Massachusetts Department of Environmental Protection
Division of Watershed Management

Assabet River Watershed Innovative Permitting

EPA 2002 State Innovation Pilot Grant

Final Report

November 2005

Introduction

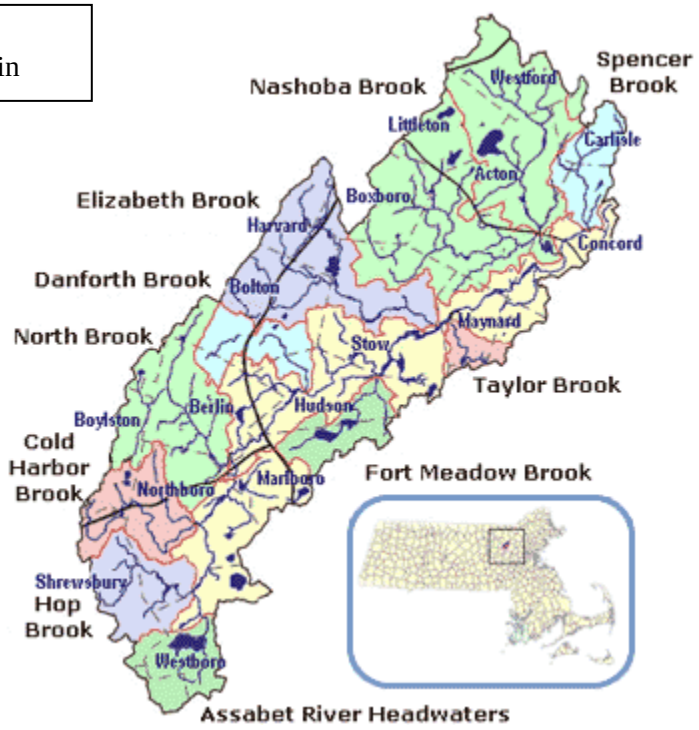
This document is the final report for the State of Massachusetts for the Assabet River Watershed Innovative Permitting Project that was partially funded through the 2002 Environmental Protection Agency (EPA) State Innovation Pilot Grant Program competition. It provides a summary of Massachusetts experience and activities associated with the project. Over the course of six years (from 1999– 2005), the Massachusetts Department of Environmental Protection (MassDEP) has worked in partnership with a coalition of community stakeholders on a common goal- *Restoring the Health of the Assabet River!*

This final report provides 1) a brief background of the Assabet River watershed, 2) the various challenges associated with project development, 3) the overarching strategic goals, and 4) the inter-connected project areas and partnerships that were developed during the project. It also provides a summary of the environmental permitting innovations used, the project accomplishments and results, and a summary of key themes and lessons learned.

Background

The Massachusetts Assabet River Watershed (see Figure 1) covers 111,542 acres and contains nine tributaries that feed the 31-mile Assabet River. Like many of the once naturally, free-flowing rivers across America more than 150 years ago, the Assabet River was tamed to help power the industrialization of communities along its path. A total of nine dams were constructed to obstruct the river's natural course that transformed the regional economy to host some of the country's most productive mills. Today, the brick mills along the Assabet River no longer house the industrial mill giants, but rather accommodate many high-technology companies and service based organizations throughout the watershed. Over 170,000 people reside in the watershed.

Figure 1
Assabet River Basin



Graphic Courtesy of the Massachusetts Organization of the Assabet River (OAR)

The steady and progressive development of communities in the watershed created major public infrastructure needs. This included the need to effectively process and treat wastewater from growing communities. In an effort to meet the growing regional wastewater demand, four major Publicly Owned Treatment Works (POTWs) that serve six communities, and three minor facilities discharge treated wastewater into the Assabet River.

In 1998, the Massachusetts Executive Office of Environmental Affairs launched the "Massachusetts Watershed Initiative". Multi-discipline watershed teams, comprised of state and federal officials, local municipal officials, non-profit watershed partners, and business leaders, were charged with providing comprehensive watershed protection in each of the 27 major watersheds in the Commonwealth. The Initiative's goal was to facilitate locally based problem identification and problem solving and coordinate implementation activities among all parties.

