CRESCENT PROJECT

LIHI APPLICATION

ATTACHMENT B

WATER QUALITY

LITTLEVILLE POWER COMPANY, INC.
A SUBSIDIARY OF ENEL GREEN POWER NORTH AMERICA, INC.

Green Power

Enel Green Power North America, Inc.

One Tech Drive, Suite 220
Andover, Massachusetts USA 01810
T 978 681 1900 F 978 681 7727

Via eFiling

January 16, 2014

Gerald L. Cross, P.E.
Regional Engineer
Federal Energy Regulatory Commission
19 West 34th Street, Suite 400
New York, NY 10001

Re: Texon (Crescent) Hydroelectric Project (FERC No. 2986-MA);
Certification of Minimum Flow Compliance

Dear Mr. Cross:

Based on a review of our operating records I hereby certify that, to the best of my knowledge, the Texon (Crescent) Hydroelectric Project (FERC No. 2986-MA) was operated in compliance with the project's minimum flow requirements during 2012.

Please do not hesitate to contact me at (978) 681-1900, extension 809 if you have any questions concerning this certification.

Sincerely,
Littleville Power Company, Inc.

Kevin M. Webb
Hydro Licensing Manager

cc: J. Schott, LPC
R. Bartlett, LPC

ANTHONY D. CORTESE, Sc. D.
Commissioner

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Water Pollution Control
One Winter Street, Boston 02108

August 11, 1981

Halliwell Associates, Inc.
865 Waterman Avenue
East Providence, Rhode Island 02914

Re: Water Quality Certification
Texon Hydroelectric
Westfield River
Russell

Dear Mr. Ryder:

In response to your request dated July 28, 1981 submitted on behalf of Texon, Inc., this Division has reviewed your application for a license for the operation and maintenance of a hydropower facility located on the Westfield River, Russell. This certification of water quality is directed solely at the operation of the facility and not any work such as dredging or cofferdam construction which is anticipated prior to operation.

In accordance with the provisions of Section 401 of the Federal Water Pollution Control Act as amended (Public Law 95-217), this Division hereby certifies that, based on information and investigations, there is reasonable assurance that the proposed activity will be conducted in a manner which will not violate applicable water quality standards adopted by this Division under authority of Section 27(5) of Chapter 21 of the Massachusetts General Laws, said water quality standards having been filed with the Secretary of State of the Commonwealth on September 15, 1978.

The proposed activity is a run-of-the-river facility with water being returned to the river through a tailrace, no further than fifty feet downstream of the hydroelectric dam. In order to maintain water quality in the vicinity of the facility, a continuous minimum low flow of 22 cubic feet per second must be maintained. This minimum low flow can be passed either through the tailrace or over the dam.

Should any violation of the water quality standards or the terms of this certification occur as a result of the proposed activity, the Division will direct that the condition be corrected. Non-compliance on the part of the permittee will be cause for this Division to recommend the revocation of the permit(s) issued therefor or to take such other action as is authorized by the General Laws of the Commonwealth. This certification does not relieve the applicant of the duty to comply with any other statutes or regulations.

Very truly yours,

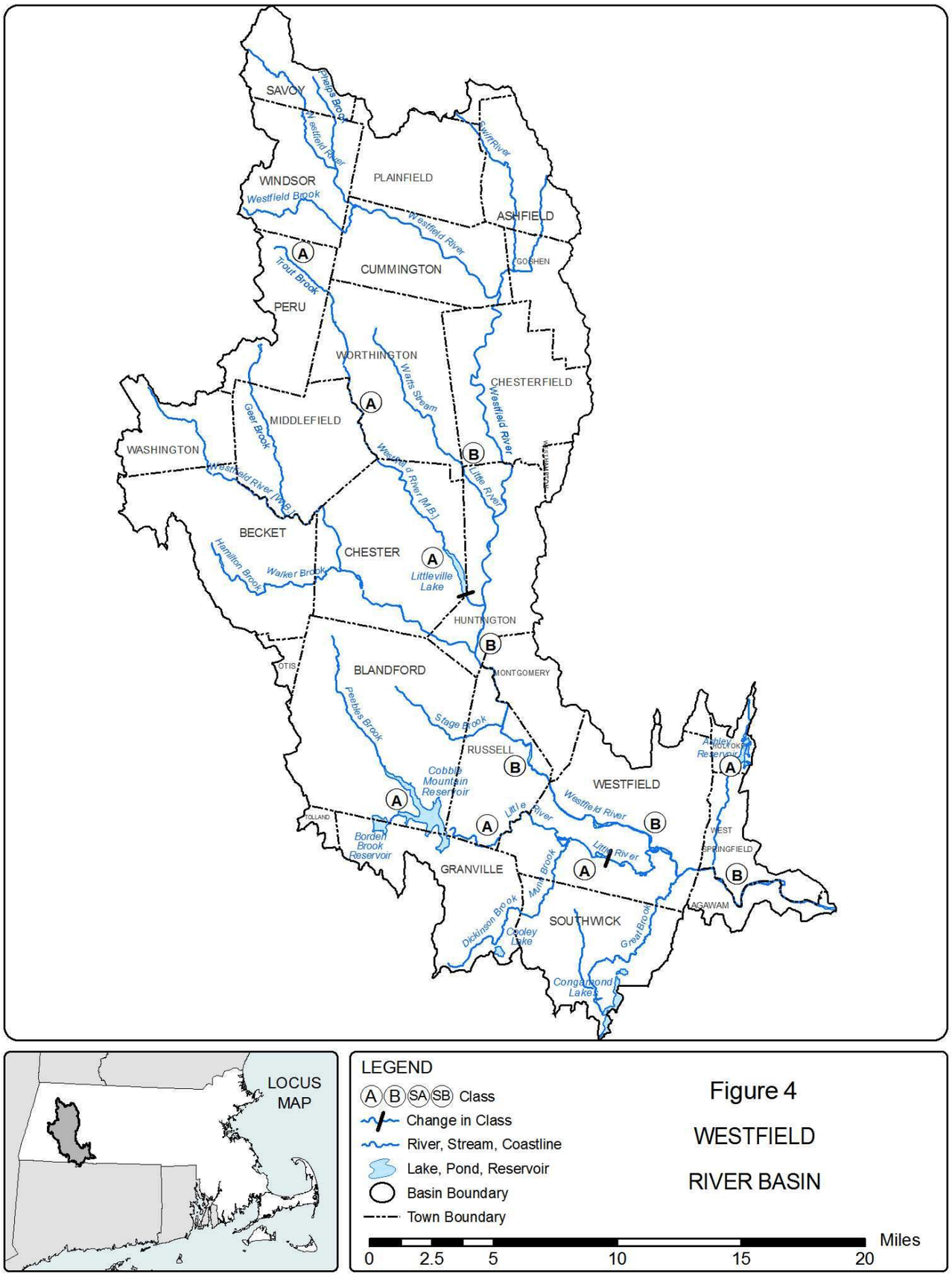
Thomas C. McMahon

Thomas C. McMahon
Director

TCM/RT/wp

cc: Anthony D. Cortese, Sc.D., Commissioner, Department of Environmental Quality Engineering, One Winter Street, Boston 02108
Morgan Rees, Chief, Permits Branch, Corps of Engineers, 424 Trapelo Road, Waltham 02154
John J. Hannon, Director, Division of Land & Water Use, Department of Environmental Quality Engineering, One Winter Street, Boston 02108
Richard Cronin, Director, Division of Fisheries & Wildlife, 100 Cambridge Street, Boston 02202
Kimball Simpson, Division of Water Pollution Control, Westboro 01581
Robert Smart, Energy Facilities Siting Council, 73 Tremont Street, Boston 02108

4.06: continued



Water quality standards for Class B and Class SB waters[1]

Designated Use/Standard	Parameter	Support
Inland waters, Class B, warm water fishery Massachusetts waters, MADEP	Dissolved Oxygen	≥ 5.0 mg/l ≥ 60% saturation unless background conditions lower
	Temperature	≤ 28.3ºC (83ºF)
	pH	6.0 to 8.3 S.U.
Coastal/marine waters, Class SB Massachusetts waters, MADEP	Dissolved Oxygen	≥ 5.0 mg/L ≥ 60% saturation unless background conditions lower
	Temperature	< 26.7ºC (80ºF)
	pH	6.5 to 8.5 S.U.
Primary contact recreation (designated swimming area), EPA and MADPH guidelines and, as of 2007, primary contact recreation, Massachusetts MADEP	*Enterococcus*	Single sample limit 61colonies/100 ml (freshwater), 104 colonies/100 ml (marine); geometric mean 33 colonies/100 ml (freshwater), 35 colonies/100 ml (marine)
Freshwater primary contact recreation (designated swimming area), EPA and MADPH guidelines; and, as of 2007, primary contact recreation, Massachusetts MADEP	*E. coli*	Single sample limit 235 colonies/100 ml (freshwater only); geometric mean 126 colonies/100 ml (freshwater only)
Prior to 2007, primary contact recreation, Massachusetts MADEP	Fecal coliform	Geometric mean ≤ 200 colonies/100 ml, no more than 10% of samples above 400 colonies/100 ml
Restricted shellfishing, Massachusetts MADMF	Fecal coliform	Geometric mean ≤ 88 colonies/100 ml

[1] According to Massachusetts Department of Environmental Protection (MADEP) standards as of January 2007

From MADEP 1996:

Inland Water Class B: These waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

Coastal and Marine Class SB: These waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.

FIGURE 3

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. Box 1518
Concord, New Hampshire 03301

OCT 03 1980

Mr. Todd Cormier
Halliwell Associates, Inc.
589 Warren Avenue
East Providence, Rhode Island 02914

Dear Mr. Cormier:

This responds to your request for our recommendation concerning streamflow regulation at the Texon hydroelectric project (FERC No. 2986). Our streamflow policy for New England recommends that on regulated rivers such as the Westfield, the Aquatic Base Flow (ABF) be 0.5 cubic feet per second per square mile of drainage area above the dam (cfsm). When inflows to the project area fall below 0.5 cfsm, the greater of inflow or 0.2 cfsm should be released. Drainage area at the Texon dam is roughly 329 square miles, which provides a value of 165 cfs for 0.5 cfsm.

While it is our recommendation that the licensee maintain an adequate maintenance streamflow (0.5 cfsm) at the project, it should not be necessary to spill water over the Texon dam to do so. Because the powerhouse is located adjacent to the dam, outflows from the tailrace will adequately cover the substrate below the dam, provided that operation is run-of-the-river. Lack of streamflow over the dam will expose a stretch of riverbed no more than 50 feet long. There would be a negligible loss of habitat in this area, however, as it consists largely of a vertical bedrock outcrop.

The Aquatic Base Flow (0.5 cfsm) should, therefore, be maintained at the tailrace for the Texon project. This should not affect the power production by the project, as proposed operation is run-of-the-river.

We hope this will clarify our recommendation regarding streamflow regulation at the Texon project.

Sincerely yours,

Gordon E. Beckett
Supervisor

FIGURE 13

MEMORANDUM

TO: Alan Cooperman

FROM: Bryant Firmin

DATE: July 30, 1981

SUBJECT: Texon, Inc. Hydroelectric Project

On Monday, July 27, 1981, the writer accompanied by Warren Kimball attended a pre-licensing conference regarding Texon, Inc. Hydroelectric proposal to generate electricity on the Westfield River in the Town of Russell, Massachusetts. The conference consisted of an on-site inspection followed by a formal meeting at the Russell Town Hall. Attached is a short narrative of the proposed project and its development.

With respect to water quality standards being maintained at and below the project site, the writer foresees no adverse impact upon the Class B status of the Westfield River as a result of the Texon project. The facility will be a run-of-the-river operation and the water diverted for power above the dam will be returned to the river via an existing tailrace no farther than fifty (50) feet downstream of the dam. Due to the natural dam features and the angle of the effluent discharge no areas of dry river bed will result. In addition, according to the consulting engineer, Jay Ryder of Halliwell Associates, a minimum of 80 cfs will be necessary to generate power which is nearly four times the $Q_{7,10}$ of 22 cfs at the Texon Dam. With no ponding capabilities, the $Q_{7,10}$ will be maintained at all times.

A minimum of dredging will be conducted in the area of the intake structure. There are no industrial discharges upstream and the river is subject to scour several times a year. The fate of the dredge spoils will be addressed in the final exemption/license application to the Federal Energy Regulatory Commission (FERC). These are expected to be minimal and generally clean.

As a result of the assurances given by Texon and Mr. Ryder as to the maintenance of the $Q_{7,10}$ (i.e. run-of-the-river mode of operation) the writer recommends that the Division's Permits Section issue a Water Quality Certificate upon request from Texon, Inc.

BF/deg

cc: Kimball Simpson
Paul Hogan
Rich Tomczyk, Permits Section

WESTFIELD RIVER WATERSHED

2001 WATER QUALITY ASSESSMENT REPORT

EXCERPTS

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
ELLEN ROY HERTZFELDER, SECRETARY
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
ROBERT W. GOLLEDGE, JR, COMMISSIONER
BUREAU OF RESOURCE PROTECTION
CYNTHIA GILES, ASSISTANT COMMISSIONER
DIVISION OF WATERSHED MANAGEMENT
GLENN HAAS, DIRECTOR

NOTICE OF AVAILABILITY

LIMITED COPIES OF THIS REPORT ARE AVAILABLE AT NO COST BY WRITTEN REQUEST TO:

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATERSHED MANAGEMENT
627 MAIN STREET
WORCESTER, MA 01608

This report is also available from the MA DEP's home page on the World Wide Web at:

http://www.mass.gov/dep/brp/wm/wqassess.htm

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.

- On shelf; retained at the State Library (two copies)
- 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
- Delivered to the University Library at UMass, Amherst
- Delivered to the Library of Congress in Washington, D.C.

Moreover, this wide circulation is augmented by inter-library loans from the above-listed libraries. For example a resident in Chester can apply at their local library for loan of any MA DEP/DWM report from the Worcester Public Library.

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 Division of Watershed Management (DWM) in Worcester.

DISCLAIMER

References to trade names, commercial products, manufacturers, or distributors in this report constituted neither endorsement nor recommendations by the Division of Watershed Management for use.

