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March 8, 2006

Dear Friends of the SuAsCo River Watershed:

It is with great pleasure that I present you with the Assessment Report for the SuAsCo River Watershed. The report helped formulate the 5-year watershed action plan that will guide local and state environmental efforts within the SuAsCo River Watershed over the next five years. The report expresses some of the overall goals of the Executive Office of Environmental Affairs, such as improving water quality, restoring natural flows to rivers, protecting and restoring biodiversity and habitats, improving public access and balanced resource use, improving local capacity, and promoting a shared responsibility for watershed protection and management.

The SuAsCo River Watershed Assessment Report is a detailed compilation of issues in the watershed and was developed with input from the SuAsCo River Watershed Team and multiple stakeholders including watershed groups, state and federal agencies, Regional Planning Agencies and, of course, the general public from across the Watershed. We appreciate the opportunity to engage such a wide group of expertise and experience as it allows the state to focus on the issues and challenges that might otherwise not be easily characterized. From your input we have identified the following priority issues:

- Growth and Development
- Water Quality
- Water Quantity
- Land Protection / Open Space
- Habitat / Biodiversity
- Outreach and Education
- Recreational Opportunities

I commend everyone involved in this endeavor. Thank you for your dedication and expertise. If you are not currently a participant, I strongly encourage you to become active in the SuAsCo River Watershed's restoration and protection efforts.

Sincerely,

A handwritten signature in black ink that reads "Stephen R. Pritchard".

Stephen R. Pritchard  
Secretary

# SUDBURY-ASSABET-CONCORD RIVER WATERSHED ASSESSMENT REPORT

Prepared in Conjunction with the 5-Year Watershed Action Plan

Prepared for the Massachusetts Executive Office of Environmental Affairs



Prepared By:

Ambient Engineering



SuAsCo Watershed Community Council



June 30, 2005

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## EXECUTIVE SUMMARY

The Sudbury-Assabet-Concord River Watershed (the Watershed) is a barometer of many of the issues facing the communities, environmental organizations, and businesses within it. The background on the Watershed encompasses many fields of science with reports, plans, studies, and maps created by a range of federal, state, municipal, and local organizations. This report endeavors to summarize a significant portion of the work done and help direct the reader to additional information.

As part of the report approximately 60 towns, cities, regional planning organizations, environmental organizations, and individuals were contacted to request plans, studies, reports, and maps identifying issues within the Watershed that might be relevant to future actions and goals for improvement. Approximately 130 documents were received, logged, and periodically referenced as background for this report. A list of those documents is included in the report for further reference.

At the same time public input and comment on Watershed issues and actions was being collected. These issues were coordinated with the background research being performed to come up with seven categories of Watershed-wide issues: growth and development; water quality; water quantity; land protection/stewardship; habitat/biodiversity; recreation; and outreach and education. This report follows that format. Results from the public input, as well as input from a steering committee made up of individuals from the constituents referenced above, are summarized in the SuAsCo Watershed Action Plan.

A significant amount of planning has already been done in the Watershed to identify issues, and actions. This report summarizes some of the most relevant planning and provides references for additional information.

## 1 INTRODUCTION

### 1.1 Purpose

The purpose of this Assessment Report is to compile watershed-related data on the SuAsCo Watershed. This information is then available to accompany the 5-year watershed action plan (WAP) that will guide state and local environmental actions within the Watershed.

The WAP creates an understanding of the watershed, identifies priority issues, and defines priority actions that protect, improve, and restore watershed resources. The WAP does this by providing an overview of the issues facing the watershed. This is informed in part by the outcome from projects in preceding year agency work plans, and partly by an extensive literature review. This sets the stage for the next five years of watershed protection and management.

The WAP also acts as an information tool and directs actions within the Watershed. By bringing together the knowledge, commitment, and resources of all the community partners, as well as state and federal partners, the WAP can ensure that all major issues in the watershed are identified and adequately addressed through prioritized action strategies. The WAP integrates the main elements of the watershed approach: growth and development, water quantity, water quality, land protection/stewardship, habitat/biodiversity, recreation, and outreach and education.

Finally, the WAP and the process involved in developing and implementing the plan improves communication and coordination between the various state, federal and local governments, watershed organizations, businesses, regional organizations, and local citizens. It is also instrumental in expanding public involvement in watershed activities.

This Assessment Report has been written to provide information to a Watershed resident or interested person with a limited knowledge of technical issues. Others may have specific knowledge of a Watershed issue, but are interested in other issues, and may find this report useful.