The Challenge

As noted above, the Assabet River is dominated by Publicly Owned Treatment Works (POTWs), both in flows and nutrient loads during low flow conditions. Beginning in 1998 and 1999, preliminary evaluations conducted by the Massachusetts Department of Environmental Protection (MassDEP) and the Organization for the Assabet River (OAR) – a non-profit river advocate, indicated that water quality conditions in the River were being negatively impacted due to excessive vegetative growth, primarily resulting from excess nutrients (phosphorus). Excessive nutrient concentrations contribute to algal blooms that impair the health of the river by choking the water resource with plant life, reducing oxygen for fish and other aquatic life and leaves them unsuitable for swimming, fishing, and boating. During low flow conditions the four major POTWs generally accounted for approximately 60-80% of the river flow and up to 97% of the phosphorus entering the river. Given the preliminary evaluations the MassDEP, EPA Region 1, OAR, and Massachusetts Watershed Initiative's **Su**dbury / **As**sabet / **Co**ncord (SUASCO) Team initiated a comprehensive, multi-phase watershed approach to document actual water quality conditions, evaluate what actions are needed to meet water quality standards, and to identify and assess both current and future wastewater and water supply needs in the affected communities. Right from the start, the Assabet River Watershed Project faced two major hurdles:

- *Financial Resources* - A steady multi-year stream of financial sources were going to be necessary to conduct the detailed water quality monitoring, assessment, modeling and evaluation activities. Existing traditional MassDEP state program sources and mechanisms were not going to be sufficient to sustain the necessary funding and technical expertise required for comprehensive watershed analysis and TMDL pollutant load (phosphorus) decisions.

- *Local Autonomy* – There are four major POTW's that treat wastewater for six communities (Hudson, Marlborough, Maynard, Northborough, Shrewsbury and Westborough) along the Assabet River. Aside from two inter-municipal wastewater-processing agreements between the towns of Northborough/Marlborough and Shrewsbury/Westborough, the remaining POTW's operate relatively independently of each other. Any additional future nutrient (phosphorus) reduction upgrades to the four-wastewater treatment plants would be borne by local community residents. Six separate Town meeting appropriation approvals would be necessary to fund preliminary environmental studies and any future long-term plant upgrades.

Strategic Goals

Driven by the federal and state Clean Water Acts, EPA and MassDEP are striving to restore and maintain the chemical, physical, and biological health of the Commonwealth's waters. The Assabet River is designated as a Class B water under the Massachusetts water quality standards [314 CMR 4.05(3)b]. Class B waters are designated as capable of providing and supporting habitat for fish and other aquatic wildlife, and for primary and secondary contact recreation, such as swimming, fishing, and boating. The goal for the Assabet River is to achieve water quality standards as defined in Massachusetts 314 CMR 4.0. The water quality standards provide numerical and narrative criteria to meet designated uses.

The strategic goals of this project are:

- *Water Quality Improvements*: To develop and implement a Total Maximum Daily Load (TMDL) analysis, which will set the "pollution budget" and outline a cleanup plan to restore the health of the Assabet River including investigating ways that may be more cost effective of achieving standards other than solely relying on facility upgrades. More specifically, the TMDL analysis includes identifying the source(s) of the pollutant from direct discharges (point sources) and indirect discharges (non-point sources including sediment), determining the maximum amount of the pollutant, including a margin of safety, that can be discharged to a specific water body while maintaining water quality standards for designated uses.

- *Community Empowerment:* To develop a comprehensive watershed-based community planning process that maximizes local municipal, state, federal, and nonprofit organizational resources (financial and technical staff) that will aid community stakeholders in making informed decisions.

- *Adaptive Management*: To develop a short and long-term, phased watershed-based cleanup plan that was both technically sound and environmentally responsive in order to limit and reduce the nutrient phosphorus in the Assabet River system and achieve water quality compliance.