WESTFIELD RIVER WATERSHED

2001 WATER QUALITY ASSESSMENT REPORT

Prepared by:

William Dunn and Laurie Kennedy

Department of Environmental Protection
Division of Watershed Management

Report Number:

32-AC-1

DWM Control Number:

CN 090.0

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

April 2005

ACKNOWLEDGEMENTS

The Massachusetts Watershed Approach is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed. Data and information used in this report were provided in part by the following agencies and organizations:

State

- Department of Environmental Protection (MA DEP)
  - Bureau of Strategic Policy and Technology Wall Experiment Station (WES)
  - Bureau of Resource Protection (BRP)
    - Division of Watershed Management (DWM)
    - Drinking Water Program (DWP)
  - Bureau of Waste Prevention (BWP)
  - Bureau of Waste Site Cleanup (BWSC)
  - Office of Research and Standards (ORS)
  - Western Regional Office (WERO)
- Department of Public Health (MA DPH)
- Department of Fish and Game (MA DFG) (formerly the Department of Fisheries, Wildlife and Environmental Law Enforcement)
  - Division of Fisheries and Wildlife (MDFW)
- Department of Conservation and Recreation (MA DCR) (formerly the Department of Environmental Management)
- Executive Office of Environmental Affairs (EOEA), Westfield Watershed Team

Federal

- United States Environmental Protection Agency (EPA)
- United States Geological Survey (USGS)
  - Water Resources Division
- United States Army Corps of Engineers (ACOE)
- Federal Energy Regulatory Commission (FERC)
- United States Fish & Wildlife Service (USFWS)
- National Park Service (NPS)

Regional

- Lower Pioneer Valley Regional Planning Commission
- Westfield River Watershed Association/ Westfield Wild and Scenic Advisory Committee
- Westfield State College
- Trout Unlimited, Pioneer Valley Chapter
- Citizens Restoring Congamond Lakes, Inc

It is impossible to thank everyone who contributed to the assessment report process: field, laboratory, data management, writing, editing, and graphics, as well as meetings, phone calls, and many e-mails. All of these contributions are very much appreciated.

Cover photo: Westfield River in Russell, Massachusetts
Photo credit: Alan Wynn, EOEA

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LIST OF ACRONYMS

7Q10.....seven day, ten year low flow
ACEC .....Area of Critical Environmental Concern
ACO.....Adminstrative Consent Order
ACOE .....Army Corps of Engineers (United States)
ADB .....assessment database
BMP.....best management practice
BOH.....Board of Health
BPJ.....best professional judgment
BRP .....Bureau of Resource Protection
BWP .....Bureau of Waste Prevention
BWSC .....Bureau of Waste Site Cleanup
CMR .....Code of Massachusetts Regulations
CNOEC .....chronic no observed effect concentration
CSO.....combined sewer overflow
CVP .....certified vernal pool
CWA..... Clean Water Act
DDT..... dichlorodiphenyltrichloroethane
DMF ..... Division of Marine Fisheries
DMR .....discharge monitoring report
DSI .....Decorative Specialties International
DO .....dissolved oxygen
DWM .....Division of Watershed Management
EOEA .....Executive Office of Environmental Affairs
EPA .....United States Environmental Protection Agency
EPT .....Ephemeroptera, Plecoptera, and Trichoptera
ESS .....Environmental Science Services
FERC .....Federal Energy Regulatory Commission
LC_{50} .....lethal concentration to 50% of the test organisms
L-EL.....low effect level
MA DCR .....Massachusetts Department of Conservation and Recreation
MA DEM.....Massachusetts Department of Environmental Management (now the Department of Conservation and Recreation)
MA DEP .....Massachusetts Department of Environmental Protection
MA DFG .....Massachusetts Department of Fish and Game
MDFW .....Massachusetts Division of Fisheries and Wildlife
MA DPH .....Massachusetts Department of Public Health
MassGIS .....Massachusetts Geographic Information System
MPN .....most probable number
NAS/NAE ... National Academy of Sciences/National Academy of Engineers
NAWQA.....National Water-Quality Assessment
NPDES.....National Pollutant Discharge Elimination System
ORS.....Office of Research and Standards
ORW .....Outstanding Resource Water
PAH.....Polycyclic aromatic hydrocarbons
PALIS .....Pond and Lake Information System
PCB.....polychlorinated biphenyls
POTW .....Publicly Owned Treatment Works
QA/QC.....quality assurance/ quality control
RBP.....rapid bioassessment protocol
S-EL .....severe effect level
SWPPP .....Stormwater pollution prevention plan
SWQS .....Surface Water Quality Standards
TMDL .....total maximum daily load
TNTC.....too numerous to count
TOXTD .....MA DEP DWM Toxicity Testing Database
TOC.....total organic carbon
TRC.....total residual chlorine
USFWS .....United States Fish & 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
kW .....kilowatt
kWh .....kilowatt hour
MGD.....million gallons per day
mg/L .....milligram per liter
ng .....nanograms
NTU.....nephelometric turbidity units
ppb .....parts per billion
ppm .....parts per million
SU ..... standard units
TEQ/kg .....toxic equivalents per kilogram
µg/kg .....microgram per kilogram
µS/cm.....microsiemens per centimeter

WESTFIELD RIVER WATERSHED DESCRIPTION AND CLASSIFICATION

WESTFIELD RIVER WATERSHED DESCRIPTION

The Westfield River Watershed drains 517 square miles from the eastern Berkshires to the Connecticut River (Figure 6). The mainstem (the upper portion sometimes referred to as the East Branch) originates in the high country of Savoy and Windsor and flows 27 miles in a southeasterly direction, where it joins the Connecticut River. The Middle Branch Westfield River begins in Peru and forms the border between Worthington and Middlefield before flowing through Chester to join the mainstem in the town of Huntington. The West Branch Westfield River, formed by the confluence of Depot and Yokum Brooks in Becket flows easterly, also meeting the mainstem in Huntington. There are a total of 850 miles of rivers, streams, and brooks and 4,200 acres of lakes and ponds in the watershed.

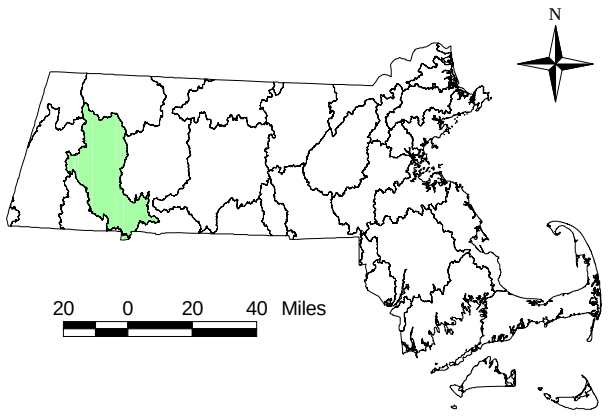


Figure 6. Location of the Westfield River Watershed

The National Park Service has designated approximately forty-three miles of the Westfield River as "Wild and Scenic". Included in this first-ever Wild and Scenic designation for a Massachusetts river are parts of the Main, Middle and West Branches.

The Westfield River Watershed is bordered by the Deerfield, Hoosic, Housatonic, Farmington and Connecticut River watersheds and is contained almost entirely within Massachusetts. The watershed covers all or a part of twenty-eight municipalities: Agawam, Ashfield, Becket, Blandford, Chester, Chesterfield, Cummington, Goshen, Granville, Hawley, Holyoke, Huntington, Middlefield, Montgomery, Otis, Peru, Plainfield, Russell, Savoy, Southampton, Southwick, Tolland, Washington, Westhampton, Westfield, West Springfield, Windsor, and Worthington.

Because the headwaters originate in mountains with little soil to retain water the Westfield River rises quickly in response to large storms and snowmelt. After those flows subside little water is left for base flows. Consequently, the river naturally fluctuates between high and low flows. Both the mainstem Westfield River and the Middle Branch Westfield River have U.S. Army Corps of Engineer dams to alleviate some of the danger of flooding. Several water supply reservoirs capture spring runoff, storing it for use throughout the year. Cobble Mountain in Blandford, Littleville in Huntington, and Bearhole in Westfield are the largest reservoirs. The lower reaches of the Westfield River flow through a broad valley filled with stratified drift, forming the Barnes Aquifer, a major groundwater resource that stretches from Holyoke to Southwick.

The upper portion of the watershed is rural. Timber harvesting and agricultural activities dominate the landuse. The lower portion of the watershed is more developed and includes the heavily urbanized areas of Agawam, West Springfield, and Westfield.

The Westfield River Watershed supplies surface water to seven public water supply systems (12 withdrawal sites) and three industrial users (four withdrawal sites) and groundwater to four of the seven municipal supply systems.

During the settlement of the watershed hydropower, available from the Westfield River, and an abundance of raw materials fueled industrial development. The major historic mill sites are still industrial sites even though hydropower has diminished in importance. In the past, sewage and industrial discharges greatly impacted the water and habitat quality of the lower mainstem Westfield River.

The Westfield River Watershed is divided into 35 segments, with sub-basins ranging in size from 0.3 to 516 square miles (with an average of 66 square miles). The impervious cover for these sub-basins was calculated into one of three impact categories as defined below. Only one sub-basin segment was classified as a moderate threat (impacted stream) to water quality: White Brook, MA32-28. All 34 other sub-basin segments were classified as low potential impact (sensitive stream) to water quality.

Research has indicated a strong correlation exists between percent impervious cover and water quality (Center for Watershed Protection 1998). Impervious cover influences streams by increasing surface runoff during storm events. In natural settings, very little annual rainfall is converted to runoff and about half is infiltrated into the ground and water table. This water is filtered by the soils and serves to supply aquifers and adjacent surface waters with clean water during dry periods. In urbanized areas less annual rainfall infiltrates and more volume is converted to runoff. The volume of runoff becomes greater and occurs more frequently and at higher magnitudes. As a result less water is available to streams during dry periods and more flow occurs during storms. Impervious cover can be a very useful indicator with which to measure the impacts of land development on aquatic systems. It can also serve as an indicator of potential problems in a watershed. The Rapid Watershed Planning Handbook (Center for Watershed Protection 1998) has defined the following three impact categories based on the percentage of impervious cover.

Water Quality	Impervious Cover	Description
Sensitive Stream	0-10%	❖ High habitat/water quality rating characterized by stable channels and good habitat structure with diverse communities of fish and aquatic insects. ❖ Hydrologic regime is consistent with natural conditions. ❖ Species sensitive to pollution are within normal abundance ranges.
Impacted Stream	11-25%	❖ Some decline in habitat and water quality is evident. ❖ Erosion and stream channel widening become evident. ❖ Sensitive fish and aquatic insects begin to drop in overall numbers. ❖ Water quality is classified as fair or good.
Nonsupporting Stream	Exceeds 25%	❖ Stream channels become highly unstable, severe widening occurs. Down-cutting and streambank erosion are chronic problems. ❖ Biological quality is relatively poor with only pollutant tolerant species existing within its reaches. ❖ Water quality is considered fair to poor. ❖ Not a candidate for stream restoration

WESTFIELD RIVER WATERSHED CLASSIFICATION

Consistent with the National Goal Uses of "fishable and swimmable waters", the classification of waters in the Wesfield River Watershed according to the Massachusetts Surface Water Quality Standards (SWQS) include the following (MA DEP 1996a).

Class A Waters
These waters are designated as a source of public water supply. To the extent compatible with its use they shall be an excellent habitat for fish, other aquatic life and wildlife, and suitable for primary and secondary contact recreation. These waters shall have excellent aesthetic value. All Class A waters are designated for protection as ORWs under 314 CMR 4.04(3) (Rojko *et al.* 1995).

In the Westfield River Watershed, the following waterbodies are classified as A.
- *Middle Branch Westfield River,* source in Peru to the Littleville Dam in Huntington
- *Long Pond (Tucker Healy Pond, Lincoln Pond),* source to outlet in Blandford and those tributaries thereto
- *Unnamed Reservoir (Austin Brook Reservoir),* source to outlet in Chester and those tributaries thereto
- *Horn Pond,* Source to outlet in Becket and those tributaries thereto
- *Huntington Reservoir (Cold Brook Reservoir),* source to outlet in Huntington and those tributaries thereto
- *Russell Reservoir,* source to outlet in Russell and those tributaries thereto
- *Bearhole Reservoir (Prudy's Pond),* source to outlet in West Springfield and those tributaries thereto
- *Granville Reservoir,* source to outlet in Granville and those tributaries thereto
- *Cobble Mountain Reservoir,* source to outlet in Blandford and those tributaries thereto

- *Ashley Pond (Wrights Pond, Cedar Reservoir),* source to outlet and those tributaries thereto in Holyoke
- *McLean Reservoir,* source to outlet in Holyoke and those tributaries thereto
- *Wright Pond,* source to outlet in Holyoke and those tributaries thereto
- *Unnamed Reservoir (Black Brook Reservoir),* Reservoir to outlet in Blandford and those tributaries thereto

It should also be noted that MA DEP's Division of Water Supply has recommended that the Little River, and its tributaries, from the source at outlet of Cobble Mountain Reservoir Dam in Russell to a dam northwest of Gorge Road, Russell be reclassified from Class B to a Class A public water supply waterbody in the next revision of the SWQS.

The designation of ORW is applied to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools (CVP), all designated Class A Public Water Supplies, and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern (ACEC) and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area. In the Westfield River Watershed one ACEC has been designated in the western edge of the watershed – The Hindsdale Flats Watershed in Dalton, Hinsdale, Peru, and Washington (MA DCR 2003a). Officially designated as an ACEC on 31 January 1992, it encompasses approximately 14,500 acres and is bordered by the Appalachian National Scenic Trail on its western edge. The following is excerpted from the MA DCR website (MA DCR 2003a).

> The Hinsdale Flats Watershed ACEC covers approximately 14,500 acres and is located at the headwaters of the East Branch of the Housatonic River in four communities in central Berkshire County. The ACEC is generally defined by several watershed subbasins that contribute to the northward-flowing headwaters of the East Branch of the Housatonic above the Old Grist Mill Dam in the town of Hinsdale. Beginning in the town of Washington, the East Branch flows through extensive wetlands and floodplains known as the Hinsdale Flats. Tributary streams flow into the Flats and East Branch from higher elevations and ridges to the east, west, and south. The Appalachian National Scenic Trail forms the western boundary of the ACEC. The unique topography and contrasting land forms provide scenic vistas of the lowlands of the Flats and the predominantly wooded uplands that surround it. Open fields and farmlands, extensive forestlands, and historic and archaeological resources are integral parts of the ACEC. The excellent water quality of the East Branch and its tributaries, the wetlands and floodplains of the Hinsdale Flats, and the surrounding uplands support an outstanding variety of natural communities and wildlife, including six state-listed rare species.

Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. Vernal pool habitat is extremely important to a variety of wildlife species including some amphibians that breed exclusively in vernal pools, and other organisms such as fairy shrimp, which spend their entire life cycles confined to vernal pool habitat. Many additional wildlife species utilize vernal pools for breeding, feeding and other important functions. Certified vernal pools are protected if they fall under the jurisdiction of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00). Certified vernal pools are also afforded protection under the state Surface Water Quality Standards, the state Water Quality Certification regulations (401 Program), the state Title 5 regulations, and the Forest Cutting Practices Act regulations. However, the certification of a pool only establishes that it functions biologically as a vernal pool. Certification does not determine that the pool is within a resource area protected by the Wetlands Protection Act (NHESP 1999). Currently 53 vernal pools have received full certification in the Westfield River Watershed (Harding 2003). These are located in the towns of Agawam, Becket, Cummington, Holyoke, Huntington, Southwick, Westfield, and West Springfield. Additional information is available from the Natural Heritage and Endangered Species Program Website: http://www.mass.gov/dfwele/dfw/nhesp/nhesp.htm

Class B Waters

These waters are designated as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

In the Westfield River Watershed, the following waterbodies are classified as B Cold Water Fisheries.

- *Westfield River*, source to confluence with Middle Branch Westfield River (this reach is sometimes referred to as the East Branch Westfield River)
- *West Branch Westfield River*, source to confluence with Westfield River

In the Westfield River Watershed, the following waterbodies are classified as B Warm Water Fisheries.

- *Middle Branch Westfield River*, Littleville Dam to confluence with the Westfield River
- *Westfield River*, from confluence with Middle Branch Westfield River to confluence with Connecticut River
- *Little River*, Cobble Mountain Reservoir Dam to confluence with Westfield River
  (Note: The MA DEP/Division of Water Supply has recommended that the Little River and its tributaries from the Cobble Mountain Reservoir Dam, Russell to a dam northwest of Gorge Road, Russell be reclassified from Class B to a Class A public water supply waterbody in the next revision of the SWQS.)

Unlisted waters in the Westfield River Watershed not otherwise designated in the SWQS are designated *Class B, High Quality Waters* for inland waters. According to the SWQS where fisheries designations are necessary they shall be made on a case-by-case basis. The Massachusetts Department of Fish and Game has recommended that an additional 55 rivers in the Westfield River Watershed be reclassified as Cold Water Fisheries in the next revision of the SWQS.

SUMMARY OF HISTORICAL CONDITIONS AND PERCEIVED PROBLEMS

Many improvements in water quality conditions in the Westfield River Watershed have occurred over the past 30 years with the abatement of point sources of pollution (MA DEQE 1986 and MA DEP 1990). The 1970's saw construction upgrades to secondary treatment levels of domestic sewage in the towns of Huntington, Russell, and Westfield. Additionally, wastewater treatment facilities were constructed and began operation at four major paper companies and one metal finishing industry. The 1990's revealed even more change including: the closing of most of the paper industries and the metal finishing industry, as well as the continued upgrades and expansion of the three municipal sewage treatment facilities, and the construction upgrade and removal of all the Combined Sewer Overflow discharges in Westfield, Agawam and West Springfield. According to the Commonwealth of Massachusetts Summary of Water Quality 1992, Appendix I: Basin/Segment Information, water quality impairment in the Westfield River Watershed was due primarily to the presence of bacteria as measured by elevated fecal coliform levels (MA DEP 1993). Sources of these contaminants when known included urban runoff, onsite wastewater systems, municipal point sources, and combined sewer overflows. The present decade is witnessing a further upgrade and expansion of capacity at the Westfield WWTP. All of these 1990 to present events should lead to a substantial improvement in overall water quality on the mainstem Westfield River from its confluence with the Middle Branch Westfield River in Huntington to its confluence with the Connecticut River in West Springfield/Agawam.

There are an estimated 112 dams in the Westfield River Watershed (Pietrzak 2004). Included in this list are the two Army Corps of Engineers (ACOE) facilities (Knightville Dam and Littleville Lake Dam), two Federal Energy Regulatory Commission (FERC) facilities (Woronoco and Decorative Specialties International (DSI) West Springfield) and one FERC exempt hydro-generating facility (Texon, USA).

The USGS, as part of their National Water Quality Assessment (NAWQA) Program in the Connecticut, Housatonic, and Thames River Basins Study Unit, conducted water quality sampling in the Connecticut River Basin between 1992 and 1995. In the Westfield River Watershed, sampling was conducted on 27 June 1994 as part of the NAWQA program to detect concentrations of pesticides in the water column at one site on the Westfield River near Westfield MA (USGS Station # 01183500) (Zimmerman 1999).

Within the last decade, the northeastern United States has been identified as receiving elevated rates of mercury deposition from the atmosphere and high levels of mercury contamination in non-commercial freshwater fish (Tatsutani 1998). Mercury is a trace metal that exists in the earth's crust. It is a toxicant that, once mobilized in the environment, can be transformed into methylmercury, a particularly toxic form that can bioaccumulate. Most of the mercury contamination in the northeastern United States has been

REPORT FORMAT

RIVERS

The rivers assessed in the Westfield River Watershed are presented in the River Segment Assessment section of this report. The order of river segments follows the Massachusetts Stream Classification Program (Halliwell *et al*. 1982) hierarchy. River segments are organized hydrologically (from most upstream to downstream) and tributary segments follow after the river segment into which they discharge. Each river segment assessment is formatted as follows.

SEGMENT IDENTIFICATION

Name, water body identification number (WBID), location, length, classification.

Sources of information: coding system (waterbody identification number e.g., MA32-01) used by MA DEP to reference the stream segment in databases such as 305(b) and 303(d), the Integrated List of Waters, the Massachusetts SWQS (MA DEP 1996), and other descriptive information.

SEGMENT DESCRIPTION

Major land-use estimates (the top three uses for the segment's subwatershed, excluding "open water", and other descriptive information.

Sources of information: descriptive information from USGS topographical maps, base geographic data from MassGIS, land use statistics from a GIS analysis using the MassGIS land use coverage developed in 1999 at a scale of 1:25,000 (Umass Amherst 1999).

SEGMENT LOCATOR MAP

Subbasin map, major river location, segment origin and termination points, and segment drainage area (gray shaded).

Sources of information: MassGIS data layers (stream segments and quadrangle maps from MassGIS 2001).

2002 INTEGRATED LIST OF WATERS CATEGORY

Category (2 – 5) in which the segment is listed on the 2002 Integrated List of Waters.

Source of information: Massachusetts Year 2002 Integrated List of Waters (MA DEP 2003a).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

Water withdrawal, NPDES wastewater discharge

Sources of information: WMA Database Printout (LeVangie 2002); open NPDES permit files located in the Worcester and Western Regional MA DEP Offices (MA DEP 2001a, Hogan 2004, Keohane 2004, McElroy 2004, and Nietupski 2004a).

USE ASSESSMENT

Aquatic Life, *Fish Consumption*, *Drinking Water* (where applicable – see note below), *Primary Contact*, *Secondary Contact*, and *Aesthetics*.

Sources of information include: MA DEP DWM 1996/1997 and 2001 survey data (Appendix A through G); MA DEP DWM Toxicity Testing Database "TOXTD". The MA DPH Freshwater Fish Consumption Advisory Lists (MA DPH 2001 and MA DPH 2004a) were used to assess the *Fish Consumption Use*. Where other sources of information were used to assess designated uses, citations were included. [Note: Although the *Drinking Water Use* itself was not assessed in this water quality assessment report the Class A waters were identified.]

SUMMARY

Use summary table (uses, status, causes and sources of impairment).

RECOMMENDATIONS

Additional protection, monitoring and implementation needs.

LAKES

The assessed lakes, identified with their Waterbody Identification Code (WBID) numbers, are listed alphabetically in the Lake Assessment section of this report (Table 5). The status of the individual uses is summarized for these lakes. The location, acreage, trophic status, use assessments, and causes of impairment, are then summarized for each individual lake.

WESTFIELD RIVER WATERSHED - RIVER SEGMENT ASSESSMENTS

There are a total of 28 rivers, comprising 35 segments, from the Westfield River Watershed assessed in this report (Figure 8). These include: the Little River (MA32-16, MA32-35, MA32-36, MA32-08); Middle Branch Westfield River (MA32-02, MA32-03); Swift River (MA32-12); West (Falls) Branch (MA32-13); West Branch Westfield River (MA32-01); Westfield River (MA32-04, MA32-05, MA32-06, MA32-07); Bedlam (MA32-33), Bradley (MA32-21), Depot (MA32-17), Dickenson (MA32-34), Glendale (MA32-10), Great (MA32-25), Kinne (MA32-32), Meadow (MA32-11), Miller (MA32-27), Moose Meadow (MA32-23), Paucatuck (MA32-29), Pond (MA32-24), Potash (MA32-22), Powdermill (MA32-09), Roaring (MA32-30), Sanderson (MA32-31), Shaker Mill (MA32-18), Walker (MA32-20), White (MA32-28), and Yokum (MA32-19) brooks; and Watts (MA32-14) and Wards (MA32-15) streams. While these rivers represent only a small number (30%) of the 89 named rivers they account for approximately 50% of the named river miles in the watershed. The remaining rivers are small and/or unnamed and are currently unassessed.

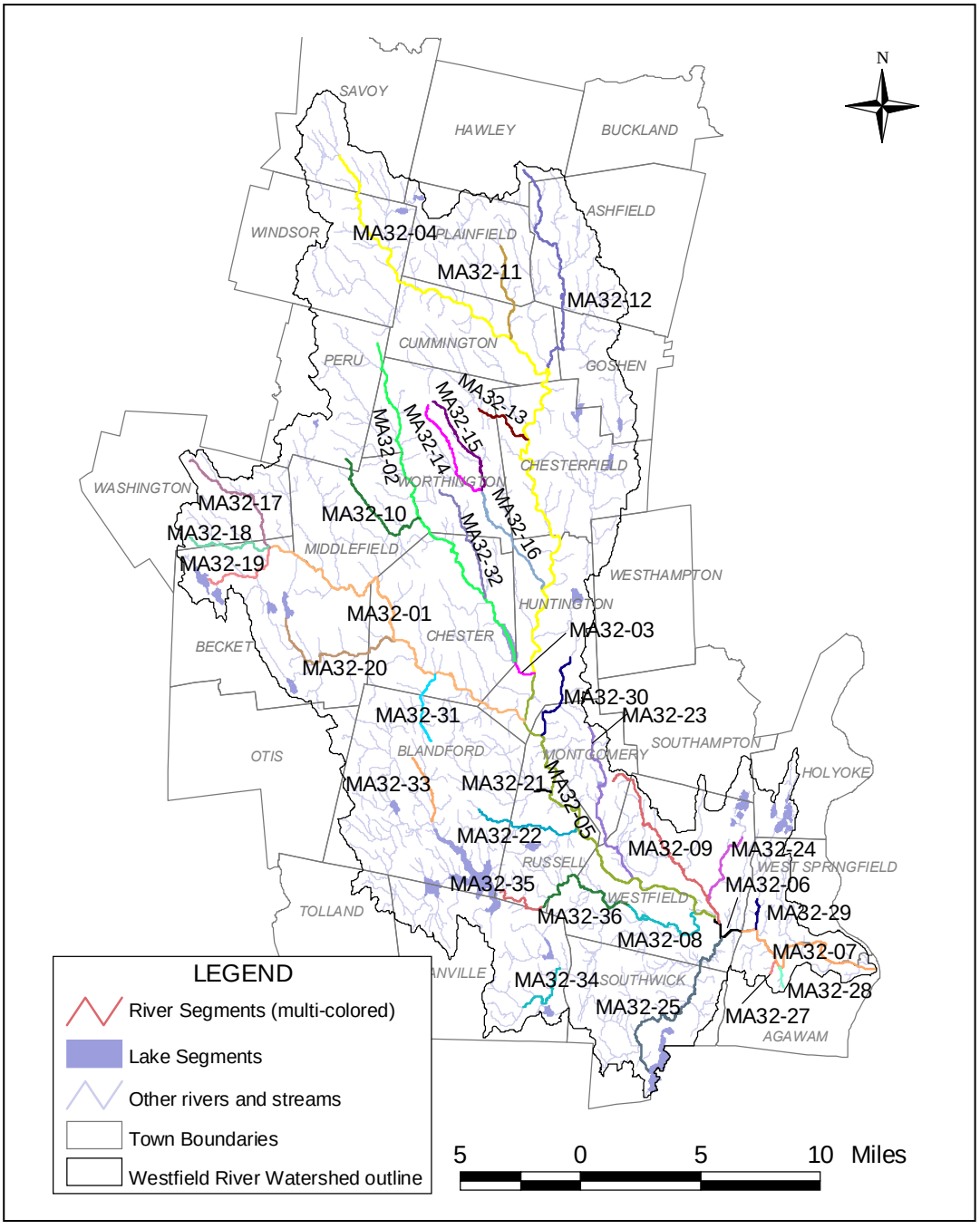
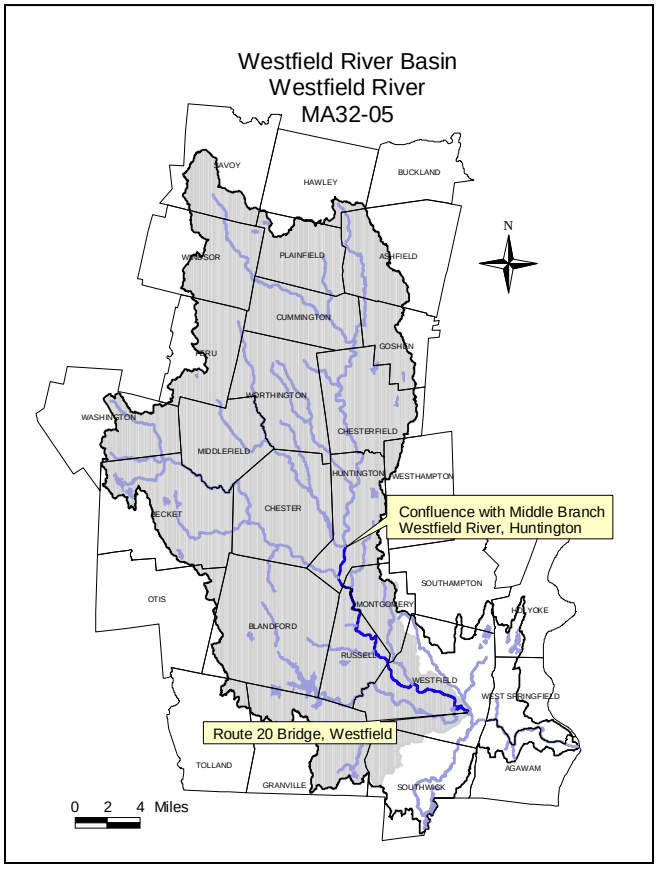


Figure 8. Westfield River Watershed - river segment locations identified by segment number.