### 1.2 Watershed Description

The Sudbury-Assabet-Concord Watershed, located in the metro-west area of the state, encompasses a large network of tributaries that ultimately flow into the Merrimack River. The watershed has a total drainage area of approximately 377 square miles. The Assabet River flows north for 30 miles from its headwaters in Westborough, through the now densely developed urban centers of Northborough, Hudson, and Maynard, to its confluence with the Sudbury River at historic Egg Rock in Concord. The Sudbury River also has its beginnings in Westborough, flowing eastward from the Great Cedar Swamp toward Framingham. It then proceeds north to Concord a total of 29 miles from Westborough to its confluence with the Assabet River at Egg Rock. The Sudbury and Assabet Rivers join together at Egg Rock to form the Concord River which flows north for 15.5 miles to join the Merrimack River in Lowell.<sup>1</sup>

The SuAsCo encompasses all or part of 36 municipalities and supports a population of 365,000 people. Acton, Carlisle, Framingham, Hudson, Marlborough, Maynard, Northborough, Southborough, Stow, and Sudbury all lie completely within the Watershed. Ashland, Bedford, Berlin, Billerica, Bolton, Boxborough, Boylston, Chelmsford, Clinton, Concord, Grafton,

Harvard, Holliston, Hopkinton, Lincoln, Littleton, Lowell, Natick, Sherborn, Shrewsbury, Tewksbury, Upton, Wayland, Westborough, Westford, and Weston are partially within the Watershed.<sup>2</sup>

Forest covers about 71% of the Watershed land area which also contains many wetlands, lakes and ponds. There are a total of 121 lakes and ponds, 75 of which have an area of 10 acres or more. Whitehall Reservoir in Hopkinton, Lake Cochituate in Framingham, Natick and Wayland, and the Sudbury Reservoir in Marlborough and Southborough are the largest lakes in the Watershed at 601, 594, and 1292 acres respectively.<sup>3</sup>

As of April 9, 1999, seventeen miles of the Sudbury River, four miles of the Assabet River, and eight miles of the Concord River were federally designated “wild and scenic rivers” based on their free-flowing condition and outstanding scenic, recreational, wildlife, cultural, literary, and historic values. The SuAsCo Watershed also encompasses two National Wildlife Refuges (NWRs) - the Great Meadows NWR, located in Billerica, Bedford, Carlisle, Concord, Lincoln, Sudbury, and Wayland, and the Assabet NWR, located in Hudson, Maynard, Stow and Sudbury. The SuAsCo Watershed also has the Commonwealth's first designated Area of Critical Environmental Concern (ACEC) - the Great Cedar Swamp located in Westborough. The Great Meadows NWR and the Great Cedar Swamp represent two of the largest wetlands in Central Massachusetts.<sup>4</sup>

The SuAsCo Watershed boasts historic sites of national significance. One is the Old North Bridge which has been prominently featured in the works of the 19th century authors Hawthorne, Emerson, and Thoreau. In close proximity to metropolitan Boston, the Sudbury, Assabet, and Concord Rivers and their watershed provide a popular area for canoeing, fishing, hiking, biking, bird watching and other recreational activities. The lower (northern) portion of the Concord River drops over 50 feet and is the location of the first mill city in America: Lowell.

Retaining the natural beauty and rural character of the SuAsCo Watershed is challenged by growth and development, as this area is one of the most rapidly growing in Massachusetts and, as such, is facing severe resource challenges. Rapid growth and development have placed land prices at a premium, making open space and habitat protection ever more difficult. Many stretches of the Sudbury, Assabet, and Concord Rivers routinely fail their water quality standard for nutrient enrichment and experience both severe flooding and low flow concerns. Water shortages are evidenced as many towns post water bans during the summer. The rivers' assimilative capacity to handle nutrients is severely stressed by non-point sources (storm water) and wastewater treatment plant discharges. Throughout much of the Sudbury River downstream into the Concord River, fish consumption is banned due to mercury-laden sediments from the Nyanza Superfund Site. Invasive aquatic plant species compromise the river habitat for native species, and impair the recreational experience for boaters and anglers.<sup>5</sup> Figure 1.1 shows the Watershed.

### **1.2.1 Ecological Niches**

There is significant biodiversity in the SuAsCo watershed because past stakeholders worked hard to preserve the area. Over 21,500 acres are permanently protected. The Great Meadows National Wildlife Refuge (GMNWR) is a nationally significant resource. The floodplain forests and marshes are critical habitat for many rare birds, including bitterns, and species more

commonly here, including great blue heron, wood ducks, and marsh wrens. The GMNWR protects the habitat of the rare Blanding's turtle and Britton's violet. The forests of Estabrook Woods in Concord and Carlisle provide seclusion for interior-forest birds, such as hermit thrush and Louisiana waterthrush. Unusual bogs with carnivorous plants exist in Walden Woods. Cedar Swamp in Westborough has rare Atlantic white cedar groves and associated state-listed rare species. Though not necessarily wilderness or pristine habitats, they are large and support a variety of plant communities and animals.

