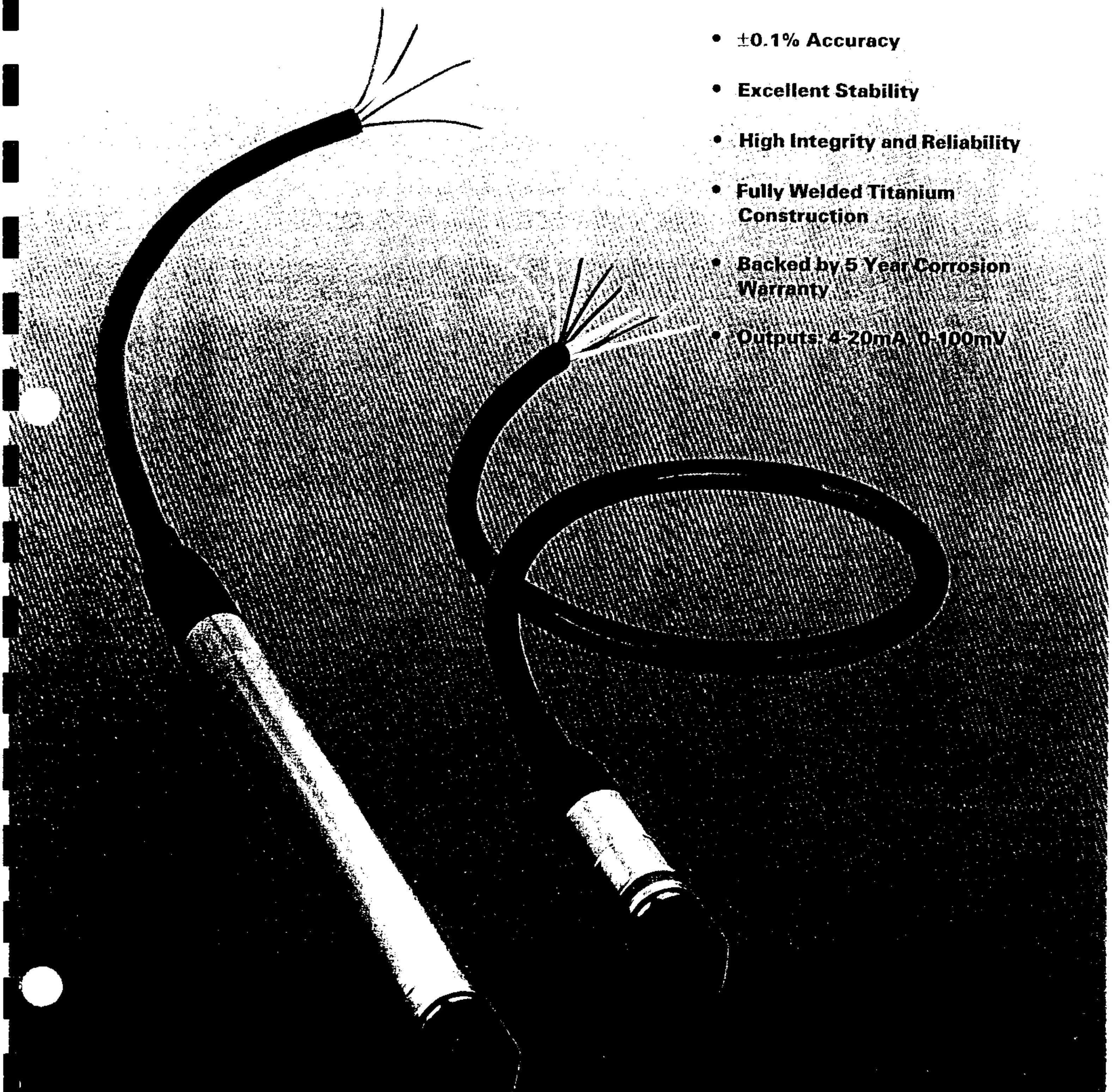


Druck

1830 SERIES

Depth & Level Pressure Sensors

- ±0.1% Accuracy
- Excellent Stability
- High Integrity and Reliability
- Fully Welded Titanium Construction
- Backed by 5 Year Corrosion Warranty
- Outputs: 4-20mA, 0-100mV

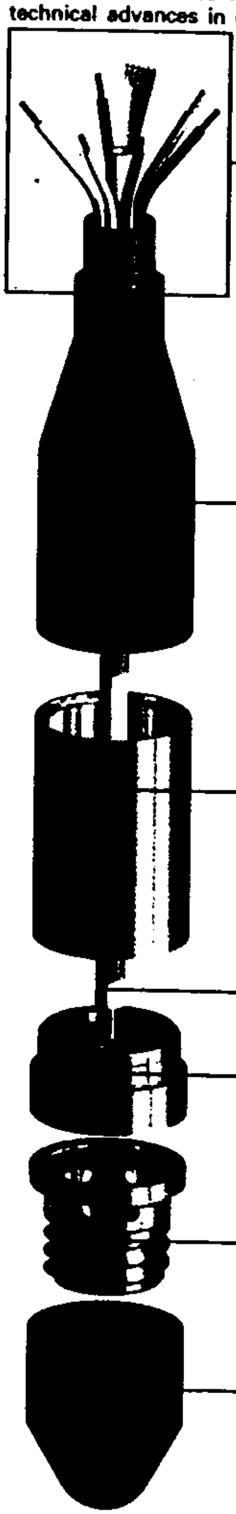


1830 SERIES: Depth & Level Pressure Sensors

INTRODUCTION

For over 20 years Druck have manufactured pressure sensors specifically for depth & level measurement.

The 1830 Series is the latest generation of fully submersible sensors which incorporate the most recent technical advances in depth & level measurement.

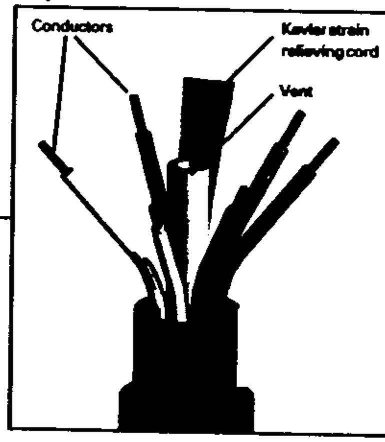


At the heart of the 1830 Series is a high stability pressure sensing element manufactured from micro-machined silicon developed within Druck's own Class 100 processing facility. The silicon sensing element is fully isolated from the media by a titanium isolation diaphragm. The use of titanium enables the sensors to be used in the most hostile of fluids where materials such as stainless steel cannot be considered.

Surface mount electronics within the all-titanium body tube assembly enables minimum sensor size with improved reliability. The purpose-designed vented electrical cable results in a depth and level sensor with the highest integrity and the lowest cost of ownership.

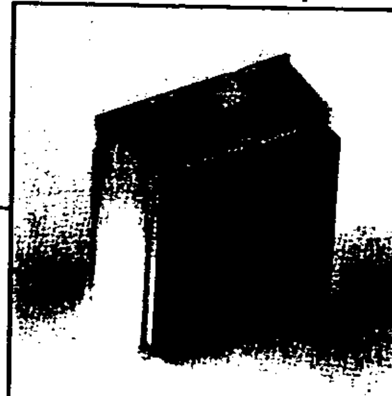
With a choice of millivolt or current outputs, small physical size and wide range of pressures, the 1830 Series can be used in a variety of applications from the smallest diameter bore holes to canals, rivers and reservoirs. They are ideally suited for depth/level application in the oceanographic and remediation industries. The 1830 series depth-sensing transmitters are backed by Druck's 5-year corrosion warranty.

Depth Cable



Purpose-designed thick walled polyurethane sheathed depth cable with integral large diameter vent tube for fast response. The shielded cable incorporates a Kevlar strain relief cord with a breaking strength of 200 lbs. min.

Pressure Module Assembly



A high stability micro-machined silicon sensing element is contained within the all-titanium pressure module assembly. The sensing element is both electrically and physically isolated from the pressure media.

1830 SERIES: Specification

PDCR 1830

Operating Pressure Range
1, 2.5 psig
5, 10, 15, 20, 30, 50, 75, 100, 150, 200, 300, 500, 900 psia or psig
Other pressure units can be specified.

Overpressure
8x for 1 and 2.5 psig ranges
6x for 5 psig range
4x for ranges of 10psi and above up to a maximum of 2000 psi.

Pressure Containment
10x for 1, 2.5, and 5 psig ranges
6x for ranges of 10 psig and above to a maximum of 2000 psig; 3000 psi for all absolute ranges.

Media Compatibility
Fluids compatible with titanium, acetal and polyurethane.

Excitation Voltage
10 Volts at 5mA maximum.

Output Voltage
25mV for 1 psig range
50mV for 2.5 and 5 psi ranges
100mV for ranges 10 psi and above
Output is ratiometric to supply.

Common Mode Voltage
Typically +3.5 to +9 V with respect to the negative supply at 10 V excitation.

Combined Non-linearity, Hysteresis & Repeatability
±0.1% F.S. BSL for all ranges.

Zero Setting
±3mV maximum.

Span Setting
±10mV maximum.

Long Term Stability
Typically ±0.1mV/annum.

Operating Temperature Range
-4° to +140°F (-20° to +60°C)

Compensated Temperature Range
+28° to +86°F (-2° to +30°C)

Temperature Effects
±0.3% F.S. Total Error Band for ranges of 5 psi and above
±0.6% F.S. Total Error Band for 1 and 2.5 psi ranges.

Pressure Connection
Depth cone with radial inlet holes.

Electrical Connection
Vented polyurethane depth cable
3 feet supplied as standard
Longer lengths available on request.

Ingress Protection
NEMA 6 (IP68) to 2300 feet of water

Insulation
Greater than 100 MegOhms at 500 Vd.c.

Safety

EMC emissions	EN50081-1
EMC immunity	EN50082-2
Certification	CE Marked

FM and CSA approved, Class 1, Div 1, Groups A, B, C, D Intrinsic Safe.

PTX 1830

Operating Pressure Range
1, 2.5 psig
5, 10, 15, 20, 30, 50, 75, 100, 150, 200, 300, 500, 900 psia or psig
Other pressure units can be specified.

Overpressure
8x for 1 and 2.5 psig ranges
6x for 5 psig range
4x for ranges of 10 psi and above up to a maximum 2000 psi.

Pressure Containment
10x for 1, 2.5 and 5 psig ranges
6x for ranges of 10 psig and above to a maximum of 2000 psig; 3000 psi for all absolute ranges.

Media Compatibility
Fluids compatible with titanium, acetal and polyurethane.

Excitation Voltage
9 to 30 V d.c.

The minimum supply voltage (V_{MIN}) that must appear across the transmitter terminals is 9V and is given by:-
$V_{MIN} = V_S - (0.02 \times R_L)$

Where *V_S is excitation voltage in volts*
R_L is total loop resistance in ohms.

Output Current
4 to 20mA, 2 wire.

Combined Non-linearity, Hysteresis & Repeatability
±0.1% F.S. BSL for all ranges.

Zero Offset & Span Setting
±0.25% F.S. maximum.

Long Term Stability
Typically ±0.1% F.S./annum

Operating Temperature Range
-4° to +140°F (-20° to +60°C)

Compensated Temperature Range
+28° to +86°F (-2° to +30°C)

Temperature Effects
±0.3% F.S. Total Error Band for ranges of 5 psi and above
±0.6% F.S. Total Error Band for 1 and 2.5 psi ranges

Pressure Connection
Depth cone with radial inlet holes.

Electrical Connection
Vented polyurethane depth cable
3 feet supplied as standard
Longer lengths available on request.

Ingress Protection
NEMA 6 (IP68) to 2300 feet of water

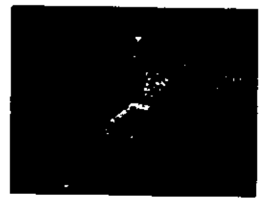
Insulation
Greater then 100 Megohms at 500 Vd.c.

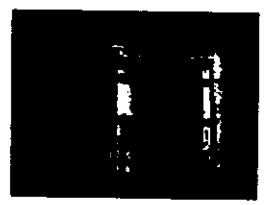
Voltage Spike Protection
Units will withstand a 600 V voltage spike in accordance with ENV 50142 without damage when applied between all excitation lines and case.

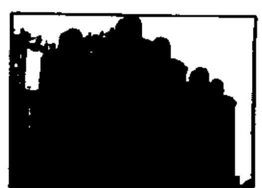
Safety

EMC emissions	EN50081-1
EMC immunity	EN50082-2
Certification	CE Marked

FM, UL and CSA approved, Class 1, Div. 1, Groups A, B, C, D Intrinsic Safe; Cenelec Intrinsic Safe approved.







1830 SERIES: Depth & Level Pressure Sensors

ORDERING INFORMATION

Please state the following:-
(1) Type number
(2) Pressure range
(3) Gauge or absolute
(4) Vented electrical cable length
3 ft. supplied as standard.

For non-standard requirements please refer to Druck.

ASSOCIATED PRODUCTS

Special Depth/Level Transmitter
PDCR/PTX 1880
- Suitable for aggressive environment
- Tefzel/Titanium construction
- Compact 0.69"
- Accuracy: ±0.1%
- 4-20mA or mV output
- Seawater compatible

Cable Termination w/ Remote Electronics
SCU-220
- 2-wire 4-20mA
- Desiccant indicator
- Din-Rail for lightning suppressor
- NEMA 4X

Cable Termination
STE 110
- Low maintenance
- Desiccant indicator
- Suitable for all sensors
- Rated NEMA 4X
- Din-Rail for lightning suppressor or IS barriers

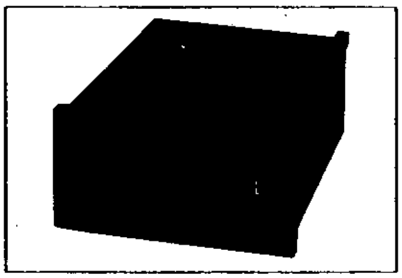
Pressure Level Handbook
- Full range of products
- Installation details
- Application information
- Lightning protection

Lightning Arresters

MDK-24	2-wire
MDK-LC	4-wire
MDK-LV	3-wire

- DIN rail mountable
- Fits in STE 110 & SCU 220

Signal Conditioners/Controllers
DPI 280 Series
- Dual Scaling
- Suitable for all sensors
- Programmable features
- Level control/ measurement
- RS 232 and RS 485 interface
- Up to 4 flexible alarms



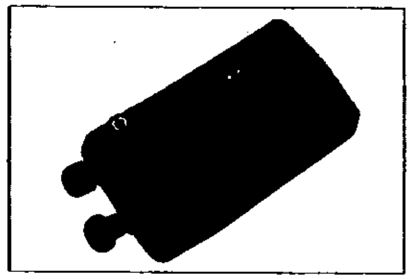
DPI 280 Series Digital Process Indicators

Portable Barometric Standards
DPI 740
- Battery powered
- Pocket-sized
- Barometric range
- Accuracy: ±0.015% value
- Stability: 100 ppm/year

Field Pressure Calibrator
DPI 600 Series
- Accuracy: ±0.025% F.S.
- Integral ranges to 300 psi
- Voltage/current power source
- Higher ranges to 10,000 psi available
- Integral pressure/vacuum generation

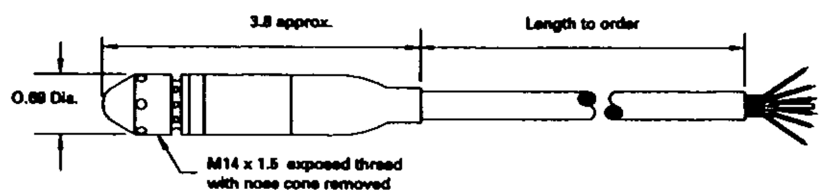
Continuing development sometimes necessitates specification changes without notice.

Druck Inc. is an ISO 9001 registered company



DPI 600 Series Field Portable Pressure Calibrators

INSTALLATION DRAWINGS Dimensions: inches (NOT TO SCALE)

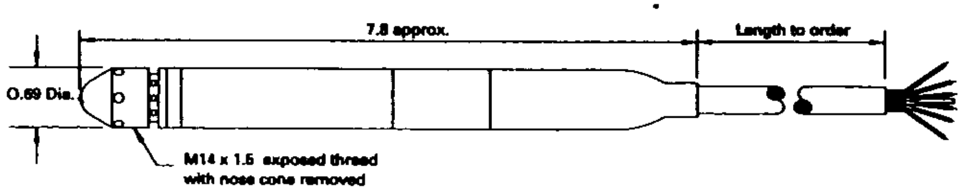


PDCR 1830
Electrical Connection
Vented polyurethane cable

Red	Positive supply
White	Negative supply
Yellow	Positive output
Blue	Negative output
Shield	connected to case

Any other conductors not connected.

PDCR 1830



PTX 1830
Electrical Connection
Vented polyurethane cable

Red	Positive supply
Black	Negative supply
Shield	connected to case

Any other conductors not connected.

PTX 1830

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Telephone: (403) 452-4630

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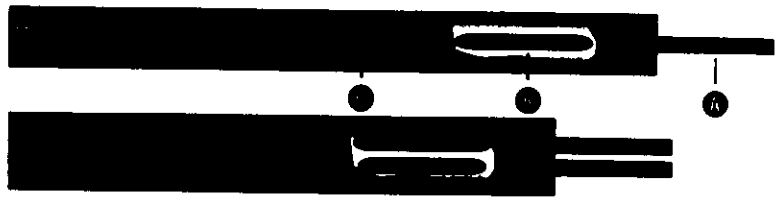
Chromalox®

Precision Heat and Control

The Solutions Innovator

MI

Mineral Insulated High Temperature



- **Constant Output**
- **Impact Resistant, Heavy Duty Alloy 825 Sheath**
- **Exposure Temperature to 1100°F (593°C)**
- **Any Design Voltage Up to 600 Volt**
- **High Watt Densities Available**
- **Industrial Freeze Protection**
- **Suitable for Hazardous Areas, Div. 1 and Div. 2**
- **Single and Two Conductor Cables Available**

Description

MI mineral insulated heating cable is ideal for rugged industrial pipe tracing applications. Its tough outer sheath of Alloy 825 resists damage during installation and provides a reliable electrical ground for safe operation. MI cable will not burn or support combustion. All materials are inorganic and will not deteriorate with age.

MI cable is made with either one or two conductors, insulated with compacted magnesium oxide for high dielectric strength. Cable assemblies are custom made at the factory to meet your specific needs.

Applications

- Tank Heating
- High Temperature Process Maintenance
- Long, Single Circuit Runs
- Cryogenic Applications
- Freeze Protection

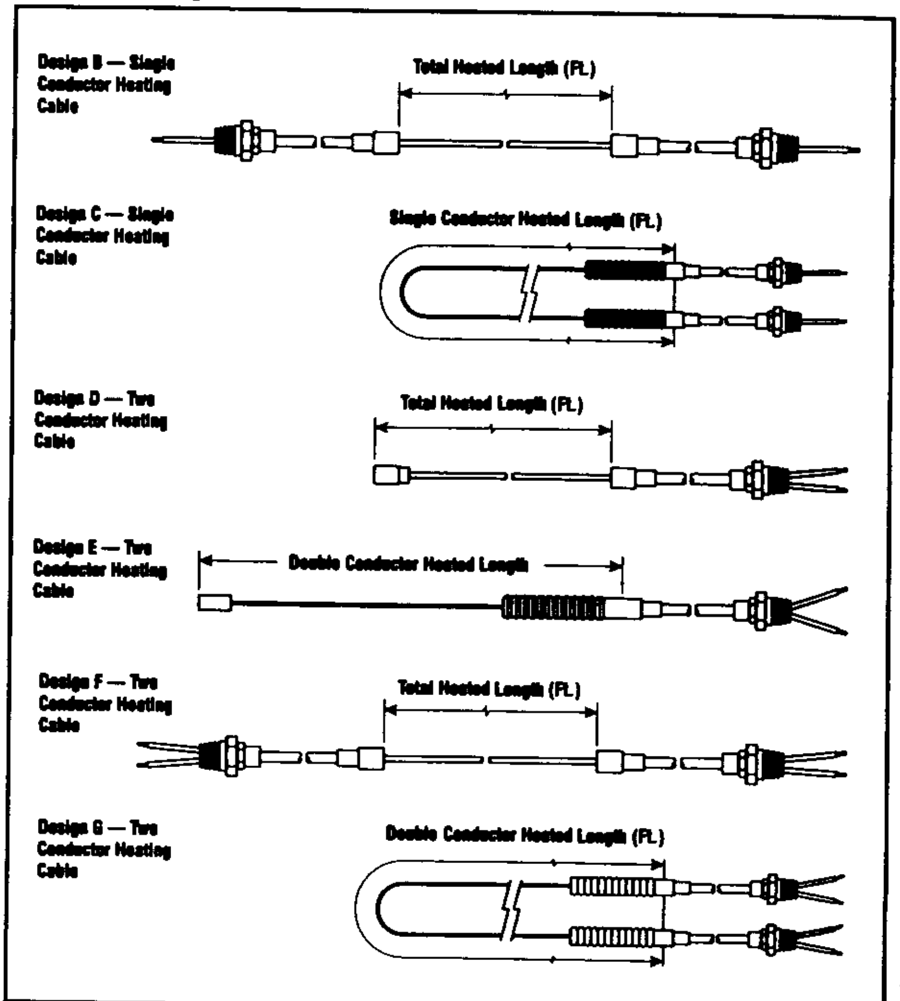
Features

- Mechanically Rugged Design
- Fire Resistant
- Alloy Features High Corrosion Resistance
- Long Circuit Lengths
- Built to Customer Design Specifications
- Series Wiring for Long Lengths
- Includes 10" Pigtails for Wiring Connections.

Construction

- **Resistance Wire** — One or two resistance wires.
- **Insulation** — High grade densely compacted mineral insulation.
- **Sheath** — Heavy Duty Alloy 825 Metallic Sheath.

Cable Set Configurations



Note — Standard cable sets include 3 feet non-heating cable with 10" pigtails, brazed to customer specified length of MI heating cable. Gland fittings are 1/2" NPT (metric also available).

MI

Mineral Insulated High Temperature *(cont'd.)*

High Temperature

For applications with maintenance or exposure temperatures of 400°F or above, cable set configuration C, E or G should be used. These configurations include a 12" transition fitting to reduce the temperature at the hot-to-cold joint. The transition fitting should be positioned outside the thermal insulation to provide long and reliable service life. Contact the Chromalox surface heating group for assistance with the design of high temperature applications.

Cable Design for Pipes

Step 1 — Heater Design
Determine heater design to use. Design D is usually the most convenient design using two conductor cable.

Step 2 — Heat Loss (W/Ft.) Use the value calculated from Technical section - Heat Loss Calculations, Pipe & Tank Tracing.

Step 3 — Cable Length (L)
Use the length calculated from Application & Selections Guidelines in this section.

Step 4 — Supply Voltage Available (V)
Determine what voltage is available. When different voltages are available, it provides multiple cable choices which may result in a more accurate design.

Step 5 — Calculate Resistance per Foot (R/Ft.)

$$R/Ft. = \frac{V^2}{W/Ft. \times L^2}$$

Step 6 — Select the Proper R/Ft. Rating
Choose a cable having equal or the next lower resistance per foot value from Ordering Information Table, next page.

Step 7 — Calculate Actual W/Ft. and total wattage (W)

$$W/Ft. = \frac{V^2}{R/Ft. \times L^2}$$

$$W = W/Ft. \times L$$

Step 8 — Determine Current Draw (I)

$$I = \frac{W}{V}$$

Step 9 — Select Heater Single or Double Conductor Cold Lead Length
The cold lead length is determined by the customer or by using a nominal 3 feet. All cold leads are #12 AWG with 40 Amp maximum current capacity.

Step 10 — Convert Design to a Model Number

Ordering Information

To Order — Complete the Model Number using the Matrix provided.

If applicable, specify hazardous location classifications.

Model	Mineral Insulated High Temperature
B	MI Heater Set Design
Code	
K012	MI Heater Cable Catalog Reference
Code	
328 Ft.	Heater Set Length in Feet (±1%)
Code	
4878W	Heater Set Wattage
Code	
240V	Operating Voltage
Code	
36"	Cold Lead Length
Code	
12	Pigtail AWG

B K012 328 Ft. 4878W 240V 36" 12 — Typical Model Number

Mineral Insulated

MI

Mineral Insulated High Temperature *(cont'd.)*

Ordering Information

Reference	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Single Conductor Cable — Alloy Sheath — 600 Volt Max.							
K009[1]	0.029	0.187	46	40	28	17	10
K012[1]	0.036	0.187	46	40	28	17	10
K017	0.052	0.187	46	40	28	17	10
K025	0.076	0.187	46	40	28	17	10
K030	0.091	0.187	46	40	28	17	10
K043	0.131	0.187	46	40	28	17	10
K060	0.182	0.187	46	40	28	17	10
K095	0.289	0.187	46	40	28	17	10
K130	0.396	0.187	46	40	28	17	10
K185	0.563	0.187	46	40	28	17	10
K260	0.792	0.187	46	40	28	17	10
K330	1.00	0.187	46	40	28	17	10
K470	1.43	0.187	46	40	28	17	10
K655	2.00	0.187	46	40	28	17	10
K935	2.85	0.187	46	40	28	17	10
K1315	4.00	0.187	46	40	28	17	10
Two Conductor Cable — Alloy Sheath — 300 Volt Max.							
H011[1]	0.033	0.187	46	40	28	17	10
H013[1]	0.039	0.187	46	40	28	17	10
H069	0.210	0.187	46	40	28	17	10
H100	0.30	0.187	46	40	28	17	10
H125	0.38	0.187	46	40	28	17	10
H195	0.59	0.187	46	40	28	17	10
H255	0.78	0.187	46	40	28	17	10
H400	1.22	0.187	46	40	28	17	10
H550	1.68	0.187	46	40	28	17	10
H670	2.04	0.187	46	40	28	17	10
H990	3.02	0.187	46	40	28	17	10
H1400	4.27	0.187	46	40	28	17	10
H1950	5.94	0.187	46	40	28	17	10
H2850	8.69	0.187	46	40	28	17	10
H3600	10.97	0.187	46	40	28	17	10
H5910	18.01	0.187	46	40	28	17	10
Two Conductor Cable — Alloy Sheath — 600 Volt Max.							
B006[1]	0.021	0.312	50	50	41	28	17
B014[1]	0.042	0.312	50	50	41	28	17
B023	0.070	0.312	50	50	41	28	17
B034	0.103	0.312	50	50	41	28	17
B050	0.152	0.312	50	50	41	28	17
B085	0.259	0.312	50	50	41	28	17
B120	0.365	0.312	50	50	41	28	17
B190	0.579	0.312	50	50	41	28	17
B260	0.80	0.312	50	50	41	28	17
B370	1.12	0.312	50	50	41	28	17
B520	1.58	0.312	50	50	41	28	17
B660	2.00	0.312	50	50	41	28	17
B940	2.87	0.312	50	50	41	28	17
B1310	4.00	0.312	50	50	41	28	17
B1870	5.70	0.312	50	50	41	28	17

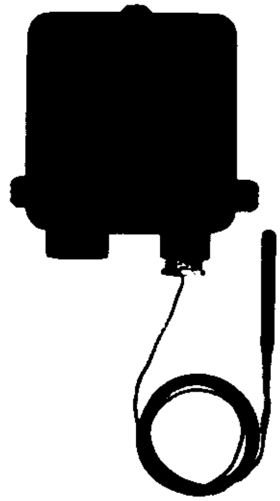
1. Multiply resistance by 1.15 for maintaining temperatures to 300°F; multiply by 1.23 for maintaining temperatures over 300°F.

PIT

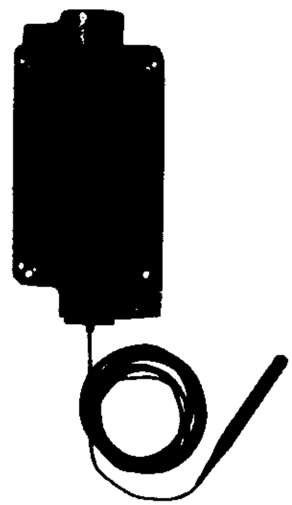
Non-Indicating Temperature Controllers

- **Compact Size**
- **Explosion Resistant and Raintight Applications**
- **0 - 150°F and 100 - 250°F Temperature Range**
- **Single Phase, 120 - 277 Vac**
- **Bulb & Capillary**

PIT
(Rain Tight)



PIT-EP
(Explosion-Resistant)



Applications

For a variety of process applications requiring rain-tight or explosion-resistant enclosure, PIT controllers may be used in pipe tracing and snow melting applications with electric heating cable.