WESTFIELD RIVER (SEGMENT MA32-05)

Location: Confluence with Middle Branch Westfield River, Huntington, to Route 20 Bridge, Westfield.
Segment Length: 17.8 miles
Classification: Class B, Warm Water Fishery



The drainage area of this segment is approximately 497 square miles. Land-use estimates (top 3, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 84%
Agriculture..... 5%
Residential 5%

The impervious cover area for the individual sub-basins located in this segment is 2.2 %, thereby classifying this subwatershed as a low threat to water quality from impervious surface water runoff (CWP 1998).

From the confluence with the Middle Branch Westfield River the Westfield River continues flowing south past the town center of Huntington to the confluence with the West Branch Westfield River (where the river receives the Huntington WWTP discharge). The Westfield River then begins to flow in a southeasterly direction. Just before passing by the village of Crescent Mills the river is dammed at the Littleville Power Company's Cresent Mill Dam, where the Crescent Hydroelectric Project is operated (also known as the Texon Project, FERC Exempt license number 2986). Downstream from the dam the river receives the process wastewater and noncontact cooling water from the Texon USA facility. The river meanders to the southeast through steep terrain to the town of Russell where it is impounded by the Westfield River Paper Company Dam. There is a hydroelectric powerhouse at this dam that is currently inactive. Just downstream from the dam the river receives the discharge of treated effluent from the Russell WWTP. A few miles further downstream in the village of Woronoco the river is again dammed at the Woronoco Dam. The Strathmore Paper Co. (MA0004995) discharges to the river in this reach. The river continues to the southeast passing under the Massachusetts Turnpike and then enters the city of Westfield. Here the topography changes to a broad floodplain and the river gradient decreases. The river then enters the urbanized part of Westfield where the Westfield WWTP (MA0101800) discharges. The Westfield River then flows southeast and continues to the Route 20 bridge in Westfield where this segment ends.

Based on the last evaluation of water quality conditions Westfield River Segment MA32-05 is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment was not assessed for any uses.

MDFW has proposed that several tributaries to this segment of the Westfield River be listed in the next revision of the SWQS as cold water fisheries (MDFW 2003). They are: Bradley Brook, Bearden Brook, Roaring Brook (East Branch), Stage Brook (Tributary to Bradley Brook), and Freeland Brook (Tributary to Stage and Bradley Brooks).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX H, TABLE H7)

Facility	WMA Registration Number	WMA Permit Number	Source (G = ground S = surface)	Authorized Withdrawal (MGD)
John S. Lane & Son, Inc.	N/A	9P210432901	Westfield River-S	0.65
Texon, USA	N/A	9P210425603	Westfield River-S	0.72
Russell Water Department*	N/A	9P210425602	Well#2, 1256000-02G	0.29
Westfield Water Department*	10432901	N/A	Well#2, 329-02G	6.11

* indicates system-wide withdrawal; all sources are not within this segment

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX H, TABLES H1, H2, AND H3)

The Town of Huntington is authorized to discharge treated sanitary wastewater from the Huntington POTW to the Westfield River (NPDES permit #MA0101265 issued 29 September 1998). The facility began operating in 1992 and is authorized to discharge an average monthly flow of 0.2 MGD via outfall #001(the discharge location is at the mouth of the West Branch Westfield River just upstream from the confluence with the Westfield River). The facility's whole effluent toxicity limits are $LC_{50} \geq$ 100% effluent with a monitoring frequency of 4X/year using both *C. dubia* and *P. promelas*. The facility utilizes chlorine for disinfection and the limits for total residual chlorine (TRC) are 0.6 and 1.0 mg/L (average monthly and maximum daily, respectively) between 1 April and 31 October. The maximum TRC concentration recorded in the toxicity testing reports for this facility was 0.1 mg/L. Effluent ammonia-nitrogen concentrations recorded in the toxicity testing reports ranged from <0.05 to 11 mg/L (TOXTD database).

Texon USA (formerly U.S.M. Corporation Texon Division – Russell), located at 1190 Huntington Rd., Russell, is a facility engaged in the manufacturing of specialty impregnated papers for use in inner soles, suitcases, and safety equipment, and other products used in the filtration and blotter markets. The company is authorized to discharge a daily maximum flow of 1.3 MGD (average monthly flow of 0.8 MGD) of treated process wastewater, floor drainage, boiler condensate and untreated non–contact cooling water via outfall #001 to the Westfield River (NPDES permit #MA0005282 issued November 1999). The facility's whole effluent toxicity limits are $LC_{50} \geq$ 100% effluent and a chronic no observed effect concentration (CNOEC) monitor only requirement with a monitoring frequency of 4X/year using both *C. dubia* and *P. promelas*. The facility has a maximum daily ammonia-nitrogen limit of 10.8 mg/L. Effluent ammonia-nitrogen concentrations recorded in the 18 toxicity testing reports ranged from 0.15 to 1.6 mg/L (TOXTD database). Total Residual Chlorine (TRC) was not detected in the effluent (<0.05 in all tests).

The Town of Russell is authorized to discharge treated sanitary wastewater from the POTW to the Westfield River (NPDES permit # MA0100960, issued 29 September 1998). The Town is authorized to discharge an average monthly flow of 0.24MGD via outfall #001 (the discharge location is just downstream from the Russell Falls Dam). Ultraviolet light is utilized as a disinfection process. The facility's whole effluent toxicity limits are $LC_{50} \geq$ 100% effluent with a monitoring frequency of 4X/year using both *C. dubia* and *P. promelas*. Effluent ammonia-nitrogen concentrations recorded in the toxicity testing reports ranged from <0.1 and 16 mg/L (TOXTD database).

The former Westfield River Paper Company, Inc. was authorized to discharge (NPDES permit #MA0004316, issued September 1989) treated process wastewater, beater room, bearing cooling water and sand filter backwash via outfall #001 and non-contact cooling water for machine bearings and calendar rolls via outfall #003 along the east bank of the Westfield River adjacent to the Russell Falls Dam. The facility closed in April 1994 and the permit was terminated by EPA in October 1994 (Nietupski 2004b and MA DEP 1994).

The Town of Russell is also authorized to discharge treated sanitary wastewater from the Woronoco Village POTW to the Westfield River (NPDES permit # MA0103233 issued 30 September 1998). The Town is authorized to discharge an average monthly flow of 0.02 MGD via outfall #001 (the discharge location is just downstream from the footpath and the Bridge Street bridge in Woronoco Village in Russell). Ultraviolet light is utilized as a disinfection process. The facility's whole effluent toxicity limits are $LC_{50} \geq$ 100% effluent with a monitoring frequency of 1X/year using both *C. dubia* and *P. promelas*. Effluent ammonia-

nitrogen concentrations recorded in the toxicity testing reports ranged from 1.4 and 6.8 mg/L (TOXTD database). According to the MA DEP Western Regional Office no permit violations have occurred during the past 5 years (Nietupski 2004a).

The Strathmore Paper Company located at Woronoco Mills), Valley View Avenue in Russell, was a facility engaged in the manufacturing of cotton content specialty fine papers. The Strathmore Paper Company was authorized (NPDES permit MA0004995 issued September 1983) to discharge non-contact cooling water via outfall #006 and treated process wastewater and filter backwash water via outfall #008 to the Westfield River. Although the facility completed a reapplication for their NPDES permit as of December 1993 a new permit was never reissued and the facility shut down their operations between December 1997 and mid summer 1998. The permit was terminated by EPA in October 2000 (St. Thomas 1997).

Jen-Coat Inc., located at 132 North Elm Street in Westfield, produces paper coated and laminated packaging. Jen-Coat Inc. is authorized (NPDES permit #MAG250856 issued 13 June 2001) to discharge an average monthly flow of 0.028MGD of non-contact cooling water to the Westfield River. Jen-Coat Inc. installed, in October 1993, a cooling tower that has essentially close-looped their cooling process (Gilli 1993). The permittee indicates that it will still keep the permit active in the event that they need to discharge their cooling water. Jen-Coat Inc. is also permitted (MAR05B629) to discharge stormwater to this segment of the Westfield River. As part of this permit the facility is required to develop a SWPPP and conduct quarterly visual monitoring of their stormwater discharge.

The City of Westfield is authorized to discharge treated effluent from the Westfield WWTP to the Westfield River (NPDES permit # MA0101800, issued 27 April 2000 and subsequently modified on 14 November 2001). The City is authorized to discharge an average monthly flow of 4 MGD via outfall #001 (the discharge location is near the treatment plant downstream from the confluence with the Little River in Westfield) and will be permitted to discharge 6.1 MGD once facility upgrade is completed (expected by December 2004). The facility's whole effluent toxicity limits are $LC_{50} \geq$ 100% effluent and a CNOEC = 9.4% (April 2000 permit) or CNOEC = 20% (November 2001 permit) with a monitoring frequency of 4X/year using *C. dubia*. Chlorination/dechlorination is utilized for disinfection. A TRC maximum daily limit of 0.20 mg/L was imposed in the April 2000 permit and 0.095 mg/L was imposed in the November 2001 permit.

Current upgrades to the Westfield WWTP and upgrades to other municipal treatment plants upstream, combined with less discharges from the various industrial permittees upstream that are no longer discharging should result in demonstrable future improvements in water quality throughout this segment.

Westfield is a Phase II Stormwater community. This community was issued a stormwater general permit from EPA and MA DEP in 2003 and is authorized to discharge stormwater from the municipal drainage system (MAR041236). Over the five-year permit term the City will develop, implement and enforce their stormwater management program to reduce the discharge of pollutants from the storm sewer system to protect water quality (Domizio 2004).

FERC (APPENDIX H, TABLE H4 AND H5)

The Littleville Power Company Inc. owns and operates the FERC-exempt Crescent Hydroelectric Project (also known as the Texon Project) # 2986A in Russell. The license was issued on 11 May 1982. The total installed generating capacity is 1500 kW. The facility operates in a run-of-river mode. The Crescent Mills Dam is an "S" shaped, stone masonry structure, approximately 250 feet long by 12' high, constructed on top of a bedrock outcrop. The spillway is topped by three foot high wooden flashboards designed to collapse under high flow conditions. The dam forms a small, three-acre impoundment. The intake and powerhouse are located at the western end of the dam and are part of a former paper mill complex. The powerhouse contains a single Kaplan turbine with a maximum hydraulic capacity of 700 cfs. The turbine discharges back to the Westfield River at the base of the dam so there is no bypassed reach of the river. A downstream fish passage flow of 20 cfs is released through a sluiceway between 1 April and 1 July of each year and trashrack overlays with one inch of clear space are installed during this period to provide additional protection to out-migrating anadromous fish (Grenier 2004).

Indian River Power Supply LLC owns the hydroelectric project formerly owned by the Westfield River Paper Company that is located at the Westfield River Paper Company Dam in Russell (Clark 2004a). The hydropower plant has not operated during the last 10 years since the paper company went out of business in 1994. An application for exemption from FERC licensing and revisions to the application has recently been filed by the owners. The hydropower project is listed as FERC Project No. 12462-000-MA. The two turbines installed in 1908 at the powerhouse have a capacity of 700 kW. The project's principal features consist of: (1) two contiguous dam sections with a crest length of 425 feet; (2) an intake area with trashracks and two 60 foot long, seven foot diameter penstocks leading to a powerhouse that contains two turbine/generator units; (3) a downstream fish passage facility will be installed adjacent to the gatehouse to conduct downstream migrants directly to the tailrace; (4) a 14.1-acre impoundment at the normal pool elevation; (5) a bypassed reach with the primary channel on the west side of the dam whose crest is 1 foot lower than the east side of the dam; and (6) appurtenant facilities. The two contiguous dam sections (east and west) provide a maximum elevation of about 30 feet above the riverbed with a crest elevation of 269.64 feet (National Geodetic Vertical Datum or NGVD) when the flashboards are installed. The powerhouse currently contains two turbines with hydraulic capacities between a minimum of 60 and a combined maximum of 543 cfs (Clark 2004b). [Following rehabilitation of the existing equipment, the owners intend to optimize the hydraulic resources by increasing capacity closer to 1,500 kW. If/when the turbines are replaced the maximum capacity would be between 1,100 and 1,200 cfs (Clark 2004b).] Based on the conditions of the proposed exemption from licensing, the Indian River Project will be operated in a run-of-river mode with a target elevation of 269.5 feet NGVD. The project's automation will minimize fluctuation of the impoundment surface water elevation by maintaining a discharge from the project so that, at any point in time, flows measured independently downstream from the project tailrace, approximate the rate of inflow into the project impoundment from Bradley Brook and from upstream. The project's bypass reach extends from the crest of the east dam down over continuous ledge outcropping to the tailrace and from the spillway and deep gate on the west side of the dam over a 80 foot diameter pool and about 70 feet of riffles for a distance of approximately 100 to 170 feet to the tailrace pool depending on the route. The minimum flow release will be made up of 25 cfs going through the downstream fish passage facility and an interim discharge of another 25 cfs through the riffle area, or inflow, whichever is less, as measured in the separate channels of the bypassed reach. Habitat evaluation and permanent minimum flow requirements will be set by FERC and the resource agencies after the hydro plant returns to service. Downstream passage flows during winter conditions result in significant ice accumulation and will be discontinued annually between December and so called "ice out" conditions or when the river temperatures reach 5 degrees Celsius. The downstream fish passage system is a free-surfaced open channel flow structure with no flow control gate (Clark 2004a).