Though the western part of the watershed has few large areas set aside for habitat protection, it has resources unique to the watershed, such as extensive dry oak forests with seeps, coldwater trout streams, vernal pool clusters, nesting goshawks, marbled salamanders, and bobcats. There are large field complexes with bobolinks, meadowlarks, and kestrels.

Threats to preserved habitats include invasion by exotic species (e.g., purple loosestrife, water chestnut, and phragmites) that overwhelm the marshes, waterways, wetlands, fields, and forests, and change the nature of the natural communities.<sup>6</sup>

Additional common species indigenous to the Watershed include white-tailed deer, coyote, red tail fox, beaver, woodchuck, raccoon, skunk, gray squirrel, chipmunk, red squirrel, bats, porcupine, fisher, and the cottontail rabbit. The Watershed is also home to a wide array of bird species: cardinal, mourning, downy woodpecker, nuthatch, tufted titmouse, English sparrow, house wren, Baltimore oriole, owls, osprey, heron, barred and barn owls, chickadee, mockingbird, purple finch, robin, goldfinch, flicker blue jay, wild turkey, grouse, pheasant, woodcock, wood ducks, oven bird, cat bird and cuckoo. Warblers migrate through the area in their spring migration north. Redtail and broadwing hawks are common. Focal species found in this area include beaver, otters, spotted turtles, and blue heron.<sup>7</sup>

### **1.2.2 Social and Economic Settings**

A unique aspect of the SuAsCo Watershed is the population growth it has seen in the last 5 years. The Interstate-495 corridor region, comprising all or part of 20 of the Watershed's 36 communities, was the fastest growing region in the state in the last decade. Population in the 5 upper Assabet communities rose from approximately 73,000 in 1980 to over 87,000 in 2000. Population: between 1990 and 2000, population of Maynard, Sudbury, Hudson, and Stow grew from 47,244 to 51,289, 8.6%.

In the 20 towns of the Assabet River Basin, alone, population grew by 15 percent between 1990 and 2000, almost three times the average growth rate throughout the Commonwealth for the same period. In some individual towns, population growth during this 10-year period was more than 30 percent.<sup>8</sup>

This growth pressure has created a heavy demand for water and sewer services, and developable land. Commercial development, with larger associated impervious areas, has increased significantly within the Watershed as well. These settings continue to impact water quantity, water quality, and habitat within the Watershed.

**Figure 1.1 SuAsCo Watershed – MassGIS ½ Meter Orthophotos**



### 1.3 Tributary Watersheds

The SuAsCo Watershed contains 25 tributary watershed sub-basins, as shown on Figure 1.2. They are listed in Table 1.1 by river, in alphabetical order.