Features

- Opens or closes a circuit on temperature rise.
- Single pole, double throw (SPDT) snap action switch.
- Rain-tight gasketed enclosure, Type PIT, is 0.062" steel. Simple mounting on three rubber-cushioned feet. Has adjustable high limit stop. Plain copper bulb and capillary.
- Capillary Length 10 ft 1/16" Dia.
- Explosion-proof cast aluminum housing approved for Class I, Group D & Class II, Groups E, F and G applications. External adjusting knob and tin-plated copper bulb and capillary.

Ampere Ratings

For control applications involving pump, fan or other motors.

Voltages (AC only)	120	208	240
Full Load Amps	16	9.2	8
Locked Rotor Amps	96	55.2	48

WARNING: Hazard of Fire. These controls function as temperature controls only. Because they do not fail-safe, an approved temperature and/or pressure safety control must be used for safe operation.

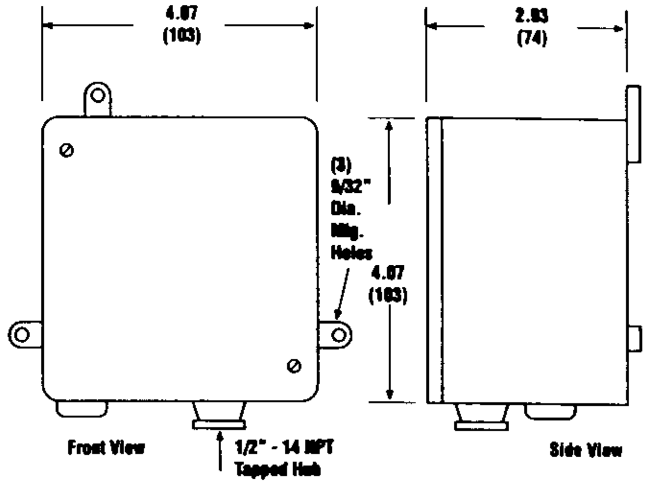
FIRST CHOICE THERMAL SOLUTIONS

PIT

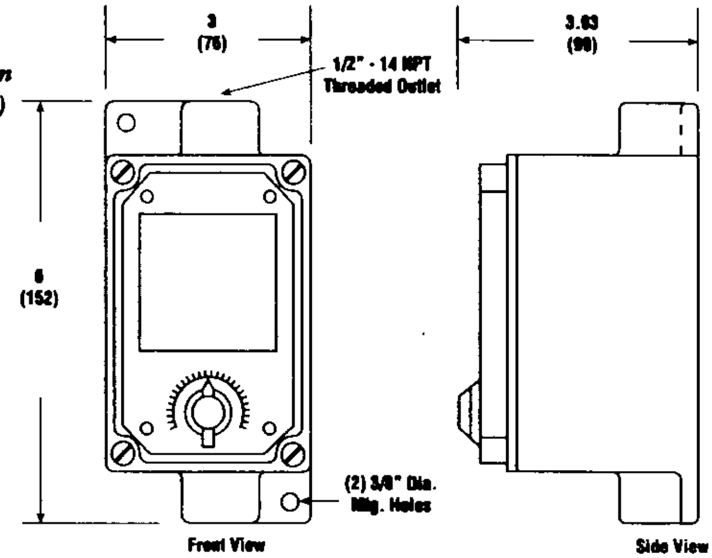
Non-Indicating Temperature Controllers *(cont'd.)*

Dimensions

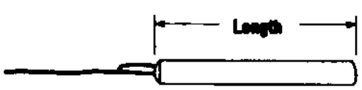
PIT (Rain-Tight)



PIT-EP (Explosion Resistant)

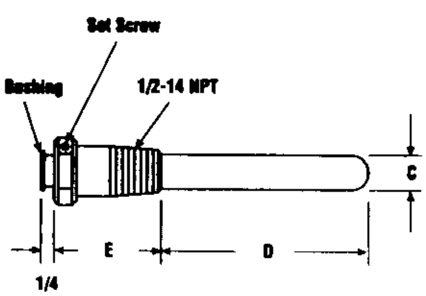


Sensing Bulbs for PIT and PIT-EP



All Dimensions in Inches (mm)

Protective Wells



Ordering Information — PIT Rain-Tight and Explosion-Proof

Rain-Tight Gasketed Enclosure								
0 - 150	22	0.290	2-1/2	6	PIT-15	S	140610	2.5
100 - 250	22	0.290	2-1/2	6	PIT-25	S	140628	2.5
Explosion-Proof Enclosure[1]								
0 - 150	22	0.290	2-1/2	6	PIT-15EP	S	140943	2.5
100 - 250	22	0.290	2-1/2	6	PIT-25EP	S	140951	2.5

Stock Status: S = stock AS = assembly stock NS = non-stock

1. PIT-EP's are UL listed for use in Class I, Group D and Class II, Groups E, F and G Hazardous Locations.

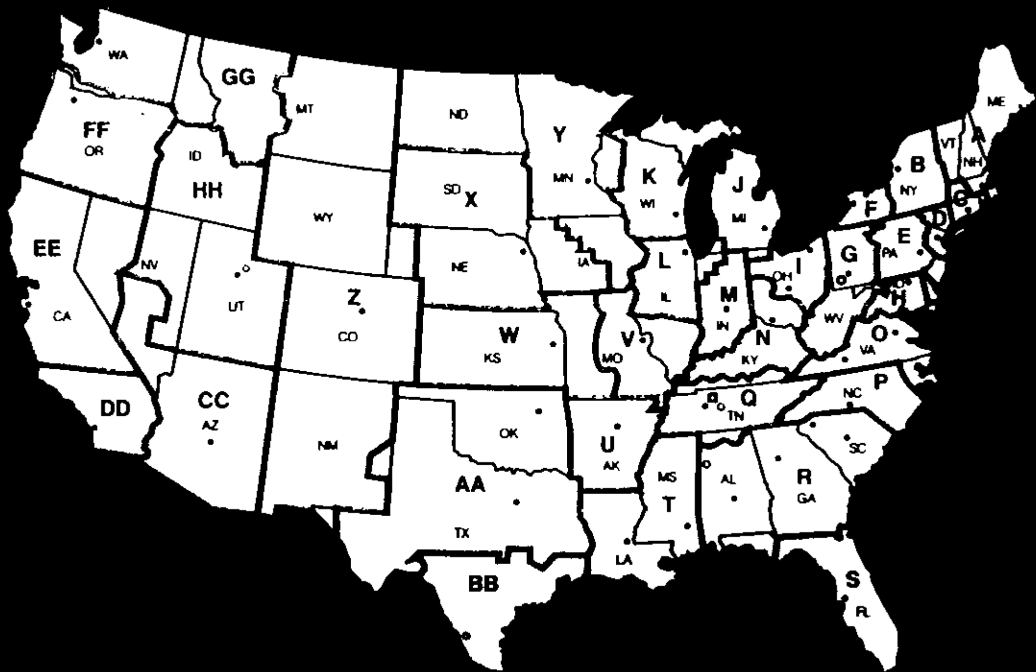
Other Notes —

A. Capillary length is 10' with 1/16" Dia.
B. See ordering information table above for Bulb and Capillary dimensions.
C. Pilot duty rating, 125 VA for 120 - 277 Vac.

PIT Protective Wells

Copper	3/8	2-3/8	3 5/6	0.290[1]	CPWC-1	S	269624	0.5
Copper	7/16	2-13/16	1-13/16	0.366[1]	CPWC-2	S	269632	0.5

Stock Status: S = stock AS = assembly stock NS = non-stock



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APPENDIX C

TEMPORARY CONSTRUCTION EMERGENCY ACTION PLAN

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

RED BRIDGE MINIMUM FLOW GATE PROJECT

TEMPORARY CONSTRUCTION EMERGENCY ACTION PLAN

In accordance with the FERC Order Amending License for the Red Bridge Project, dated December 29, 1999, Consolidated Edison Energy Massachusetts, Inc. (CEEMI) will be providing a minimum flow gate system at the project's spillway including mobilization, demobilization of utilities, care of water, cofferdams, and required hardware and equipment. In accordance with the Order and Section 12(a)(2) of the FERC's regulations, CEEMI has prepared this Temporary Construction Emergency Action Plan (TCEAP) for the construction work.

1.0 PROPOSED IMPROVEMENTS

The project has a required minimum flow release of 237 cfs in to the bypass reach. The present method of passing flows over the unregulated spillway portion of the main dam results in varied flow release. In order to provide a more constant flow rate, a gate system will be installed at the spillway.

2.0 DESCRIPTION OF PROPOSED CONSTRUCTION ACTIVITIES

2.1 Gate

The proposed gate system consists of a new 8 ft high x 7 ft wide opening on the spillway in which the gate system guides and seals will be installed.

2.2. Construction

The new gate opening in the existing spillway will require the construction of a cofferdam system which will allow the gate system to be installed while the project is still operating and flows are passed over the spillway.

It is anticipated that a shallow structure will be required on the upstream side of the spillway structure to allow local dewatering of the work area. The dewatering structure will be placed against the existing spillway and abutment face and water removed from the area. In addition, a temporary timber diversion wall will be placed along the spillway surface parallel with the flow path to divert spilled flows from the work area.

2.3 Site Access

Access to the work will be along the downstream face of the project's embankment dam.

A crane pad will be placed to support both concrete, and installation of the new gate system. Demolition will be performed primarily with hand operated jack hammers inside the cofferdam. Demolition material will be loaded by crane on to a truck for removal to a suitable disposal site.

Work will be performed so as to not affect any traffic.

2.4 Construction Schedule

Construction is scheduled to occur from mid-June through early September, 2001. Approximate dates for each phase of construction are as follows:

1) Project planning and mobilization	May 2001
2) Prepare construction access and staging	June 2001
3) Demolition	June-July 2001
4) Construct Opening	July-August 2001
5) Install gate system	August to September 2001
6) Site demobilization	Late October 2001

3.0 SAFETY PRECAUTIONS AND EMERGENCY ACTION PLAN

Safety precautions being proposed to protect those individuals working at the construction site during the construction period include:

- In case of an emergency, the construction superintendent will be responsible for immediately notifying the Owner's supervisory personnel.
- A specific individual shall be designated and made responsible for coordinating the safety program and rescue operations.
- Comply with other CEEMI, State, or Federal OSHA-required equipment, or any equipment or procedures which will enhance and improve the overall safety of the Contractor's or the Owner's personnel.
- An automatic visual/audible alarm system will be utilized at the site to alert the work force to a rise in water elevation. This stand-alone system will also be capable of being manually triggered by workers. The alarm system will be placed in areas where it will be visible and audible to those working in the vicinity of the work area.
- Use of emergency ladders, and the designation of "safe areas";
- Any construction personnel working around water will be required to wear life jackets.
- Coast Guard Type IV throwable flotation devices will be located immediately around the work areas and will remain in place for the duration of the construction period, and must be readily available in the event of an emergency situation.
- All construction personnel will be required to comply with OSHA Regulations when working adjacent to the water.

The contractor will be required to hold informational meetings, prior to initiating any construction activity and periodically thereafter, to inform workers of the actions to be followed should any of the alarms be activated. The workers will be instructed to exit the work area via one of several ladders extending into the work area and will be informed of the "safe areas,". Any new workers joining the crew after construction begins will be given the same instructions prior to their starting work.

In case of an emergency, the construction superintendent will be responsible for immediately notifying CEEMI. They will have the telephone numbers of key emergency response personnel to be contacted and will be responsible for contacting those agencies in the event of an emergency.

In the event of an emergency during construction, CEEMI will be responsible for notifying:

Mr. Anton Sidoti FERC NY Regional Office	(212) 631-8110

or

Mr. Charles Cataldo FERC NY Regional Office	(212) 631-8120

This TCEAP is for alerting the construction workers and other supervisory personnel in the immediate vicinity of the project to a rise in water level, or any other occurrence that may threaten safety. Further precautions to protect workers will be provided by the contractor in accordance with regulatory and insurance obligations, and CEEMI's <u>Contractor Safety Work Rules</u> (located elsewhere in this project manual).

APPENDIX D

QUALITY CONTROL AND INSPECTION PROGRAM

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.

RED BRIDGE MINIMUM FLOW GATE PROJECT

QUALITY CONTROL AND INSPECTION PROGRAM

In accordance with the FERC Order Amending License dated December 29, 1999, Consolidated Edison Energy Massachusetts, Inc., (CEEMI) will be selectively removing portions of the masonry spillway, installing concrete piers and sills, installing a single steel gate and installing electrical controls and operators at the Red Bridge project. Other demolition, access provisions, fencing, guardrails, and miscellaneous items incidental to the work is included. In accordance with the Order and Section 12(a)(2) of the FERC's regulations, CEEMI has prepared this Quality Control and Inspection Program (QCIP) for the construction work.

CEEMI proposes to commence construction activities in mid-June 2001. The estimated length of time to complete the repair work is 5 months (June through October 2001). The project design engineers are Kleinschmidt Associates of Pittsfield, Maine.

1. Organization Chart

Observation of construction activity will be conducted periodically by a Resident Project Representative (RPR) employed by CEEMI. The RPR's primary contact with the construction work force will be through the Construction Supervisor. Other specialized representatives, as discussed in Item 2 below, will be present to assist the RPR in specialized monitoring tasks.

The Project Quality Control Team will consist of the Project Design Engineers, the RPR, and the concrete testing agency.

2. Number and Specialties of Field Representatives

Observation and monitoring of construction activities will be conducted in the field by the RPR on a periodic basis. The RPR will observe and report on compliance with contract documents. Concrete sampling and testing will be conducted by an independent testing laboratory. No blasting is anticipated.

Supervision and inspection will be conducted by the RPR.

3. Duties and Responsibilities

Attached as Appendix D2 to this report are resumes of the RPR and key engineering personnel assigned to the project. Any change in personnel, responsibilities, or in the scope of activities will be noted in the quarterly reports which will be filed with the Regional Director.

The RPR will be at the construction site during times of major construction activities and will report on progress and potential problems to the project design engineer and CEEMI. The concrete testing agency will frequent the project site only during those times when construction activities which they have been assigned to monitor are occurring. They will report on testing results to the RPR.

The contractor will be responsible for the safety of all personnel at the construction site. Contractor adherence to applicable safety requirements, including the Temporary Construction Emergency Action Plan for this project work, is required by the contract specifications.

The duties and responsibilities of the RPR are outlined in Appendix D1 of this report.

4. Field Tests

Field tests to be performed will consist of concrete sampling and testing. Taking of fresh concrete samples will be performed by the testing agency. Details regarding the frequency of testing and monitoring will be discussed on the drawings and in the monitoring activities report which will be submitted to the Commission. As a minimum, one sample consisting of four cylinders will be taken on any day concrete is placed, and not less than one sample per 100 cubic yards per day, or at such other times when changes or alterations in mixtures occur. Monitoring of form removal, surface defects, etc., will be done by the RPR.

5. Field Laboratory Facilities

No field laboratory facilities are planned.

6. Commercial Testing Services

The testing of the concrete samples will be performed by a local independent material testing firm.

7. Use of Consultants

The Project Owner does not anticipate using any additional consultants other than those described above.

8. Schedule of Construction

Award of Contractor's Contract	April 2001 – May 2001
Mobilization	June 2001
Demobilization	Mid June 2001 – July 2001
Concrete Work	July 2001 – August 2001
Gate Installation & Testing	August 2001 – September 2001
Demobilization	October 2001

Observation of construction activities will cover, among other things, the following items:

a. Access road construction
b. Demolition work
c. Placement of reinforcing steel
d. Placement of concrete

e. Construction and removal of formwork

9. Erosion Control and Other Environmental Measures

A separate soil erosion and sedimentation plan will be incorporated into the work.

APPENDIX D1

DUTIES AND RESPONSIBILITIES OF THE RESIDENT PROJECT REPRESENTATIVE

DUTIES, RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY OF RESIDENT PROJECT REPRESENTATIVE

ENGINEER shall furnish a Resident Project Representative (RPR), assistants and other field staff to assist ENGINEER in observing progress and quality of the work of the Contractor.

Through more extensive on-site observations of the work in progress and field checks of materials and equipment by the RPR and assistants, ENGINEER shall endeavor to provide further protection for OWNER against defects and deficiencies in the work of Contractor. However, ENGINEER shall not, during such visits or as a result of such observations of Contractor's work in progress, supervise, direct, or have control over Contractor's work nor shall ENGINEER have authority over or responsibility for the means, methods, techniques, sequences or procedures selected by Contractor, for safety precautions and programs incident to the work of Contractor, for any failure of Contractor to comply with laws, rules, regulations, ordinances, codes or orders applicable to Contractor's performing and furnishing the work, or responsibility of construction for Contractor's failure to furnish and perform the work in accordance with the Contract Documents.

The duties and responsibilities of the RPR are limited to those of ENGINEER in ENGINEER's agreement with Owner and in the construction Contract Documents and are described as follows:

A. *GENERAL*

RPR is ENGINEER's agent at the site, will act as directed by and under the supervision of ENGINEER, and will confer with ENGINEER regarding RPR's actions. RPR's dealings in matters pertaining to the on-site work shall in general be with ENGINEER and Contractor keeping OWNER advised as necessary. RPR's dealings with subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with OWNER with the knowledge of and under the direction of ENGINEER.

B. *DUTIES AND RESPONSIBILITIES OF RPR*

1. Schedules: Review the progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by Contractor and consult with ENGINEER concerning acceptability.

2. Conferences and Meetings: Attend meetings with Contractor, such as pre-construction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.

3. Liaison:

   a. Serve as ENGINEER's liaison with Contractor, working principally through Contractor's superintendent and assist in understanding the intent of the Contract Documents; and assist ENGINEER in serving as OWNER's liaison with Contractor when Contractor's operations affect OWNER's on-site operations.

   b. Assist in obtaining from OWNER additional details or information, when required for proper execution of the Work.

4. Shop Drawings and Samples:

   a. Record date of receipt of Shop Drawings and Samples.

   b. Receive Samples which are furnished at the site by Contractor, and notify ENGINEER of availability of Samples for examination.

   c. Advise ENGINEER and Contractor of the commencement of any Work requiring a Shop Drawing or Sample if the submittal has not been approved by ENGINEER.

5. Review of Work, Rejection of Defective Work Inspections and Tests:

   a. Conduct on-site observations of the Work in progress to assist ENGINEER in determining if the Work is in general proceeding in accordance with the Contract Documents.

   b. Report to ENGINEER whenever RPR believes that any Work will not produce a completed Project that conforms generally to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test of approval required to be made; and advise ENGINEER of Work that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

c. Verify that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor maintains adequate records thereof; and observe, record and report to ENGINEER appropriate details relative to the test procedures and startups.

d. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these Inspections and report to ENGINEER.

6. Interpretation of Contract Documents: Report to ENGINEER when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by ENGINEER.

7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to ENGINEER. Transmit to Contractor decisions as issued by ENGINEER.

8. Records:

a. Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and Samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, ENGINEER's clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.

b. Prepare a daily report or keep a diary or log book, recording Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to ENGINEER.

c. Record names, addresses and telephone numbers of all Contractors, subcontractors and major suppliers of materials and equipment.

9. Reports:

   a. Furnish ENGINEER periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and sample submittals.

   b. Consult with ENGINEER in advance of scheduled major tests, inspections or start of important phases of the Work.

   c. Draft proposed Change Orders and Work Directive Changes, obtaining backup material from Contractor and recommend to ENGINEER Change Orders, Work Directive Changes, and Field Orders.

   d. Report immediately to ENGINEER and OWNER upon the occurrence of any accident.

10. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to ENGINEER, noting particularly the relationship of the payment requested to the schedule of values, Work completed and materials and equipment delivered at the site but not incorporated in the Work.

11. Certificates, Maintenance and Operation Manuals: During the course of the Work, verify that certificates, maintenance and operation manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to ENGINEER for review and forwarding to OWNER prior to final payment for the Work.

12. Completion:

   a. Before ENGINEER issues a Certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.

   b. Observe whether Contractor has had performed inspections required by laws, rules, regulations, ordinances, codes, or orders applicable to the work, including but not limited to those to be performed by public agencies having jurisdiction over the work.

c. Conduct final inspection in the company of ENGINEER, OWNER and Contractor and prepare a final list of items to be completed or corrected.

d. Observe that all items on final list have been completed or corrected and make recommendations to ENGINEER concerning acceptance and issuance of Notice of Acceptability of the Work.

C. *LIMITATIONS OF AUTHORITY*

1. Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items), unless authorized by ENGINEER.

2. Shall not exceed limitations of ENGINEER's authority as set forth in the Agreement or Contract Documents.

3. Shall not undertake any of the responsibilities of Contractor, Subcontractors, Suppliers, or Contractor's superintendent.

4. Shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advice or directions are specifically required by the Contract Documents.

5. Shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.

6. Shall not accept Shop Drawing or Sample submittals from anyone other than Contractor.

7. Shall not authorize OWNER to occupy the Project in whole or in part.

8. Shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by ENGINEER.

APPENDIX D2

RESUMES

Kleinschmidt
Energy & Water Resource Consultants

PROFESSIONAL RESUME

Alfred J. Nash, PE

Civil Engineer

Alfred J. Nash has been a project manager and civil engineer with Kleinschmidt since 1987. He received a Bachelor of Science degree in Civil Engineering from the University of Maine at Orono in 1986 and is a Registered Professional Engineer in Maine and Connecticut.

Since joining Kleinschmidt, he has been involved in the design and analysis of reinforced concrete, timber and steel structures serving as a design engineer as well as a project representative for a variety of industrial projects.

The following is a representative list of the projects Mr. Nash has been involved in.

Project/Client	Date	Responsibility
Salmon Falls Fish Passage CHI Energy, New Hampshire Andover, MA	2000	Project Manager for upstream and downstream fish passage for a 25' high dam. Responsibilities included preparation of conceptual designs and costs for alternatives, design and direction to team members for an upstream Denil ladder and downstream angled bar rack system, preparation of biding documents and assistance in permit application preparation.
DEA Response for the Oswego River Erie Boulevard Hydropower, LP Liverpool, NY	2000	Project Engineer for a response to the draft environmental assessment for the Oswego River in New York state. Responsibilities included the review of documents regarding fish passage and pneumatic flashboards, preparation of opinion of costs, and assistance in drafting the response to the DEA.
Ocean Ave Quarry Expansion Dragon Products Co. South Portland, ME	1999-2000	Project Manager for the permitting of a controversial quarry expansion project. Responsibilities included the preparation of 3-D and 2-D color graphics and documents for public meetings, development of a physical 3-D model, research and coordination of field blasting, noise and vibration studies and summaries, conceptual designs of roadway entrances and landscape, and preparation of design drawings.
Sithe Hydroelectric Due Diligence Reliant Energies, Inc. Houston, TX	1999-2000	Project Engineer for the due diligence review of thirteen hydroelectric projects located on the East and West coasts. Responsibilities included data review, identification of capital expenditures, development of financial model and preparation of a summary report.
Glen Park Due Diligence Northbrook Energy, LLC Chicago. IL	1999	Project Engineer to review the fish passage and structural requirements for a three unit hydroelectric project in New York. Responsibilities included the review of project information, coordination of team efforts, preparation of opinion of costs and conceptual design, and preparation of a summary report for the results of the investigation.

Crown Vantage Due Diligence NRG Energy Chicago, IL	1999	Project Engineer for the review of six hydroelectric projects in New Hampshire. Responsibilities included project inspection, review of project license conditions, preparation of opinion of costs, assistance in financial review and value of the project, assistance in developing pricing strategy, coordination of project team members, and preparation of a summary report of the due diligence review.
Western Massachusetts Portfolio Due Diligence Consolidated Edison Energy, Inc New York, NY	1998-2000	Project Engineer for the successful acquisition of five hydroelectric projects in Massachusetts. Responsibilities included project inspection, review of project license conditions, preparation of opinion of costs, assistance in financial review and value of the project, assistance in developing pricing strategy, assistance in developing strategy to address outstanding project issues, coordination of project team members, and preparation of a summary report of the due diligence review. After sale completion responsibilities included the assistance in public and governmental agency negotiations, assistance in cash flow analysis for the projects, asset management assistance, coordination of other team members, responsible for schedule and budget tracking and coordination of owner staff and resolution of conflicts.
Gardners Falls Fish Passage Consolidated Edison Energy, Inc New York, NY	1999-2000	Project Engineer to resolve deficiency in newly installed louver array for downstream passage of migrating fish. Responsibilities included identifications of passage deficiencies, preparation of corrective measures, negotiations of corrective measures with resource agencies, preparation of opinion of costs and design of corrective measures.
Chicopee River Project Capacity Expansion Consolidated Edison Energy, Inc New York, NY	1999-2000	Project Engineer to provide detailed engineering assistance for required capacity increases at four hydroelectric projects. Responsibilities included physical inspection of mechanical and electrical equipment, preparation of opinion of costs and summary report, determination of alternatives and recommendations, presentation of results to public and governmental agencies, and preparation of implementation and turbine upgrade documents.
Runner Replacement Study Florida Power and Light Energy Lewiston, ME	1999	Project Engineer for the runner replacement study at four hydroelectric projects. Responsibilities included identification of work scope and alternatives, development of opinion of costs, assistance in development of financial model and preparation of summary report with recommendations.
2nd Street Runner Replacement City of Norwich Norwich, CT	1999	Project Manager for the replacement of a failed runner design. Responsibilities included assistance in review of why the new runner assembly failed, assistance in recommendations for replacement, preparation of bidding documents and bid evaluation for redesigned runner.
2nd Street Runner Bearing City of Norwich Norwich, CT	1999	Project Manager to review bearing cooling and replacement for a vertical Francis runner assembly. Responsibilities included research of bearing products, discussion with bearing and bearing cooling manufacturers, and development of summary report with recommendations.

South Locks Repairs The Dexter Corporation Windsor Locks, CT	1999	Project Engineer for repairs to an historic masonry lock system. Responsibilities included presentation of repair options, design of selected option and development of bidding documents and permit applications.
Dwight Station Headgate Replacement Consolidated Edison Energy, Inc New York, NY	1999	Project Engineer to provide detailed engineering for replacement of six canal headgates with new automated hydraulic steel gates. Responsibilities included physical inspection of existing conditions, preparation of bidding documents, and assistance in bidding and construction activities and preparation of operational conditions.
Boston Terminal Project Coastal Cement Co. Boston, MA	1999	Project Manager for assistance in resolution of development impacts on a cement distribution facility. Responsibilities included negotiations between all parties to identify and resolve impacts to new development, survey layout of barrier with adjacent properties, preparation of site plan drawings, and assistance in review of legal contracts.
Walters Station Tainter Gate Operators South Carolina Electric and Gas Columbia, SC	1999	Project Engineer for investigation of replacement tainter gate operators. Responsibilities included identification of alternative operating systems, listing of benefits and drawbacks, preparation of opinion of costs and conceptual design figures, and assistance in final summary report with recommendations.
Saludia Tainter Gate Evaluation South Carolina Electric and Gas Columbia, SC	1999	Project Engineer to analysis four 25 ft high by 36 ft wide tainter gates and two 32 ft high by 44 ft wide tainter gates to satisfy FERC guidelines. Responsibilities included preparation of computer templates to analysis the main gate components, preparation of 3-D computer modeling, review of applicable code requirements and preparation of a summary report for submission to FERC.
Blenheim-Gilboa and Crescent Tainter Gate Inspection and Analysis New York Power Authority White Plains, NY	1999	Project Engineer to inspect and analysis three 40 ft wide by 55 ft high gates and one 30 ft wide by 15 ft high tainter gate. Responsibilities included the physical inspection of the gates with repelling equipment, structural analysis review, review of alternatives to address deficiencies and preparation of summary report for submittal to governmental agencies.
Connecticut Light and Power Due Diligence City of Norwich, Connecticut Norwich, CT	1999	Project Manager for the due diligence review of three hydroelectric projects being auctioned. Responsibilities included training of owner staff, physical inspection of facilities, development of strategy to address project expenses, development of financial model and strategy for purchase, discussions and research of project requirements and preparation of a summary report of the findings.
Otis Station Due Diligence International Paper Co. Jay. ME	1999	Project Engineer for a due diligence review of a single hydroelectric project. Responsibilities included the review of project information, identification of items impacting the project financial structure, coordination of team efforts, preparation of opinion of costs, assistance in development of financial model to determine purchase price, research for comparative sales analysis, and preparation of a summary report for the results of the investigation.