Woronoco Hydro, LLC owns and operates the Woronoco Hydroelectric Project licensed as FERC Project No. 2631. The license was issued on 30 April 2002. The total installed capacity is 2,700 kW. The project's principal features consist of: (1) two non-contiguous dam sections and an earthen dike; (2) an intake area leading to a powerhouse that contains three turbine/generator units; (3) a downstream fish passage facility; (4) a 43-acre impoundment at the normal pool elevation; (5) a bypassed reach with three channels; and (6) appurtenant facilities. The two non-contiguous dam sections (north and south) provide an elevation of about 25 feet above the riverbed with a crest elevation of 229.0 feet (National Geodetic Vertical Datum or NGVD). The powerhouse contains three turbine-generating units with minimum and maximum hydraulic capacities of 45 cfs and 710 cfs, respectively. Based on the conditions of the FERC license, the Woronoco Hydroelectric Project will be operated in a run-of-river mode with a target elevation of 229.0 feet NGVD and will minimize fluctuation of the impoundment surface water elevation by maintaining a discharge from the project so that, at any point in time, flows measured independently downstream from the project tailrace approximate the sum of inflows to the project impoundment. The project's bypass reach extends from the toe of the north and south dams to the confluence with the project tailrace (approximately 0.2 river miles). There are three bypass reaches at the project for each of which a combined minimum flow release of 57 cfs, or inflow, whichever is less, as measured in the separate channels of the bypassed reach, is required. Downstream passage flows during winter conditions result in significant ice accumulation and will be discontinued annually between December and so called "ice out" conditions or when the river temperatures reach 5 degrees Celsius. The downstream fish passage system is a free-surfaced open channel flow structure with no flow control gate. The bypass channels and minimum flow requirements are described below.

- North Dam channel - The secondary erosion channel begins at the base of the north dam's spillway and extends about 1,000 feet to its confluence with the original channel. The minimum flow required in this channel of 22 cfs is discharged from the deep gate located on the north end of the north dam.
- South Dam channel - The original river channel extends about 700 feet from the ledge base of the south dam's spillway to the project tailrace. The minimum flow required in this channel of 15 cfs cfs is discharged from the deep gate located in the middle of the south dam.
- Fish Passage channel - This channel is located adjacent to the project intake at the base of the south dam and cascades some 200 feet over bedrock ledges to its confluence with the original river channel. The minimum flow required through this downstream fish passage of 20 cfs drops approximately eight feet into a 10-foot deep plunge pool that discharges into a rocky channel dropping into the bypass reach.

Below the confluence of all of these channels the bypass flows drop over 14.6 feet of very steep ledge that form a natural block to upstream migrant fish. In the future there will be eel passage facilities installed allowing upstream and downstream eel passage over the dam at each of the discharge points (Clark 2004a).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

The USGS gage 01179500 is located on the Westfield River approximately 0.2 miles downstream from the Knightville Dam (upstream from this segment of the Westfield River). The USGS remarks for this gage indicate that flow has been regulated by Knightville Reservoir since 1941 (Socolow *et al*. 2003). The average discharge at this gage reported by USGS for the period of record (1909 to 2002) is 332 cfs. There is no evidence of aberrant streamflow fluctuations at this gage when viewing real-time USGS gaging data (USGS 2004).

The Littleville Power Company Inc. is supposed to operate the FERC exempt Texon Project # 2986A located at the Crescent Mills Dam in Russell in a run-of-river mode. The turbine discharges back to the Westfield River at the base of the dam so there is no bypassed reach of the river. A downstream fish passage flow of 20 cfs is released through a sluiceway between 1 April and 1 July of each year and trashrack overlays with one inch of clear space are installed during this period to provide additional protection to out-migrating anadromous fish (Grenier 2004). According to MDFW, between 15 October and iceup, flow through the sluiceway is also required for spawned out adult salmon (kelt) passage (Slater 2004).

Indian River Power Supply LLC owns the hydroelectric project at the former Westfield River Paper Company Dam in Russell (Clark 2004a). Although the hydropower plant is now inactive the owners have filed for a FERC exemption to operate the project. Based on the conditions of the proposed exemption from licensing the Indian River Project will be operated in a run-of-river mode and the flows measured independently downstream from the project tailrace will approximate the rate of inflow into the project impoundment from Bradley Brook and from upstream. The project's bypass reach extends from the crest of the east dam down over continuous ledge outcropping to the tailrace and from the spillway and deep gate on the west side of the dam over a 80 foot diameter pool and about 70 feet of riffles for a distance of approximately 100 to 170 feet to the tailrace pool depending on the route. The minimum flow release will be made up of 25 cfs going through the downstream fish passage facility and an interim discharge of another 25 cfs through the riffle area, or inflow, whichever is less, as measured in the separate channels of the bypassed reach. Habitat evaluation and permanent minimum flow requirements will be set by FERC and the resource agencies after the hydropower plant returns to service. Downstream passage flows during winter conditions result in significant ice accumulation and will be discontinued annually between December and so called "ice out" conditions or when the river temperatures reach 5-degrees Celsius. The downstream fish passage system is a free-surfaced open channel flow structure with no flow control gate (Clark 2004a). According to MDFW the project will also be required to have upstream passage for American eels (Slater 2004).

A minimum flow release of 57 cfs or inflow, whichever is less, as measured in the separate channels of the bypass reach of the Westfield River is required at the Woronoco Hydro, LLC (FERC Project

2631). To ensure these conditions are met hourly impoundment level data are being continuously recorded. The free discharge from the gates and passage system are also being documented through the use of visual observations downstream of the gates at the confluence of the bypass reach sections. Articles 403 and 404 of the FERC license required Woronoco Hydro to develop a plan to monitor impoundment levels and minimum flow releases and to develop a comprehensive fish passage plan (Nash 2004). The plans were submitted to FERC in May 2004 (Kleinschmidt 2004a and Kleinschmidt 2004b). The project's bypass reach extends from the toe of the north and south dams to the confluence with the project tailrace (approximately 0.2 river miles). Downstream passage flows during winter conditions result in significant ice accumulation and will be discontinued annually between December and so called "ice out" conditions or when the river temperatures reach 5-degrees Celsius. According to MDFW the project will also be required to have upstream passage for American eels in 2005 (Slater 2004).

As part of the 2001 DWM Westfield River Watershed benthic macroinvertebrate survey a habitat survey was performed in three reaches of this segment of the Westfield River (Appendix B). From upstream to downstream the locations were as follows: 250m downstream from the discontinued Strathmore Paper Company treated effluent discharge in Russell (Station WR05), outside of the Westfield WWTP discharge mixing zone in Westfield (Station WR06B) and 340m downstream from the Westfield WWTP discharge in Westfield (Station WR06A). The habitat score at Station WR05 was 185 out of a possible 200 and was only slightly compromised by the drought-induced low baseflow conditions observed (Appendix B). The habitat score at Station WR06B was 165 out of 200 (Appendix B). Habitat quality in the Westfield River downstream from the Westfield WWTP outfall (Station WR06A) was limited primarily to riffle habitat, green algae covering virtually all the stream bottom, and sewage fungus beinh noted along the margins of the sampling reach. The habitat assessment score was 168 out of 200 (Appendix B).

A zone of passage for migrating fish was documented in the Westfield River during the dye study conducted by Metcalf & Eddy in September 2000 at the Westfield WWTP (Metcalf and Eddy 2000).

The USGS gage 01183500 is located downstream from this segment of the Westfield River. The USGS remarks for this gage indicate that flow is regulated (Borden Brook Reservoir, Cobble Mountain Reservoir, Knightville Reservoir and Littleville Lake, and diversion from Little River for municipal supply of Springfield) (Socolow *et al*. 2003). Evidence of substantial streamflow fluctuations are apparent when viewing real-time USGS gaging data (USGS 2004).

A benthic macroinvertebrate and habitat survey was performed by DWM biologists in the summer of 1996 at a total of six reaches in this segment of the Westfield River. From upstream to downstream the locations were as follows: upstream from the Texon USA facility near the roadside park near Huntington Health Center in Huntington (Station WR02), 450m downstream from the Texon USA discharge in Russell (Station WR03), upstream from Strathmore Paper across from the Whippernon Golf Club in Russell (Station WR04), 250m downstream from the Strathmore Paper Company treated effluent discharge in Russell (Station WR05), just upstream from the confluence with the Little River in Westfield (Station WR06), and 340m downstream from the Westfield WWTP discharge in Westfield (Station WR07). Habitat quality conditions at these locations are described in detail in Appendix C.

Biology

This segment of the Westfield River is regularly stocked by MDFW with trout.

In August 2001 MDFW conducted barge electrofishing within two reaches of this segment of the Westfield River upstream from the Texon Mill in Russell (slightly downstream from the Huntington/Russell town line and upstream from the confluence with Roaring Brook) and across from Wippernon Golf Course (downstream from the confluence with Bradley Brook, Richards 2003). Seven species of fish were collected upstream from the Texon Mill including, in order of abundance, common shiner, Micropterus dolomieu (smallmouth bass), longnosed dace, tessellated darter, Atlantic salmon, and an individual each of Lepomis gibbosus (pumpkinseed) and white sucker. The presence of a number of fluvial specialists/dependants is indicative of stable flow regimes. The presence of Atlantic salmon, an intolerant stream species (also endangered), is most likely the result of upstream fry stocking. Although other intolerant species are absent (except for two salmon), most

species collected are considered moderately tolerant and are consistent with those found in larger streams and rivers in western Massachusetts. Further downstream near Wippernon Golf Course in the town of Russell, ten fish species collected, in order of abundance, were smallmouth bass, American eel, fallfish, rock bass, creek chubsucker, tessellated darter, common shiner, white sucker, pumpkinseed, and Atlantic salmon. Smallmouth bass, a macrohabitat generalist, dominated the fish sample. This is not unusual in that smallmouth bass prefer cool, rocky, riverine habitats. Six of the remaining nine fish species collected in this reach of the Westfield River are fluvial specialists/dependants. The presence of Altantic salmon is most likely a result of upstream fry stockings. The fish community present appears to be indicative of good habitat and water quality conditions as well as stable flow regimes.

In September 2001 DWM conducted a modified Rapid Bioassessment Protocol III (RBP III) benthic macroinvertebrate survey at three reaches of this segment of the Westfield River (Appendix B). From upstream to downstream the locations were as follows: 250m downstream from the discontinued Strathmore Paper Company treated effluent discharge in Russell (Station WR05), outside the Westfield WWTP discharge mixing zone in Westfield (Station WR06B) and 340m downstream from the Westfield WWTP discharge in Westfield (Station WR06A). The RPB III analysis of the benthic macroinvertebrate community collected downstream from the discontinued Strathmore Paper Company discharge in Russell (Station WR05) indicated slightly impacted conditions compared to reference station on the Westfield River near Route 112 in Huntington (Station WR01). A dramatic improvement was found over conditions documented during the 1996 survey when Strathmore Paper Company still maintained two discharges: a discharge of non-contact cooling water and a treated process wastewater and filter backwash discharge (Appendices B and C). No periphyton samples were collected by DWM biologists from this sampling location (Appendix D).

The RPB III analysis of the benthic macroinvertebrate community collected in the Westfield River downstream from the confluence with the Little River outside the Westfield WWTP discharge mixing zone in Westfield (Station WR06B) indicated slightly impacted conditions compared to the reference station on the Westfield River near Route 112 in Huntington (Station WR01). Similarly, the RBP III analysis of the benthic macroinvertebrate community collected in the Westfield River downstream from the Westfield WWTP discharge (Station WR06A) indicated slightly impacted conditions compared to both the reference station on the Westfield River near Route 112 in Huntington (Station WR01) and the reference station downstream from the confluence with the Little River outside the Westfield WWTP discharge mixing zone in Westfield (Station WR06B). Slight improvements in community structure were evident since the last DWM survey here--results of the 1996 RPB II evaluation upstream and downstream from the Westfield WWTP discharge indicated moderately impacted benthic community downstream from the discharge (Appendix C). Metcalf & Eddy also conducted a benthic macroinvertebrate study (EPA RBP II protocols) in August 1999 at the sites used by MA DEP DWM biologists in 1996. The samples were analyzed at the Great Lakes Environmental Center. The results from the study also indicated slight improvements in water quality since the 1996 MA DEP evaluation (Metcalf & Eddy 2000). The benthic community sampled by Metcalf & Eddy was strikingly similar to that observed by DWM in 2001 (Fiorentino 2004a). The apparent improvements in the biological condition in the river downstream from the Westfield WWTP discharge appear to coincide with the ongoing upgrade of the WWTP. The green filamentous algae *Ulothrix zonata* was very abundant in the Westfield River at both sampling stations, covering an estimated 100% of the reach (Appendix D).

A benthic macroinvertebrate and habitat survey was performed by DWM biologists in the summer of 1996 at a total of six reaches in this segment of the Westfield River. From upstream to downstream the locations were as follows: upstream from the Texon USA facility near the roadside park near Huntington Health Center in Huntington (Station WR02), 450m downstream from the Texon USA discharge in Russell (Station WR03), upstream from Strathmore Paper across from the Whippernon Golf Club in Russell (Station WR04), 250m downstream from the Strathmore Paper Company treated effluent discharge in Russell (Station WR05), just upstream from the confluence with the Little River in Westfield (Station WR06), and 340m downstream from the Westfield WWTP discharge in Westfield (Station WR07). Results of the RBP II analyses are provided in detail in Appendix C.

Toxicity

Ambient

Water from the Westfield River was collected 50 yards upstream from the dam at Texon USA and in inclement weather from screens in the mill for use as dilution water for the Texon USA facility's whole effluent toxicity tests. Between January 2000 and March 2004 survival of *C. dubia and P. promelas* exposed (7 days) to the river was good (≥ 80%) in all 18 tests conducted.

Water from the Westfield River was collected just below Main Street Bridge for use as dilution water for the Russell WWTP whole effluent toxicity tests. Between November 1998 and May 2004 survival of *C. dubia and P. promelas* exposed (48 hr) to the river was good (≥ 83%) in 21 of the 22 tests conducted. Survival was low (50 and 43% for *C. dubia* and *P. promelas*, respectively) during the May 2003 test event.

Water from the Westfield River was collected just below Bridge Street Bridge for use as dilution water for the Russell, Woronoco Village POTW whole effluent toxicity tests. Between September 1999 and September 2003 survival of *C. dubia and P. promelas* exposed (48 hr) to the river was excellent (≥98%) in the five tests conducted.

Water from the Westfield River was collected approximately 200 feet upstream from the Westfield WWTP outfall on the south side of the river in back of the former Garvelle Appliances (now a cell phone store) for use as dilution water for the Westfield WWTP whole effluent toxicity tests. Between May 2000 and March 2004 survival of *C. dubia* exposed (7 day) to the river was good (≥ 80%) in the 15 tests conducted.

Effluent

A total of 22 definitive acute whole effluent toxicity tests were conducted on the Huntington POTW treated sanitary wastewater effluent (outfall #001) using both *C. dubia* and *P. promelas* between November 1998 and May 2004. The effluent was acutely toxic to *C. dubia* on two occasions (May 2001 and July 2003 with LC_{50}'s of 61.8 and 40.6 % effluent, respectively). Effluent water quality data during the two toxic episodes indicated the following: pH of 4.9 and 4.4 SU, aluminum concentrations of 0.32 and 0.33 mg/L, copper concentrations of 0.14 and 0.098 mg/L and zinc concentrations of 0.23 mg/L. The effluent was not acutely toxic to *P. promelas* during any of the 22 test events.