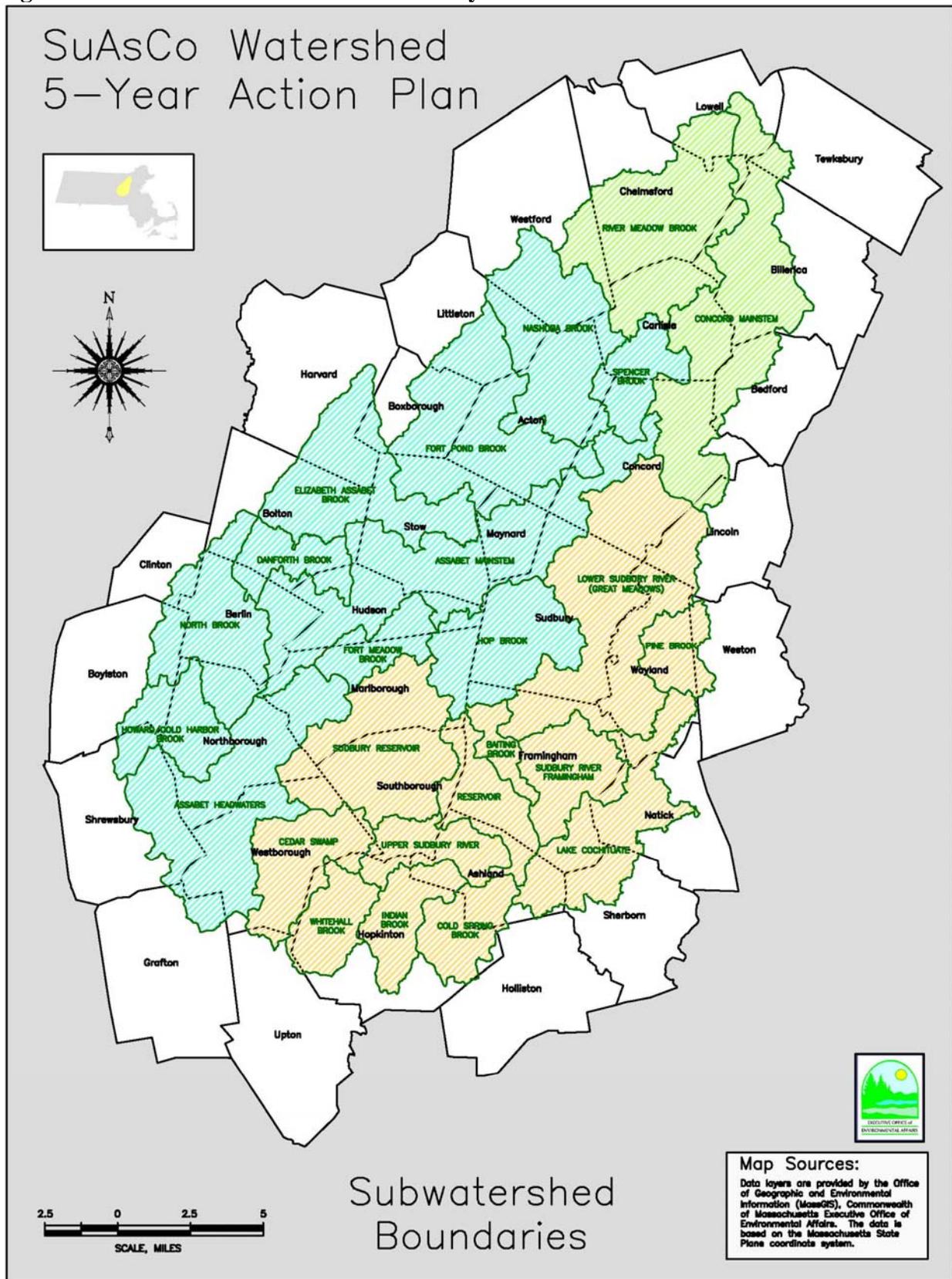
<b>Table 1.1 Tributary Watershed Sub-Basins</b>		
<b>Sudbury River</b>	<b>Assabet River</b>	<b>Concord River</b>
Bathing Brook	Assabet Headwater	Concord Mainstem
Cedar Swamp	Assabet Mainstem	River Meadow Brook
Cold Spring Brook	Danforth Brook	
Hop Brook	Elizabeth/Assabet Brook	
Indian Brook	Fort Meadow Brook	
Lake Cochituate	Fort Pond Brook	
Lower Sudbury River (Great Meadows)	Howard/Cold Harbor Brook	
Pine Brook	Nashoba Brook	
Reservoir 1-3	North Brook	
Sudbury Reservoir	Spencer Brook	
Sudbury River Framingham		
Upper Sudbury River		
Whitehall Brook		

### 1.4 Executive Office of Environmental Affairs Watershed Priorities

As of 2003, the Executive Office of Environmental Affairs had published four watershed priorities for the SuAsCo Watershed. They are to:

- Gather water quality data to determine the areas most affected by point source and nonpoint source pollution;
- Obtain a better understanding of the watershed hydrology to aid in decisions concerning the Inter-Basin Transfer Act and Water Management Act permit requests;
- Maintain a healthy and seasonal variability of stream flow to sustain aquatic and terrestrial biodiversity; and
- Decrease impervious surface area and local water consumption.

Figure 1.2 SuAsCo Watershed – Tributary Watersheds



### **1.5 Massachusetts Watershed Initiative**

The Massachusetts Watershed Initiative was a broad partnership of state and federal agencies, conservation organizations, businesses, municipal officials and individuals and was the original implementation mechanism for the Watershed Assessment Report and Action Plan program. Begun in 1996 by the Massachusetts Executive Office of Environmental Affairs, the MWI was an innovative, results-oriented program that protects and restores natural resources and ecosystems on a watershed basis by:

- Finding the sources of pollution and taking cooperative action to clean them up;
- Teaching and helping groups and communities to protect and restore their local waters;
- Expanding communication among local, private and public partners so everyone works together to solve water resource problems;
- Improving coordination among government agencies; and,
- Directing resources to critical needs so our limited dollars go further to resolving the most important problems.