Project Areas and Partnerships

A three-phased approach was developed for the project to address the three strategic goals previously identified. The first two phases included data collection/monitoring and data analysis. In order to achieve phase 1 objectives several partnerships were formed to obtain the necessary funding. During phase 1 the watershed team, with the support of the state and community stakeholders, was able to secure $224,000 in state funding for data collection activities. That funding was matched with $127,500 of federal Section 22 funding from the Army Corps of Engineers. Combined this funding was used to hire a consultant to conduct 13 water quality surveys at 26 river locations and in 5 impoundments necessary for detailed water quality assessment and modeling studies on the river. All partners assisted in this effort. The Organization for the Assabet River (OAR) partnered with the state consultant and assisted in the field data collection activities as defined in a Quality Assurance Project Plan (QAPP) and the POTWs assisted by first optimizing their treatment processes to reduce effluent phosphorus concentrations and by increasing the effluent sampling frequency for phosphorus in order to quantify the amount of phosphorus discharged by each facility during the study period.

Once the data identified the extent of impairment it became clear that a second phase of the project was necessary that contained two additional activities. First, funding was needed to develop a detailed water quality model that could be used to evaluate potential options to restore the river to

water quality standards including investigating innovative and potentially cost effective alternatives such as dam removal and sediment remediation. With support from the communities and environmental groups MassDEP was able to provide about $300,000 in state funding for this effort. At the same time and on a parallel track the POTW communities, with assistance from the State Revolving Fund (SRF) began development of a Comprehensive Water Resource Management Planning (CWRMP) to determine the future needs of each community, treatment options, costs, and ultimately develop a recommended plan. The goal was to have the TMDL process and CWRMP process completed at approximately the same time so decisions could be made on how best to proceed. What is not evident is how unique this process was and the partnerships that were formed. It was recognized early in the process that if each community applied for SRF funding individually they would likely not receive enough priority points in the SRF program to be eligible for funding. As a result, the communities formed the "Assabet River Consortium" which was made up of the six communities currently treating and discharging wastewater to the Assabet River. Rather than requesting funding support individually the Consortium requested funding jointly to address all their needs at once as well as to address a number of watershed issues common to all. As a group they received high priority points and were ultimately awarded $3.5 million in SRF funding for this evaluation. This was critical to not only obtaining the necessary funding but to analyze the watershed as a whole. This was the first time this process was used in MA and is a good model for future watershed permitting proposals.

The figure below provides a summary of the integrated project areas, partnerships, and leveraged contractual resources of the Massachusetts Assabet Watershed Project (**Bolded Activities** either currently in-process or will occur in the near future): *During the first two critical phases of the project, a total of approximately $4 million of contractual resources were been effectively leveraged from a variety of federal, state, local, and nonprofit sources into a common goal*- Restoring the Health of the Assabet River!

PROJECT AREAS

Phase 1	*Phase 2*	***Phase 3***
TMDL Data Collection / Monitoring (1999-2001)	*Analysis (2000 –2004)*	***Implementation (2004 –2009)***
MA Watershed Initiative (Exec. Office of Env.) **($224,000)**	Watershed Management (CWRMP (1))	TMDL Modeling	NPDES Permit (EPA & MassDEP)
US Army Corps of Engineers (ACOE) **($127,500)**	Assabet River Consortium **($ 3,500,000 SRF)** 1. Needs Analysis 2. Treatment Options 3. Costs & Disposal 4. Recommended Plan	MassDEP **($300,000 (2))** 1. WQ Model 2. Run Options 3. Develop TMDL	**Sediment Evaluation ($100,000 EPA & $130,000 MassDEP/USGS)** 1. Extent & Quality 2. Evaluation
Organization for the Assabet River **(Volunteer Monitoring and In-Kind Services)**			**Sediment Restoration Plan** (ACOE $300,000; MassDEP $500,000; Assabet Consortium $350,000)
			Monitoring Plan (Cost Undetermined)

(1) CWRMP- MassDEP's Comprehensive Water Resource Management Planning process.
(2) Estimated amounts.