Foote Dam Fish Entrainment Study Consumers Energy Cadillac, MI	1999	Project Engineer for the design and fabrication of draft tube net framing for a full discharge entrainment study. Responsibilities included the review of alternatives, design of selected alternatives, preparation of construction drawings and assistance during installation and sampling.
Columbia Station Fish Passage South Carolina Electric and Gas Columbia, SC	1999	Design Engineer for conceptual design of a vertical slot upstream ladder and downstream fish passage system. Responsibilities included review of project operations and features, assistance in preparation of operation memorandum, assistance in drawing preparation.
Lower Penobscot Fish Passage Costing Penobscot Hydro Milford, ME	1999	Project Manager to develop opinion of costs for upstream and downstream fish passage facilities in Maine. Responsibilities included the review of agency correspondence and project licenses, conceptual level review of passage alternatives, preparation of opinion of costs for passages at four projects and preparation of summary report.
Sandy River Fish Passage Madison Electric Works Madison, ME	1999	Project Engineer for conceptual design of a Denil fish ladder and downstream fish passage system. Responsibilities included review of project operations and features, preparation of design memorandum, review of system options, negotiations with resource agencies and preparation of functional design drawings for agency approval.
York Haven Fish Ladder GPU Harrisburg, PA	1998-1999	Design Engineer for final design of vertical slot fish ladder. Responsibilities included negotiations of design details and configuration with resource agencies, review of constructability and maintenance access, assistance to design team for project criteria and details, and assistance during construction.
Bangor Hydro Due Diligence STS Hydro Chicago, IL	1998	Project Engineer for due diligence of seven projects being auctioned in Maine. Responsibilities included project inspection, review of project license conditions, preparation of opinion of costs, assistance in financial review and value of the project, assistance in developing pricing strategy, assistance in developing strategy to address outstanding project issues, coordination of project team members, and preparation of a summary report of the due diligence review.
Pepperell Penstock Evaluation Pepperell Paper Co. Pepperell, MA	1998	Project Engineer to review replacement options for a 13 ft diameter steel penstock. Responsibilities included evaluation of existing condition and replacement alternatives, preparation of opinion of costs, and preparation of summary report and recommendations.
Taintor Gate Evaluation Northeast Utilities Service Co. Berlin, CT	1998	Project Engineer to analyze two 28-ft high by 35-ft wide taintor gates to satisfy FERC guidelines. Responsibilities included preparation of computer template to analyze the main gate components, review of applicable code requirements and preparation of summary report of the analysis.
Phoenix Hydro Taintor Gate Review Oswego Hydro Partners, L.P. Woodcliff Lake, NY	1998	Project Engineer to analyze six 12-ft high taintor gates varying in width from 37-ft to 47-ft. Responsibilities included preparation of computer template to analyze the main gate components, review of applicable code requirements. Review of maintenance program and preparation of summary report for submission to FERC.

Riley Maintenance Gate International Paper Co. Jay, ME	1998	Project Engineer for the design of a maintenance gate system for a six unit project. Responsibilities included field survey and data collection, supervision of underwater inspection, design of steel slide gate, preparation of fabrication and installation drawings, preparation of opinion of costs and bid documents, and on-site construction assistance.
Worumbo Inflatable Flashboards Miller Hydro Co. Augusta, ME	1998	Project Engineer for the installation of a 2ft high inflatable dam on a timber crib dam. Responsibilities included the design of support piers, review of dam stability, assistance in preparation of construction drawings and assistance during construction.
Trench Box Design Newport Industrial Fabricators Newport, ME	1998	Project Engineer for the design of aluminum pipe trench boxes. Responsibilities included the design of aluminum trench boxes of varying size and rated for various soil conditions, and preparation of fabrication sketches.
Cabinet Gorge Fish Protection/Passage Study Washington Water Power Noson, MT	1997	Project Engineer to evaluate upstream and downstream passage technologies for a 100-ft. high dam and powerhouse. Responsibilities included development of conceptual design for fish passage, preparation of written evaluation of each concept and development of opinion of costs. Additional responsibilities included review of international development of "natural" fish passage systems and review of protection and entrainment technologies.
Benton Falls Upstream Fish Passage Benton Falls Associates Benton Falls, ME	1997	Project Engineer to develop functional design of upstream fish passage at a 28-ft. high dam. Responsibilities included presentation of applicable options, review of agency correspondence, development of passage configuration and drawings.
Review of Central Maine Power Portfolio NRG Energy	1997	Project Engineer to review fish passage requirement for eleven hydroelectric stations in Maine for assistance in project evaluation and purchase. Responsibilities included development of conceptual plan for upstream and downstream passage systems, review of passage system impacts to operation and generation including costs, determination of alternatives to reduce system impacts, development of system costs and resolution of conflicting cost opinions from other hydrosites.
Glen Penstock Replacement Central Vermont Public Service Rutland, VT	1997	Project Engineer for replacement of 2300 lineal feet of 6.5-ft. diameter ruptured steel penstock. Responsibilities included revised layout for installation ease, review of design calculations, development of contract drawings, review of fabrication drawings and assistance during field installation.
Woronoco Interim Downstream Fish Passage Facility International Paper Co Westfield, MA	1997	Project Engineer for design of interim downstream passage facilities at a 20-ft. high dam. Responsibilities included consultations with resource agencies, preparation of passage options, preparation of calculations and fabrication/installation drawings.

Stone Container Roof Cianbro Corporation Pittsfield, ME	1997	Project Engineer to design and review connection for a new industrial building roof. Responsibilities included coordination with fabricator, review of fabrication drawings and design of column splices.
Occum Station Fish Passage City of Norwich Norwich, CT	1997-1998	Project Engineer for conceptual design of upstream and downstream fish passage for American Shad and River Herring. Responsibilities included preparation of passage alternatives and evaluation, preparation of opinion of costs, consultation with resource agencies and preparation of design drawings.
Wiscasset Community Center ARC Enterprises Kingfield, ME	1997	Project Engineer for design of aluminum structure for a community center. Responsibilities included review and coordination of fabrication drawings and preparation of design calculations.
Kinneytown Fish Passage Kinneytown Hydro Inc. Seymour, CT	1997-1999	Project Engineer for the conceptual and final design of a denil upstream fish ladder and downstream fish passage. Responsibilities included comparison of passage options, configuration determination, material selection, assistance in agency negotiations, preparation and design of facilities and drawings, and assistance during construction.
Churchill Lake Dam Sate of Main Augusta, ME	1997	Project Engineer for final design of a concrete and earthen dam with a vertical slot fishway. Responsibilities included design of fishway and concrete structures, design of sediment control measures, preparation of bidding documents and assistance during construction.
EFC Passage Study Electric Corporation of New Zealand Hamilton, New Zealand	1997	Project Engineer for a scoping study of downstream Eel passage at four Hydroelectric stations. Responsibilities included review of conceptual designs, preliminary calculations and written report.
Stony Brook Aqueduct Repairs The Dexter Corporation Windsor Locks, CT	1997-1998	Project Engineer for the final design of the replacement of a 100-ft square timber aqueduct. Responsibilities included design of cast and pre-cast, pre-stressed concrete structures, preparation of opinion of costs and bidding documents, assistance in permitting, construction management and resolution, and historic write-up.
Passumpsic River Downstream Fish Passage Central Vermont Public Service Rutland, VT	1996-1997	Project Engineer for final design and construction of downstream fish passage at five hydroelectric stations. Responsibilities included design of steel removable rack systems, concrete design and on-site layout determination and assistance.
Stewarts Bridge Fish Protection Study Niagara Mohawk Power Corp. Syracuse, NY	1996-1997	Project Engineer for investigation of fish protection and passage alternatives for resident fish. Responsibilities included identification and evaluation of latest protection and passage technologies, preparation of costing information, determination of effects on station operation and maintenance and presentation of results in a written report.
Canal Headgate Repairs The Dexter Corporation Windsor Locks, CT	1996-1997	Project Engineer for repairs of a timber gate and masonry structure. Responsibilities included design of concrete retaining walls and repairs, preparation of construction and bidding documents and assistance during construction.

School Street Station Downstream Fish Passage Niagara Mohawk Power Corp. Syracuse, NY	1996-1997	Project Engineer for conceptual design of downstream fish passage for Blueback Herring. Responsibilities included identification and evaluation of alternatives, preparation of cost opinions, determination of effects on station operation and maintenance and preparation of a written report detailing potential alternatives.
Stewarts Bridge Base Flow Discharge Niagara Mohawk Power Corporation Syracuse, NY	1996-1997	Project Engineer for conceptual design of devices to pass a base flow at a 100-ft. high dam and powerhouse. Responsibilities included identification and evaluation of alternatives, preparation of cost opinions, determination of effects on station operation and maintenance and preparation of a written report detailing potential alternatives.
Fishway Inspection Georgia Pacific Corporation Woodland, ME	1996	Project Engineer for inspection of four fishways. Responsibilities included an evaluation of the fishway conditions, required maintenance and operation, determination of potential effectiveness and improvements, and preparation of an operation and maintenance manual.
Worumbo Station Stoplogs Miller Hydro Co. Augusta, ME	1996	Project Engineer for design of a retrofit dewatering device for gate maintenance. Responsibilities included design of steel and timber components and assistance during installation.
Brooklyn Dam Evaluation Wausau Papers of New Hampshire, Inc. Groveton, NH	1996	Project Engineer to review the condition of a 20-ft high timber dam and evaluate repair options. Responsibilities included review of repair history and methods, prepare listing and comparison of viable repair/replacement options and provide written report and recommendation.
1st Floor Load Study Warnaco Waterville, ME	1996	Project Engineer to investigate floor capacity for an existing industrial building. Study involved review of as-built drawings, preparation of load ratings for each floor element and preparation of written report.
Lockhart Power Fish Passage/ Exclusion Study Lockhart Power Co. Lockhart, SC	1996	Project Engineer to assess fish passage and exclusion alternatives using biological and physical deterrents. Responsibilities included review of state-of-the-art fish passage barriers and applicability to project site, preparation of opinion of costs and written report including recommendations.
Gorge 18 Downstream Fish Passage Green Mountain Power Corp. South Burlington, VT	1995	Project Engineer for final design of a downstream fish passage facility. Responsibilities included agency consultation, layout determination, design of dam modifications to incorporate new fishway, design of reinforced concrete and metal fabrications, preparation of bid and construction documents, review of shop drawings and resolution of construction questions and difficulties.
Vail and Great Falls Fish Passage Study Lyndonville Electric Co. Lyndonville, VT	1995	Project Engineer for conceptual design study of downstream fish passage at two hydroelectric stations. Study involved comparison of passage options and effect of options on station operation. Responsibilities included identification of viable fish passage options, preparation of opinion of cost, option comparison and preparation of written report.

Assessment of Methodologies for Estimation of Entrainment and Turbine Passage Survival at the St. Lawrence Project New York Power Authority Massena, NY	1995	Project Engineer for a detailed study to review entrainment and mortality methodologies for fish passage through turbines. Study involved comparison of present day methods, their effectiveness and accuracy and costs. Responsibilities included review of various methods to estimate turbine entrainment and mortality and their applicability to the site, preparation of opinion of costs for various study methods, preparation of written report and preliminary design of floating work platform.
Edwards Dam Fish Passage Edwards Manufacturing Company Augusta, ME	1995	Project Engineer for design of a fully automated fish lift and downstream fish passage facility. Facility also included trap and truck facilities. Responsibilities included detailed layout and construction drawing development, supervision of design team members, consultation with owner for option selection, design of fabricated steel products and fish holding tanks, assistance in logic control system for stand alone automatic operation and preparation of construction documents.
Essex 19 Rehabilitation Green Mountain Power Corp. South Burlington, VT	1995	Project Engineer for detailed construction of an automated downstream fish passage and inflatable flashboard facility. The project included multiple passage collection points and a pump back water recovery system. Responsibilities included conceptual and final design of the downstream fish passage collection system and pump back facility, agency consultation, detailed layout and design of steel and concrete devices, review of hydraulics in fishway, review of inflatable flashboard details and preparation of construction drawings and specifications.
Eel Weir Dam Sluice Gate Repair S.D. Warren Company Westbrook, ME	1995	Project Engineer for design of a temporary bulkhead and new timber replacement gate. Responsibilities included access considerations to minimize modifications to existing structures, preparation of calculations and drawings for a movable dewatering bulkhead and preparation of details to modify and improve the sealing and lifting of a timber deep gate.
Riverside Penstock Inspection James River Corporation Berlin, NH	1994	Project Engineer for a condition assessment of a 13-foot diameter wooden penstock. Responsibilities included a physical inspection of the penstock and its foundation, assistance in repair prioritization. repair method selection and preparation of the project report.
Greenville Dam Fish Passage City of Norwich Norwich, CT	1994-1996	Project engineer for 2.2 million automated fish passage facility. The project included both upstream and downstream migrant facilities. Responsibilities included conceptual design, preparation of options and cost opinions, interaction with fisheries agency personnel, assistance to owner in review and selection of upstream passage design type, assistance in permit applications, and license filings, and development of construction drawings and specifications for a lift type upstream fish passage and a downstream fish passage facility. Responsibilities also included construction management, supervision of field personnel, resolution of field changes, periodic inspection, and assistance in license compliance studies and plans.

Fish Entrainment Study Niagara Mohawk Power Corporation Syracuse, NY	1993-1994	Design engineer for fish entrainment studies at several power stations. Responsibilities included design of collection net frames and hoist system, development of construction drawing and details and resolution of construction difficulties and design changes.
Index Test Program Niagara Mohawk Power Corporation Syracuse, NY	1993-1994	Field Engineer for the index testing of 13 turbines of various design. Responsibilities included coordination of equipment installation, supervision of equipment installation, reduction of test data and presentation of test results in written and graphical form.
Harrington Lake Dike Repair Bowater/Great Northern Paper Millinocket, ME	1993-1994	Project Engineer for repairs to eroded shores of an earthen dike. Responsibilities included survey of existing condition, research and recommendation of repair options, development of construction drawings, details and specifications, assistance in development of permit application and cost opinion and assistance for funding request.
Dole Pond Dike Repair Bowater/Great Northern Paper Millinocket, ME	1993-1994	Project Engineer for repairs to eroded shores of an earthen dike. Responsibilities included survey of existing condition, research and recommendation of repair options, development of construction drawings, details and specifications, assistance in development of permit application and cost opinion and assistance for funding request.
McKay Station Rock Cliff Repair Bowater/Great Northern Paper Millinocket, ME	1993-1994	Project engineer for a containment of rock fragment projectiles for a 90-foot high vertical rock face. Responsibilities included survey of existing condition, research and recommendation of repair options, development of construction drawings, details and specifications, assistance in development of permit application and cost opinion and assistance for funding request.
Rainbow Station Downstream Migrant Facility The Stanley Works New Britain, CT	1993	Project Engineer for a downstream migrant and fish sorting facility. Responsibilities included conceptual design and configuration, interaction with fisheries agency personnel, consultations with contractor to reduce costs, design of facility, development of construction drawing and details, selection of materials and shop drawing review, provide periodic site inspection, and final testing of the completed facility.
Oswegatche Feasibility Study Niagara Mohawk Power Corporation Syracuse, NY	1993	Project engineer to examine options to improve generating and reliability of an existing hydroelectric power station. Responsibilities included development of rehabilitation options and cost opinions, conceptual design and layout of rehabilitation options, perform a benefit/cost analysis using the owner's economic program, and present findings and recommendation in a written report to the owner.
Piercefield Station Rehabilitation Niagara Mohawk Power Corporation Syracuse, NY	1993	Design engineer for a proposed $4.5 million rehabilitation and upgrade of an existing 3 unit powerstation. Responsibilities included a site survey and layout, design of a new concrete forebay dewatering structure, design of repair details for existing facilities, coordination of work performed by other engineering disciplines, development of construction details and cost opinion, and assistance to owner for communications with FERC.

Grand Falls Walkway Pier Replacement Georgia-Pacific Corporation Woodland, ME	1993	Project engineer for the replacement of four timber crib piers with new precast concrete to supply anchorage for a 850 foot floating walkway and log boom. Responsibilities included development of construction drawings and details, assistance for permit application, and review of design calculations.
Gambo Gate Replacement S.D. Warren Company Cumberland Mills, ME	1993	Project engineer for the replacement of an existing wooden gate with a steel sluice gate. Responsibilities included an examination of operation options and costs, design of the new gate and operator support frame, and development of construction drawings and specifications.
CSO Monitoring Program Town of Skowhegan Skowhegan, ME	1993	Field engineer for sampling of river water during rainstorm events. Responsibilities included working with the owner to establish required operations, programming and checking of an automatic sampling device, and review of laboratory test results.
Connection Tables Kingsbury Steel Drafting Gardner, ME	1993	Design engineer responsible for development of standard steel beam connections to be used by steel fabrications. Responsibilities included development of a computer program to generate allowable connection loads, and presentation of tables to be submitted by fabrications for approval by other design engineers.
Raw Cook Bypass Enclosure S.D. Warren Company Hinckley, ME	1993	Project engineer for a metal insulated enclosure around an existing conveyor. Responsibilities included survey of existing site constraints, access platform and enclosure layout and design, selection of materials, and development of construction drawings and details.
Ragged Lake Dike Repair Bowater/Great Northern Paper Millinocket, ME	1993	Project Engineer for repairs to an eroded shore of an earthen dike. Responsibilities included survey of existing conditions, research and recommendation of repair options, development of construction drawings and specifications, assistance in development of permit application, preparation of cost opinion and funding request documents, and periodic site inspections.
Heuvelton Dam Taintor Gate Rehabilitation and Replacement Niagara Mohawk Power Corporation Syracuse, NY	1992-1993	Design Engineer for a $3 million dam rehabilitation project to install two rubber gates and four steel taintor gates. Responsibilities included review of rehabilitation options and cost opinions, coordination of work and details of other engineering disciplines, development of contract drawings, details and specifications, design of a composite bridge deck, design of mechanical components for the steel taintor gates, review of rubber gate shop drawings, and consultation during construction.
Rainbow Dam Resurfacing and Trashrack Replacement The Stanley Works New Britain, CT	1992-1993	Project Engineer for the $1 million resurfacing of a 400-foot long dam and replacement of steel intake trashracks. Responsibilities included design of new trashracks, preparation of construction drawings and details, and inspection and analysis of existing support steel to determine its load capacity.
Upper Dam Resurfacing Boise Cascade Rumford, ME	1992-1993	Design Engineer for resurfacing of a 480-foot long concrete spillway with shotcrete. Responsibilities included development of a modified dam configuration to provide provisions for future rubber dam, preparation of construction drawings and details, resolution of field changes and periodic site inspections.

West Grand Lake Georgia-Pacific Corporation Woodland, ME	1991-1993	Project and Field Engineer for modifications to an earth dike to meet FERC safety guidelines. Responsibilities included development of contract drawings and specifications, development of bubbler system details for ice protection, development of construction options and cost opinion, coordination of work and details of other engineering disciplines, resolving construction difficulties and design changes, review of shop drawings and payment requests, general inspection and progress reporting, and interacting with the public on environmental concerns.
800 hp Boiler Project The Jackson Laboratory Bar Harbor, ME	1992	Design Engineer for maintenance platforms for the installation of a 800-hp boiler. Responsibilities included layout and coordination of work by other engineering disciplines, development of load criteria, design of steel framing, and development of construction drawings and details.
Stone Dam Walkway Great Northern Paper/Bowater Millinocket, ME	1992	Project Engineer for preliminary design of a 428-ft long access walkway. Responsibilities included layout options, development of options and cost opinions, and development of option sketches.
Beam Reinforcement Kingsbury Steel Drafting, Inc. Gardner, ME	1992	Project Engineer for steel beam connections. Responsibilities included providing detail sketches and calculations to reinforce steel beams with large copes, and coordinating with fabricator on preferred methods.
Dorset St. Vaults Green Mountain Power Burlington, VT	1992	Project Engineer for the structural analysis of 8' x 14' concrete vaults. Responsibilities included the determination of the required concrete strength to meet current ACI and AASHTO codes, develop load criteria and perform a finite element analysis, coordinate and develop a core testing program and review modifications proposed to assure structural capacity.
Dean Auditorium Backstage Area Mid-Maine Medical Center Waterville, ME	1992	Project Engineer for the installation of a new floor within an existing masonry building. Responsibilities included design of a concrete deck and steel support framing, and development of construction details and drawings.
Pulp Mill Absorber S.D. Warren Company Hinckley, ME	1992	Project Engineer for access platforms and roof rigging required for a new absorber tower. Responsibilities included layout, design of steel framing, development of construction drawings using the "AutoCAD" computer drafting program, and checking the load capacity of an existing steel framed roof.
O.R. Storage Addition Mid-Maine Medical Center Waterville, ME	1991	Project Engineer for the installation of a 24-ft x 37-ft steel framed building onto an existing concrete roof. Responsibilities included general arrangement, design of steel framing, review of existing structure capacity, and development of construction drawings and specifications.
Dundee Dam Resurfacing S.D. Warren Company Cumberland Mills, ME	1991	Design Engineer for an enclosed access walkway. Responsibilities included layout, development of construction drawings and details, design and selection of materials, and check of existing concrete roof capacity.

Inspection of Hydroelectric Facilities International Paper Company Jay, ME	1991	Project Engineer for inspection of four hydroelectric power plants and their associated structures and equipment. Responsibilities included direction of underwater inspections, development of repair options, creation of repair sketches using the "VersaCAD" computer drafting program, cost opinions, and author and review portions of the final written report.
New Kiln Building Pride Manufacturing Company Florence, WI	1991	Project Engineer to review the structural adequacy of a pre-engineered metal building. Responsibilities included structural analysis of the building and providing revised connection details for inadequately designed framing.
Polaroid 11X Facility Issacson Structural Steel, Inc. Berlin, NH	1991	Project Engineer to review steel framing connections. Responsibilities included confirmation of beam sizes and loading, and correction of connection details to meet the current steel code.
Piece Parts Warehouse Floor Load Capacity G.S. Edwards Company Pittsfield, ME	1991	Project Engineer for a floor load capacity analysis of a 3-story timber warehouse. Responsibilities included obtaining samples for wood specie determination, calculation of allowable floor loading, proposing methods to increase capacity and providing a load capacity drawing.
16 Ton Capacity Hook and Beam Lane Supply Company Brewer, ME	1991	Project Engineer for a 16-ton lifting beam for grinder stone maintenance. Responsibilities included hook design and configuration, lifting beam sizing, development of fabrication details and shop drawing review.
Gilman Gate Repair Simpson Paper Company Gilman, VT	1991	Design Engineer for the repairs and modifications of a 18' x 26' flap gate with twin hydraulic cylinder operators. Responsibilities included layout of new gate configuration, review of modified gate stress calculations, design of new concrete cylinder support pedestals and steel maintenance strut.
Chipper Silo Fire Escape Cianbro Corporation Pittsfield, ME	1991	Project Engineer for the design of exterior OSHA approved fire escape platforms and ladders. Responsibilities included layout of doorways and platforms and development of drawings and details.
#7 Boiler Installation Project Madison Paper Industries Madison, ME	1991	Design Engineer for installation of a new boiler within an existing mill. Responsibilities included design of metal access platforms and equipment supports, development of contract drawings and details and review of contract drawings.
Fish Passage Modifications Georgia-Pacific Corporation Woodland, ME	1990-1993	Project and Field Engineer for the installation of downstream fish passage facilities and modifications to existing upstream denil fish passage facilities. The facilities included a pump back recovery system. Responsibilities included the design of trashrack support structure, hoisting frame design, development of construction drawings and details, preparation of construction specifications and cost opinion, resolving construction difficulties and design changes, review of shop drawing, general inspection and assistance with interaction between owner and contractor.
Cabot Station Upgrade Northeast Utilities Turners Falls, MA	1991	Design engineer responsible for the preliminary design of two piece steel gate with hydraulic cylinder operators. Responsibilities also included powerhouse structure repair/modifications and cost opinions.

No. 1 & M.O.L. Slaker Scrubbers S.D. Warren Company Hinckley, ME	1990	Structural design engineer for the installation of new scrubber equipment and stacks. Responsibilities included the design of a steel access platform to support new scrubber equipment and stacks, development of construction drawings, details and layout, investigation of existing support structures and shop drawing review.
Repair to Headworks Trashracks Central Vermont Public Service Rutland, VT	1990	Design engineer responsible for the design of steel trashracks to the powerhouse intake.
25-Ton Capacity Hook Lane Supply Company Brewer, ME	1990	Design Engineer for a 25-ton capacity crane hook. Responsibilities included layout and shop drawing review.
Edwards Hydro Rebuild Edwards Manufacturing Augusta, ME	1990	Design Engineer for the repair of 6 generators and associated equipment. Responsibilities included design of steel framed and sided generator buildings, concrete and steel intake deck and trashrack support, 10-ton capacity monorail system, electrical cable tray support, hydraulic gate operator supports, preparation of construction drawings and details, shop drawing review and resolution of construction questions and difficulties.
Ragged Lake Dam Concrete Repairs Great Northern Paper Millinocket, ME	1990	Project engineer for the misc. repairs to an existing dam structure. Responsibilities included the preparation of construction drawings, specifications and cost opinion, selection of repair material and methods and preparation of funding request forms.
Ragged Lake Dam Dike Great Northern Paper Millinocket, ME	1990	Project engineer for the modification of 1000 feet of earthen dike. Responsibilities included preparation of construction drawings, specification and cost opinion, survey of existing dike, development of dike cross sections, and preparation of funding request forms.
Canada Falls Dam Concrete Repairs Great Northern Paper Millinocket, ME	1990	Project Engineer for the misc. repairs to an existing dam structure. Responsibilities included preparations of construction drawings, specification and cost opinion, selection of repair materials and method, and preparation of funding request forms.
Dolby Dam Repairs Great Northern Paper Millinocket, ME	1990	Project Engineer for the repairs to an existing dam & gate structure. Responsibilities included preparation of construction drawings, specification and cost opinion, preparation of funding request forms, investigation of existing gate operator system and design of a new timber intake deck.
3-Ton Bridge Crane S.D. Warren Hinckley, ME	1990	Structural design engineer for the installation of a new 3-ton capacity bridge crane. Responsibilities included the investigation of the structural capacity of existing supports and preparation of construction drawings.
Ames Department Store Ames Corporation Skowhegan, ME	1990	Project engineer for the installation of two air conditioning units on the roof of a large department store. Responsibilities included design and layout of an elevated steel support platform and preparation of construction drawing and details.

Falls Village Canal Repair Northeast Utilities Falls Village, CT	1989-1990	Project engineer for the repair of 300 lineal feet of breached canal. Responsibilities included investigation of canal stability, design of reinforced concrete walls, slab and columns, coordination of work done by others, preparation of construction drawings, specifications, layout and details, shop drawings review, periodic inspection and construction progress meetings, resolution of contractor and owner questions, interferences and difficulties.
Grand Falls Dam Repair 1988 Georgia-Pacific Corporation Woodland, ME	1988-1989	Field Engineer responsible for general inspection and progress reporting on a 4.8 million Amburson dam rehabilitation project with 9 taintor gates. The project included installation of a new 150Hp-air compressor and bubbler piping, modernizing gate operations, and inspection of gate modifications. Other responsibilities included review of shop and record drawings, resolving construction problems and design changes and training of personnel on the operation of the dam's new control systems using the operational manual which was developed for the project, design of taintor gate hoist and shop inspections.
Stillwater Dam Resurfacing Hudson River-Black River Regulating District Watertown, NY	1989	Field Engineer for the general inspection of the installation of six 105 kip capacity rock anchors. Responsibilities included handling construction technical problems and the preparation of a summary report which was submitted to the Federal Energy Regulatory Commission. The Project included epoxy-bonded anchors, grouted anchors and testing of the anchor capacity.
Seboomook Dam Bridge Great Northern Paper Millinocket, ME	1988	Design Engineer for the replacement of a concrete bridge deck on the Seboomook Dam as well as miscellaneous concrete repairs. Responsibilities also included an estimate of project costs, filing an application for funding request forms, and preparation of the contract documents and drawings.
Shawmut Station Emergency Gate Modification Central Maine Power Company Augusta, ME	1988	Design Engineer for preliminary design options for the modification of two steel gates as well as preparing the cost estimates of the options.
Wappingers Falls Hydroelectric Project Might Development Corp.Wappingers Falls, NY	1988	Design Engineer for a concrete retaining wall for the powerhouse intake structure.
Victory Memorial Hospital Duratherm Window Corp. Vassalboro, ME	1988	Design Engineer for the wood and steel supports of various window units.
Sebec Dam Flood Damage Repair American International Adjustment Co. Claremont, NH	1987	Field Engineer responsible for periodic monitoring of repairs and preparing progress reports to the client for replacement of a concrete apron.
Livermore Falls Dike Repair International Paper Co. Livermore Falls, ME	1987	Field Engineer responsible for periodic construction monitoring and repainting of the repair of 600 lineal feet of breached dike. Responsibilities also included preparation of record drawings and survey.
Shelburne Sluice Gate Replacement James River Corp. Berlin, NH	1987	Design Engineer responsible for cost estimates to install a 250 LF rubber dam with related structures.