Watershed teams, made up of representatives of governmental agencies and community partners (non-profit organizations, municipal boards, and businesses), coordinated the watershed protection efforts in each of the 27 major watersheds of Massachusetts. Between 1998 and 2003, each team has had a full-time leader employed by EOEA.

The Watershed Teams focused on an innovative five-year management process that is designed to collect and share resources and information, target existing and potential impacts to natural resources, assess impacts to natural resources, and develop and implement activities to protect and improve the Commonwealth's land and water resources. The five-year process is sequenced such that year builds on the work of the previous year. Annual Work Plans are developed with active team involvement and serve as a guide for coordinating Watershed Team efforts. The Annual Work Plans are the building blocks of the more comprehensive Five Year Watershed Action Plan. Action Plans influence which projects receive state and federal grants and loans, regulatory decision-making, and educational/technical assistance programs to solve the most important environmental problems affecting communities.

The primary goals of the Watershed Initiative are to:

- Improve water quality;
- Restore natural flows to rivers;
- Protect and restore habitats;
- Improve public access and balanced resource use;
- Improve local capacity to protect water resources; and,
- Promote shared responsibility for watershed protection and management.

The Watershed Initiative was ended in 2003. However, many of its components, such as Stream Teams and five year planning through the Watershed Assessment Report and Action Plan, are still in place.

In the SuAsCo Watershed, the Watershed Initiative developed ongoing organizations. The SuAsCo Watershed Community Council was established in 1998 and provides a unique, collaborative role in the Watershed by bringing together industry, environmental organizations, municipalities, and federal, state, and regional agencies. In addition, many stream teams were established that are still active today.

## 1.6 Watershed Successes

There are many successes in the Watershed due to past and current efforts. They include river clean ups, Watershed studies, stenciling, TMDL and habitat studies, invasive species harvesting and removal, land acquisitions, and assessment and cleanup of Superfund and 21E sites. Specifically, the following achievements have occurred in the last 10 years:

- Growth and Development
  - The Greenways Plan for the SuAsCo Watershed, completed in 2000, proposed greenways to link together many of the parks, wildlife refuges, and other protected lands of the Watershed.
- Water Quality
  - Stream teams were developed and include Acton Stream Teams, Concord River Environmental Stream Team, Mill Brook Task Force, Nashoba Brook Stream Team, Ashland Stream Team. These teams help maintain a grassroots presence in the watershed. The results of their surveys will help lay the groundwork for non-point source pollution remediation and future grant targeting. They have conducted surveys in Maynard, Acton, Framingham, Concord, Billerica, Northborough, Sudbury, and other communities. . Stream Team Action Plans exist for Hop Brook, 1995, Maynard/Assabet Initiative, 1996, Framingham Advocates, 1997, Mill Ponds & Canal, Assabet River – Maynard and OAR, 1998, Acton Stream Teams in cooperation with OAR, 1998, SWAMP, 1998, CREST, 1999; Mill Brook, Concord, 2000; Hopkinton, 2002, Ashland, 2002, and Northborough 2002
  - Alewife spawning occurred in the Concord River for the first time since the early 19th Century. The Middleborough-Lakeville Herring Fisheries Commission provided 7,500 alewives for reintroduction this year and plans to introduce 7,500 more alewives in each of the next two years.<sup>9</sup>
  - The Organization for the Assabet River (OAR) tests water quality at 15 mainstem sites distributed from the headwaters of the Assabet River in Westborough to the end of the Concord River in Lowell. Water quality data and reports are available below and on the StreamWatch page (for each tributary stream). Water quality reports include measurements of flow; water temperature, pH, and conductivity; dissolved oxygen; nutrients and suspended solids; and stream health index readings

- In 2005 MA DEP finalized the SuAsCo Watershed 2001 Water Quality Assessment Report. The assessment report presents a summary of current water quality data and information used to assess the status of three designated uses as defined in the Massachusetts Surface Water Quality Standards for the SuAsCo Watershed. These uses include aquatic life, fish consumption, and primary and secondary contact recreation and aesthetics.
- Water Quantity
  - In 2005 USGS prepared a fact sheet giving an accounting of the inflows, outflows, and uses of water in the Assabet River basin.
- Land Protection/Open Space
  - The SuAsCo Watershed Greenprint for Growth, completed in 2001, provides a foundation for innovation and cooperation in the communities of the SuAsCo watershed.
  - Over 21,000 acres, or approximately 9%, of the Watershed are permanently protected from development
- Biodiversity/Habitat
  - The SuAsCo Biodiversity Protection and Stewardship Plan, completed in 2000, provides recommendations to help conserve and restore natural biodiversity in the watershed by protecting and managing natural communities and focal species habitat and by motivating and involving land trusts, conservation commissions, conservation organizations, and concerned citizens in accomplishing this goal.
- Recreation
  - 29 miles of the Sudbury, Assabet, and Concord Rivers are designated part of the National Wildlife Scenic River System, one of only six such designations in New England.
- Outreach and Education
  - The SuAsCo Watershed Community Council Stormwater Community Assistance Program, a collaboration of environmental groups, state agencies, municipal officials, and private consultants, provides a NPDES Phase II Community Assistance program to two-thirds of the Watershed communities.
  - There have been 8 River Vision Forums and 3 Wild & Scenic River Fest celebrations.