Project Status

At the time of grant application we had completed phase 1 of the project (data collection) and portions of phase 2 (modeling and analysis). MassDEP's proposal was to use the $100,000 innovations grant funding, matched by an additional $100,000 in state funds to make some

additional model runs and to better define options for achieving water quality standards and to begin phase 3 of the project (to quantify and qualify the extent of sediment in downstream impoundments with a goal of developing a final permit conditions at the end of 2003 or early to mid 2004. Since that time the Consortium has finalized the first two phases of their Comprehensive Water Resources Management Plan (CWRMP) and is in the process of completing steps 3 and 4 of that process as previously identified. Approximately 10 additional model runs, in the form of alternative analysis, were made bringing the total to about 30 separate runs that evaluated water quality results resulting from various phosphorus reduction strategies, including but not limited to, those resulting from reductions in point sources, sediment, and those that may result from watershed alternatives such as dam removal. Those runs concluded that reductions in point sources alone would not be sufficient to achieve water quality standards and that a combination of point source reductions (down to 0.1 mg/l total phosphorus) and 90% reduction in sediment phosphorus were needed to meet water quality goals.

As a result of the above analysis, the MassDEP developed a detailed TMDL, and held many meetings with all stakeholders and the public prior to finalizing the TMDL and submitting it to EPA for final approval. It included a detailed implementation plan that outlines actions to be taken using an adaptive management approach over the next ten years or two permit cycles. The TMDL was finalized on June 1, 2004 and approved by EPA Region 1 on September 23, 200, MassDEP's TMDL, formal response to comments, and other documents are attached for additional information.

Implementation

Permitting Actions:

As noted above, the TMDL outlines two specific implementation needs to meet water quality goals in the Assabet River. Those two measures include a reduction of phosphorus from the four major POTWS and a reduction of phosphorus from the sediments particularly within the impounded areas of the river.

To address the first need, MassDEP and EPA Region 1 developed and issued draft NPDES permits for the four major POTWs on the Assabet River on June 9, 2004. Those permits incorporated the requirements and timelines of the TMDL. Several meetings were held with the communities and public hearings on each of the permits were held on July 13th and 14th of 2004. . Although two of the communities have appealed portions of the final permits all the communities and other stakeholders have continued to work together to evaluate options for sediment remediation as outlined below.

Sediment Evaluation:

One of the goals of the project was to evaluate and identify the most cost effective actions, which would result in meeting water quality standards in the Assabet River. The TMDL process identified that sediment phosphorus, although not a significant source under present nutrient saturated conditions would become a significant nutrient source once upgrades were completed to the four major POTWs. As a result the stakeholders identified that it may be more cost effective to remove or effectively eliminate sediment phosphorus than to require further reductions at the POTWs. Given this possibility, all the stakeholders agreed to jointly pursue an evaluation of potential and feasible options for sediment remediation. The first step in this process was to quantify and quality the sediment in each of the six major impoundments. Funding from this grant was combined with $100,000 of additional state match to hire the United States Geological Survey (USGS) to conduct this evaluation, which commenced in the summer and fall of 2003.

The specific objective of this study was the determination of the sediment volume, extent, and chemistry in the sediments. More than one hundred sediment cores were collected in pairs from the six impoundments. Once the volume and extent of sediment was defined the chemistry was compared to existing sediment quality guidelines for the protection of aquatic life and to state guidelines for the reuse and disposal of sediment in landfills. In addition, the USGS conducted a second study to examine the changes in phosphorus concentrations in surface and pore waters in one impoundment in an effort to determine whether the sediments could release sufficient amounts of phosphorus to render ineffective decreased phosphorus discharges from the POTWs.

Defining the sediment quantity, distribution, and chemistry was a vital first step to determine if sediment remediation is a feasible option. The final USGS report, "Sediment Studies in the Assabet River, Central Massachusetts, 2003; Report 2005-5131" is attached and can be accessed on the World-Wide Web at this URL: http://water.usgs.gov/pubs/sir/2005/5131/

The report identified the extent of sediment in each impoundment as well as the phosphorus concentration with depth. It also concluded that all of the impoundments have concentrations of some metals and organic compounds that may harm aquatic life, but few of these chemical constituents exceed criteria for human contact or for disposal in landfills.

These results are essential for local managers to consider in selecting among the options for improving or restoring the river. The limited phosphorus study found no strong relation between rainfall and phosphorus mass and was unable to determine that the sediments contributed a substantial fraction of the phosphorus found in one impoundment.