Harrington Lake Dam Great Northern Paper Millinocket, ME	1987	Design Engineer of a new concrete dam and fishway at Harrington Lake.
Grand Falls Dam Repair - 1987 Georgia-Pacific Corp. Woodland, ME	1987	Design Engineer responsible for answering design questions and making all necessary design changes. Responsibilities also included shop drawing review and gate modification inspection.
Millinocket Mill Hydroelectric 60 Hz Conversion Great Northern Paper Millinocket, ME	1987	Design Engineer and Draftsman for the installation of two 6,800 KVA generators and auxiliary equipment.

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PROFESSIONAL RESUME

Leslie L. Corrow

Civil/Structural Engineer

Leslie Corrow has been an Assistant Engineer in the Structural Engineering Group at Kleinschmidt since May of 1997. She earned Bachelor of Science and Master of Science degrees in Civil Engineering from the University of Maine in 1995 and 1997, respectively. Ms. Corrow majored in structural engineering. She is a registered Engineer-Intern in Maine and an associate member of the American Society of Civil Engineers. Ms. Corrow is a certified Concrete Field Testing Technician, ACI Grade I Technician and has certification for the Nuclear Density Meter.

Prior to joining Kleinschmidt, she was a full-time student holding summer jobs that broadened her engineering experience. She worked for SW Cole Engineering, Inc. in Caribou, Maine as a Construction Materials Testing Technical and Laboratory Manager during the summers of 1993 and 1994. She also worked the summers of 1995 and 1996 at Kleinschmidt as an assistant engineer in the Structural Engineering Group.

The following is a representative list of the projects Ms. Corrow has been involved in.

Project/Client	Date	Responsibility
Rotterdam vs. GE Beebe, Grossman, Bergins & Manuso, LLP Clifton Park, NY	1999-present	Performed structural quantity take offs for industrial buildings of the GE turbine manufacturing facility.
Black Brook Powerhouse Adirondack Hydro, Inc. Lake Placid, NY	1999-present	Primary structural designer of 500 KW powerhouse. Designed structural concrete and steel components.
H. E. Sargent, Inc. Stillwater, ME	1998-present	Designed modular steel trench boxes for excavations per OSHA requirements.
American Steel Fabricators Greenfield, NH	1998-present	Performed structural steel stair and handrail calculations for various buildings.
Somerset Mill SAPPI Skowhegan, ME	1996-present	Structural design and drafting on various monorails, platforms, and structural projects. Also performed OSHA load ratings on numerous existing lifting beams, crane rails, and monorails throughout the paper and pulp mills.
York Haven Fish Ladder Project GPU/Genco Middletown, PA	1998-1999	Primary structural designer of large multi-million dollar design-build project. Performed stability analysis of new and existing structures. Designed rock anchors for new cofferdam cells and existing dam. Designed most concrete and steel components of project including complicated concrete fish ladder, steel access bridges, permanent cellular cofferdams, and steel bulkhead gates. Performed construction assistance by handling field questions and reviewing construction submittals.
Monadnock Paper Mill Intake Trashracks Monadnock Paper Benington, NH	1999	Structural design of trashrack frame.

Wallenpaupack Flowline Pennsylvania Power & Light Allentown, PA	1999	Pressure transient analysis of flowline/penstock.
Remmel Dam Entergy, Inc. Hot Springs, AR	1999	Performed structural steel calculations to check existing trash racks and supports for various debris levels.
Carver Falls Resurfacing Project Central Vermont Public Service Corp. Rutland, VT	1998	Performed concrete design for resurfacing. Designed concrete wall in place of stoplogs. Assisted in writing technical specifications and contract documents.
Maine Welding Fabrication Lewiston, ME	1998	Performed detailed structural steel connection calculations for various buildings.
Walters Hydroelectric Plant Carolina Power & Light Raleigh, NC	1998	Pressure transient analysis of penstock/tunnel.
Foote Dam Fish Protection Screens Consumers Energy Cadillac, MI	1997-1998	Structural design of the fish protection screens, cranes, and supports.
Lake St. Lawrence New York Power Authority Massena, NY	1997-1998	Assisted in cost estimating boat launches, docks, marinas and park facilities along a 40-mile stretch of the St. Lawrence River. This is part of a study that will identify deficiencies and needed upgrades to over 16 sites, including two major parks.
Big Indian Lake Dam Town of St. Albans St. Albans, ME	1997	Acted as construction monitor during the concrete placements.
J.J. Nissen Bakery Project Cianbro Corporation Portland, ME	1997	Performed special inspection of structural steel at the job site per the BOCA code.
H. E. Sargent, Inc. Stillwater, ME	1997	Performed load ratings for manhole lifting beams.
Upper Falls Dam Mead Paper Rumford, ME	1997	Structural design for head gate.
Salisbury and Pittsford Penstocks Central Vermont Public Service Rutland, VT	1997	Pressure transient analysis of penstock systems.
Mead Paper Cianbro Corporation Pittsfield, ME	1997	Structural design of foul condensate storage tank.
Bradford Dam Central Vermont Public Service Rutland, VT	1997	Performed finite element analysis and stability analysis of the dam for a safety inspection.

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PROFESSIONAL RESUME

Robert N. Smart, PE

Senior Engineer

Robert N. Smart joined Kleinschmidt in 1999 as a Project Engineer. He holds a Bachelor of Science degree in Civil Engineering from Michigan Technological University where he was also elected to Tau Beta Pi and Phi Beta Kappa honorary fraternities and a Master of Science degree in Engineering from the University of Michigan115. Mr. Smart is a Registered Professional Engineer in Connecticut, Massachusetts, New Hampshire, and Illinois. Mr. Smart has been a member of the American Society of Civil Engineers, the American Concrete Institute, the Town Flood and Erosion Commission, and the Conservation Commission. He was also past Chairman of Edison Electric Institute's Hydraulic Power Committee and past Officer of Connecticut ASCE. In addition to working for Kleinschmidt, Mr. Smart is President of Smart Engineering International, Inc.

Prior to joining Kleinschmidt, Mr. Smart was employed by Northeast Utilities' Fossil/Hydro Engineering and Construction Department as Supervisor and Manager for 25 years. He gained supervisory and engineering experience while employed with Harza Engineering Company prior to his tenure with Northeast Utilities. Presently Mr. Smart serves as a Project Manager and Project Engineer for a wide variety of projects. He is a resource to other project engineers of matters involving civil engineering, construction services, and providing advice to other project managers on contractual matters.

The following list of projects is representative of Mr. Smart's experience in the design and management of civil engineering and power generation projects:

Project/Client	Date	Responsibility
Steam Turbine/Generator Manufacturing Facility Town of Rotterdam Schenectady, NY	1999	Engineering evaluation and expert witness testimony to support appraisal for property tax appeal.
Gardners Falls Hydroelectric Project Northeast Utilities Hartford, CT	1998	Licensed, designed, and supervised the installation of the gate, crane, automatic control equipment, and louvers to meet the minimum flow and fish passage requirements of the FERC. Mr. Smart was also responsible for purchasing equipment for the project.
Wind-plant Inspection Vachon Associates Manchester, MA	1998	Inspected a wind-plant as part of due diligence for a potential buyer. The inspection included the units, towers, electrical collection facilities, switchyard and the site.
Plantas Eolicas Wind-Plant Charter Oak Energy Hartford, CT	1996	Designed the site plan and was the Owner's Engineer responsible for the oversight of a turnkey contract including equipment supply, construction of the plant and transmission line, and acceptance testing.
Chapter VIII of FERC Engineering Guidelines Probable Maximum Floods FERC Washington, DC	1994	Peer group reviewer to the Federal Energy Regulatory Commission and Electric Power Research Institute in their efforts to prepare a Safety Guideline.
Hydroelectric Plant Evaluation Charter Oak Energy Hartford, CT	1994	Inspected and performed technical evaluation of eight Argentine hydroelectric stations to estimate energy production and O&M costs.
Merger of NUSCO and PSNH Northeast Utilities Hartford, CT	1990	Evaluated the PSNH fossil-fueled and hydro plants to determine production potential and cost exposure to prepare bid to bankruptcy court.

Millstone Unit No. 3 Northeast Utilities Hartford, CT	1985	Responsible for directing studies to establish earthquake risk and the capacity of safe shutdown equipment. Present results to Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards.
Hadley Falls Unit No. 2 Northeast Utilities Hartford, CT	1984	Licensed a 15 MW addition to the station and directed consultant and contractor with design and construction of unit.
Fossil System Upgrade Plan Northeast Utilities Hartford, CT	1981	Participated in study for extensive upgrade of NU fossil fleet. Conceptual designs for converting plants to burn coal or gas. Included advanced industrial and aeroderivative gas turbines for additions.
South Meadow Gas Turbine Facilities Northeast Utilities Hartford, CT	1980	Investigated foundation failure caused by construction at an adjacent site. Designed plan for remedial action and monitoring.
Mark I Containment Program Northeast Utilities Hartford, CT	1979	Chaired the Technical Committee of Owners' Group. Redefined containment loads, developed structural modeling techniques, and presented acceptance criteria to Nuclear Regulatory Commission. Installed modifications at Millstone Unit No. 1.
Northfield Mountain Pumped Storage Project Northeast Utilities Hartford, CT	1971	Directed contractor for construction of dams of this 1,080 MW project. Responsible for the license and development of public recreation and educational facilities.
Canaan Mountain and Schenob Brook Pumped Storage Projects Northeast Utilities Hartford, CT	1970	Directed feasibility studies.
Mossyrock Arch Dam Northeast Utilities Hartford, CT	1965	Performed structural calculations for the design of the arch dam.
Mangla Project Harza Engineering Company Chicago, IL	1965	Performed studies to develop a river diversion scheme.
Canaveral and Guajoyo Stations Harza Engineering Company Chicago, IL	1962	Designed reinforced concrete features of powerhouses.

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PROFESSIONAL RESUME

David A. Robinson, P.E.

Senior Engineer

Mr. Robinson is a Senior Engineer with Kleinschmidt. He received a B.S. degree in Civil Engineering from the University of Hartford in 1973 (Dean's List) and continues to enhance his education in Business Administration, Structural Analysis, and Computer Analysis. Mr. Robinson is a Registered Professional Engineer in Connecticut and Massachusetts.

Prior to joining Kleinschmidt, Mr. Robinson worked almost exclusively at hydroelectric facilities owned and operated by Northeast Utilities and possess a great deal of experience in the design of these civil structures. His experience also includes fish passage development, design, and evaluations. Mr. Robinson has worked with many of the fish agency regulators in New England and has instructed the USFWS course in Fish Passageways and Diversion Structures. He is responsible for the development, design, and patenting of fish passage technologies currently used in the US and Canada.

Mr. Robinson joins Kleinschmidt Associates with the following experience:

Project/Client	Date	Responsibility
Shepaug Dam Post-Tensioned Anchoring System Scotland Project Dam Stabilization Downstream Fish Passage Projects Connecticut River Hydroelectric Facilities Northeast Utilities Service Company Hartford, CT	1987-1998	Project Manager responsible for coordinating the completion of multi-million dollar project activities at generating facilities. Activities included engineering, design, budgeting, construction, and scheduling.
Civil, Structural, and Hydraulic Projects Fossil Fuel/Hydroelectric Generating Facilities Northeast Utilities Service Company Hartford, CT	1987-1998	Design Engineer for projects at both fossil fuel and hydroelectric generating facilities in the NY System. Projects included numerous upstream and downstream fish passage facilities, new buildings/building modifications, plant modifications and enhancements, structural repairs, and personnel safety/fall protection devices. Structural design of concrete and steel structures and facilities requiring structural analysis, design, and preparation of drawings utilizing AutoCAD 14.
Connecticut and Merrimack River Projects Northeast Utilities Service Company Hartford, CT	1987-1998	Fishway conceptual designs and FERC functional design drawings for Hydroelectric Plants operated by NU. Practical experience with the operation of fish ladders, fish lifts, and downstream fish passage facilities.
Millstone Unit No.3 Northeast Utilities Service Company Hartford, CT	1985-1986	Lead Civil/Structural Engineer assigned to site during plant startup and testing. Responsible for the civil/structural technical resolution of engineering and design modifications identified during plant startup.

Shearon Harris Nuclear Power Plant Carolina Power & Light Company New Hill, NC	1983-1984	Project Engineer responsible for the site structural and mechanical engineering activities related to pipe stress analysis, pipe support/restraint designs, welded pipe attachments, as built reconciliation of safety-related piping systems, and certification of ASME III stress reports. Also responsible for manpower scheduling and forecasts, development of project schedules, status updates to project management, interfacing directly with construction and startup management for technical support, resolution of field problems, and design changes. Responsible for the transfer of engineering activities from plant design firm to the owners site staff which involved the selection and hiring of qualified individuals, development of site procedures, and the establishment of site computer facilities.
Thames Valley Steel Corporation New London, CT	1981-1983	Chief Engineer responsible for all technical and administrative activities of the Engineering Division, including supervision and scheduling of a 30 member staff of engineers and detailers. Played a key roll in acquiring Thames Valley Steel's AISC Category II certification and ASME "N" certification for design and fabrication of nuclear pressure vessels, storage tanks, and piping systems. Responsibilities included marketing of engineering and design services, structural design of buildings, connections, and numerous mechanical and structural components for clients.
Three Operating Nuclear Power Facilities Northeast Utilities Service Company Hartford, CT	1977-1981	Project Engineer for NRC Inspection and Enforcement Bulletins 79-02 and 80-11 requiring management of engineering consultants and coordination of construction and plant operational activities. Responsibilities included written and verbal responses correspondence with NRC, technical structural support for numerous nuclear power plant "backfit" and maintenance projects during operation and shutdown, design criteria review for Millstone Unit No. 3, nuclear power plant support analysis and design, and structural component support design per ASME computer analysis. Experience included site selection, turbine selection, general arrangement and structural design, restoration and renovation of existing hydroelectric facilities.
Substation Design Northeast Utilities Service Company Hartford, CT	1973-1977	Design Engineer responsible for site development, drainage, road and conduit layout, structural steel, and foundation design. Developed and incorporated several computer programs to design tower foundations resulting in considerable savings over conventional design. Performed analysis and redesign of existing facilities utilizing computer analytical techniques, frame analysis, and finite element.

APPENDIX E

SOIL EROSION AND SEDIMENTATION CONTROL PLAN

SOIL EROSION AND SEDIMENTATION CONTROL PLAN

1.0 INTRODUCTION

The following sections describe the measures to be utilized during the construction of the Red Bridge Project's minimum flow gate. The purpose of this plan and the proposed soil erosion control measures is to minimize soil erosion and sediment transport from the project site during and after construction of the improvements. The approved plan will become part of the contract documents for the project.

The construction activities associated with the project will include the following major items:

- Surface Disturbance for Access
- Borrow, Stockpile and Disposal of Unsuitable Materials
- Planting of Vegetation for Landscaping

The following sections describe the proposed protection measures and associated construction sequence.

2.0 Site Preparation
3.0 Access to Work Site
4.0 Borrow, Stockpile, and Disposal of Unsuitable Materials
5.0 Inspection and Maintenance
6.0 Permanent Erosion Control Measures

2.0 SITE PREPARATION

The Contractor shall initiate the soil erosion and sediment control measures as described in this plan or as shown on the final design drawings approved by the permitting agencies prior to exposing the ground surface in the designated construction areas. All construction areas potentially subjected to erosion shall be protected by silt fences.

During construction, the Contractor shall minimize the area of disturbance of existing ground coverage such as shrubs, trees, and grass so that the smallest practical area of land is exposed at any one time during construction. At the earliest possible date, the Contractor shall establish the permanent erosion and sediment controls described in Section 6.0. The Contractor shall inspect and maintain the facilities or control measures until the Owner's acceptance of the completed project, whereupon the Owner will assume maintenance responsibilities.

2.1 Clearing and Grubbing

During construction of the project, some trees may require removal. Prior to beginning the clearing activities, the Contractor shall place a row of silt fence along the alignment of the project improvements. The trees will be cut and stockpiled as directed by the Owner's personnel. Branches and slash may be chipped on site for use as wood chips or mulch or removed from the site and properly disposed of in an approved landfill.

Upon completion of the clearing activities, the stumps within the improvement area will be removed and the site grubbed. This material shall be disposed of in accordance with Section 4.0 requirements and Local, State and Federal regulations.

3.0 ACCESS TO WORK SITE

Installing the proposed gate may require disturbance of the existing embankment. All disturbances shall occur on the uphill side of the silt fences. Gravel travel-ways may be required to prevent damage to the embankment. Promptly repair all rutted or damaged areas.

4.0 BORROW, STOCKPILE, AND DISPOSAL OF UNSUITABLE MATERIALS

The new construction may require gravel, crushed stone, and borrow materials for the project improvements. These materials will be obtained from commercial pits in the vicinity of the project. The pits are not subject to control or operation by the project owner, and erosion control measures in the pits are the responsibility of the pit owner.

Borrow material may be temporarily stockpiled at the construction site until it is needed. The location of any borrow stockpile area shall be approved by the Owner prior to construction. Erosion control measures will be used to minimize the transport of sediment from the stockpiles. The downhill/down-gradient side of the stockpile will be protected with an individual silt fence barrier. The surface of the stockpile that is subject to wind action will be seeded and mulched. Suitable overburden earthen materials will be used for backfill and slope stabilization. Excess earthen material will be stockpiled as directed by the Owner and stabilized with seed and mulch.

Unsuitable soil materials will be disposed of at the Contractor's spoil area. The Contractor shall comply with all permit conditions applicable to the operation of the landfill's facility.

5.0 INSPECTION AND MAINTENANCE

The Contractor will be required to seed and mulch disturbed ground in the project area within 7 days of stopping a construction activity. In no case will an area remain unprotected for longer than 7 days.

The Contractor will be required to inspect each soil erosion and sediment control structure (silt fences, dikes, hay bale berms, etc.) and newly seeded areas at least once per week and immediately following rain storms and other periods of heavy runoff. The Owner (or representative) will also periodically inspect the site to confirm that the erosion and sediment control structures are being installed and maintained according to this plan. The Owner (or representative) will notify the Contractor of observed deficiencies or additional measures necessary to maintain the sediment control structures. The Contractor, upon observing or receiving notification of deficiencies, will correct such deficiencies within 24 hours. The Contractor will maintain a weekly log of the condition of the sediment control measures, any sediment control problems, and additional measures or repair work necessary.

The Contractor will remove and properly dispose of all sediment collected at dikes, ditches, or other areas. Sediment shall be removed from the sediment barriers when the reserve storage capacity is reduced by 20%.

As conditions require, the Contractor will cut/mow grass areas and remove cuttings before the grass reaches a height of 4 inches.

This program of inspection and maintenance will be initiated within 14 days of the project starting date and will remain in effect until project completion; at such time, the Owner will assume responsibility for maintenance of the permanent erosion and sediment control measures.

6.0 PERMANENT EROSION CONTROL MEASURES

Upon substantial completion of the project, the temporary soil erosion and sediment control facilities will be removed as appropriate. The disturbed areas will be graded, loamed, seeded, and mulched in accordance with Specification Section 02800. Upon establishing the permanent erosion control measures, and a sufficient "catch" of grass, the temporary erosion control measures will be removed and disposed of in accordance with Local, State and Federal regulations. The Contractor shall re-seed all washouts and stabilize the project area prior to project acceptance.

APPENDIX F

STATE PERMIT APPLICATION

Enter Your Transmittal Number ⟶ **W 017816**

Your unique Transmittal Number can be accessed through DEP's web site or by calling the DEP InfoLine as listed on the last page of this document

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

Instructions

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Your check should be made payable to the Commonwealth of Massachusetts. Please mail your check along with a copy of this form to: DEP, P.O. Box 4062, Boston, MA 02211.

3. Three (3) copies of this form will be needed.

Copy 1 (the original) must accompany your permit application.
Copy 2 must accompany your fee payment.
Copy 3 should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to DEP, P.O. Box 4062, Boston, MA 02211

For DEP Use Only
Permit No._______
Rec'd Date_______
Reviewer_______

A. Application Information

DEP Permit Code (the 7 or 8 character code from first page of permit application instructions): BP WW 01
Name of Permit Category: Waterways License or Permit
Type of Project or Activity: Dam modification

B. Applicant Information (Firm or Individual)

Name of Firm: Consolidated Edison Energy Massachusetts, Inc.

Or, if party needing this approval is clearly an individual:

Individual's Last Name:	First Name	MI

Street Address			
15 Agawam Avenue			
City/Town: West Springfield	State: MA	Zip Code: 01089	Telephone Number: (413) 730-4721 ext.
Contact: Kim Marsili		e-mail address (optional): marsilik@conedenergy.com	

C. Facility, Site or Individual Requiring Approval

Name of Facility, Site or Individual: Red Bridge Dam		DEP Facility Number (if Known)	
Street Address: Red Bridge Road		e-mail address: (optional)	
City/Town: Wilbraham	State: MA	Zip Code: 01095	Telephone Number: ( ) ext.

D. Application Prepared by (if different from Section B)

Name of Individual or Firm: Kleinschmidt Associates			
Address: 75 Main Street Box 576			
City/Town: Pittsfield	State: ME	Zip Code: 04967	Telephone Number: (207) 487-3328 ext.270
Contact: Allison Murray		LSP Number (21E only)	

E. Permit - Project Coordination

Is this project subject to MEPA review? ☐ yes ☒ no
If yes, indicate the project's EOEA file number (assigned when an Environmental Notification Form is submitted to the MEPA unit)
EOEA # Is an Environmental Impact Report Required? ☐ yes ☒ no
Is this application part of a larger project for which two or more DEP permits are being or will be sought? ☐ yes ☒ no
List any other DEP permits that apply to this project:

Permit Category	Date of Submission (tentative or actual)	Transmittal Number (if application already submitted)
WPA Form 3 – Notice of Intent		

F. Amount Due

Special Provisions:
☐ Fee Exempt* (city, town or municipal housing authority)(state agency if fee is $100 or less)
☐ Hardship Request [payment extensions according to 310 CMR 4.04(3)(c)]
☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10)
*There are no fee exemptions for 21E, regardless of applicant status

Check #:	Dollar Amount:	Date:
Please make check payable to the Commonwealth of Massachusetts and mail check and one copy of this form to DEP, P.O. Box 4062, Boston, MA 02211		

rev 03/21/00

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Waterways
BRP WW 01 Waterways License or Permit
BRP WW 03 License or Permit Amendment
General Waterways Application

W017816
Transmittal Number

A. Project Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

1. Which Permit are you applying for? x BRP WW 01 ☐ BRP WW 03

   If this is an amendment, please reference the license #

2. Applicant:

   Consolidated Edison Energy Massachusetts, Inc.

   15 Agawam Avenue

   West Springfield MA 01089

   (413) 730 - 4721 ext.
   Day Telephone #

3. Authorized Agent (if any):

   Kleinschmidt Associates
   Name

   75 Maine Street, P.O. Box 576
   Mailing Address

   Pittsfield | ME | 04967
   City/Town | State | Zip Code

   (207) 487 - 3328 ext. 270
   Day Telephone #

Note: Please refer to the "Instructions for Completing Application BRP WW 01 & BRP WW 03" before completing sections A-E of this form.

4. Property Information (all information must be provided):

   Owner Name (if different from applicant)

   Lot 5V, Map 9900, Block 5
   Tax Assessor's Map and Parcel Numbers

   Red Bridge Road | Wilbraham
   Location (street address) | City/Town

   Hampden | 01095 | 42d10'42"N | 72d24'30"W
   County | Zip Code | Latitude | Longitude

5. Name of the water body:

   Chicopee River

6. The waterbody at the project site is within: (check a, b & c)

   a. ☐ uncertain ☒ river/stream ☐ tidal ☐ filled tidelands ☐ great pond

   b. ☐ uncertain ☐ natural ☒ enlarged/dammed

   c. ☒ uncertain ☐ ocean sanctuary ☐ ACEC ☐ DPA

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Waterways

BRP WW 01 Waterways License or Permit
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A. Project Information Cont.

7. Project/Activity description:
   See Attached

8. Description of existing and/or proposed uses(s):
   (select use(s) from Appendix C)
   Dam – To produce electricity

9. Is this project: ☒ water-dependent? ☐ non water-dependent?

10. What is the approximate total cost of any proposed work (including materials & labor)?
    $200,000

11. List the name & complete mailing address of each abutter (attach additional sheets, if necessary):
    Denise Lafountain, c/o Barbara Lafountain: 28 Wood Drive, Ludlow, MA 01056
    Gleason Realty: Berkshire Ave., Springfield MA 01109
    Elizabeth Hetzel: 7 Red Bridge Road, Wilbraham, MA 01095
    Commonwealth of Massachusetts: Dept. of Natural Resources

12. "I have attached project plans in accordance with the instructions contained in…":
    - ☐ Appendix A (for permit applications)
    - ☒ Appendix B (for license applications)
    - ☐ Appendix C (use statements for permit & license applications)

    Appendices A-D begin on page 5 of this application package.

13. Term:
    - ☒ Standard 30 years
    - ☐ Extended 31-99 years
      - Provide additional documentation in accordance with 310 CMR 9.15 (1)(b)(2).
      - Provide appropriate application fee in accordance with "Table 1" at 310 CMR 9.16.

14. Other Approvals:
    - Water Quality Certificate (Date of Issuance _____)
    - MEPA File No. _____
    - Wetlands File No. NOI being submitted concurrently
    - Date of Secretary Certificate _____

Question 7. Project Description

Consolidated Edison Energy Massachusetts, Inc. is proposing to construct an automated minimum flow slide gate at the direction of the Federal Energy Regulatory Commission (FERC), the State of Massachusetts Division of Fisheries and Wildlife (MDFW) and the U.S. Fish & Wildlife Service (USFWS). These agencies directed installation of minimum flow passage devices to provide uniform flows into the bypass channel of the existing facility. The purpose of the approximately 7.5'x 8.5' steel gate, to be constructed at the southern end of the spillway section, is to provide a year-round minimum flow in the bypass channel to protect fisheries and other aquatic resources. Currently the civil facilities supply this flow over the spillway section but result in varied flows due to impoundment level changes.

Construction would be undertaken in the dry, in a de-watered area behind an approximately 15' x 15' temporary wood and steel box coffer dam. The temporary cofferdam will be installed along the upstream face of the existing spillway by use of a shore-based crane and divers. Installation will not require dredging or the placement of fill either on the embankment or within the impoundment. De-watering of the cofferdam will be accomplished through the use of electric submersible pumps. Pump discharge will be placed into sediment control devices or discharged into the bypass channel if no sediments are present. The sediment control devices will consist of hay baled areas with grass bottom and silt fencing along the device perimeter. Discharge from the control devices will be through stone check dams of approximately ¾" crushed stone. Additional silt fencing and turbidity curtain will be placed down gradient of the work area to capture sediment-laden run-off during rain events.

Use of the cofferdam will preclude the need to lower the impoundment on the upstream side of the dam during construction, eliminating any potential affect on aquatic resources, recreation, and shoreland uses. Minimum flow requirements will be maintained throughout the construction project by the current method of passing water over the spillway face. A temporary timber diversion wall will be placed parallel to the flow along the upper spillway face to divert water away from work areas.

The construction will occur over a period of approximately three months, weather permitting. Construction of the sluice gate will consist of mechanical removal of materials (concrete) to accommodate the new structure and the consequent installation of the gate. Removal will be accomplished through small equipment mounted or hand held hydraulic or air hammers. Material handling equipment (*i.e.* crane) will be stationed above the high water level. After completion of removal the new cast-in-place concrete sill and piers will be installed. Gate and operator installation would follow installation of the new concrete sill and piers.

The contractor will access the construction site across the south embankment of the project, and will install siltation fencing down gradient of the work area to reduce any siltation exiting the work area. No disturbance of vegetated areas on the embankment is anticipated. If, during construction the need to remove vegetation for access occurs, such vegetation will be replaced following construction. Cofferdam removal will occur after final testing of the new gate system.

W017816
Transmittal Number

B. Certification

All applicants, property owners and authorized agents must sign this page. All future applications correspondence may be signed by the authorized agent alone.

"I hereby make application for a permit or Massachusetts Coastal Zone Management Program to enter upon the premises of the project site at reasonable times for the purpose of inspection.

"I hereby certify that the information license to authorize the activities I have described herein. Upon my signature, I agree to allow the duly authorized representatives of the Massachusetts Department of Environmental Protection and the submitted in this application is true and accurate to the best of my knowledge."