### **1.7 Assessment Report Document and Personnel Research**

As part of the report approximately 60 towns, cities, regional planning organizations, environmental organizations, and individuals were contacted to request plans, studies, reports, and maps identifying issues within the Watershed that might be relevant to future actions and goals for improvement. Initially 43 towns, cities, and environmental organizations were contacted, and as the project progressed approximately 17 more agencies and organizations provided material and feedback. Approximately 130 documents were received, logged, and

periodically referenced as background for this report. A list of those documents is included in the report for further reference.

The project team (Ambient Engineering, Inc. and SuAsCo Watershed Community Council) collected a range of current studies, plans, maps, and reports related to water quantity; water quality; biological data/habitat; open space, land use, and growth; recreation; and outreach and education. In addition, the team interviewed select individuals with unique knowledge of the Watershed. A list of organizations contacted is in Appendix A. A list of documents collected and reviewed is in Appendix B. Copies of most of these documents are on file with the SuAsCo Watershed Community Council.

### **1.8 Report Format**

The Massachusetts Executive Office of Environmental Affairs, through the Massachusetts Watershed Initiative, established the following priorities:

1. Growth and Development
2. Water Quality
3. Water Quantity
4. Land Protection/Open Space
5. Biodiversity/Habitat
6. Recreation
7. Outreach and Education

Section 9 of this report deals with key areas of concern and assessment needs.

### **1.9 Research Methodology**

Research was based on the following sources:

- Recommendations in the WAP guidance document
- Plans, reports, studies, maps, and GIS data from surveyed constituents
- MA EOE and DEP web site information
- MassGIS information
- US EPA information
- Other local, state, and national sources

## 1.10 Appendices

A number of appendices have been included to provide additional information about the Watershed.

### 1.11 Supporting Watershed Maps

A range of maps were created using information from the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs. Data from the maps was provided from MassGIS and is based on the Massachusetts State Plane coordinate system. The maps are included at the end of each of Sections 1 through 7. In order to provide additional detail they are divided into five geographic sections (Upper Sudbury, Lower Sudbury, Upper Assabet, Lower Assabet, and Concord River).

The GIS maps include datalayers as shown in Table 1.2.

<b>Datalayer</b>	<b>Overview Map</b>	<b>Growth and Development</b>	<b>Water Quality</b>	<b>Water Quantity</b>	<b>Land Protection/ Stewardship</b>	<b>Habitat/ Biodiversity</b>	<b>Recreation</b>
Watershed Boundary	X						
Subwatershed Boundaries	X	X	X	X	X	X	X
Town Boundaries	X	X	X	X	X	X	X
Hydrography	X		X	X	X	X	X
Major Roads	X	X	X	X	X	X	X
Land Use Breakdown		X					X
Assessed River Segments			X				
Public Water Supplies			X	X			
21E Sites			X				
303D Sites			X				
Ground Water Discharge Points			X				
Interim Wellhead Protection Areas			X				
100-Year Floodplain				X			
Stream Gaging Stations				X			
Chapter 61 Lands					X	X	X
Protected and Recreational Open Space					X		X

<b>Table 1.2 SuAsCo GIS Maps Datalayer Summary</b>							
<b>Datalayer</b>	<b>Overview Map</b>	<b>Growth and Development</b>	<b>Water Quality</b>	<b>Water Quantity</b>	<b>Land Protection/ Stewardship</b>	<b>Habitat/ Biodiversity</b>	<b>Recreation</b>
Areas of Critical Environmental Concern						X	
NHESP Priority Habitats						X	
NHESP Estimated Habitats						X	
NHESP Potential Vernal Pools						X	
NHESP Certified Vernal Pools						X	
Public Access Board Sites							X
Canoe Access Points							X
Bicycle and Hiking Trails							X

<sup>1</sup> SuAsCo Watershed Community Council Web Site, [www.suasco.org](http://www.suasco.org)

<sup>2</sup> SuAsCo Watershed Community Council Web Site, [www.suasco.org](http://www.suasco.org)