A total of 18 modified acute and chronic whole effluent toxicity tests were conducted on the Texon USA treated effluent (outfall #001) using both *C. dubia* and *P. promelas* between January 2000 and March 2004. The effluent was acutely toxic to *C. dubia* in five of the eighteen tests with LC_{50}s ranging between 20 and 89% effluent. The effluent was acutely toxic to *P. promelas* in three of the eighteen tests with LC_{50}s ranging between 39 and 87% effluent. In all but one of the modified acute tests the *C. dubia* were the more sensitive test organism. The CNOECs ranged between <6.25 and 50% effluent for *C. dubia* and between <6.25 and 100% effluent for *P. promelas*. The CNOECs were ≤ 6.25% effluent in six and two of the 18 tests for *C. dubia* and *P. promelas,* respectively.

A total of 20 of 22 definitive acute whole effluent toxicity tests conducted on the Russell POTW treated sanitary wastewater effluent (outfall #001) using both *C. dubia* and *P. promelas* between November 1998 and May 2004 were valid. The effluent was acutely toxic to *C. dubia* on two occasions (July 2000 and September 2002 with LC_{50}s of 19 and 59% effluent, respectively). The effluent was not acutely toxic to *P. promelas* during any of the 20 valid test events.

A total of 5 definitive acute whole effluent toxicity tests were conducted on the Russell Woronoco Village POTW treated sanitary wastewater effluent (outfall #001) using both *C. dubia* and *P. promelas* between September 1999 and September 2003. No acute toxicity was detected (LC_{50}s all ≥100% effluent).

A total of 15 modified acute and chronic whole effluent toxicity tests were conducted on the Westfield WWTP treated effluent (outfall #001) using *C. dubia* between May 2000 and March 2004. The effluent was acutely toxic to *C. dubia* in six of the 15 tests with LC_{50}s ranging between 44 and 82% effluent. The CNOECs ranged between 9 and 50% effluent.

Chemistry – water

a. Water from the Westfield River was collected 50 yards upstream from the dam at Texon USA (during inclement weather from screens in the mill) for use as dilution water for the Texon USA facility's whole effluent toxicity tests. Data from these reports (maintained in the TOXTD database) between January 2000 and March 2004 are summarized below.

b. Water from the Westfield River was collected just below Main Street Bridge for use as dilution water for the Russell WWTP whole effluent toxicity tests. Data from these reports (maintained in the TOXTD database) between November 1998 and May 2004 are summarized below.

c. DWM collected *in-situ* measurements from a station on the Westfield River (Station WSFR21.3, Unique ID W0810 - on the Western bank at Main Street, Russell) between 1 August and 3 October 2001 (n=4). Parameters measured were dissolved oxygen, pH, temperature, conductivity, and total dissolved solids. Between 1 August and 3 October grab samples were also collected and analyzed for alkalinity, hardness, chloride, suspended solids, ammonia-nitrogen, nitrate nitrogen, total phosphorus (n=8) (Appendices B and C of Appendix A).

d. Water from the Westfield River was collected just below Bridge Street Bridge for use as dilution water for the Russell, Woronoco Village POTW whole effluent toxicity tests. Data from these reports (maintained in the TOXTD database) between September 1999 and September 2003 are summarized below.

e. DWM collected *in-situ* measurements from a station on the Westfield River (Station WSFR12.7, Unique ID W0807, ~350 feet upstream from Route 202/10 bridge, Westfield) on four occasions between 1 August and 3 October 2001. Parameters regularly measured were dissolved oxygen, pH, temperature, conductivity, and total dissolved solids. Grab samples were also collected on those occasions and analyzed for alkalinity, hardness, chloride, suspended solids, ammonia-nitrogen, nitrate nitrogen, total phosphorus (Appendices 2 and 3 of Appendix A).

f. Water from the Westfield River was collected approximately 200 feet upstream from the Westfield WWTP outfall on the south side of the river in back of the former Garvelle Appliances (now a cell phone store) for use as dilution water for the Westfield WWTP whole effluent toxicity tests. Data from these reports (maintained in the TOXTD database) between May 2000 and March 2004 are summarized below.

DO

The instream DO measured by DWM in the Westfield River at Main Street, Russell (Station WSFR21.3) ranged from 8.2 to 10.0 mg/L (92% to 99% saturation) (Appendix 2 of Appendix A).

The instream DO measured by DWM on the Westfield River, ~350 feet upstream from Route 202/10 bridge, Westfield (Station WSFR12.7) ranged from 7.9 to 11.1 mg/L (91% to 107% saturation) (Appendix 2 of Appendix A). Three of the four measurements were representative of pre-dawn conditions.

Temperature

Temperatures recorded by DWM at ranged from 14.2 to 24.0°C and 14.1 to 23.3°C at Stations WSFR21.3 and WSFR12.7, respectively.

pH

a. Instream pH ranged between 6.0 and 7.5 SU and only one of the 18 measurements was < 6.5 SU.
b. Instream pH ranged between 6.5 and 7.7 SU.
c. DWM pH measurements ranged from 7.0 to 7.3 SU at Station WSFR21.3.
d. Instream pH ranged between 6.8 and 7.7 SU.
e. DWM pH measurements ranged from 7.2 to 7.3 SU at Station WSFR12.7.
f. Instream pH ranged between 6.5 and 8.0 SU.

Suspended Solids

a. The maximum suspended solids concentration was 8.0 mg/L.
b. The maximum suspended solids concentration was 6.0 mg/L.

c. The maximum suspended solids concentration in the Westfield River at Main Street Bridge in Russell (Station WSFR21.3) was 2.9 mg/L in all eight samples analyzed.
d. The suspended solids concentrations were all <5.0 mg/L.
e. The maximum suspended solids concentration in the Westfield River upstream from Route 202/10 bridge, Westfield (Station WSFR12.7) was 1.9 mg/L in all four samples analyzed.
f. The maximum suspended solids concentration was 9.5 mg/L.

Ammonia-Nitrogen
a. Of the 18 measurements, the maximum ammonia-nitrogen concentration was 0.2 mg/L.
b. Of the 22 measurements, the maximum ammonia-nitrogen concentration was 0.3 mg/L.
c. The concentration of ammonia-nitrogen in the Westfield River at Main Street Bridge in Russell (Station WSFR21.3) was <0.02 mg/L in all eight samples analyzed.
d. Of the 5 measurements, the maximum ammonia-nitrogen concentration was 0.2 mg/L.
e. The concentration of ammonia-nitrogen in the Westfield River upstream from Route 202/10 bridge, Westfield (Station WSFR12.7) was <0.02 mg/L in all four samples analyzed.
f. Of the 14 measurements, the maximum ammonia-nitrogen concentration was 0.3 mg/L.

None of these measurements exceeded the instream chronic criterion of 1.32 mg N/L at the highest pH (8.0SU) and temperature (24.0°C) recorded in this segment.

Total Residual Chlorine
a. All of the TRC measurements were $\leq$ 0.05 mg/L.
b. All of the TRC measurements were $\leq$ 0.05 mg/L.
c. N/A at Station WSFR21.3.
d. All of the TRC measurements were $\leq$ 0.05 mg/L.
e. N/A at Station WSFR12.7.
f. With the exception of one measurement (0.06) the remaining 14 TRC measurements were $\leq$ 0.05 mg/L.

Alkalinity
a. Alkalinity measurements ranged between 8 and 22 mg/L.
b. Alkalinity measurements ranged between 7 and 24 mg/L.
c. Alkalinity measurements ranged from 13 to 20 in the Westfield River at Main Street Bridge in Russell (Station WSFR21.3) in all eight samples analyzed.
d. Alkalinity measurements ranged between 17 and 25 mg/L.
e. Alkalinity measurements ranged from 15 to 25 in the Westfield River upstream from Route 202/10 bridge, Westfield (Station WSFR12.7) in all four samples analyzed.
f. Alkalinity measurements ranged between 8 and 30 mg/L.

Hardness
a. Hardness measurements ranged between 12 and 40 mg/L, with 15 out of 18 samples $\leq$25 mg/L.
b. Hardness measurements ranged between 16 and 35 mg/L, with 14 out of 22 samples $\leq$25 mg/L.
c. Alkalinity measurements ranged from 18 to 22 in the Westfield River at Main Street Bridge in Russell (Station WSFR21.3) in all eight samples analyzed.
d. Hardness measurements ranged between 22 and 32 mg/L, with 2 out of 5 samples $\leq$25 mg/L.
e. Alkalinity measurements ranged from 18 to 26 in the Westfield River upstream from Route 202/10 bridge, Westfield (Station WSFR12.7) in all four samples analyzed.
f. Hardness measurements ranged between 18 and 96 mg/L, with 9 out of 15 samples $\leq$25 mg/L.

Total Phosphorus (as P)
a. N/A at this station.
b. N/A at this station.
c. The maximum total phosphorus concentration measured in the Westfield River at Main Street Bridge in Russell (Station WSFR21.3) in the eight samples analyzed was 0.030 mg/L.
d. N/A at this station.
e. N/A at this station.
f. The maximum total phosphorus concentration measured in the Westfield River upstream from Route 202/10 bridge, Westfield (Station WSFR12.7) in the four samples analyzed was 0.012 mg/L.

The *Aquatic Life Use* is assessed as support in the upper 16.8 mile reach of this segment of the Westfield River based primarily on the benthic macroinvertebrate community analysis, the good survival of test organisms exposed to river water, and the presence of a balanced riverine fish community. The absence of American eel upstream from the Texon USA dam may be the result of the dam(s) located downstream from the sampling station. Aberrant streamflow fluctuations in this segment of the Westfield River, however, and the continued presence of numerous barriers to fish migration are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status. Downstream from the Westfield WWTP discharge however, the *Aquatic Life Use* is assessed as impaired based on the best professional judgment of DWM biologists. Although the RBP III analysis indicated slight impairment at the WR06A station the percent comparability to the reference station (60%) is at the low end of that impairment category. That, coupled with a clear and dramatic shift (pollution tolerant chironomids displace virtually all sensitive EPT taxa) in community composition downstream from the discharge point, warrants the decision to list the downstream portion of this segment as impaired. Acute and chronic whole effluent toxicity detected in the Westfield WWTP effluent and the amount of green filamentous algae *Ulothrix zonata* downstream from the discharge is also of concern.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Within the last five years fecal coliform bacteria samples were collected from a total of four locations along this segment of the Westfield River (Appendix 3 of Appendix A and ESS 2000).

- Environmental Sciences Services, Inc. (ESS) collected fecal coliform bacteria samples above confluence with the West Branch Westfield River, Huntington (Station SS-2) in 1999.
- DWM collected fecal coliform bacteria samples near the western bank of the Westfield River at Main Street, Russell (Station WSFR21.3, Unique ID W0810) between 1 August and 3 October 2001.
- DWM collected fecal coliform bacteria samples ~350 feet upstream from Route 202/10 bridge, Westfield (Station WSFR12.7, Unique ID W0807) between 1 August and 3 October 2001.
- (ESS) collected fecal coliform bacteria samples at the Route 202 and 10 bridge, Westfield (Station PS-1).

Of the validated ESS data the fecal coliform bacteria count was elevated at SS-2 on 30 September 1999 (1200 cfu/100 mls) (ESS 2000). The highest count (n=3) documented by DWM in the river at the Main Street Bridge in Russell (Station WSFR21.3) was 90 cfu/100 ml (Appendix 3 of Appendix A). Fecal coliform counts (n=4) were higher in the river upstream from the Route 202/10 Bridge (ranged between 62 and 690 cfu/100 mls) (Appendix 3 of Appendix A). Of the validated ESS data the count was 190 cfu/100 ml at PS-1 on 28 December (ESS 2000).

It should also be noted that several fecal coliform bacteria samples were also collected by DWM from this segment of the Westfield River in May and August 1996. The three sampling stations were located as follows: at the pull-off just south of Route 20, Huntington (Station WSFR23.5), the pull-off near Whippernon Golf Course, Russell (Station WSFR20.3), and 200 feet downstream from the Route 90 bridge access from route 20, Russell (Station WSFR17.3). Fecal coliform bacteria counts at these stations did not exceed 180 cfu/100 ml (Appendix D, Table D4).

Too limited recent bacteria data are available and, therefore, both the *Primary* and *Secondary Contact Recreational* uses are not assessed for this segment of the Westfield River.

AESTHETICS

There were no objectionable odors, deposits or turbidity noted by MA DEP DWM sampling crews at the station on the Westfield River (Station WSFR21.3) on the Western bank at Main Street, Russell, between 1 August and 3 October 2001 (MA DEP 2001b).

There were no objectionable deposits or oils observed by MA DEP DWM biologists in the Westfield River 250m downstream from the Strathmore Paper Company treated effluent discharge in Russell (Station WR05) in September 2001 (MA DEP 2001c). The river did have a slight effluent odor.

MA DEP DWM field sampling crews noted occasional odors of petroleum and sulfide in the Westfield River upstream from the confluence with the Little River (Station WSFR12.7, Unique ID W0807, ~350 feet upstream from Route 202/10 bridge, Westfield) between 1 August and 3 October 2001(MA DEP 2001b). No visual turbidity or other objectionable deposits were observed except for isolated amounts of trash/debris.

Downstream from the confluence with the Little River, but out of the mixing zone for the Westfield WWTP discharge, and downstream from the Westfield WWTP discharge MA DEP DWM biologists observed that the Westfield River was slightly turbid and a sewage odor was present. Some sewage fungus was observed along the river outside of the effluent mixing zone. No other objectionable conditions were noted (MA DEP 2001c). Algal growth of primarily the green filamentous algae *Ulothrix zonata* covered an estimated 100% of both reaches sampled (Appendix D).

MA DEP DWM biologists surveyed a total of six reaches in this segment of the Westfield River in the summer of 1996 (Appendix C). From upstream to downstream the locations were as follows: upstream from the Texon USA facility near the roadside park near Huntington Health Center in Huntington (Station WR02), 450m downstream from the Texon USA discharge in Russell (Station WR03), upstream from Strathmore Paper across from the Whippernon Golf Club in Russell (Station WR04), 250m downstream from the Strathmore Paper Company treated effluent discharge in Russell (Station WR05), just upstream from the confluence with the Little River in Westfield (Station WR06), and 340m downstream from the Westfield WWTP discharge in Westfield (Station WR07).