Sediment-management options that may be appropriate for the Assabet River include the following: decreasing the concentrations of phosphorus released from treatment plants, partial or complete dredging, dam removal or modification, phosphorus sequestration by chemical treatment and making no changes. The information gained from this USGS sediment study has formed the basis for evaluating and developing a detailed feasibility study to investigate the options identified above and the most cost effective alternatives to achieve water quality standards. *In order to manage the Sediment Study and to ensure that all parties had a voice in the project, a Memorandum of Understanding was entered into between the MassDEP and the Assabet River Consortium (consisting of six communities – Hudson, Marlborough, Maynard, Northborough, Shrewsbury and Westborough). A Study Coordination Team was formed comprised of six members from the Assabet River Consortium as well as six members selected by MassDEP. The members chosen by MassDEP include three MassDEP representatives as well as one representative each from the Mass. River ways Program, OAR and EPA. The Study Coordination Team is co-chaired by one representative from MassDEP and one from the Assabet River Consortium and meets on a regular basis to oversee the Study and to focus on technical issues, scheduling and contract modifications.*

MassDEP contracted with the US Army Corps of Engineers to develop a scope of work and estimate costs for developing the plan. The plan will evaluate and address many technical, legal, financial, and environmental issues and ultimately identify a recommended alternative to address sediment throughout the Assabet River system. Tasks include, but are not limited to, the following:

1. Evaluate dam and impoundment ownership and real estate issues.
2. Evaluate cultural resources
3. Evaluate the feasibility of sediment and/or dam removal and their anticipated impacts on the local habitat and environment
4. Evaluate economic and financial considerations
5. Develop a recommended plan.

The estimated cost of all the study activities is in excess of $1.0 million.

In order to meet this challenge all of the stakeholders worked together to leverage the necessary funds. First, the state appropriated $500,000 for this purpose, which was used to leverage an additional $150,000 from the ACOE under a Section 22 (state assistance) grant. Second, the Consortium agreed to contribute up to $350,000 (if needed), with each member community sharing equally in the $350,000 cost. In addition, representatives from OAR and the Consortium traveled to Washington to seek additional assistance from the Congressional delegation to increase financial support to the ACOE for this project. Recently, the ACOE has been notified that an additional $300,000 has been targeted through the ACOE for this project. Thus, due in part to this *Watershed Innovative Permitting Project* grant award by EPA, the amount of $1,300,000 has been leveraged through federal, state and local funds for implementation of this project.

Monitoring Plan

Finally, in order to assess the progress being made towards meeting the goals of the phosphorus TMDL for the Assabet River, a comprehensive monitoring plan was developed and proposed by MassDEP. It is imperative that any of the monitoring that will be accomplished through this plan be done through a cooperative effort since no one entity has the resources to conduct the entire effort on its own. The proposed monitoring plan was presented to the Sediment Study Coordination Team for its review and input. The proposed sampling plan and a copy of the power point presentation that was made at a Study Coordination Team meeting are attached.

Project Innovations

The Assabet River Watershed Project has created innovations on several very important environmental and community fronts as highlighted below.

- *Watershed Permitting*. As a result of the comprehensive watershed and water quality modeling analysis, an adaptive management approach was collectively formulated that enabled the four community wastewater treatment plants to pursue nutrient reduction strategies likely to be most effective at improving water quality conditions in both the short and long term. In May of 2005, the EPA / MassDEP issued final wastewater permits (NPDES) for all four POTW's which included a 87% reduction of total phosphorus (from .75mg/L to .1mg/L) during the five-year permit cycle, along with an extensive sediment evaluation, and an implementation plan to possibly remediate phosphorus-laden sediments from the river impoundments.

- *Community-Based Environmental Protection.* Building local capacity by collaborating among a wide range of stakeholders and using both voluntary and regulatory tools and approaches has been a critical part of this project. First, the voluntary formation of the Assabet River Consortium- which comprises six communities (Hudson, Marlborough, Maynard, Northborough, Shrewsbury and Westborough) which operate four wastewater treatment plants on the Assabet River provided, along with support of the local

environmental organization, a sustaining structure of municipal leaders, environmental consultants, and river advocates for watershed project development, leveraging of funding and technical resources, sharing of information and coordinated decision-making, and cost-effective implementation. Second, the Clean Water Act and TMDL analysis provided the necessary regulatory driver and framework to pursue "fishable and swimmable" goals.