<sup>3</sup> USGS Web site, <http://ma.water.usgs.gov/basins/concordsfw.htm>

<sup>4</sup> EOE A Web Site, <http://www.mass.gov/envir/water/suasco/suasco.htm>

<sup>5</sup> SuAsCo Watershed Community Council Web Site, [www.suasco.org](http://www.suasco.org)

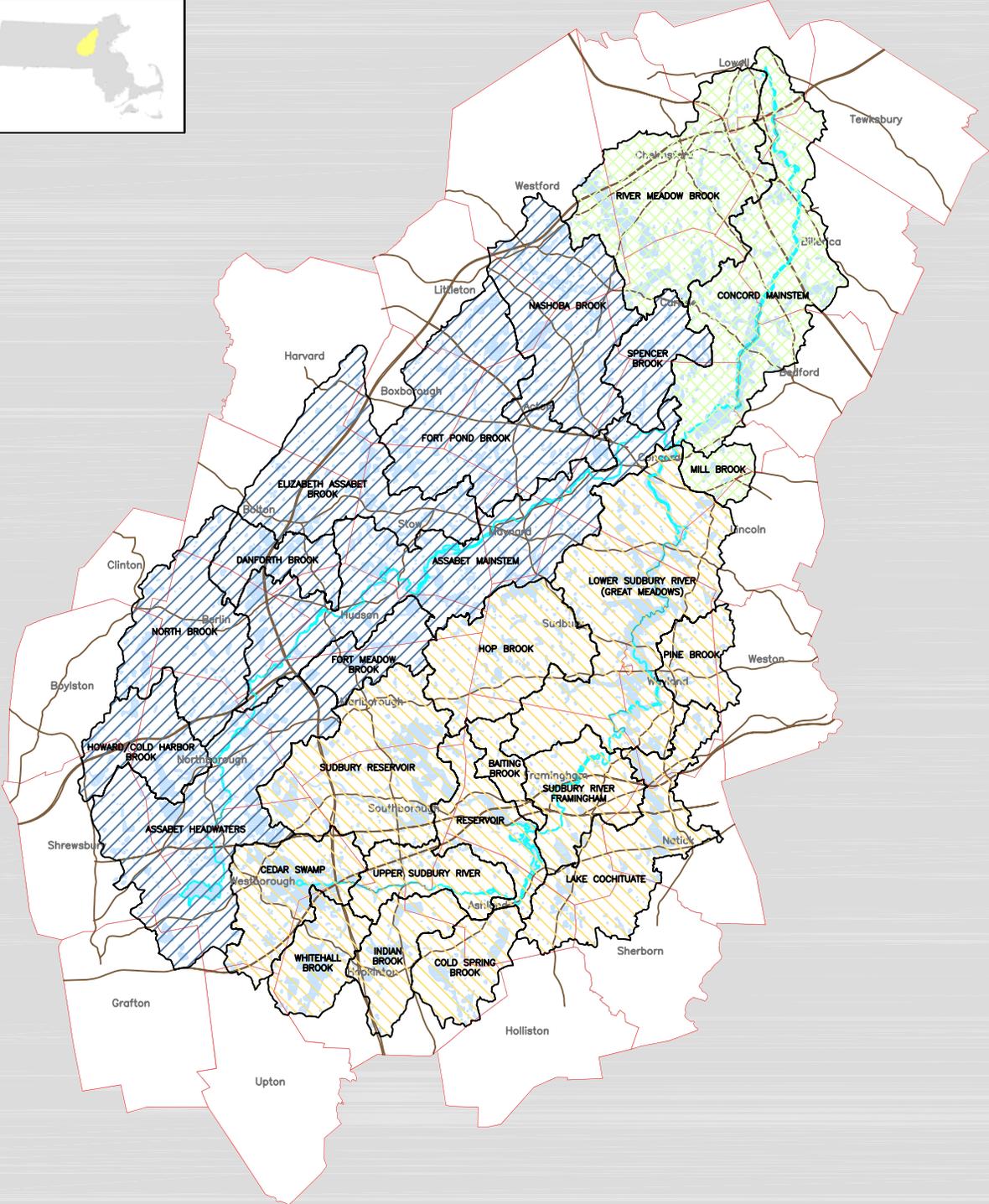
<sup>6</sup> SuAsCo Biodiversity Protection and Stewardship Plan