The *Aesthetics Use* is assessed as support for the upper 16.8-mile reach of this segment of the Westfield River. The lower 1.0 mile reach of the river (downstream from the Westfield WWTP discharge) is assessed as impaired for the *Aesthetics Use* because of the slight instream turbidity, presence of sewage fungus, excess algal growth, and the sewage odor as documented during the 2001 MA DEP surveys.

Westfield River (MA32-05) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT upper 16.8 miles IMPAIRED lower 1.0 miles Cause: Unknown Source: Municipal point source discharge (Suspected source: Discharge from municipal separate storm sewer systems)
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT upper 16.8 miles IMPAIRED lower 1.0 miles Cause: Excess algal growth, Turbidity, and Odor Source: Municipal point source discharge (Suspected source: Discharge from municipal separate storm sewer systems)

RECOMMENDATIONS WESTFIELD RIVER (MA32-05)

- Evaluate flow data for FERC Project 2631 to ensure that run-of-river conditions, minimum flow releases and impoundment fluctuation conditions of the license are being met.
- Further investigate source(s) of aberrant streamflow fluctuations observed using on-line real-time data for the USGS gage 01183500. Ideally, a natural flow regime should be restored in the Westfield River.
- To ensure run-of-river operations all dam operators should install, calibrate and maintain a continuous streamflow monitoring gage or determine some other method to ensure compliance with run-of-river operations.
- Conduct fish population sampling to determine the effectiveness of fish passage facilities at FERC licensed and exempt projects.
- An upstream/downstream evaluation of the benthic macroinvertebrate community in the Westfield River should be conducted during the next Westfield River Watershed Survey to document any improvements associated with the upgrades at the Westfield WWTP.
- Conduct bacteria monitoring to assess the *Primary* and *Secondary Contact Recreational* uses.
- Review the community of Westfield (MAR041236) Phase II Stormwater SWPPP, extent of compliance, and the effectiveness in minimizing impacts of stormwater runoff from their facilities into the Westfield River mainstem and subwatershed tributaries.

WESTFIELD RIVER WATER QUALITY MONITORING PROJECT

FINAL REPORT
2008-04/604b

EXCERPTS

June 21, 2010

Prepared By
Pioneer Valley Planning Commission

Table of Contents

INTRODUCTION

The Westfield River Watershed encompasses a total of 517 mi^2 in Hampshire, Hamden, and Berkshire Counties of western Massachusetts. The Westfield River Watershed is bordered by the Deerfield, Hoosic, Housatonic, Farmington, and Connecticut River Watersheds. The Westfield River is a major tributary to the Connecticut River. The main stem Westfield River originates in Savoy and Windsor. It flows in a generally southerly direction for 27 miles. There are a total of 850 miles of rivers, streams, and brooks and 4,200 acres of lakes and ponds in the watershed. The Westfield River corridor encompasses many valuable features and resources, including: the first designated National Wild and Scenic River in Massachusetts (forty-three miles of the river); the longest uncontrolled river in the state (West Branch of the Westfield River); Massachusetts' only regenerating Atlantic salmon habitat; and, an active corps of volunteer and professional planners, government officials, environmentalists, developers, advocates, builders and citizens.

Although municipalities, state and federal agencies, and several citizen groups have a keen interest in the health and vitality of the watershed, this is the first volunteer water quality monitoring program with an approved quality assurance project plan for the watershed. This project has fulfilled a 2005 Five Year Watershed Action Plan for the Westfield River recommendation to develop and implement a water quality monitoring program within the watershed. Based on the bacteria monitoring results, it is recommended that this project be continued in 2010 and source tracking activities initiated.

Project Partners

The primary project partners included Pioneer Valley Planning Commission (PVPC) and the Westfield River Environmental Center and Biology Department at Westfield State College (WSC). The following additional agencies and organizations were involved in site selection and technology transfer: Massachusetts Department of Environmental Protection's Western Regional Office, the Westfield River Watershed Association, the Westfield River Wild and Scenic Advisory Committee, the Massachusetts Department of Fish and Game Riverways Program, and local Conservation Commissions.

The project received matching funds from the U.S. Environmental Protection Agency in the form of an EPA Equipment Loan Grant to Westfield State College for water quality monitoring equipment. The equipment purchase valued at $5,420 included: a Hach digital titrator, Ohaus Pioneer balance, certified thermometer, oven thermometer, YSI H/temp meter, and 8 YSI pH meters. Documentation regarding the match is provided in the Appendices.

PROJECT APPROACH

Site Selection

Recommendations for monitoring locations were made based on input from the following organizations and studies: the Pioneer Valley Planning Commission, the Massachusetts Department of Environmental Protection, faculty members of the Westfield State College Westfield River Environmental Center (WREC), the Westfield River Watershed Association (WRWA), the Westfield River Wild and Scenic Committee, Massachusetts Riverways personnel, *Westfield River Watershed 2001Water Quality Assessment Report*[1], and the *Westfield River Five Year Watershed Action Plan*[2]. Input was also solicited from local Conservation Commissions, Boards of Health and chief elected officials via notice mailed August 4, 2008. The goal of the QAPP was to design an approach that would provide useful data and generate awareness of water quality problems to better identify sources of contamination. While the *Watershed Action Plan* stresses bacterial monitoring, the QAPP committee identified the additional need for monitoring selected physical and chemical parameters at almost monthly intervals for at least a year at traditional sites such as the four USGS gauging stations in the watershed as well as sites of concern identified in the *Water Quality Assessment Report* and the *Watershed Action Plan*. While local groups and students at Westfield State College have conducted sporadic samplings in the watershed and DEP conducts a concentrated sampling of many parameters at selected sites once every five years, there is no consistent data at specific sites at monthly intervals for consecutive years. The only study that comes close is the acid rain monitoring project organized by the Mass Water Watch Partnership at UMass, which has samples selected sites for pH and alkalinity in April and October/November. A small number of the sites are also analyzed for anions and cations. The development of the QAPP for this project was separate from these other monitoring efforts.

Figure 4 Jack's Brook

[1] *Water Quality Assessment Report*, Massachusetts Department of Environmental Protection, 2001
[2] *Westfield River Five Year Watershed Action Plan*, Pioneer Valley Planning Commission, June 2006.

The *2001 MassDEP Westfield River Watershed Water Quality Assessment Report* states that several sections of the Westfield River and a number of its tributaries are impaired due to bacteria contamination from stormwater runoff. Bacteria contamination has led these stretches of river to fail to meet designated uses such as primary and secondary contact recreation. MassDEP recommended additional bacteria sampling at targeted locations to identify the sources of contamination. The *Watershed Action Plan* cites the Main Stem of the Westfield River (MA32-04) in the vicinity of the two DCR state beaches as being highly impacted by bacteria contamination and both beaches were closed to swimming. The Gardner State Park area was closed to swimming in 2006. DCR uses Enterococcus as the indicator bacteria for monitoring swimming water quality at this beach and the weekly monitoring here frequently exceeded Enterococcus standards for bathing beaches[3]. MassDEP conducted targeted sampling to locate possible sources upstream of the Gardner beach in 2005. Intensive sampling was conducted int eh river as well as nearby upstream tributaries but no elevated dry weather counts were detected during these surveys and a potential source was never identified. Impacted areas also are found in the Little River (MA32-08) in the City of Westfield. This section is impaired for primary recreational contact because of bacteria contamination. Two tributaries of the Little River, Ashley Brook and Jack's Brook, are suspected as possible bacteria sources based on information provided by the Westfield Water Resources Department. Pond Brook (MA32-24) in the City of Westfield has also been identified as impacted based on past water quality data provided by the Westfield Water Resources Department withelevated levels of fecal coliform contamination. Data from Pond Brook will also be important in the near future as a developer is planning to put a mall on the over 200-acre site that includes a large segment of the brook. Two sites in Russell will bracket the proposed Russell Biomass project which proposes to take 800,000 gallons of

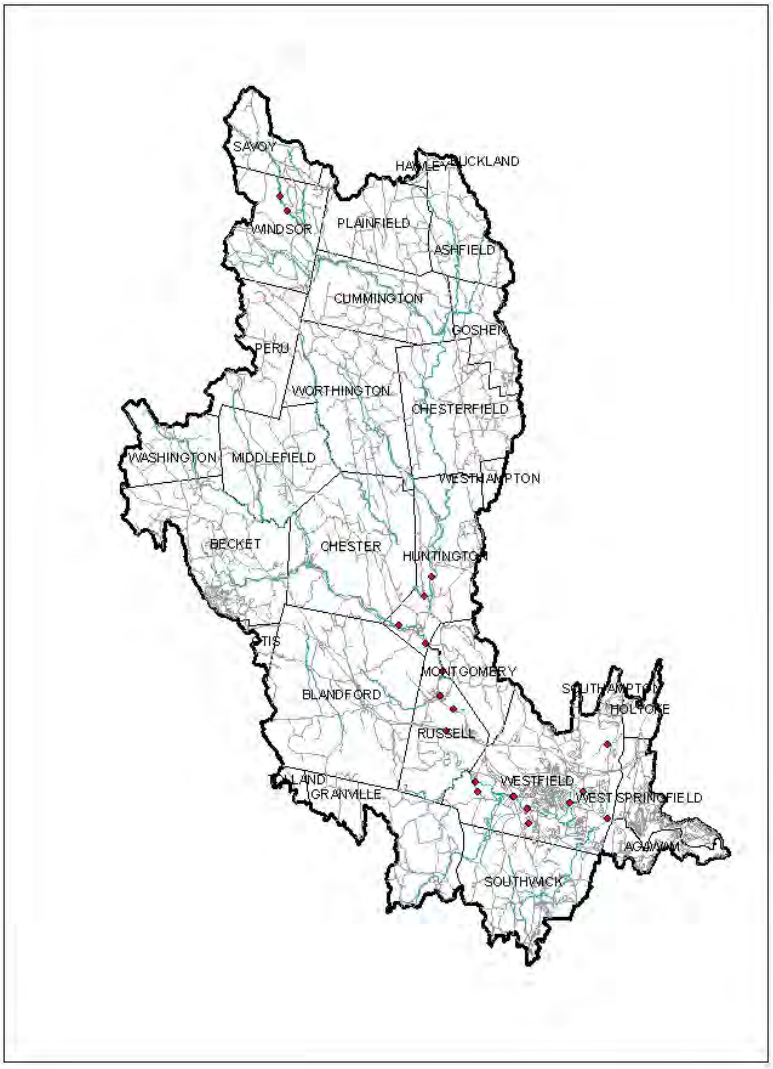


Figure 5 Westfield River Watershed

[3] *Enteroccocus* standards for bathing beaches is 33 colonies/100 ml calculated from a geomean of 5 or more samples or 61 colonies /100 ml single sample

water from the river per day and return only 100,000 gallons of heated water. Two other sites in Russell, Potash Brook and Bradley Brook, were chosen because they drain water from Blandford where, recently, there have been problems with failing septic systems according to input from the Blandford Board of Health.

Figure 5 is a map of the monitoring sites for the entire watershed. The Appendix contains topographic maps by region of the watershed with the sampling locations identified.

Quality Assurance Project Plan

The QAPP Committee included: Robert Thompson (WREC coordinator), David Doe (Biology Dept. WSC), Michael Vorwerk (WSC Environmental Science coordinator), Michael Young (WSC Physical Science chairman and WRWA board member), Anne Capra (PVPC), Christine Duerring (MassDEP), and Carrie Banks (Westfield River Wild and Scenic Committee). The Committee reviewed existing water quality data and previous sample collection locations for the watershed, discussed proposed sampling locations with stakeholders, and selected sampling locations in targeted sub-watersheds for a total of twenty-one (21) baseline sampling locations, used to gather physical and chemical data from April to November, 2009. Data included air and water temperature, pH, alkalinity, and total suspended solids. Using the 2001 MassDEP Water Quality Report, the 2005 Watershed Action Plan, the 2006 MassDEP Westfield Watershed Sampling and Analysis Plan, and information from MassDEP WERO Bacteria Source Tracking Program, twelve (12) sites were identified for monthly sampling for *E. coli* using the IDEXX Colilert system. These 12 sites are described below:

East/Main Branch Westfield River – Two (2) sites in the vicinity of Windsor State Park beach, one at the Gardner State Park beach, and one at the USGS Knightville Dam gauging station

Middle Branch Westfield River - USGS Goss Hill gauging station, below the Littleville dam

West Branch Westfield River - USGS gauging station in Huntington.

Westfield River Main Stem – Three (3) sites between Huntington and Westfield along Rt. 20, at the rest area opposite the Huntington Health Center, at the rest area opposite the Countryside Woodcraft, and at the rest area opposite the former Wippernon Golf Course; USGS gauge station in Westfield along Route 20 near the Westfield/West Springfield boundary.

Potash Brook - Approximately 1 mile from the junction of Routes 20 and 23 in Russell

Bradley Brook - Behind the post office in Russell

Little River – At Northwest Road crossing, at Horton's Bridge (Granville Road), and about 50 meters above the confluence of the Little River and the Westfield River (Main Street, Westfield).

Cook Brook - Northwest Road crossing

Jack's Brook - City View Road crossing

RESULTS

Monthly water quality monitoring was performed at 21 locations in Windsor, Huntington, Russell, Westfield and West Springfield from April to November 2009. The data collected is located in Table 1 and 3 on the following pages.

Bacteria Levels

Twelve (12) sites were monitored for E. coli (Table 1). Eleven (11) of these (92%) had E. coli values one or more times in excess of primary contact standards (235 MPN/100 mls, single sample). Of the 11 sites with single sample E. coli exceedances, 7 sites (64%) also exceeded the geometric mean (126 MPN/100 mls) for primary contact during the prime recreational season (June to October). Although there appears to be a correlation between wet weather and elevated E. coli counts for some sites, others (Little River, Jack's Brook, Ashley Brook, and Pond Brook) also tested high during dry weather events.

There are two MA DCR beaches on the East Branch of the Westfield River that have been permanently closed since 2006 due to consistently elevated *E. coli* levels. Both of these beaches are within the Wild and Scenic designated areas including Gardner State Park Beach on the lower East Branch and Windsor State Forest on the upper East Branch in Windsor. Sampling on the East Branch upstream of the Westfield River Beach at Windsor State Forest resulted in one high dry weather value of 260 MPN/100 mls on September 27, 2009. Although there may be a bacteria source upstream, the data collected at Windsor State Forest beach suggests the possibility for re-opening the beach for public use. However, further downstream on the East Branch at Gardner State Park, water quality continues to be poor. Results for Gardner State Park beach had high *E. coli* wet weather levels on May 18, 2009 ((461.1 MPN/100 mls) and October 25, 2009 (866.4 MPN/100 mls). The other 3 wet weather sampling events at this location did result in a violation of primary contact recreation standards for E. coli. Hence, 40% of wet weather sampling at this location violated these standards. Upstream bacteria sources remain unidentified.