Project Accomplishments and Results

The Assabet River Watershed Project has realized a variety of environmental accomplishments. Although the primary goal of ecological restoration and water quality improvements will be achieved during the next 5 – 10 years, a variety of intermediate measures demonstrate the success of this project.

- *Watershed Coalition*. Over the project course of six years (1999 – 2005), stakeholders covering a range of public, private, and non-government organizational interests collectively collaborated and deliberated on a watershed-modeled phosphorus "pollutant budget" that would significantly reduce the permitted levels of direct total phosphorus entering the Assabet River system. More specifically, the new EPA / MassDEP NPDES permit discharge limits of 0.1mg/L, which were issued in May of 2005, represent an approximate 87% reduction of phosphorus-tainted discharge from four major wastewater treatment plants during April 1 - October 31 (the vegetative growing season of river weeds nourished by phosphorus).

- *Phased Adaptive Management Approach.* Although considerable and significant discussions and deliberations occurred among the stakeholders on a potentially lower POTW discharge limit, the extensive river sampling conducted by regulators, river advocates and municipalities when combined with the participatory TMDL model analysis supported an adaptive regulatory management approach. More specifically, the water quality modeling revealed that a more restrictive, and potentially unachievable wastewater discharge limit would not produce the future attainment of water quality standards in the river by itself. Hence, a two-prong phased implementation approach was adopted, which includes current sediment analysis and an evaluation of potential sediment remediation and dam removal options that may be more cost effective in achieving the overall water quality goals. This grant provided in-part funding to begin evaluating those options and identifying the quantity and quality of the sediment in each of the major impoundments on the river and the vertical extent of phosphorus throughout each impoundment. This information will help determine potential remediation options. This adaptive approach goes well beyond the traditional NPDES regulatory requirements by integrating environmental, economic, and social objectives into the community based decision-making process.

- *Capacity Building and Sustainability.* The multi-stakeholder partnerships that were forged during the first five years of this project (Phase 1 & 2 from 1999-2004) have contributed to citizen empowerment. Local officials from six geographically separate communities, working under a watershed approach, have effectively partnered with state, federal, and non-profit organizations to restore the health of the Assabet River. These working partnerships are continuing in the implementation phase. For example, the Assabet River Consortium (six local governments) joined up with OAR (non-profit river advocate) to lobby the New England congressional delegation to earmark $300,000 of the Army Corps of Engineers (ACOE) Section 206, Aquatic Ecosystem Restoration Program, to the Assabet River Restoration Project feasibility study. To date the amount of $1,300,000 has been

leveraged through federal, state and local funds to develop a preliminary restoration plan and recommended implementation plan that would address remediation of the phosphorus released from the bottom sediments of the Assabet River.

Summary of Key Themes and Lessons Learned

- *Building local community capacity for environmental protection is more than a trend, it's a necessity!*
  - Building trustful regulatory and community relationships is crucial.
  - Open, candid and frequent dialogue with local officials and interests groups is hard work and resource intensive. However, once a foundation of trust is established and relationships are built, the collective returns can be significant. (Note: Initially, the goal of this project was to complete phases 1 & 2 in two years; it actually took five years.)
  - The realization that 100% consensus in multi-stakeholder policy decisions is rarely achieved. However, the citizen participation process "of being represented at the table" and "engaging in public dialogue" is critical in garnering local and sustaining support for project development and implementation.

- *Limited Resources*
  - Limited resources constantly challenge local, state, and federal governmental officials. This project showed the importance of bringing multi-interest stakeholders, who have diverse, unique and relevant skills, into the environmental decision making process. The combined "community horsepower" provided a maximization of local, state, federal, and nonprofit resources into a sustaining project package. This innovative and effective utilization of public and private resources is a critical part of environmental restoration efforts on the Assabet River.