Applicant's signature

Date

Property Owner's signature (if different than applicant)

Date

Agent's signature (if applicable)

Date

C. Waterways Dredging Addendum N/A

1. Provide a description of the dredging project:

   ☐ Maintenance Dredging (include date of last dredge & Permit No.) ☐ Improvement Dredging

   purpose of dredging

2. What is the volume (cubic yards) of material to be dredged?

3. What method will be used to dredge?

   ☐ Hydraulic ☐ Mechanical ☐ Other

4. Describe method of disposal and give the disposal location (include a separate disposal site location map):

5. In the event beach nourishment is proposed for private property, pursuant to 310 CMR 9.40(4)(a)1, easements for public access below the existing high water mark shall be secured by the applicant and submitted to the Department.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Waterways

BRP WW 01 Waterways License or Permit
BRP WW 03 License or Permit Amendment
General Waterways Application

W017816
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D. Municipal Zoning Certificate N/A

Name of Applicant

Project street address

Waterway

City/Town

Description of use or change in use:

To be completed by municipal clerk or appropriate municipal official:

"I hereby certify that the project described above and more fully detailed in the applicant's waterways license application and plans is not in violation of local zoning ordinances and bylaws."

Printed Name of Municipal Official

Signature of Municipal Official

Title

City/Town

Date

W017816
Transmittal Number

E. Municipal Planning Board Notification

Notice to Applicant: This Municipal Planning Board Notification section must be submitted along with the original application material. If it cannot be signed by the appropriate municipal official at the time of delivery, the applicant should wait until he or she receives the executed signature before submitting the completed application package to DEP.

Consolidated Edison Energy Massachusetts Inc.
Name of Applicant

Red Bridge Road
Project street address

Chicopee River
Waterway

Wilbraham
City/Town

Description of use or change in use: Consolidated Edison Energy Massachusetts, is proposing to construct an automated minimum flow slide gate at the direction of FERC and the USFWS. The purpose of the approximately 7.5 x 8.5 foot gate is to provide a year round minimum flow in the bypass channel to protect and enhance fisheries and other aquatic resources. There is no change in use associated with this structural modifcation.

To be completed by municipal clerk or appropriate municipal official:

"I hereby certify that the project described above and more fully detailed in the applicant's waterways license application and plans have been submitted by the applicant to the municipal planning board."

Printed Name of Municipal Official

Signature of Municipal Official

Title

City/Town

Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Waterways

BRP WW 01 Waterways License or Permit
BRP WW 03 License or Permit Amendment
General Waterways Application

W017816
Transmittal Number

Appendix B: Mylar Plan Specification Checklist for Licenses

General

- [x] PE or RLS, as deemed appropriate by the Department, stamped and signed, in ink, each sheet within 8 1/2 inch by 11 inch border
- [x] Format and dimensions conform to "Sample Plan" (attached)
- [x] Permanent ink or reproductions on mylar or linen .003 mls thick
- [x] Minimum letter size is 1/8 of an inch if freehand lettering, 1/10 of an inch letter guides are used
- [x] Sheet number with total number in set on each sheet
- [x] Title sheet contains the following in lower left: Plans accompanying Petition of [Applicant's name, structures and/or fill or change in use, waterway and municipality]
- [x] North arrow
- [x] Scale is suitable to clearly show proposed structures and enough of shoreline, existing structures and roadways to define its exact location
- [x] Scale is stated & shown by graphic bar scale on each sheet

Boundaries

- [x] Property lines, full black lines, ———, along with abutters' names and addresses
- [x] Mean High Water (MHW)* or Ordinary High Water (OHW)*, full black line ———
- [x] Mean Low Water (MLW)*, black dotted line, (............)
- [x] Historic MHW* or OHW*, (— — — —)
- [x] Historic MLW*,(..._..._..._)
- [ ] State Harbor Lines, black dot-dash line (- . - . - . -) with indication of Chapter & Act establishing them (Ch. , Acts of)
- [x] Reference datum is Mean Low Water*, (MLW = 0.0) in tidal waters and USGS or NGVD in non-tidal waters
- [ ] Floodplain Boundaries according to most recent FEMA maps
- [ ] Proposed & Existing Easements described in metes & bounds

Structures and Fill

- [x] All Structures and Fill shown in full BLACK lines, clearly labeling which portions are existing, which are Proposed and indicating Existing Waterways Licenses
- [x] *Cross Section Views* show MHW* and MLW* and structure finish elevations
- [ ] *Dredge* or *Fill*, actual cubic yardage must be stated and typical cross sections shown
- [x] Actual dimensions of structures(s) and or fill and the distance which they extend beyond MHW* or OHW*
- [ ] Change in Use of any structures on site must be stated*

See 310 CMR 9.02, Waterways Regulations definitions of High Water Mark, Historic High Water Mark, Historic Low Water Mark, and Low Water Mark.

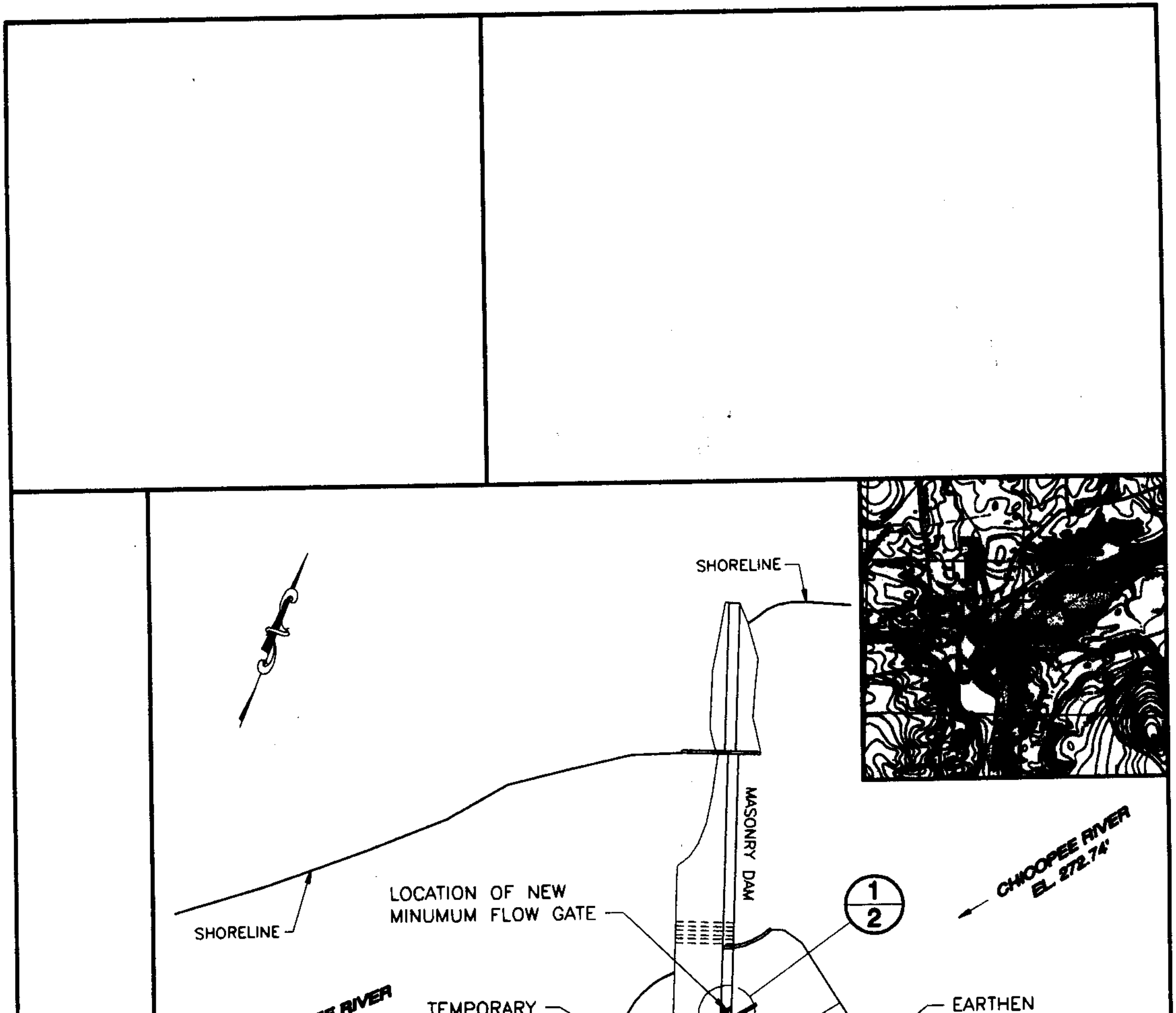
Note: DEP may, at its discretion, accept appropriately scaled preliminary plans in lieu of the plans described above. In general, DEP will accept preliminary plans only for non-water dependent projects and projects covered by MEPA to address site design components such as visual access, landscaping & site coverage. *Anyone wishing to submit preliminary plans must obtain prior approval of the DEP Waterways Program* before submitting them with their application.

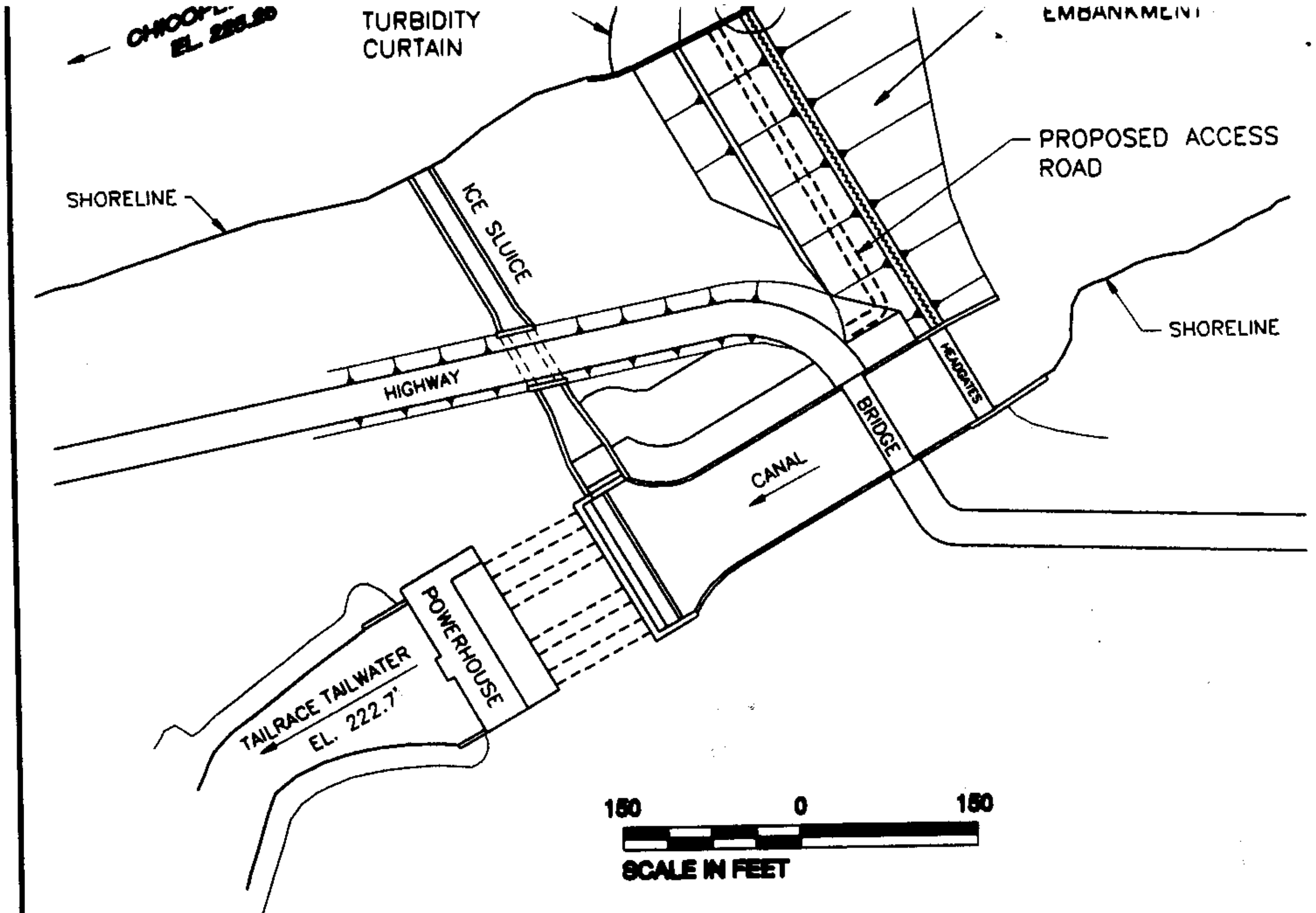
Water-Dependent Structures

- [ ] Distance from adjacent piers, ramps or floats (minimum distance of 25, where feasible)
- [ ] Distance from nearest opposite shoreline
- [ ] Distance from outside edge of any Navigable Channel
- [ ] Access stairs at MHW for lateral public passage, or 5 feet of clearance under structure at MHW.

Non Water-Dependent Structures

- [ ] Depict extent of "Water-dependent Use Zone". *See Waterways Regulations at 310 CMR 9.51-9.53 for additional standards for non water-dependent use projects.*


SHORELINE
MASONRY DAM
CHICOPEE RIVER
EL. 272.74'
1
2
LOCATION OF NEW
MINUMUM FLOW GATE
SHORELINE
TEMPORARY
EARTHEN



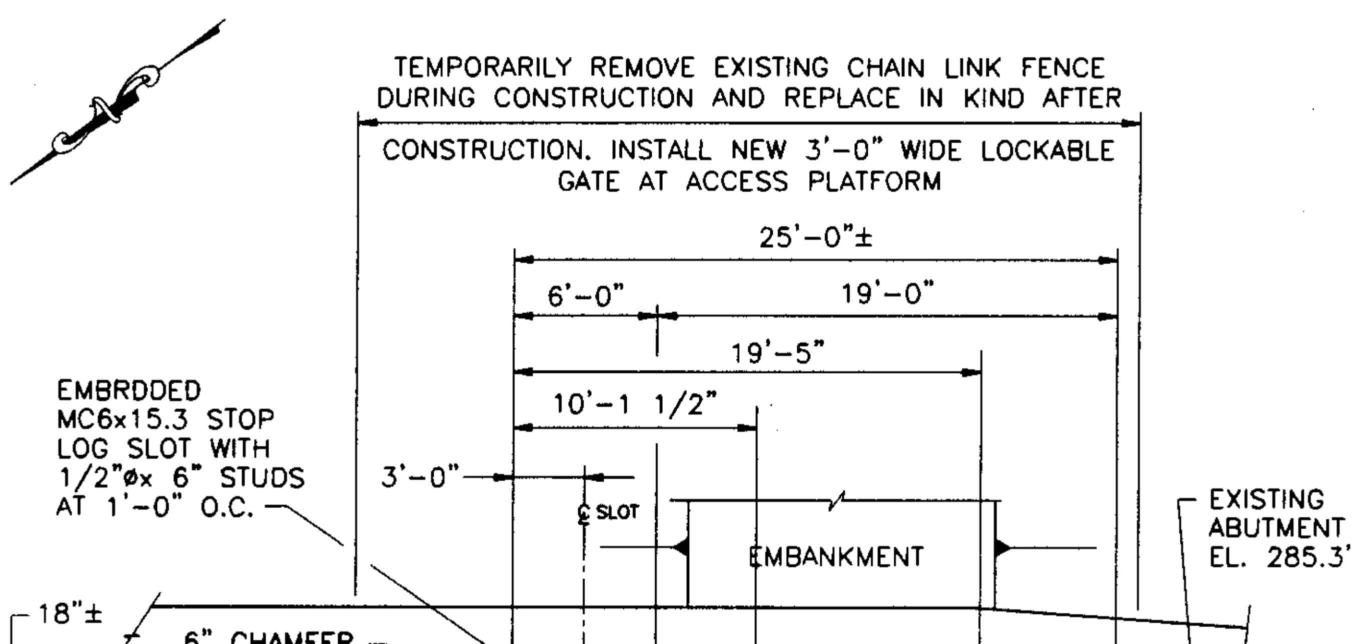
CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.
WEST SPRINGFIELD, MASSACHUSETTS

MINIMUM FLOW GATE PROJECT
CHICOPEE RIVER

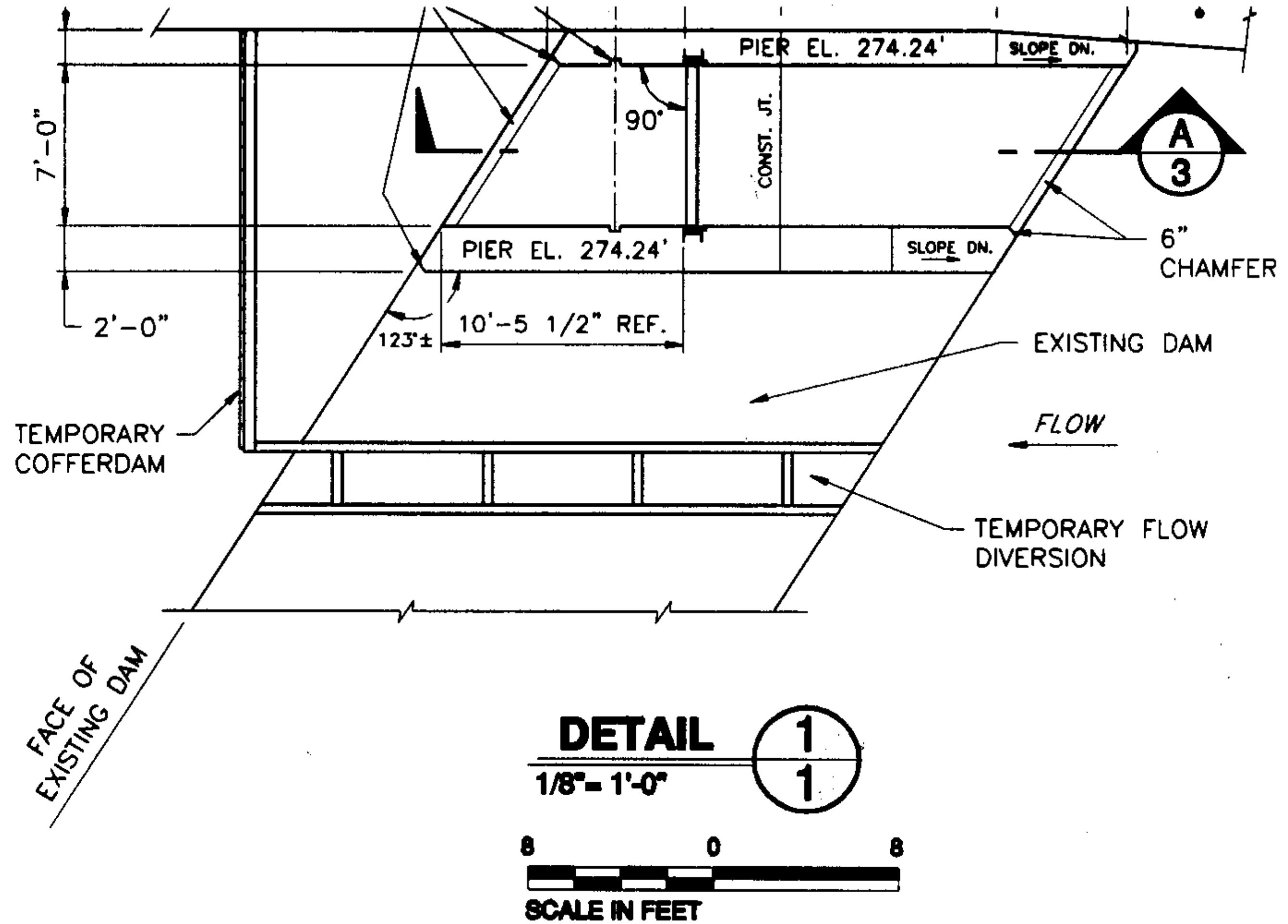
RED BRIDGE DAM
GENERAL PLAN

12/18/00

SHEET 1 OF 5



TEMPORARILY REMOVE EXISTING CHAIN LINK FENCE DURING CONSTRUCTION AND REPLACE IN KIND AFTER CONSTRUCTION. INSTALL NEW 3'-0" WIDE LOCKABLE GATE AT ACCESS PLATFORM
25'-0"±
6'-0"
19'-0"
19'-5"
10'-1 1/2"
3'-0"
℄ SLOT
EMBANKMENT
EMBRDDED MC6x15.3 STOP LOG SLOT WITH 1/2"ø x 6" STUDS AT 1'-0" O.C.
EXISTING ABUTMENT EL. 285.3'
18"±
6" CHAMFER

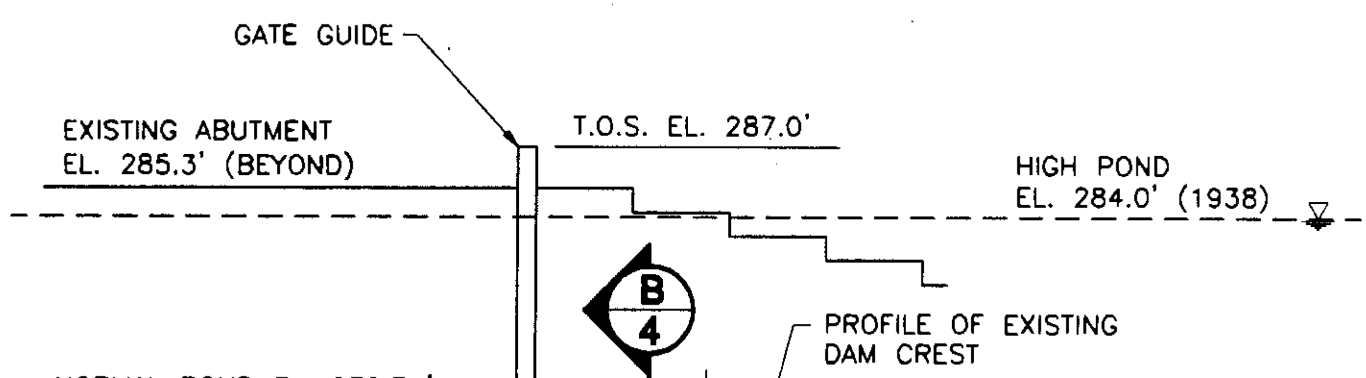


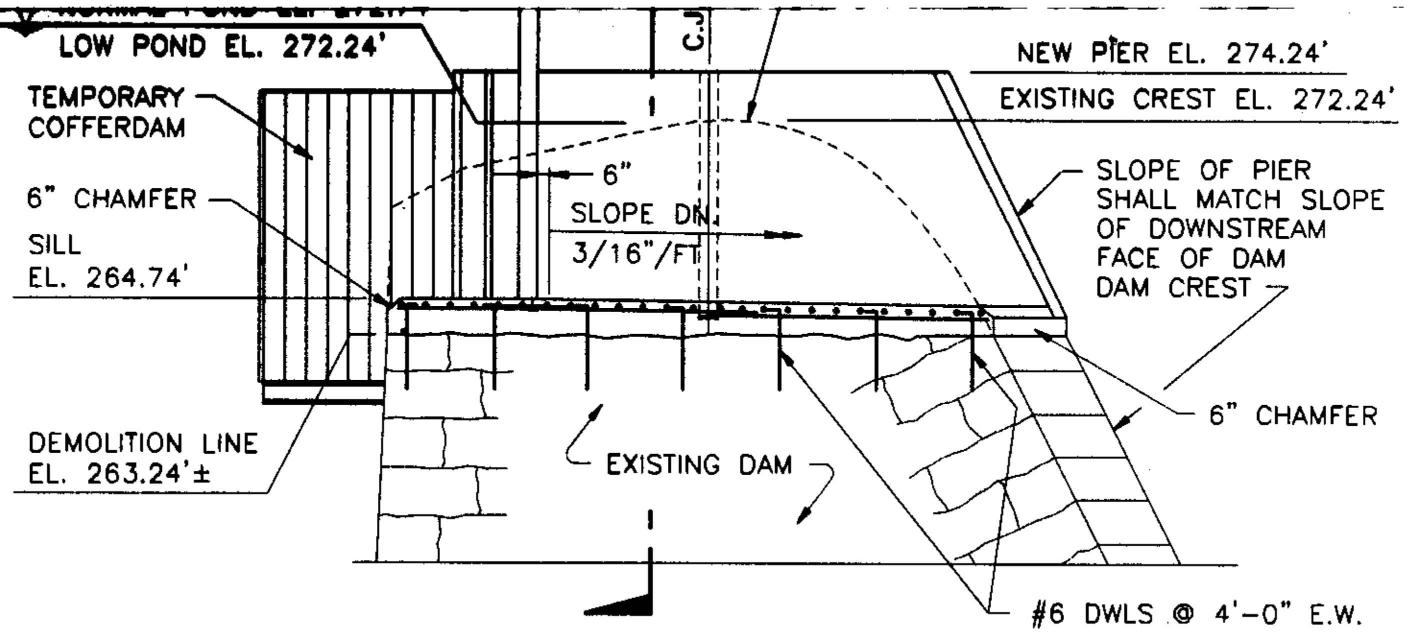
CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.
WEST SPRINGFIELD, MASSACHUSETTS

MINIMUM FLOW GATE PROJECT
CHICOPEE RIVER

RED BRIDGE DAM
PLAN OF MINIMUM FLOW GATE AREA

12/18/00 SHEET 2 OF 5


GATE GUIDE
EXISTING ABUTMENT
EL. 285.3' (BEYOND)
T.O.S. EL. 287.0'
HIGH POND
EL. 284.0' (1938)
B
4
PROFILE OF EXISTING
DAM CREST



SECTION A/2
1/8"= 1'-0"

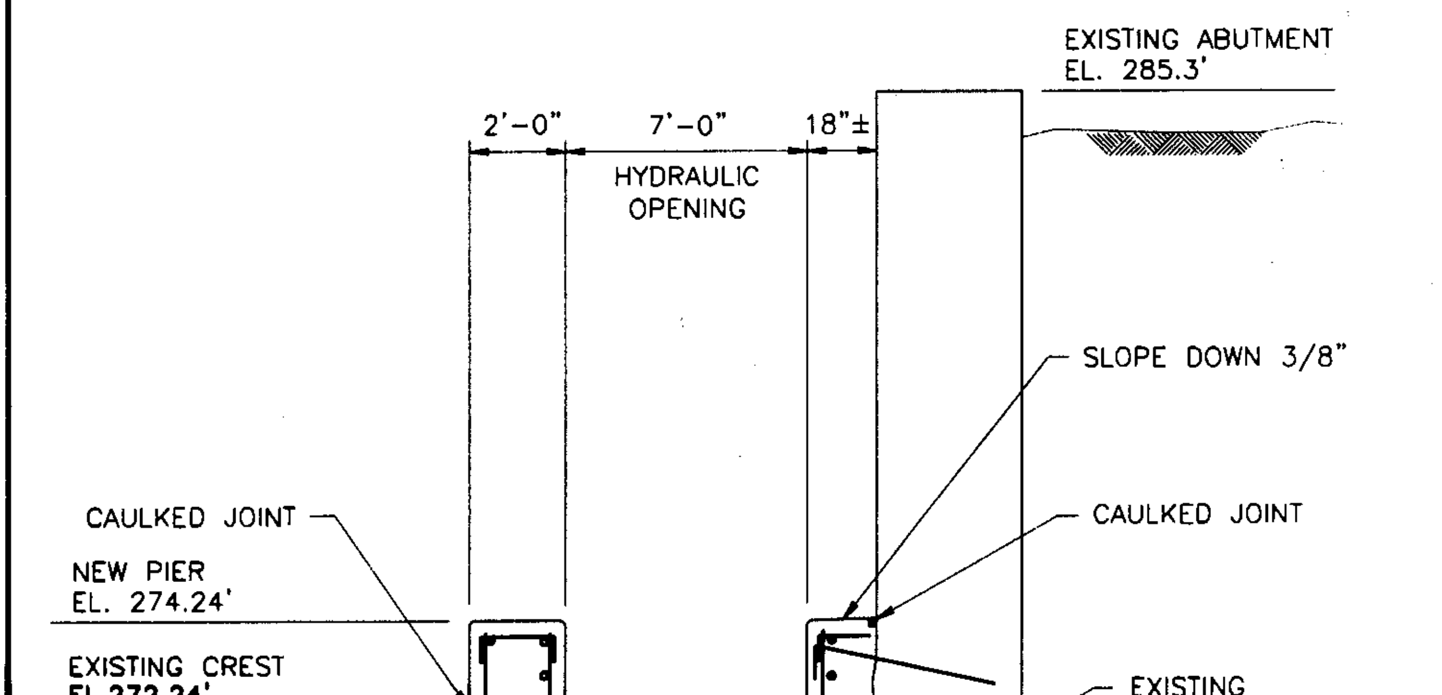
8 0 8
SCALE IN FEET

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.
WEST SPRINGFIELD, MASSACHUSETTS