Table 1 E. coli Results (MPN/100 mls)								
Site	**26-Apr**	**18-May**	**28-Jun**	**26-Jul**	**23-Aug**	**27-Sep**	**25-Oct**	**22-Nov**
WREB27.8	<1	38.4	23.5	52.9	95.9	190.4	76.7	21.1
WREB28.6	1	37.3	39.3	48.7	98.5	260.3	53.7	60.8
WREB0.78	1	461.1	43.5	90.8	224.7	35.9	866.4	15.5
BRB0.16	3.1	17.5	27.8	30.1	613.1	187.2	58.8	1
PTB1.3	53.8	161.6	44.1	248.9	>2419.6	224.7	201.4	27.9
LTR4.8	21.6 and 1.0	209.8 and 27.9	214.2	178.5	2419.6	225	1203.3	46.4
LTR0.01	1986.3	1553.1 and 204.6	185	344.8	>2419.6	1374	2382	325.5
COB0.47	3	19.9	74.9	64.4	>2419.6	43.5	112.6	7.5
JACB0.01	1413.6	104.3 and 17.1	80.9	117.8	517.2	>2419.6	547.5	76.2
ASHB0.3	224.7	143.9	866.4	387.3	1732.9	>2419.6	1299.7	517.2
PNDB3.3	12	209.8	29.5	54.8	547.5	290.9	1553.1	12.2
PNDB0.01	6.3	209.8	70.3	72.8	209.8	435.2	67.7	111.9

Sampling with two values include data for a normal sample (first value) and a 1:10 dilution (second value)

Green data represent dry weather days with 48 hours of less than 0.1" of precipitation

Red data represent wet weather days in which >.1 inch of rain falls within the past 48 hrs

Data values of <1 were graphed as 0.5.

Data values of >2419.6 were graphed as 2450.

Temperature

All sampling sites were Class B waters, with 9 out of 21 designated Cold Water Fisheries and the remaining 12 designated Warm Water Fisheries (Table 4). Temperature is based on the mean of the daily maximum temperature over a seven day period for Class B Cold Water Fisheries, which must be • 68° F (20° C). Temperature standards for Warm Water Fisheries in rivers are based on the minimum expected flow for the month, at which the temperature must be • 83° F (28.3° C). These standards vary slightly due to the change in temperature caused by known, permitted discharges.

Table 2 MA Water Quality Standards for Temperature

Class	MA Surface Water Quality Standard for Temperature
Class BCWF	• 68° F (20° C) based on the mean of the daily maximum temperature over a seven day period in al cold water fisheries, unless naturally occurring, and • T due to discharge • 3° F (1.7° C)
Class BWWF	• 83° F (28.3° C) and • T due to discharge • 5° F (2.8° C) in rivers (based on the minimum expected flow for the month)

It is not possible to determine from the temperature monitoring data from this project whether the water temperature was meeting the designated standards for each river segment. Temperature was not monitored daily over a seven day period for cold water fisheries, nor was it monitored at the expected low flow for the month for warm water fisheries.

However, water temperature data for Pond Brook in Westfield (Table 3) suggests further temperature monitoring should be performed to determine if the water meets its proposed Class B Cold Water Fisheries standard. At PNDB3.3 (Pond Brook at East Mountain Country Club), temperature exceeded 20° C in June, July, and August on the single sample dates. At PNDB0.01 (Pond Brook at Union Street) temperature exceeded 20° C in July and August on the single sample dates.

Figure 7 Pond Brook at East Mountain Country Club

Table 3 Monthly Water Temperature By Site (°C)

Segment	Class	4.26.09	5.17.09	6.28.09	7.26.09	8.23.09	9.27.09	10.25.09	Mean
WREB27.8	BCWF	15	10.5	15	18	18	12	6	13.5
WREB28.6	BCWF	15	11	15.5	18	18	12	6	13.6
WREB0.78	BCWF	16	12	18	19	20	13	6	14.9
WREB2.4	BCWF	16	14	16	19	20	13	6	14.9
WRMB0.3	BWWF	14	13	20	20	19	13	8.5	15.4
WRWB1.5	BCWF	13	12.3	18.2	19.5	20	13	10	15.1
WR24.1	BWWF	13	13	19	20	21	13	10.5	15.6
WR22.6	BWWF	14	14	19	21	22	14	10	16.3
WR20.1	BWWF	14	14	19	21	22	14	11	16.4
WR8.3	BWWF	16	16	20	20	23	16	10	17.3
WR Canoe Access	BWWF	NS	13	20	22	24	18	11	18
BRB0.16	B (Proposed for BCWF)	13.5	12	18	18	21	12	10	14.9
PTB1.3	B (Proposed for BCWF)	14.1	11	17	18	20	12	11	14.7
LTR7.5	BWWF	16	11	16.9	13.7	20	12.8	11.1	14.5
LTR4.8	BWWF	17	13	18	20	23	15	12	16.9
LTR0.01	BWWF	18	13	17	12	20	13	9	14.6
COB0.47	BWWF	17	11	18	19	21	12.6	12	15.8
JACB0.01	BWWF	12	11.5	15.5	17.7	19	12.1	11.3	14.2
ASHB0.3	BWWF	17	15	16	18	19	13.6	11.2	15.7
PNDB3.3	B (proposed BCWF)	20	17	22	28.9	25	16	11	20
PNDB0.01	B (proposed BCWF)	19	14	19	22	22	12.8	10	17

* Highlighted values exceed standards for Class B Cold Water Fisheries

Table 4 Surface Water Quality Classification by Site

Site Number	Site Name	Surface Water Quality Classification	DEP River Segment
MAINSTEM			
WREB27.8	*East Branch/Windsor State Forest beach*	BCWF	MA32-04
WREB28.6	*East Branch/Windsor State Forest, East Branch*	BCWF	MA32-04
WREB0.78	*East Branch/Gardner State Park beach*	BCWF	MA32-04
WREB2.4	East Branch/Knightville Dam gage station	BCWF	MA32-04
WRMB0.3	Middle Branch/Goss Heights gage station	BWWF	MA32-03
WRWB1.5	West Branch gage station	BCWF	MA32-01
WR24.1	Westfield River rest area opposite Huntington Health Center	BWWF	MA32-05
WR22.6	Westfield River rest area opposite Countryside Woodcraft	BWWF	MA32-05
WR20.1	Westfield River rest area opposite former Whippernon Golf Course	BWWF	MA32-05
WR8.3	Westfield River gage station near West Springfield	BWWF	MA32-05
No site number	Westfield River Canoe and Fishing Access Trail	BWWF	MA32-05
TRIBUTARIES			
BRB0.16	*Bradley Brook behind post office*	B (Proposed for BCWF)	MA32-21
PTB1.3	*Potash Brook along Rte 23, below Turnpike overpass*	B (Proposed for BCWF)	MA32-22
LTR7.5	Little River at Northwest Road bridge	BWWF	MA32-36
LTR4.8	*Little River at Horton's Bridge*	BWWF	MA32-36
LTR0.01	*Little River near Westfield River confluence*	BWWF	MA32-08
COB0.47	*Cook Brook at Northwest Road*	BWWF	MA-32-36
JACB0.01	*Jack's Brook at City View Road*	BWWF	MA32-08
ASHB0.3	*Ashley Brook at Hillside Road*	BWWF	MA32-08
PNDB3.3	*Pond Brook at East Mountain Country Club*	B (proposed BCWF)	MA32-24
PNDB0.01	*Pond Brook at Union Street*	B (proposed BCWF)	MA32-24

Total Suspended Solids

Total Suspended Solids (TSS) is comprised of organic and mineral particles that are transported in the water column. TSS is closely linked to land erosion and to erosion of river channels, and therefore can be a good indicator of whether or not land disturbances within the watershed can be affecting aquatic life. TSS can be extremely variable, ranging from less than 5 mg/L to extremes of 30,000 mg/L in some rivers. TSS is an important measure of erosion in river basins, and is closely linked to the transport of nutrients (especially phosphorus), metals, and a wide range of industrial and agricultural chemicals through river systems. In most rivers TSS is primarily composed of small mineral particles and is often referred to as “turbidity”. Higher TSS (>1000 mg/L) may greatly affect water use by limiting light penetration and can limit aquatic life through sedimentation of suspended matter. TSS levels and fluctuations influence aquatic life, from phytoplankton to fish. TSS, especially when the individual particles are small (< 63µm), carry many substances that are harmful or toxic. As a result, suspended particles are often the primary carrier of these pollutants to lakes and to coastal zones of oceans where they settle. In rivers, lakes and coastal zones these fine particles are a food source for filter feeders which are part of the food chain, leading to biomagnification of chemical pollutants in fish and, ultimately, in humans. In river basins where erosion is a serious problem, suspended solids can blanket the river bed, thereby destroying fish habitat.

TSS results (Appendices) were either low (below 10 mg/L) throughout the season at all sites except for a single high value of 156.4 mg/L at ASHB0.3 (Ashley Brook at Hillside Road). TSS at this site was less than 2 mg/l on all other sampling dates. TSS at all sites did not indicate major problems associated with erosion or other sources of land disturbance.

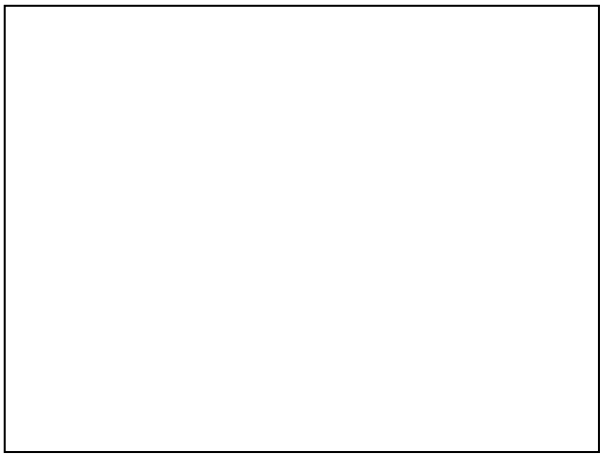


Figure 8 Ashley Brook

The accuracy and precision of the TSS data has been called into question during QA review. Potential sources of bias in TSS tests may have been due to: 1) lack of complete mixing immediately prior to sub-sampling; 2) high filter only weights; 3) too high drying temperatures; and, 4) poor standard preparation. Therefore, the TSS data presented is not considered valid.

Alkalinity and pH

Alkalinity is a measure of all the substances in water that can resist a change in pH when acid is added to the water. In other words, alkalinity describes how well water recovers from an "acidic" punch. Alkalinity is typically expressed in mg/L of calcium carbonate ($CaCO_3$) because calcium carbonate is a good acid neutralizer. Water with low alkalinity has a low capacity to neutralize or "buffer" incoming acids and is, therefore, very susceptible to acidic pollution. In contrast, water with greater alkalinity, or buffering capacity, will have the ability to neutralize more of the incoming acidity and, therefore, resist rapid changes in pH. Sufficient alkalinity in water protects

aquatic life against rapid changes in pH and makes water less vulnerable to acid rain. Alkalinity of 100-200 mg/L will sufficiently stabilize the pH in a stream.

Alkalinity of natural water is determined by the soil and bedrock through which it passes. The main sources for natural alkalinity are rocks which contain carbonate, bicarbonate, and hydroxide compounds. Borates, silicates, and phosphates also may contribute to alkalinity. Limestone is rich in carbonates, so waters flowing through limestone regions or bedrock containing carbonates generally have high alkalinity - hence good buffering capacity. Conversely, areas rich in granites and some conglomerates and sandstones may have low alkalinity and therefore poor buffering capacity.

The Westfield River Basin is largely comprised of crystalline, sedimentary, and some carbonate rocks. Sedimentary rocks, such as sandstone, siltstone, and shale, occur only in valleys and lowlands of the eastern part of the Westfield River basin.[4] Low levels of carbonate rock in the watershed result in the very low alkalinity observed. The mean alkalinity values ranged from 5.1 to 43.3 at all of the sites with an average mean value of 18 mg/L. Along the main branches of the Westfield River, there was less of a range in alkalinity values with mean values between 12 and 19.4 mg/L.

Table 5 Alkalinity (mg/L)

Segment	4.26.09	5.17.09	6.28.09	7.26.09	8.23.09	9.27.09	10.25.09	Mean
WREB27.8	8.5	9.8	11.2	11.2	12.3	13.8	21.3	12.6
WREB28.6	9.2	10.9	12.6	12.1	13.2	15.4	22.1	13.6
WREB0.78	10.9	11.4	14	11.8	14.8	17.6	9.4	12.8
WREB2.4	10.6	11.2	14	12	15.2	17.6	11	13.1
WRMB0.3	7.8	9.3	9.2	12.3	14.5	18	22.1	13.3
WRWB1.5	13.5	12.1	15	14.5	15	22.8	11.5	14.9
WR24.1	12.2	11.9	14.5	14	14.2	19.7	11.1	13.9
WR22.6	11.2	12.4	14.2	13.1	14.2	19.1	10.9	13.6
WR20.1	10.9	12.6	14	12.9	14	18.8	11.2	13.5
WR8.3	21.4	16	19.9	19.1	15.4	28.8	15.5	19.4
WR Canoe Access	NS	19.8	18	16.5	13.4	28.8	NS	19.3
BRB0.16	7.6	7.6	9.5	9.7	8.5	11.9	8.5	9
PTB1.3	11.8	13.4	16.9	15.9	15.4	19	13.8	15.2
LTR7.5	4.5	3.9	5.3	4.7	6.1	6.5	4.9	5.1
LTR4.8	8.9	10.4	11.2	10.2	11.4	14.5	11.2	11.1
LTR0.01	13.1	12.7	14	12	13.8	17.9	13.7	13.9
COB0.47	7.4	4	11.5	11	11.4	6.8	8.9	8.7
JACB0.01	31	26.8	29.8	27.8	30.4	25	18.1	27
ASHB0.3	43.3	45.8	50.4	46.9	52.1	35.9	29.6	43.4
PNDB3.3	28.7	29.8	33.1	27.2	35.4	37.9	29.1	31.6
PNDB0.01	35.8	35.1	36.5	33.8	38.9	35	30.7	35.1

[4] USGS, http://ma.water.usgs.gov/basins/westfieldgw.htm