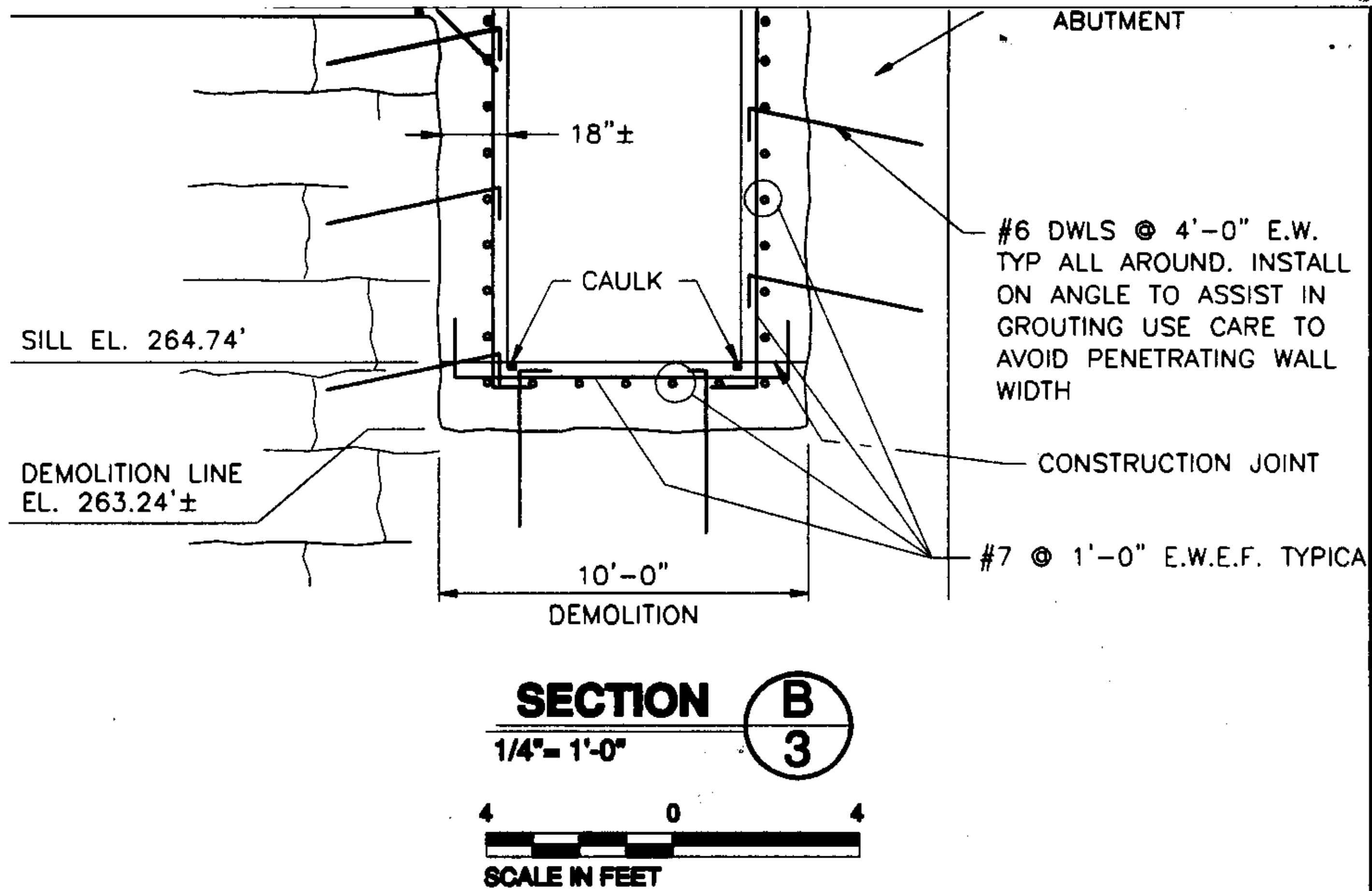
MINIMUM FLOW GATE PROJECT
CHICOPEE RIVER

RED BRIDGE DAM
SECTION OF MINIMUM FLOW GATE AREA

12/18/00 SHEET 3 OF 5



EXISTING ABUTMENT
EL. 285.3'
2'-0"
7'-0"
18"±
HYDRAULIC
OPENING
SLOPE DOWN 3/8"
CAULKED JOINT
CAULKED JOINT
NEW PIER
EL. 274.24'
EXISTING CREST
EXISTING

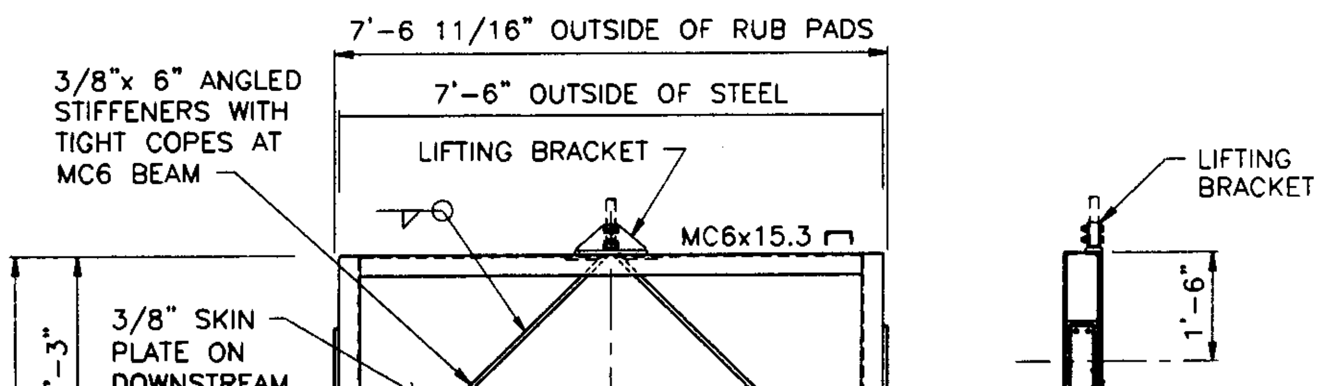


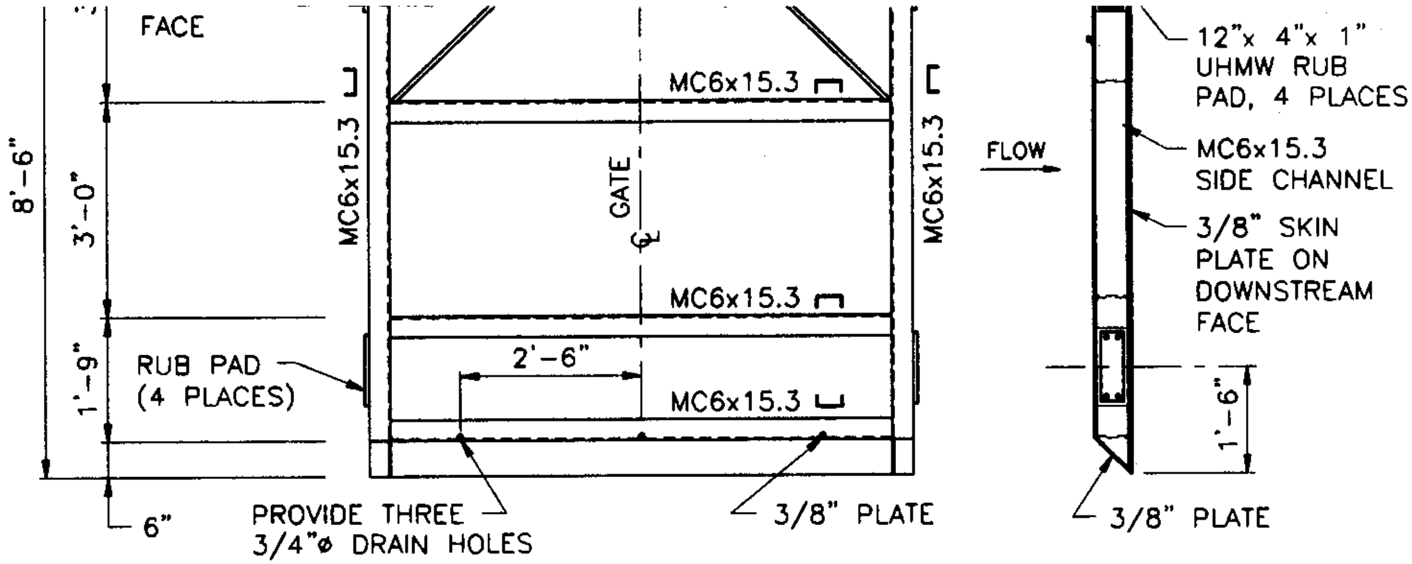
CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.
WEST SPRINGFIELD, MASSACHUSETTS

MINIMUM FLOW GATE PROJECT
CHICOPEE RIVER

RED BRIDGE DAM
SECTION OF OPENING FOR GATE

12/18/00 SHEET 4 OF 5


7'-6 11/16" OUTSIDE OF RUB PADS
7'-6" OUTSIDE OF STEEL
3/8"x 6" ANGLED STIFFENERS WITH TIGHT COPES AT MC6 BEAM
LIFTING BRACKET
MC6x15.3
3/8" SKIN PLATE ON DOWNSTREAM
LIFTING BRACKET
1'-6"



UPSTREAM ELEVATION

SIDE VIEW

GATE DETAIL

3/8"= 1'-0" SEALS NOT SHOWN

SCALE IN FEET

CONSOLIDATED EDISON ENERGY MASSACHUSETTS, INC.
WEST SPRINGFIELD, MASSACHUSETTS

MINIMUM FLOW GATE PROJECT
CHICOPEE RIVER

RED BRIDGE DAM
DETAIL OF MINIMUM FLOW GATE

12/18/00 SHEET 5 OF 5

W017816
Transmittal Number

Appendix C: Use Statements for Permit & License Applications

Project	Use Statement
• Pier (private, non-commercial)	noncommercial docking and boating access to navigable waters.
• Marina (public recreational boating facility)	to provide a public recreation boating facility
• Marina (private recreational boating facility)	to provide a private recreational boating facility
• Bulkhead/Seawall/Revetment/Riprap, etc	shoreline stabilization for the protection of a) existing structures b) a water dependant use Notes: 1) Pick either a) or b) above, which ever is appropriate 2) If these structures will protect a new non-water dependant use then the use of these structures will also be considered non-water dependant. [see CMR 9.12(2)(a)(11)]
• Pipeline crossing (sewer water line, gas, etc)	Transmission of water/wastewater/natural gas
• Powerline crossing (transmission/telecommunication)	Transmission of electricity/telecommunication
• Public Boardwalk/Waterfront Park (Including facilities for water dependent recreation activities)	Public access to waterfront open space for passive recreational purposes
• Public Landing/Boat Ramp	Public access to navigable waters
• Beach Nourishment	1) Public access to waterfront open space for recreational purposes and/or 2) Shoreline stabilization
• Boathouse (accessory to private noncommercial pier)	Noncommercial storage of boats and other associated water dependent purposes
• Water Dependent Industrial Uses	
• Waterborne Passenger Facilities (ferries, taxis, etc)	To provide a waterborne passenger transportation facility
• Dams/Tidal Gates	To control water levels

- If none of the above statements describe the project entirely, the Department will consider this application a nonwater-dependent application. Upon review of the application, the Department will issue the applicant a Use Statement.

W017816
Transmittal Number

Application Completeness Checklist

☐ A completed and signed copy of Section A of the General Waterways Application, Sections B, C, D, or E (as appropriate), and documentation along with the white page of the Transmittal Form, has been sent to the appropriate regional office:

- Department of Environmental Protection
- Waterways Program
- _____ Regional Office
- _____ Other

☐ The Transmittal Form is completed.

Send the appropriate fee (see table below), in the form of a check or money order, along with the yellow page of the Transmittal Form to:

Department of Environmental Protection
P.O. Box 4062
Boston, MA 02211

This table is also found in Question 4 of the instruction for completing the application, "How to Apply" guide:

	Water-dependent use projects[1] (accessory to a residential use of a 4 dwelling units)	Other water-dependent use projects	Residential non water-dependent use projects	Other non water-dependent use projects	Licenses with extended terms
License or permit application	$100.00	$250.00	$500.00	$1500.00	2500.00
License or permit amendment or renewal application	$50.00	$100.00	$250.00	$750.00	$1000.00

[1] Except for facilities subject to 310 CMR 9.16(3)(b)(2)., for which the applicable fees shall be the same as those listed for licenses with extended terms.

☐ If required under 310 CMR 9.34(1), the application must include: a completed Municipal Zoning Certification (Section D of the application) signed by the municipal clerk or appropriate municipal official or, for the initial filing, an explanation of why the form is not included with the initial application submittal. If the project is a public service project subject to zoning but will not require any municipal approvals, submit a certification to the effect pursuant to 310 CMR 9.34(1).

W017816
Transmittal Number

Application Completeness Checklist Cont.

☒ Included is a completed Municipal Planning Board Notification (Section E of the application) signed by the municipal clerk, or appropriate municipal official for each town where the work is to be performed, except in the case of a proposed bridge, dam, or similar structure across a river, cove, or inlet, in which case it must be certified by every municipality into which the tidewater of said river, cove, or inlet extends.

☒ Included are copies of all state regulatory approvals which are applicable pursuant to 310 CMR 9.33 or, for the initial filing, a list of such approvals which must be obtained.

☒ Included is a copy of one of the following: the final Order of Conditions (with accompanying plan) under the Wetlands Protection Act, or a final Determination of Applicability under that Act stating that an Order of Conditions is not required for the project or, for the initial filing (if the project does not trigger review under MEPA), a copy of the Notice of Intent.

☐ If the project is subject to the Massachusetts Environmental Protection Act (MEPA), MGL 30, subsections 61-61A and 301 CMR 11.00, submit as appropriate: a copy of the Environmental Notification Form (ENF) and a Certificate of the Secretary of Environmental Affairs thereon, or a copy of the final Environmental Impact Report (EIR) and Certificate of the Secretary stating that it adequately and properly complies with MEPA; and any subsequent Notice of Project change and any determination issued thereon in accordance with MEPA. For the initial filing, only a copy of the ENF and the Certificate of the Secretary thereon must be submitted.
*If the project is subject to MEPA, the Chapter 91 Public Notice must also be submitted to MEPA for publication in the "Environmental Monitor". Filing deadlines for MEPA are the 15th and 30th of each month.

☐ A Water Quality Certificate, if applicable, pursuant to 310 CMR 9.33, is included.

☐ For non water-dependent projects, a statement is included explaining how the project serves a proper public purpose which provides greater benefit than detriment to public rights in tidelands or great ponds, and the manner in which the project meets the applicable standards identified in Appendix D. If the project is a non water-dependent project located in the coastal zone, the statement should explain how the project complies with the standard governing consistency of the policies of the Massachusetts Coastal Zone Management Program, according to 310 CMR 9.54. If the project is located within an area covered by a Municipal Harbor Plan, the statement should describe how the project conforms to any applicable provisions of such plan pursuant to 310 CMR 9.34(2).

☒ Plans have been prepared in accordance with the instruction contained in Appendix A-B of the application. For initial filing, meeting the requirements of 310 CMR 9.11(2)(b)(3).

☒ A completed copy of the Public Notice has been submitted with the application. All appropriate information (in bold type) has been completed.

Checklist for projects involving dredging:

☐ Included is a completed and signed copy of Part C of the application.

Public Notice Attachment

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Waterways Regulation Program

Notice of License Application pursuant to M.G.L. Chapter 91
Waterways License Transmittal Number
(W017816)

Notification Date: (Insert date of publication)

Public notice is hereby given of the application by Consolidated Edison Energy Massachusetts, Inc. to license the construction of a sluice gate at the Red Bridge Dam on Red Bridge Road, assessor's lot 5V block 5 map 9900, in the municipality of Wilbraham, in and over the waters of the Chicopee River. The proposed use of the structure is to generate hydro-electric power and is a water-dependent use project.

The Department will consider all written comments submitted **30 days** for license, subsequent to the "Notification Date". All comments must reference the Waterways License Transmittal Number. A public hearing may be held upon written request by the municipal official. Furthermore, a municipality, ten-citizen group or any aggrieved person that has submitted written comments may become a party before the close of the comment period. Failure to submit such comments will result in the waiver of any rights to an adjudicatory hearing. For information call 413-784-1100. Plans and documents for this application are on file with the Department for public viewing at the address below. Written comments should be addressed to Section Chief, DWW, 436 Dwight Street, Suite 402, Springfield, MA 01103.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Appendix B – Wetland Fee Transmittal Form
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

A. Applicant Information

1. Applicant:

Consolidated Edison Energy Massachusetts, Inc.
Name

15 Agawam Avenue
Mailing Address

Springfield	MA	01089
City/Town	State	Zip Code

413-730-4721
Phone Number

2. Property Owner (if different):

Name

Mailing Address

City/Town | State | Zip Code

Phone Number

3. Project Location:

Red Bridge Road	Wilbraham
Street Address	City/Town

B. Fees

To calculate filing fees, refer to the category fee list and examples in Section D of this form.

Abbreviated Notice of Resource Area Delineation (Form 4A):

The fee is calculated as follows (check applicable project type):

☐ single family house project

________ X $1.00= ________
(feet of BVW)

Total fee (not to exceed $100)

☐ all other projects

________ X $1.00= ________
(feet of BVW)

Total fee (not to exceed $1,000)

State share of filling fee: ________
(1/2 of total fee **less** $12.50)

City/Town share of filling fee: ________
(1/2 of total fee **plus** $12.50)

WPA Appendix B – Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (cont.)

Abbreviated Notice of Intent (Form 4) or Notice of Intent (Form 3):

The fee should be calculated using the following six-step process and worksheet:

Step 1/Type of Activity: Describe each type of activity (see Section D for a list of activities) that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories in Section D.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category(identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Dam/sluiceway	1	725.00	725.00

Step 5/Total Project Fee: 725.00

Step 6/Fee Payments:

Total Project Fee: 725.00
(Total fee from Step 5)

State share of filing fee: 350.00
(1/2 total fee less $12.50)

City/Town share of filling fee: 350.00
(1/2 total fee plus $12.50)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

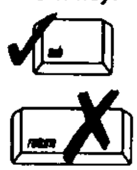
DEP File Number:

Provided by DEP

Town

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

1. Applicant:

Consolidated Edison Energy, Massachusetts, Inc.
Name | E-Mail Address (if applicable)

15 Agawam Avenue
Mailing Address

West Springfield | MA | 01089
City/Town | State | Zip Code

(413) 730-4721
Phone Number | Fax Number (if applicable)

2. Representative (if any):

Kleinschmidt Associates
Firm

Allison Murray | Allison.Murray@KleinschmidtUSA.com
Contact Name | E-Mail Address (if applicable)

75 Main Street Box 576
Mailing Address

Pittsfield | ME | 04967
City/Town | State | Zip Code

(207) 487-3328 | (207)487-3124
Phone Number | Fax Number (if applicable)

3. Property Owner (if different from applicant):

Name

Mailing Address

City/Town | State | Zip Code

4. Total Fee:

(from Appendix B: Wetland Fee Transmittal Form)

5. Project Location:

Red Bridge Road | Wilbraham
Street Address | City/Town

Map 9900, Block 5 | Lot 5V
Assessors Map/Plat Number | Parcel /Lot Number

6. Registry of Deeds:

Hampden
County | Book | Page

Certificate (if Registered Land)

A. General Information (cont.)

7. Summary of Project Impacts:

a. Is any work being proposed in the Buffer Zone?

☐ Yes   If yes, how many square feet?

Square Feet

☒ No

b. List the impacts of proposed activities on each wetland resource areas (temporary and permanent impacts, prior to restoration and mitigation):

Resource Area	Size of Impact (e.g., sq. ft.)
Land Under Water Bodies	Temporary impact: 225 sq. ft.
Land Under Water Bodies	Permanent impact: 0

B. Project Description

1. General Project Description:

See Attached

2. Plan and/or Map References:

Title   Date

B. 1. Project Description

Consolidated Edison Energy Massachusetts, Inc. is proposing to construct an automated minimum flow slide gate at the direction of the Federal Energy Regulatory Commission (FERC), the State of Massachusetts Division of Fisheries and Wildlife (MDFW) and the U.S. Fish & Wildlife Service (USFWS). These agencies directed installation of minimum flow passage devices to provide uniform flows into the bypass channel of the existing facility. The purpose of the approximately 7.5'x 8.5' steel gate, to be constructed at the southern end of the spillway section, is to provide a year-round minimum flow in the bypass channel to protect fisheries and other aquatic resources. Currently the civil facilities supply this flow over the spillway section but result in varied flows due to impoundment level changes.

Construction would be undertaken in the dry, in a de-watered area behind an approximately 15' x 15' temporary wood and steel box coffer dam. The temporary cofferdam will be installed along the upstream face of the existing spillway by use of a shore-based crane and divers. Installation will not require dredging or the placement of fill either on the embankment or within the impoundment. De-watering of the cofferdam will be accomplished through the use of electric submersible pumps. Pump discharge will be placed into sediment control devices or discharged into the bypass channel if no sediments are present. The sediment control devices will consist of hay baled areas with grass bottom and silt fencing along the device perimeter. Discharge from the control devices will be through stone check dams of approximately ¾" crushed stone. Additional silt fencing and turbidity curtain will be placed down gradient of the work area to capture sediment-laden run-off during rain events.

Use of the cofferdam will preclude the need to lower the impoundment on the upstream side of the dam during construction, eliminating any potential affect on aquatic resources, recreation, and shoreland uses. Minimum flow requirements will be maintained throughout the construction project by the current method of passing water over the spillway face. A temporary timber diversion wall will be placed parallel to the flow along the upper spillway face to divert water away from work areas.

The construction will occur over a period of approximately three months, weather permitting. Construction of the sluice gate will consist of mechanical removal of materials (concrete) to accommodate the new structure and the consequent installation of the gate. Removal will be accomplished through small equipment mounted or hand held hydraulic or air hammers. Material handling equipment (*i.e.* crane) will be stationed above the high water level. After completion of removal the new cast-in-place concrete sill and piers will be installed. Gate and operator installation would follow installation of the new concrete sill and piers.

The contractor will access the construction site across the south embankment of the project, and will install siltation fencing down gradient of the work area to reduce any siltation exiting the work area. No disturbance of vegetated areas on the embankment is anticipated. If, during construction the need to remove vegetation for access occurs, such vegetation will be replaced following construction. Cofferdam removal will occur after final testing of the new gate system.

C. Activities Subject to Regulation

1. a. Check the applicable resource areas if work is to be conducted in an associated Buffer Zone:

Inland Resource Areas

☐ Inland Bank

☐ Bordering Vegetated Wetland (BVW)

Coastal Resource Areas

☐ Coastal Beach ☐ Barrier Beach

☐ Rocky Intertidal Shore ☐ Coastal Dune

☐ Salt Marsh ☐ Coastal Bank

b. Complete for all proposed activities located, in whole or in part, in Wetland Resource Area(s).

Inland Resource Areas:

Bordering Vegetated Wetlands:

0
Square Feet altered

0
Square Feet replaced

Land Under Water Bodies:

225 sf
Square Feet altered

0
Cubic Yards dredged

Bank:

0
Linear Feet altered

Bordering Land Subject to Flooding:

0
Volume of Flood Storage Lost (cubic feet)

0
Volume of Flood Storage Compensation (cubic feet)

Isolated Land Subject to Flooding:

0
Volume of Flood Storage Lost (cubic feet)

0
Volume of Flood Storage Compensation (cubic feet)

Coastal Resource Areas:

Coastal Dune:

Square Feet altered

Cubic Yards/Volume removed

Salt Marsh:

Square Feet altered

Coastal Bank:

Linear Feet altered

Land Under Salt Pond:

Square Feet altered

Cubic Yards dredged

Rocky Intertidal Zone:

Square Feet altered

Designated Port Area:

Square Feet altered

C. Activities Subject to Regulations (cont.)

Fish Run:

Linear Feet altered

Land Containing Shellfish:

Square Feet altered

Land Subject to Coastal Storm Flowage:

Square Feet altered

Beach:

Square Feet altered

Land Under Ocean:

Square Feet altered

Cubic Yards dredged

Riverfront Area:

a. Name of Waterway (if available):

Chicopee

b. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☒ 200 ft. - All other projects

c. Describe how the Mean Annual High-Water Line was determined:

Impoundment is controlled by dam at project location.

d. Distance of proposed activity closest to the Mean Annual High-Water line:

10 feet from bank, into channel
Feet

e. Total area of Riverfront Area on the site of the proposed project:

Square Feet

f. Proposed alteration of the Riverfront Area:

0	0	0
Total Square Feet	Square Feet within 100 ft.	Square Feet between 100 ft. and 200 ft.

C. Activities Subject to Regulation (cont.)

2. Check all methods used to delineate the Bordering Vegetated Wetland (BVW) boundary:

   ☐ Final Order of Resource Area Delineation issued by Conservation Commission or DEP (attached)

   ☐ DEP BVW Field Data Form (attached)

   ☐ Final Determination of Applicability issued by Conservation Commission (attached)

   ☐ Other Methods for Determining the BVW boundary (attach documentation):

   - ☐ 50% or more wetland indicator plants
   - ☐ Saturated/inundated conditions exist
   - ☐ Groundwater indicators
   - ☐ Direct observation
   - ☐ Hydric soil indicators
   - ☐ Credible evidence of conditions prior to disturbance.

3. a. Is any portion of the proposed project located in estimated habitat as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program?

   ☐ Yes If yes, include proof of mailing or hand delivery of NOI to :

   Natural Heritage and Endangered Species Program
   Division of Fisheries and Wildlife
   Route 135, North Drive
   Westborough, MA 01581

   ☒ No

   '99-'01
   Date of Map

   b. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   ☐ Yes If yes, provide name of ACEC (see Appendix D for ACEC locations):

   ☒ No ____________________

   c. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   ☐ Yes

   ☒ No

D. Performance Standards

1. Is any portion of the proposed activity eligible to be treated as a limited project subject to 310 CMR 10.24 or 310 CMR 10.53?

   ☐ Yes   If yes, describe which limited project applies to this project: ______

   ☒ No

2. Is any activity within any Resource Area or Buffer Zone exempt from performance standards of the wetlands regulations, 310 CMR 10.00.

   ☐ Yes   If yes, describe which exemption applies to this project: ______

   ☒ No

3 a. Is the project located in the Riverfront Area?

   ☐ Yes   If yes, indicate the proposed project purpose:

   ☐ Single Family House   ☐ Industrial Development
   ☐ Residential Subdivision   ☐ Commercial Development
   ☐ Transportation   ☐ Other (describe) ______

   b. Was the lot where the activity is proposed created prior to August 1, 1996?

   ☒ Yes

   ☐ No

4. a. Describe how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location. Attach narrative and supporting documentation.

   b. Is this project exempt from the DEP Stormwater Policy?

   ☒ Yes   If yes, explain why the project is exempt:

   No stormwater discharge associated with this dam improvement

   ☐ No   If no, stormwater management measures are required. Applicants are encouraged to complete Appendix C: Stormwater Management Form and submit it with this form.

E. Additional Information

Applicants must include the following with this Notice of Intent (NOI):

- USGS or other map of the area (along with a narrative description, if necessary), containing sufficient information for the Conservation Commission and the Department to locate the site.
- Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland (BVW) replication area or other mitigating measure) relative to the boundaries of each affected resource area.
- Other material identifying and explaining the determination of resource area boundaries shown on plans (e.g., a DEP BVW Field Data Form).
- List the titles and final revision dates for all plans and other materials submitted with this NOI.

F. Fees

The fees for work proposed under each Notice of Intent must be calculated and submitted to the Conservation Commission and the Department (see Instructions and Appendix B. Wetland Fee Transmittal Form).

No fee shall be assessed for projects of the federal government, the Department, or cities and towns of the Commonwealth.

Applicants must submit the following information (in addition to pages 1 and 2 of Appendix B) to confirm fee payment:

Check Number ____________________ Check date ____________________

Payor name on check ____________________ Applicant name (if different from payor) ____________________

G. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

Signature of Applicant ____________________ Date ____________

Signature of Property Owner (if different) ____________________ Date ____________

Signature of Representative (if any) ____________________ Date ____________

G. Signatures and Submittal Requirements (cont.)

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents; two copies of pages 1 and 2 of Appendix B; and the city/town fee payment must be sent to the Conservation Commission by certified mail or hand delivery.

For DEP:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents; two copies of pages 1 and 2 of Appendix B; and a copy of the state fee payment must be sent to the DEP Regional Office (see Appendix A) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection

Bureau of Resource Protection - Wetlands

WPA Appendix A – DEP Regional Addresses

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Mail transmittal forms and DEP payments, payable to:

Commonwealth of Massachusetts
Department of Environmental Protection
Box 4062
Boston, MA 02211

DEP Western Region
436 Dwight Street
Suite 402
Springfield, MA 01103
Phone: 413-784-1100
Fax: 413-784-1149

Adams	Colrain	Hampden	Monroe	Pittsfield	Tyringham
Agawam	Conway	Hancock	Montague	Plainfield	Wales
Alford	Cummington	Hatfield	Monterey	Richmond	Ware
Amherst	Dalton	Hawley	Montgomery	Rowe	Warwick
Ashfield	Deerfield	Heath	Monson	Russell	Washington
Becket	Easthampton	Hinsdale	Mount Washington	Sandisfield	Wendell
Belchertown	East Longmeadow	Holland	New Ashford	Savoy	Westfield
Bernardston	Egremont	Holyoke	New Marlborough	Sheffield	Westhampton
Blandford	Erving	Huntington	New Salem	Shelburne	West Springfield
Brimfield	Florida	Lanesborough	North Adams	Shutesbury	West Stockbridge
Buckland	Gill	Lee	Northampton	Southampton	Whately
Charlemont	Goshen	Lenox	Northfield	South Hadley	Wilbraham
Cheshire	Granby	Leverett	Orange	Southwick	Williamsburg
Chester	Granville	Leyden	Otis	Springfield	Williamstown
Chesterfield	Great Barrington	Longmeadow	Palmer	Stockbridge	Windsor
Chicopee	Greenfield	Ludlow	Pelham	Sunderland	Worthington
Clarksburg	Hadley	Middlefield	Peru	Tolland	

DEP Central Region
627 Main Street
Worcester, MA 01605
Phone: 508-792-7650
Fax: 508-792-7621
TDD: 508-767-2788

Acton	Charlton	Hopkinton	Millbury	Rutland	Uxbridge
Ashburnham	Clinton	Hubbardston	Millville	Shirley	Warren
Ashby	Douglas	Hudson	New Braintree	Shrewsbury	Webster
Athol	Dudley	Holliston	Northborough	Southborough	Westborough
Auburn	Dunstable	Lancaster	Northbridge	Southbridge	West Boylston
Ayer	East Brookfield	Leicester	North Brookfield	Spencer	West Brookfield
Barre	Fitchburg	Leominster	Oakham	Sterling	Westford
Bellingham	Gardner	Littleton	Oxford	Stow	Westminster
Berlin	Grafton	Lunenburg	Paxton	Sturbridge	Winchendon
Blackstone	Groton	Marlborough	Pepperell	Sutton	Worcester
Bolton	Harvard	Maynard	Petersham	Templeton	
Boxborough	Hardwick	Medway	Phillipston	Townsend	
Boylston	Holden	Mendon	Princeton	Tyngsborough	
Brookfield	Hopedale	Milford	Royalston	Upton	

DEP Southeast Region
20 Riverside Drive
Lakeville, MA 02347
Phone: 508-946-2700
Fax: 508-947-6557
TDD: 508-946-2795

Abington	Dartmouth	Freetown	Mattapoisett	Provincetown	Tisbury
Acushnet	Dennis	Gay Head	Middleborough	Raynham	Truro
Attleboro	Dighton	Gosnold	Nantucket	Rehoboth	Wareham
Avon	Duxbury	Halifax	NewBedford	Rochester	Wellfleet
Barnstable	Eastham	Hanover	North Attleborough	Rockland	West Bridgewater
Berkley	East Bridgewater	Hanson	Norton	Sandwich	Westport
Bourne	Easton	Harwich	Norwell	Scituate	West Tisbury
Brewster	Edgartown	Kingston	Oak Bluffs	Seekonk	Whitman
Bridgewater	Fairhaven	Lakeville	Orleans	Sharon	Wrentham
Brockton	Fall River	Mansfield	Pembroke	Somerset	Yarmouth
Carver	Falmouth	Marion	Plainville	Stoughton	
Chatham	Foxborough	Marshfield	Plymouth	Swansea	
Chilmark	Franklin	Mashpee	Plympton	Taunton	

DEP Northeast Region
205 Lowell Street
Wilmington, MA 01887
Phone: 978-661-7600
Fax: 978-661-7615
TDD: 978-661-7679

Amesbury	Chelmsford	Hingham	Merrimac	Quincy	Wakefield
Andover	Chelsea	Holbrook	Methuen	Randolph	Walpole
Arlington	Cohasset	Hull	Middleton	Reading	Waltham
Ashland	Concord	Ipswich	Millis	Revere	Watertown
Bedford	Danvers	Lawrence	Milton	Rockport	Wayland
Belmont	Dedham	Lexington	Nahant	Rowley	Wellesley
Beverly	Dover	Lincoln	Natick	Salem	Wenham
Billerica	Dracut	Lowell	Needham	Salisbury	West Newbury
Boston	Essex	Lynn	Newbury	Saugus	Weston
Boxford	Everett	Lynnfield	Newburyport	Sherborn	Westwood
Braintree	Framingham	Malden	Newton	Somerville	Weymouth
Brookline	Georgetown	Manchester-By-The-Sea	Norfolk	Stoneham	Wilmington
Burlington	Gloucester	Marblehead	North Andover	Sudbury	Winchester
Cambridge	Groveland	Medfield	North Reading	Swampscott	Winthrop
Canton	Hamilton	Medford	Norwood	Tewksbury	Woburn
Carlisle	Haverhill	Melrose	Peabody	Topsfield	

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Barnstable	Piping Plover	Threatened	Coastal Beaches	All Towns
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	All Towns
	Northeastern beach tiger beetle	Threatened	Coastal Beaches	Chatham
	Sandplain gerardia	Endangered	Open areas with sandy soils.	Sandwich and Falmouth.
	Northern Red-bellied Cooter	Endangered	Inland Ponds and Rivers	Bourne (north of the Cape Cod Canal)
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Berkshire	Bog Turtle	Threatened	Wetlands	Egremont and Sheffield
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Bristol	Piping Plover	Threatened	Coastal Beaches	Fairhaven, Dartmouth, Westport
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	Fairhaven, New Bedford, Dartmouth, Westport
	Northern Red-bellied Cooter	Endangered	Inland Ponds and Rivers	Taunton
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Dukes	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	All Towns
	Piping Plover	Threatened	Coastal Beaches	All Towns
	Northeastern beach tiger beetle	Threatened	Coastal Beaches	Aquinnah and Chilmark
	Sandplain gerardia	Endangered	Open areas with sandy soils.	West Tisbury
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

Updated 02/05/2016

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Essex	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Gloucester, Essex and Manchester
	Piping Plover	Threatened	Coastal Beaches	Gloucester, Essex, Ipswich, Rowley, Revere, Newbury, Newburyport and Salisbury
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Franklin	Northeastern bulrush	Endangered	Wetlands	Montague, Warwick
	Dwarf wedgemussel	Endangered	Mill River	Whately
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Hampshire	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Hadley
	Puritan tiger beetle	Threatened	Sandy beaches along the Connecticut River	Northampton and Hadley
	Dwarf wedgemussel	Endangered	Rivers and Streams.	Hatfield, Amherst and Northampton
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Hampden	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Southwick
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Middlesex	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Groton
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Nantucket	Piping Plover	Threatened	Coastal Beaches	Nantucket
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	Nantucket
	American burying beetle	Endangered	Upland grassy meadows	Nantucket
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

Updated 02/05/2016

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Plymouth	Piping Plover	Threatened	Coastal Beaches	Scituate, Marshfield, Duxbury, Plymouth, Wareham and Mattapoisett
	Northern Red-bellied Cooter	Endangered	Inland Ponds and Rivers	Kingston, Middleborough, Carver, Plymouth, Bourne, Wareham, Halifax, and Pembroke
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	Plymouth, Marion, Wareham, and Mattapoisett.
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Suffolk	Piping Plover	Threatened	Coastal Beaches	Revere, Winthrop
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Worcester	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Leominster
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

[1]Migratory only, scattered along the coast in small numbers

-Eastern cougar and gray wolf are considered extirpated in Massachusetts.
-Endangered gray wolves are not known to be present in Massachusetts, but dispersing individuals from source populations in Canada may occur statewide.
-Critical habitat for the Northern Red-bellied Cooter is present in Plymouth County.

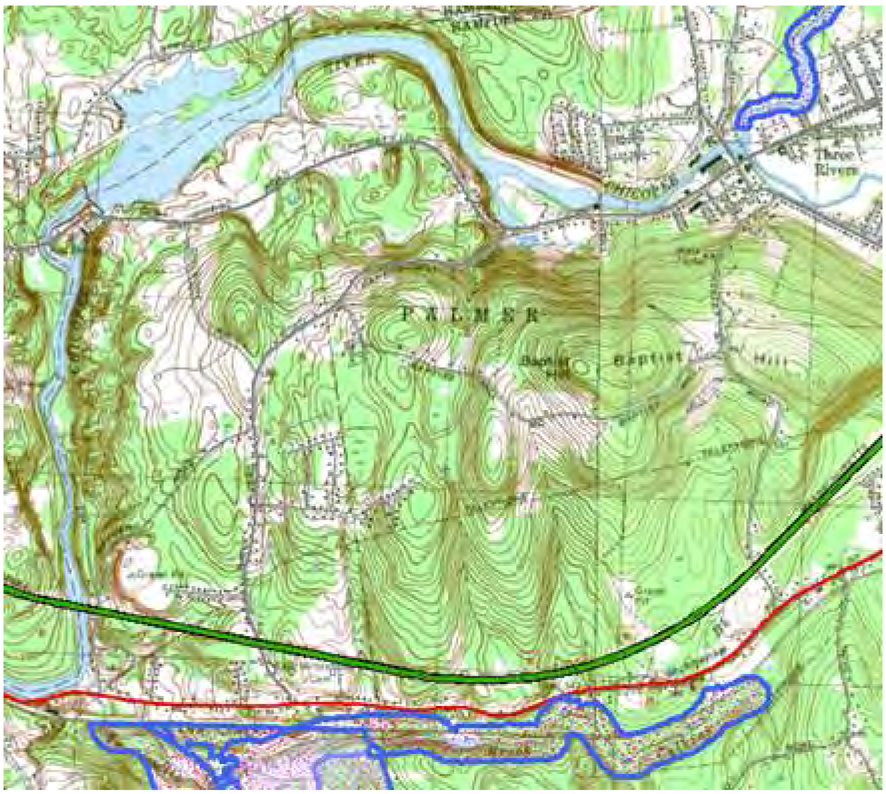
Updated 02/05/2016

William P. Short III

From: Cheeseman, Melany (FWE) <melany.cheeseman@state.ma.us>
Sent: Thursday, May 31, 2018 12:28 PM
To: w.shortiii@verizon.net
Subject: RE: Chicopee River Watershed Water Quality Assessment Report

Bill,

Lauren is out of the office and asked me to respond to your email. Our mapping has been updated since the 2011 information request for the Red Bridge project was sent out. Most of the area around the dam is no longer mapped as Priority Habitat for rare species. There is Priority Habitat upstream and downstream of the project location (the area enclosed by the blue border in the topo map below):



Are you looking for species information this far from the project location? Please let me know. Thank you,

Melany Cheeseman
Endangered Species Review Assistant
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
ph: 508.389.6357 | fax: 508.389.7890
melany.cheeseman@state.ma.us | www.mass.gov/nhesp

From: William P. Short III [mailto:w.shortiii@verizon.net]
Sent: Tuesday, May 29, 2018 11:40 AM

To: Glorioso, Lauren (FWE)
Cc: 'Kevin Telford'; 'Randall Osteen'; 'Matthew Willis'
Subject: Chicopee River Watershed Water Quality Assessment Report

Lauren,

I am working on a LIHI filing for Red Bridge Project.

I am trying to get an update of this letter from NHESP; however, I need that letter sub-divided into three areas –

- the Red Bridge Impoundment;
- the Red Bridge By-pass Reach; and
- the Red Bridge Tailrace to the confluence with the By-pass Reach.

Attached is a similar work that your organization performed for Gardners Falls last year for me.

Can you give me a call to discuss this request?

Bill Short

William P. Short III
Meter Reader
(917) 206-0001 Work
(201) 970-3707 Mobile
w.shortiii@verizon.net
P.O. Box 237173 (Mailing Address)
New York, New York 10023-7173
44 West 62nd Street (Street Address)
New York, New York 10023-7008

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

June 05, 2018

William Short
PO Box 237173
New York NY 10023-7173

RE:	Project Location:	Red Bridge Dam; impoundment, bypass reach, and tailrace
	Town:	LUDLOW, PALMER, WILBRAHAM, BELCHERTOWN
	NHESP Tracking No.:	**11-30159**

To Whom It May Concern:

Thank you for contacting the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for information regarding state-listed rare species in the vicinity of the above referenced site.

Based on the information provided (aerial photographs from Google Earth), the Division has determined that at this time the sites: **Red Bridge Impoundment ZoE, Bypass Reach ZoE, and Tailrace ZoE** are not mapped as Priority or Estimated Habitat. The NHESP database does not contain any state-listed species records in the immediate vicinity of this site.

This evaluation is based on the most recent information available in the Natural Heritage database, which is constantly being expanded and updated through ongoing research and inventory. If you have any questions regarding this letter please contact Lauren Glorioso, Endangered Species Review Assistant, at (508) 389-6361.

Sincerely,

Thomas W. French

Thomas W. French, Ph.D.
Assistant Director

APPENDIX E

Red Bridge Project

Threatened and Endangered Species Protection

There are no threatened or endangered species listed under state or federal Endangered Species Acts present in the Facility area and/or the downstream reach. There are two non-fish species, the wood turtle and stygiandragon, in the vicinity of the Project, of which neither appears to be impacted by the Facility. Both of these species are listed by MDFW as warranting special concern status but not as an endangered or threaten species. (A website link to a list of Massachusetts threatened, endangered or special concern species can be found in the footnote at the end of this Appendix).[1]

In conjunction with the Environmental Assessment prepared by WMECO in connection with its application for an Exemption from Licensing, FWS and various Massachusetts agencies were consulted to determine whether any federally listed or proposed threatened and endangered species under the jurisdiction of MDFW or FWS are known to occur in the project area, with the exception of occasional, transient, individuals, including bald eagles. Neither the FWS nor any Massachusetts agency reported that any known federally listed populations of endangered, threatened or rare vegetative, fish or wildlife species occur in the project area and none were discovered during any field survey.

Currently, the shortnose sturgeon is the only federally listed endangered fish species in Massachusetts. The habitat and distribution of this species does not include the project area. Massachusetts lists several fishes as rare; however, MDFW reported that none of these species occur in headwaters, tributaries or other upstream or immediate downstream areas of the Chicopee River drainage affected by the Red Bridge project.

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[1] The Massachusetts Division of Fisheries and Wildlife maintains a list of threatened, endangered and special concern species on its website at http://www.mass.gov/dfwele/dfw/nhesp/species_info/mesa_list/mesa_list.htm. The following fish species are listed as threatened, endangered or special concern. None appear to be found in the Chicopee River immediate below or above the Red Bridge Project (between Collins Hydro on the Chicopee River, Thorndike Dam on the Ware River and Upper Bondsville Dam on the Swift River, respectively).

Federally Endangered Species	Shortnose Sturgeon (Acipenser brevirostrum)
Massachusetts Endangered Species	Atlantic Sturgeon (Acipenser oxyrinchus) Lake Chub (Couesius plumbeus) Northern Redbelly Dace (Phoxinus eos) Shortnose Sturgeon (Acipenser brevirostrum)
Massachusetts Threatened Species	American Brook Lamprey (Lampetra appendix) Threespine Stickleback (Gasterosteus aculeatus)
Massachusetts Special Concern Species	Eastern Silvery Minnow (Hybognathus regius) Bridle Shiner (Hybognathus regius) Longnose Sucker (Catostomus catostomus) Burbot (Lota lota)

In its letter dated October 26, 2011, MDFW reported that no threaten, endangered or special concern fish species exist in the Facility area and/or its downstream reach.

October 26, 2011

William P. Short III
PO Box 237173
New York NY 10023-7173

RE: Project Location: Red Bridge Dam and Impoundment
Town: LUDLOW, PALMER, WILBRAHAM
NHESP Tracking No.: 11-30159

Dear Mr. Short:

Thank you for contacting the Natural Heritage and Endangered Species Program ("NHESP") of the MA Division of Fisheries & Wildlife for information regarding state-listed rare species in the vicinity of the above referenced site. Based on the information provided, this project site, or a portion thereof, is located **within** *Priority Habitat 674* (PH 674) and *Estimated Habitat 628* (EH 628) as indicated in the *Massachusetts Natural Heritage Atlas* (13th Edition). Our database indicates that the following state-listed rare species have been found in the vicinity of the site:

Scientific name	Common Name	Taxonomic Group	State Status
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern
Neurocordulia yamaskanensis	Stygian Shadowdragon	Dragonfly	Special Concern

The species listed above are protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife are also protected under the state's Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for most state-listed rare species can be found on our website (www.nhesp.org).

Please note that projects and activities located within Priority and/or Estimated Habitat **must** be reviewed by the NHESP for compliance with the state-listed rare species protection provisions of MESA (321 CMR 10.00) and/or the WPA (310 CMR 10.00).

Wetlands Protection Act (WPA)

If the project site is within Estimated Habitat and a Notice of Intent (NOI) is required, then a copy of the NOI must be submitted to the NHESP so that it is received at the same time as the local conservation commission. If the NHESP determines that the proposed project will adversely affect the actual Resource Area habitat of state-protected wildlife, then the proposed project may not be permitted (310 CMR 10.37, 10.58(4)(b) & 10.59). In such a case, the project proponent may request a consultation with the NHESP to discuss potential project design modifications that would avoid adverse effects to rare wildlife habitat.

A streamlined joint MESA/WPA review process is available. When filing a Notice of Intent (NOI), the applicant may file concurrently under the MESA on the same NOI form and qualify for a 30-day streamlined joint review. For a copy of the NOI form, please visit the MA Department of Environmental Protection's website: http://www.mass.gov/dep/water/approvals/wpaform3.doc.

MA Endangered Species Act (MESA)

If the proposed project is located within Priority Habitat and is not exempt from review (see 321 CMR 10.14), then project plans, a fee, and other required materials must be sent to NHESP Regulatory Review to determine whether a probable "take" under the MA Endangered Species Act would occur (321 CMR 10.18). Please note that all proposed and anticipated development must be disclosed, as MESA does not allow project segmentation (321 CMR 10.16). For a MESA filing checklist and additional information please see our website: www.nhesp.org ("Regulatory Review" tab).

We recommend that rare species habitat concerns be addressed during the project design phase prior to submission of a formal MESA filing, as avoidance and minimization of impacts to rare species and their habitats is likely to expedite endangered species regulatory review.

This evaluation is based on the most recent information available in the Natural Heritage database, which is constantly being expanded and updated through ongoing research and inventory. If you have any questions regarding this letter please contact Lauren Glorioso, Endangered Species Review Assistant, at (508) 389-6361.

Sincerely,

Thomas W. French

Thomas W. French, Ph.D.
Assistant Director

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF ENERGY PROJECTS
Division of Dam Safety and Inspections – New York Regional Office
19 West 34th Street – Suite 400
New York, New York 10001

Office No. (212) 273-5900 **FAX No. (212) 631-8124**

In reply refer to:
P-10676-MA
NATDAM# MA00723

Red Bridge Penstock Repair - Preconstruction Filing Response

November 10, 2014

Mr. Nicholas Hollister
Manager – Hydro Operations
EP Energy Massachusetts, LLC
15 Agawam Avenue
West Springfield, MA 01089

Dear Mr. Hollister:

We have reviewed the pre-construction filing for the Red Bridge Penstock Repair Project submitted by Kleinschmidt on October 24, 2014. In order to expedite our response ahead of your planned mobilization for the project during the week of November 10, 2014, we emailed the following comments. Your email responses, which are attached, have adequately addressed these comments.

1. The head loss analysis indicates that the friction factor had been doubled to account for the irregularities in the existing pipe shape, while the analysis for the proposed conditions did not. How will the shotcrete layer, which is to be placed to a uniform thickness of 4 inches +/- ¼ inch, be placed so as to not have a similar effect on head losses in the proposed condition?

2. The notes related to the spacing of shear studs to be installed on details 1 and 2 on Drawing No. 2 conflict with Note 4.C on Drawing No. 2 and in Specification Section 01 1100 Par. 1.1.2 #2. Please confirm the proper spacing of these studs.

   In addition to clarification on the notes, the ACI "Guide to Shotcrete" included in the submittal package suggests that anchor stud spacing should be uniform in both directions (here radially and longitudinally), and minimum spacing should be as follows:

- Floor – 36 inches
- Vertical or Inclined surfaces – 24 inches
- Overhead – 18 inches

Please confirm that spacing detailed on the drawings is adequate.

3. Please justify the 2-foot increase in pressure head as the result of water hammer that was used in the analyses.

4. Please review the weight of soil overburden on the pipe. There appears to be an error in selecting the coefficient for earth loading in a trench, C_d, which results in a significantly underestimated soil load.

Should you have any questions, please contact Ms. Katy Adnams at (212) 273-5921 or by email at Katherine.adnams@ferc.gov.

Sincerely,

Gerald L. Cross, P.E.
Regional Engineer

Attachment: November 7, 2014 Email Correspondence

Katherine Adnams

From:	Jillian Davis <Jillian.Davis@KleinschmidtGroup.com>
Sent:	Friday, November 07, 2014 7:51 AM
To:	Katherine Adnams; nicholas.hollister@essentialpowerllc.com; kim.marsili@essentialpowerllc.com
Cc:	John Spain
Subject:	RE: Red Bridge Penstock Lining
Attachments:	CEII Appendix D of QCIP - Design Drawings - 11-7-14.pdf; CEII Appendix E of QCIP - Technical Specifications 11-7-14.pdf; Attachment 2 - Red Bridge Penstock Design Calculations - CEII - 11-7-14.pdf

Katherine,

Thank-you for letting us know ahead of the formal letter some of your main concerns. I have attached revised Drawings, Technical Specifications, and Calculations which address the concerns that you highlighted below. I have also provided specific answers to each item. Please let me know if any of these responses raise new or additional questions.

Due to the size of the attachments, if you could please confirm receipt of this e-mail, I would appreciate it.

Thank you,

Jillian Davis, P.E.
Structural Engineer
Office: 207.487.3328, Ext. 294
Cell: 207.313.0726
www.KleinschmidtGroup.com

From: Katherine Adnams [mailto:Katherine.Adnams@ferc.gov]
Sent: Thursday, November 06, 2014 11:06 AM
To: nicholas.hollister@essentialpowerllc.com; kim.marsili@essentialpowerllc.com
Cc: Jillian Davis; John Spain
Subject: Red Bridge Penstock Lining

Nick and Kim,

As we just discussed by phone, we have a few design concerns, which I wanted to get to you before your mobilization next week. A formal letter will be coming the beginning of next week. I have included the draft of the main points of the letter below. As I mentioned, the main concerns from an installation perspective are items 2, 3 and 4. Item 1 pertains to capacity for future generation.

1. The head loss analysis indicates that the friction factor had been doubled to account for the irregularities in the existing pipe shape, while the analysis for the proposed conditions did not. How will the shotcrete layer, which is to be placed to a uniform thickness of 4 inches +/- ¼ inch, be placed so as to not have a similar effect on head losses in the proposed condition?

   Kleinschmidt's hydraulic engineer had mistakenly assumed that the shotcrete would be placed in varying thicknesses to re-round the pipe interior. He has updated the calculations for the proposed conditions so that the friction factor is doubled to account for the irregularities in the pipe. Doubling the friction factor resulted in a doubling of the friction head losses from 0.06 feet to 0.12 feet. The total head losses for the proposed conditions increased from 0.40 feet to 0.46 feet. This is 0.03ft more than the existing conditions, a value that EP has expressed as acceptable. Updated Calculations are attached.

2. The notes related to the spacing of shear studs to be installed on details 1 and 2 on Drawing No. 2 conflict with Note 4.C on Drawing No. 2 and in Specification Section 01 1100 Par. 1.1.2 #2. Please confirm the proper spacing of these studs.

   The proper spacing of the studs is as shown in the drawing detail, 36" o.c. longitudinally and 18" o.c. circumferentially. Revised Drawings and Technical Specifications are attached.

   In addition to clarification on the notes, the ACI "Guide to Shotcrete" included in the submittal package suggests that anchor stud spacing should be uniform in both directions (here radially and longitudinally), and minimum spacing should be as follows:

   - Floor – 36 inches
   - Vertical or Inclined surfaces – 24 inches
   - Overhead – 18 inches

   Please confirm that spacing detailed on the drawings is adequate.

   The ACI "Guide to Shotcrete" is a set of recommendations and the shear stud recommendations that you reference are geared more towards surfaces where the rebar is not continuous (like the hoops at Red bridge) from one surface to another. Also, the studs are not considered to add in any way to the structural capacity of the penstocks. The design is for the concrete to be able to fully support the loading conditions without working integrally with the steel. As such, the spacing detailed on the drawings is adequate.

3. Please justify the 2-foot increase in pressure head as the result of water hammer that was used in the analyses.

   The 2-foot increase in water hammer head is a conservative increase to the calculated water hammer on the steel Penstocks 3 and 4 during normal pond conditions for a conservative 3 second unit trip time. The calculated water hammer is 0.74ft. These calcs are included in the revised calculations.

4. Please review the weight of soil overburden on the pipe. There appears to be an error in selecting the coefficient for earth loading in a trench, C_d, which results in a significantly underestimated soil load.

   You are correct, the C_d value should be 0.82 instead of 0.14. This does greatly increase the overburden soil load, but the conservative reinforcement design of the penstocks is adequate as detailed. The attached updated calculations have been revised to support this.

Please don't hesitate to call if you have any questions.
Katy

Katherine E. Adnams, P.E.
Division of Dam Safety Inspections
NYRO
Federal Energy Regulatory Commission
19 West 34th Street - Suite 400
New York, NY 10001
Office: (212) 273-5921
Fax: (212) 631-8124
Katherine.Adnams@ferc.gov

Document Content(s)

APPENDIX F

Red Bridge Project

Cultural Resource Protection

The Facility is in compliance with all requirements regarding cultural resource protection, mitigation or enhancement included in its FERC exemption from license. In view of the results of discovery efforts and the SHPO's determination, the FERC found that the Facility would have no effect on any structure, site, building, district, or object listed in or eligible for listing in the National Register of Historic Places.

Commission staff specifically determined that exempting the proposed project would have no effect on National Register or eligible properties based on the Exemptee proposal to use the existing project works for its historic purpose.[1] Article 11 was included to require the Exemptee to notify the Commission of any property transfers.[2] Commission staff found that no properties of historic significance would be adversely affected by continued use of the project for hydropower as proposed. In addition, the possibility exists that properties could be adversely affected by unforeseen ground-disturbing activities or by project operation not already considered in the Environmental Assessment. For these reasons, Articles 12[3] and 13[4] were included to ensure that

---

[1] In fact, on February 22, 1993, the Project was included in the National Register of Historical Places as part of the Ludlow Village Historic District.

[2] Article 11 states that "In addition to the notification of the Commission required by standard article 9, and within 30 days of transferring any property interests, the exemption holder must inform the Commission's New York Regional Director of the identity and address of the transferee."

[3] Article 12 states that "The Exemptee shall, before undertaking any construction activities at the project that would result in any modification of the existing historic facilities: (1) consult with the State Historic Preservation Officer (SHPO) concerning preliminary design of the new facilities to be constructed at the project to establish specific design criteria consistent with the Secretary of the Interior's "Standards for Rehabilitation; (2) afford the SHPO the opportunity to review preliminary and final design drawings of the new facilities; and (3) file the final design drawings, along with the SHPO's comments on the final design drawings, for Commission approval. The Exemptee shall undertake no construction activities at the project that would result in any modification of the existing historic facilities until informed by the Commission that the final design drawings have been approved."

[4] Article 13 states that "The Exemptee, before starting any land-clearing or land-disturbing activities within the project boundaries, including recreation developments at the project and any construction activities or alterations at or within the historic Red Bridge Generating Station -- other than those land-clearing and land-disturbing activities, and construction activities and alterations at and within the historic Red Bridge Generating Station that are specifically authorized in this license – shall consult with the State Historic Preservation Officer (SHPO).

"If the Exemptee discovers previously unidentified archeological or historic properties during the course of constructing or developing project works or other facilities at the project, the Exemptee shall stop all land-clearing and land-disturbing activities in the vicinity of the properties and consult with the SHPO.

"In either instance, the Exemptee shall file for Commission approval a cultural resource management plan (plan) prepared by a qualified cultural resource specialist after having consulted with the SHPO. The plan shall include the following items: (1) a description of each discovered property indicating whether it is listed on or eligible to be listed on the National Register of Historic Places; (2) a description of the potential effect on each discovered property; (3)

the Exemptee, before engaging in any ground disturbance not already considered in the Environmental Assessment, takes protective measures.

In 1999, the Exemptee proposed to install an automated slide gate at the spillway instead of minimum flow unit powerhouse. The new slide gate would be capable of releasing the required minimum flow from a single point on the spillway during full and low pond conditions. The CEEI indicated in the December 6, 1999 letter that the use of a new slide gate at the spillway is also acceptable to both the FWS and the MDFW.

Articles 12 and 13 of the exemption preclude adverse impacts to historic resources. Article 12 required CEEI to: (1) consult with the State Historic Preservation Officer (SHPO) before undertaking any construction activity that would result in any modification of the project's existing historic facilities; and (2) file, for Commission approval, its final design drawings, including SHPO's comments on these drawings. Article 13 required that CEEI consult with the SHPO and, if necessary, develop and implement a cultural resource management plan before undertaking any project-related construction activity that is not specifically authorized by the 1992 exemption order. Since the proposed automatic slide gate was not authorized by the subject order, CEEI was required to fulfill the measures delineated by Articles 12 and 13 before proceeding with its proposed installation.

Before the construction of the automated slide gate, MHC was consulted for its approval of the installation of the slide gate. With its letter, dated July 2, 2002, MHC consented to the installation of the slide gate and appropriate mitigation. In addition, in its letter September 27, 2011, MHC noted no known deficiencies of the Project.

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proposed measures for avoiding or mitigating effects; (4) documentation of the nature, extent, and results of consultation; and (5) a schedule for mitigating effects and conducting additional studies. The Commission may require changes to the plan.

"The Exemptee shall not begin land-clearing or land-disturbing activities within the project boundaries, including recreation developments at the project and any construction activities or alterations at or within the historic Red Bridge Generating Station complex -- other than those land-clearing and land-disturbing activities, and construction activities and alterations at and within the historic Red Bridge Generating Station complex that are specifically authorized in this license -- or resume such activities in the vicinity of a property, discovered during construction, until informed by the Commission that the requirements of this article have been fulfilled."

ORIGINAL

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OF THE SECRETARY

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FEDERAL ENERGY
REGULATORY COMMISSION

The Commonwealth of Massachusetts

William Francis Galvin, Secretary of the Commonwealth

Massachusetts Historical Commission

July 2, 2002

Project # 10676

Mr. John E. Estep
Division of Hydropower Administration and Compliance
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

RE: Red Bridge Hydroelectric Project (Installation of Minimum Flow Gate), Wilbraham, MA; MHC#4544

Dear Mr. Estep,

Staff at the MHC have reviewed the letter you sent (received June 3, 2002), regarding the proposed project referenced above. As you are aware, the Red Bridge Generating Station is eligible for listing in the National Register of Historic Places. The proposed project involves the installation of a minimum flow gate, which requires the removal of historic dam materials.

The MHC previously determined that the project would have an "adverse effect" on the Red Bridge Generating Station due to the removal of historic materials (36 CFR 800.5(2)(i)). The installation of minimum flow gates was an adverse effect to an historic property because of the removal of historic fabric (36 CFR 800.5(2)(i)). Despite the fact that the proposed mitigation for the adverse effect is photo-documentation completed during a prior project, the project still constitutes an adverse effect. The MHC cannot concur that the project did not have an adverse effect, because the effect was not avoided, as outlined in 36 CFR 800.5(b), but rather mitigated because the adverse effect was unavoidable. The resolution of an "adverse effect" is through a Memorandum of Agreement (MOA), and therefore the MHC proposed photo-documentation because it is a typical mitigation. Although the work has already been completed and the photo-documentation already exists, the MHC is willing to sign the proposed MOA.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800). Please do not hesitate to contact Debra Lavoie at this office should you have any questions.

Sincerely,

Brona Simon

Brona Simon
Deputy State Historic Preservation Officer
Massachusetts Historical Commission

xc: Wilbraham Historical Commission

DOCKETED

220 Morrissey Boulevard, Boston, Massachusetts 02125
(617) 727-8470 • Fax: (617) 727-5128
www.state.ma.us/sec/mhc

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

September 27, 2011

William P. Short III
North American Energy Alliance, LLC
PO Box 2371773
New York, NY 10023-7173

RE: Red Bridge Hydroelectric Project, Wilbraham, MA.
MHC#RC.4544. FERC Project No. 10676-001.

Dear Mr. Short:

Staff at the Massachusetts Historical Commission have reviewed information that you submitted concerning the proposed project referensced above, and the MHC's files.

The Red Bridge Generating Station (WIL.108) is listed in the National Register of Historic Places.

To ascertain the project's compliance with the Federal Energy Regulatory Commission's conditions, the MHC suggests that you contact FERC. The MHC has no further information than the MHC's previous comments noted in your letter.

If any project is proposed at the property the involves new construction, demolition, or modification, then a completed Project Notification Form (available at the MHC website), USGS locus map, and scaled plans showing existing and proposed conditions should be submitted to the MHC.

Sincerely,

Edward Bell
Technical Services Division
Massachusetts Historical Commission

220 Morrissey Boulevard, Boston, Massachusetts 02125
(617) 727-8470 • Fax: (617) 727-5128
www.sec.state.ma.us/mhc

APPENDIX G

Red Bridge Project

Recreation

The Facility is in compliance with the recreational access, accommodation (including recreational flow releases) and facilities conditions in its FERC license. In addition, the facility allows access to the reservoirs and downstream reaches without fees or charges.

The Red Bridge Project is located in a suburban/rural section of western Massachusetts. The major types of recreation at the Project are boating, fishing and hiking.

During the 1970's WMECO developed various recreational facilities in the Red Bridge Project area and then deeded these lands around the impoundment and below the powerhouse (with these recreation facilities) to the Commonwealth of Massachusetts. The facilities consist of a small boat access along the impoundment near the Red Bridge gatehouse, picnic facilities along the impoundment, a hiking trail following an abandoned railroad right-of-way generally paralleling the north shore of the impoundment and a small boat/canoe put-in below the Red Bridge powerhouse tailrace.

These facilities were developed by WMECO as a result of perceived demand at that time. The impoundment was (and still is) very scenic and supported a warmwater fishery. Walking for pleasure and jogging for exercise were then coming into vogue. Waterfowl hunting was popular in the fall, as was ice fishing during the winter. A large population could easily reach this area within a very few minutes of driving time.

At the impoundment, WMECO elected to develop a car-top boat access to allow fishermen, hunters and canoeists, etc. to gain access to the water.[1] A formal boat launch was decided against, based upon the small size of the impoundment periphery available for development. Picnic areas were developed along the impoundment where they would serve a dual usage, i.e., from walkers using the trail system to boaters using the impoundment. Walk-in fishermen, hunters, etc. also used the picnic facilities.

Below the power station, WMECO developed an access road leading to the tailrace area, where another small boat access (not a full-size boat launch) and picnic area were developed. All of these facilities (with the land) were turned over to the Commonwealth of Massachusetts, allowing the commonwealth to then inaugurate a "park" to serve the people in this area.

Although a scenic area, no portions of the Project area or areas affected by the Project have been identified or included in the National Wild and Scenic Rivers in the Nationwide Rivers Inventory. There are no areas along the Project that have been identified under the provisions of the Wilderness Act.

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[1] Subsequently, the Commonwealth of Massachusetts developed a formal boat launch at the impoundment.

In its recent inspection report on the Project, the Commission noted two items that did not meet the requirements of the Project's Exemption from License. First, that the recreational facilities were not being maintained and, second, that lands had been transferred to others without first informing the Commission. On the first matter, the Commission orally and in e-mails stated that its findings were in error and that it had failed to delete from the inspection report the inapplicable portions of an inspection report of a different project when they prepared the Red Bridge inspection report.

On the second matter, the Commission requested a report on the subsequent transfers of recreational lands of the Project to others since it appeared to the inspector that these transfers had recently occurred. In a letter dated March 7, 2011,[2] NAEA informed the Commission that, among other things, these lands were conveyed to the Commonwealth of Massachusetts in 1973, nearly 16 years prior to the application for and 19 years since the issuance of the Exemption from Licensing.

Subsequently, FERC, Essential Power and others reviewed the responsibility for the maintenance of the Commonwealth of Massachusetts upstream boat ramp and downstream car-top boat launch. It was determined that two Commonwealth agencies (Massachusetts Department of Conservation and Recreation and Massachusetts Department of Fish and Game) are responsible for the maintenance of the boat ramp and boat launch while Essential Power is ultimately responsible for maintenance.

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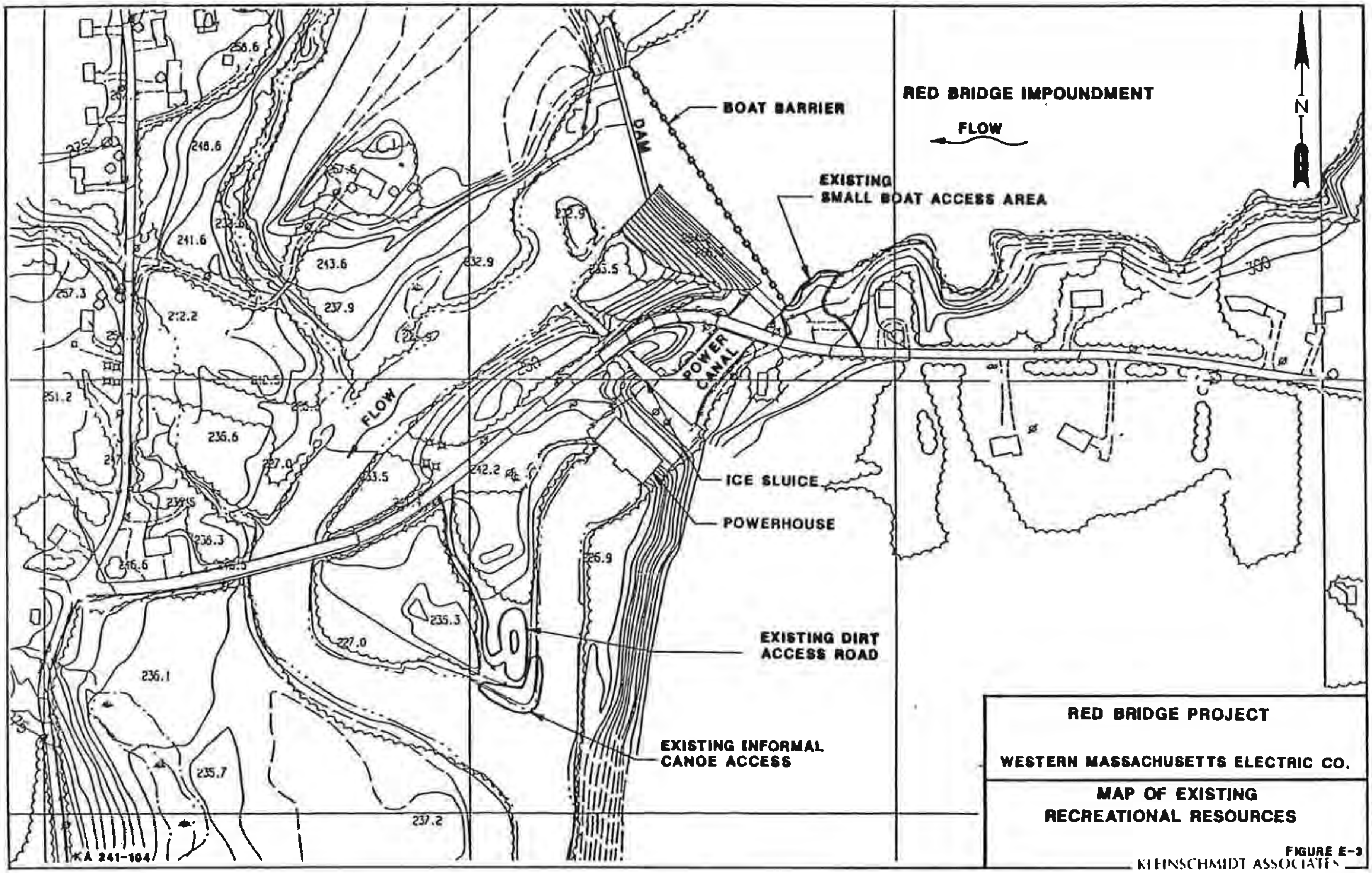
[2] See Appendix G-3, NAEA Letter, dated March 7, 2011, responding to FERC Environmental Inspection Report.



RED BRIDGE PROJECT

WESTERN MASSACHUSETTS ELECTRIC CO.

MAP OF EXISTING RECREATIONAL RESOURCES

FIGURE E-3

KLEINSCHMIDT ASSOCIATES
CONSULTING ENGINEERS

ENVIRONMENTAL INSPECTION REPORT
(ELECTRONICALLY SUBMITTED)
FEDERAL ENERGY REGULATORY COMMISSION

New York Region

Date of Inspection – September 30, 2010

Name Red Bridge **Project No.** 10676-MA

Exemptee Consolidated North American Energy Alliance LLC **Exemption Type** Case Specific

Exemption Issued September 11, 1992 **Expires** N/A

Location Chicopee River (**waterway**) None (**reservation**)

Hampden & Hampshire (**county**) Massachusetts (**state**)

Inspector Joseph Enrico

Licensee Representatives Mr. David Schmidt, Senior Engineer

Other Participants None

Summary of Findings

The inspection of this minor project revealed maintenance of the project's recreational facilities is being done the by State of Massachusetts. The facilities consist of a boat launch and canoe access trail and the lands that they are located on may no longer be within the project. A letter requesting the exemptee address the use and maintenance of this facility was as a result of this inspection on October 19, 2010.

Submitted November 4, 2010

Joseph G. Enrico
Environmental Protection Specialist

A. Inspection Findings

Requirements*	Date of Requirement	Follow-up Needed	Photo Nos.
CULTURAL RESOURCES			
Article 12 requires the Exemptee to consult with the SHPO prior to construction. **C-184**	**O: 9-11-92**	No	
Article 13 requires the Exemptee to consult with the SHPP prior to any land clearing. **C-184**	**O: 9-11-92**	No	
FISH AND WILDLIFE RESOURCES			
Standard Article 2 requires the Exemptee to comply with the terms and conditions specified by state and federal resource agencies:	**O: 9-11-92** USDOI letter 7-31-92 MDFW letter 10-20-89	No	
Minimum flow release of 237 cfs into the bypass reach. **C-089.**	USDOI letter 7-31-92	No	1-2
Construct, operate and maintain upstream and downstream fish passage facilities when requested by the USFWS. **C-020**	**O: 9-11-92** USDOI letter 7-31-92 MDFW letter 10-20-89	No	
Operate the project impoundment with a maximum drawdown of one-foot below crest (272.3' NGVD) from April 1 through June 30 and two-feet from July 1 through March 30, each year. **C-188**	**O: 9-11-92** USDOI letter 7-31-92 MDFW letter 10-20-89	No	
Provide plan for monitoring impoundment level and minimum flow releases. Filed 11-10-94**C-188, 091**	**O: 9-11-92** USDOI letter 7-31-92 MDFW letter 10-20-89	No	
PUBLIC SAFETY			
Facilities and measures to assure public safety, 18CFR. Public safety plan filed 4-24-92. **C-111**	**O: 9-11-92** **Ap:6-17-92**	No	3-6

Requirements*	Date of Requirement	Follow-up Needed	Photo Nos.
RECREATION RESOURCES			
Standard Article 2 requires the Exemptee to comply with the terms and conditions specified by state and federal resource agencies: The Exemptee shall construct and operate a public parking facility and allow access to project waters. **C-118**	**O: 9-11-92** USFWS letter 7-31-92 MDFW letter 10-20-89	Yes	7-10
OTHER ENVIRONMENTAL RESOURCES			
Article 11 required the Exemptee to file a soil erosion and control plan. Filed 6-6-96.	**O: 9-11-92**	No	

O =Order C=OEP-IT Code **18CFR=**Title 18 Code of Federal Regulations, **AP=**Approved **Am-**Amended

Comments and Follow-Up Action

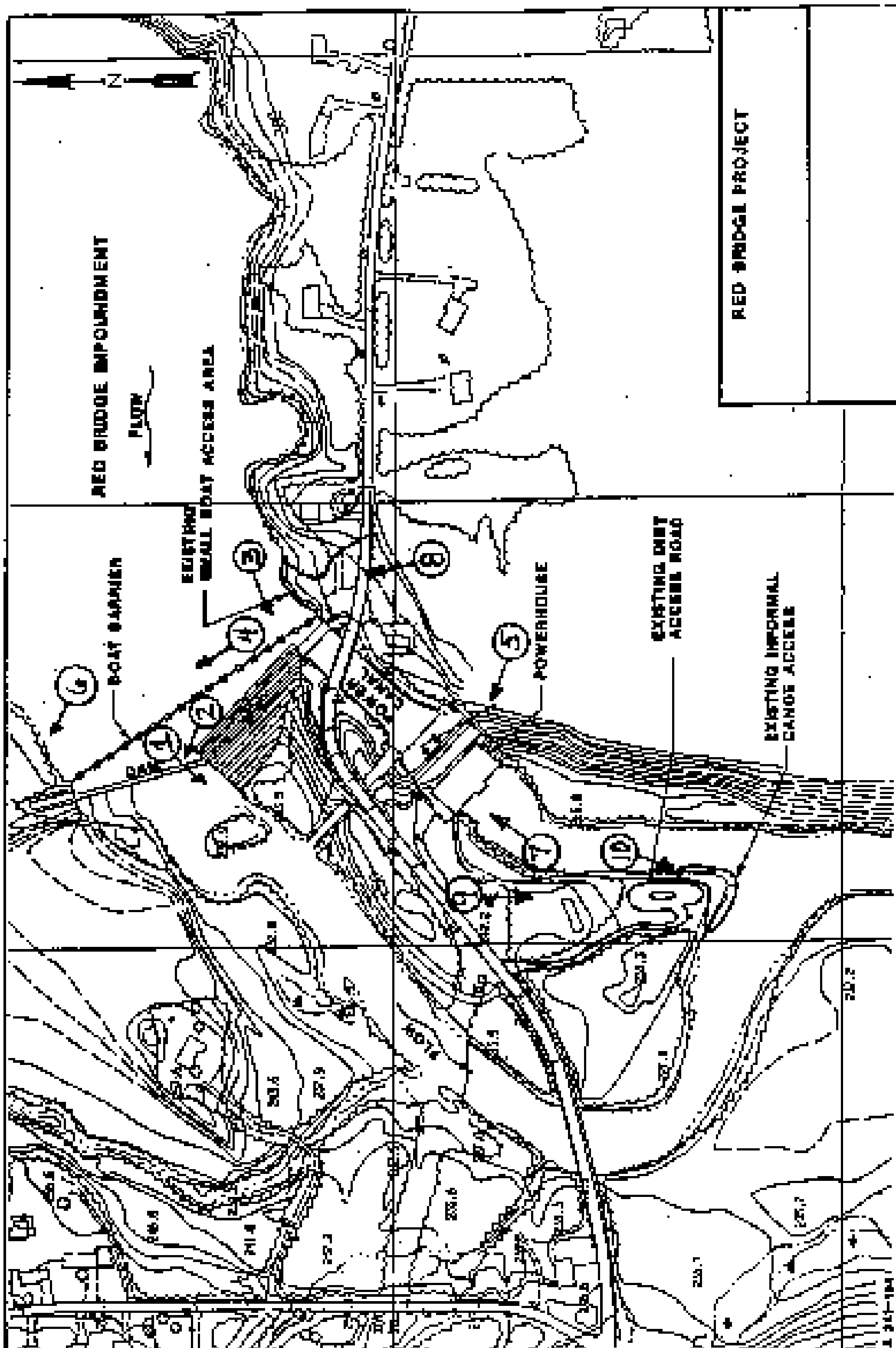
Recreation: The project's recreational facilities consist of a paved boat launch at the reservoir and canoe access/fishermen trail downstream of the powerhouse. Maintenance of the facilities is done by the Massachusetts Department of Environmental Management. A picnic facility and handicap access have not been developed. This was outlined in the exemptee's application for exemption. In addition, the lands that the facilities are located on may no longer be within the project but there is no Commission approval for transfers of any properties. A follow-up letter was sent on October 19, 2010, requesting that the exemptee update its intent to provide the picnic facility and handicap access and provide information as to the extent of project land ownership.

B. Exhibits and Photographs

The following are provided to show the location of the project and to illustrate project features:

- Photograph Location Map and ten photographs.

OEP/DHAC Enrico, J.
NYRO DHAC ELIBRARY ENRICO



P- 10676-MA, Red Bridge Project Photograph Location Map

Photograph No. 1 - Minimum flow release at dam.

Photograph No. 2 - Gate release structure for minimum flow at dam.

Photograph No. 3 - Headgate structure with warning sign. Note camera and fencing (arrow).

Photograph No. 4 - View of upstream boat barrier and warning sign on right bank.

Photograph No. 5 - Perimeter fencing and locking gate at powerhouse.

Photograph No. 6 - View at boat barrier and warning sign (arrow) at right shoreline of impoundment.

Photograph No. 7 - View of tailrace.

Photograph No. 8 - Paved boat launch adjacent to gatehouse maintained by the state of Massachusetts.

Photograph No. 9 - Portion of access and canoe trail maintained by the state.

Photograph No. 10 - Canoe and fishermen access downstream of the project at confluence of tailrace and bypass reach.

Document Content(s)

ORIGINAL

NAEA

NORTH AMERICAN ENERGY ALLIANCE, LLC

FILED
SECRETARY OF THE COMMISSION
2011 MAR 17 A 10: 25
FEDERAL ENERGY REGULATORY COMMISSION

March 7, 2011

Ms. Kimberly Bose
Office of Secretary
FEDERAL ENERGY REGULATORY COMMISSION
888 FIRST Street North East
Washington, DC 20426

Re: FERC Project Nos. 10676, 10677 and 10678
Response to October 19, 2010 letter from Mr. Robert H Grieve to John McTear

Dear Ms. Bose:

This correspondence is in response to Robert H. Grieve's October 19, 2010 letter to Mr. John McTear related to NAEA Energy Massachusetts, LLC's ("NAEA") Red Bridge Project, Putts Bridge Project and Indian Orchard Project. I am responding to Mr. Grieve's letter because Mr. McTear is no longer employed by NAEA or any of its affiliates.

NAEA took ownership of the Red Bridge Project (FERC No. 10676), the Putts Bridge Project (FERC No. 10677) and the Indian Orchard Project (FERC No. 10678) located on the Chicopee River in Western Massachusetts in June of 2008. Mr. Grieve's letter seeks information related to operation and maintenance of recreational facilities located adjacent to each of these Projects. Specifically he asks for additional information regarding the transfer of these recreational facilities to new owners.

The Red Bridge parking area and car-top boat access was transferred to the Commonwealth of Massachusetts on October 2, 1973 as recorded in the Registry of Deeds for Hampden County Book 3901 and Page 128 and Hampshire County Book 1751 and Page 271. This transfer predates NAEA ownership of the Projects. The Commonwealth of Massachusetts maintains the recreation area and boat ramp to the pond area of the Red Bridge Project.

The property in question at the Indian Orchard Project was transferred to the City of Springfield to be used by the City Park and Recreation Department. The transfer of this property was registered on August 23, [2006] in the Registry of Deeds for Hampden County Book 16139 and Page 138. Once again this transfer predates NAEA ownership. The City of Springfield maintains the area and boat ramp access.

15 Agawam Ave West Springfield Massachusetts 01089

Phone: (413)730-4721 • Fax: (413) 730-4769

The car top boat ramp access for the Putt Bridge Project is still owned and maintained by NAEA. NAEA's maintenance plans for 2011 are to replace the existing signage and continue to maintain the grounds for public access.

If you have any questions please contact Kim Marsili at 413-730 4721 or by e-mail at kim.marsili@naeallc.com.

Sincerely, Kim C Marsili

Kim Marsili
Station Manger

cc:

J. Bahrs (NAEA)
C. Lane (NAEA)
R Grieve (FERC)

15 Agawam Ave West Springfield Massachusetts 01089

Phone: (413)730-4721 • Fax: (413) 730-4769

FEDERAL ENERGY REGULATORY COMMISSION
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project Nos. P-10676-018 -- Red Bridge
P-10677-015 -- Putts Bridge
P-10678-018 -- Indian Orchard

NAEA Energy Massachusetts, LLC

NAEA Energy Massachusetts, LLC
c/o Industry Funds Management Times Square Tower
Attn: Mr. Kim Marsili
7 Times Square 25th Floor
New York, NY 10036

OCT 12 2011

Subject: Recreational facility maintenance

Dear Mr. Marsili:

This is in response to your letter filed with the Federal Energy Regulatory Commission on March 17, 2011 providing information regarding recreation access at the above referenced projects. By letter dated October 19, 2010, we requested specific information concerning recreational access as a result of environmental inspections of the projects. During the inspections, it was determined that certain lands where the project's recreational facilities were located, were either sold or transferred and that the maintenance and operation of certain facilities were no longer performed by the exemptee.

Standard article 2 of the Order Issuing Exemptions for the Red Bridge, Putts Bridge and Indian Orchard projects issued on September 11, 1992 requires the exemptee to comply with the mandatory terms and conditions provided by state and federal resource agencies. By letters dated July 31, 1992 and October 20, 1989 the US Department of the Interior (USDOI) and the Massachusetts Division of Fisheries and Wildlife (MADFW) provided conditions for the exemptions. Specifically, the agencies' letters required the installation, operation and maintenance of the following recreational facilities:

1) Red Bridge Project (P-10676) --a parking area and car-top boat access to provide angler access near the powerhouse with signs;

2) Putts Bridge (P-10677) -- a parking area and small boat dock to provide angler access to the impoundment with signs (the environmental inspection report noted a missing picnic area, but no such facility is required at this project); and

3) Indian Orchard (P-10678) -- informal boat access area upstream of the dam with launching and dock facilities, and a foot path along the south shore of the impoundment with picnic tables and signs leading to the area known as Indian Leap. It should be noted that by Commission letter dated July 15, 1999 the relocation of the picnic tables to the area near the boat ramp and removal of the boat dock was found be acceptable.

In your March 17 letter, you state that NAEA owns the lands occupied by the public access facilities at the Putts Bridge Project and maintains these facilities. You added that the existing signage at the Putts Bridge facility will be replaced and the facility will be repaired as needed. You also state that the lands occupied by the facilities at the Red Bridge and Indian Orchard Projects were previously transferred to the Commonwealth of Massachusetts and the City of Springfield, respectively, and that these entities operate and maintain these facilities. You are reminded that, as the exemptee for these projects, you are ultimately responsible for compliance with the exemption order requirements. In this regard, you must ensure that the public access facilities required by the terms and conditions are properly maintained and available for public use, regardless of any arrangements you have made with other entities to provide such facilities.

In conclusion, your March 2011 response adequately addresses the issues we raised in our October letter and completes our review and inspection process. Thank you for your cooperation and if you have any questions regarding this letter, please contact Mr. Joseph Enrico at (212) 273-5917.

Sincerely,

Thomas J. LoVullo

Thomas J. Lovullo
Aquatic Resources Branch
Division of Hydropower Administration
and Compliance

Commonwealth of Massachusetts
Department of Fish and Game

OFFICE OF FISHING AND BOATING ACCESS

1440 Soldiers Field Road, Brighton, MA 02135
Tel. (617)727-1843 **Fax. (617)727-7214**
John P. Sheppard, Director

December 1, 2011

William P. Short
P.O. Box 237173
New York, New York
10023-7173

Dear Mr. Short:

The Massachusetts Department of Fish and Game's (DFG) Office of Fishing and Boating Access (FBA) in conjunction with the Massachusetts Department of Conservation and Recreation (DCR) manage a number of boating and fishing access facilities statewide.

Facilities built on DCR land by FBA or its predecessor are normally managed on a day to day basis by DCR with capital expenses (major repairs and or reconstruction) done by FBA. Facilities on DFG property that are managed by DCR would also be subject to the aforementioned. Facilities on DCR properties, but not built (originally) by the FBA (and carried in the FBA list of boating and fishing sites) would be managed on a day to day basis by DCR with possible assistance from FBA, thru design and permitting services and possible assistance with repairs/reconstruction etc. as determined in each individual case. This is the category that would cover the Red Bridge Landing sites.

We would advise you to contact Mr. John Dwinell, (508-278-5576), DCR District Supervisor (representing the property owner) if you require a more detailed description of the maintenance at these locations.

Please do not hesitate to call if we can be of further assistance.

Sincerely,

John P. Sheppard

John P. Sheppard
Director and Chief Engineer

Cc: John Dwinell, DCR