<sup>7</sup> Upper Assabet Riverway Plan

<sup>8</sup> USGS Fact Sheet FS-2005-3034

<sup>9</sup> MA EOE A, <http://www.mass.gov/envir/water/suasco/suasco.htm>

# SuAsCo Watershed 5-Year Watershed Action Plan



## Map Sources

Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



## MAP 1



SCALE, MILES

June 30, 2005



## Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- Sudbury River Subwatershed
- Assabet River Subwatershed
- Concord River Subwatershed

## 2 GROWTH AND DEVELOPMENT

With growing pressures on our lands and increasing demands for water and land resources, it is important to protect and conserve what we currently have and plan for a sustainable future.<sup>10</sup>

Many documents have been written to address issues of growth and development in the Watershed by municipalities, regional agencies, state agencies, and environmental organizations. Most towns and cities in the Watershed have developed Open Space and Recreation Plans to help document growth and development and identify at-risk resources within the communities. Regional planning agencies, state agencies, and environmental organizations have studied various aspects of growth and development in the Watershed and created numerous documents to help plan future growth and development.

In this section some of the more significant growth and development documents are discussed and many of the most important issues are summarized. These include the SuAsCo Greenprint for Growth, regional impact review, brownfields redevelopment, demographic data and transportation plans, sustainability, low impact development, “right to farm”, superfund and 21E sites, and climate change.

### 2.1 Greenprint for Growth

The SuAsCo Watershed Greenprint for Growth was created in 2001 by the Sudbury Valley Trustees and the Metropolitan Area Planning Council. The goal of the Greenprint for Growth initiative is to expand upon the buildout analyses, the Greenways and Biodiversity Plans, and other tools the Commonwealth is providing, in two ways.

The first way is to take the buildout analyses one step further. Sudbury Valley Trustees and the Metropolitan Area Planning Council worked with Framingham, Boxborough and Stow to study the impacts different land use regulations would have on each community’s original buildout projections. The goal of the project was to find alternatives to the towns’ current zoning that promote natural resource protection and preserve community character.

The second way is to expand upon the tools provided by the Commonwealth to inspire an exchange of information, experiences and ideas between volunteer and professional planners and conservationists in the SuAsCo watershed. During this time of rapid growth and development, this exchange can encourage innovative changes to impact the region’s future. The Greenprint for Growth sponsored several forums that covered a variety of topics related to growth planning: the Community Preservation Act, Town Centers, Business Location, Open Space Planning, and Transfer of Development Rights. The presentations gave planners and conservationists an opportunity to learn about and share a variety of techniques employed by SuAsCo communities to shape future growth.

The Greenprint for Growth is designed to provide a foundation for innovation and cooperation in the communities of the SuAsCo watershed. As evidenced by the Best Planning Practices highlighted in this report, the region hosts a wealth of knowledge and experience. In looking for solutions to planning challenges, the best inspiration can come from a neighboring community facing similar issues. The success of the Greenprint will be measured by the degree to which it

helps communities shape growth in positive ways while preserving their essential environmental resources in permanently protected Greenways and Biodiversity Reserves.<sup>11</sup>

## **2.2 Regional Impact Review**

The regional impacts of development in the Watershed are widely recognized. Currently, the review mechanism in place for development projects in the Watershed is primarily through the Massachusetts Environmental Policy Act (MEPA). MEPA is administered through the Massachusetts Environmental Policy Act Office.

MEPA requires that state agencies study the environmental consequences of their actions, including permitting and financial assistance. It also requires them to take all feasible measures to avoid, minimize, and mitigate damage to the environment. Thus a project that requires a state action and triggers a MEPA review threshold in any of a number of categories is subjected to a range of impact reviews. Review thresholds include land; rare species; wetlands, waterways, and tidelands; water; wastewater; transportation; energy; air; solid and hazardous waste; historic and archeological resources; and areas of critical environmental concern. Impact reviews consist of either an Environmental Notification Form (ENF) or an ENF and Environmental Impact Report (EIR). Part of the review process includes opportunities for public comment as well as review by state agencies.

## **2.3 Brownfields Redevelopment**

In conjunction with federal programs administered by the Environmental Protection Agency (EPA), Massachusetts has created legislation to deal with properties, commonly called “brownfields”, that often have certain characteristics in common: they are typically abandoned or for sale or lease; they typically have been used for commercial or industrial purposes; they may have been reported to DEP because contamination has been found; or they may not have been assessed due to fear of unknown contamination conditions. This legislation, Chapter 206 of the Acts of 1998, is known as the Brownfields Act and provided agencies at the State level with \$50 million to administer programs targeted towards the cleanup and reuse of contaminated property.<sup>12</sup> The State Brownfields program is administered by the DEP.

In the SuAsCo watershed, some municipalities, including Lowell, Marlborough and Shrewsbury, have been awarded EPA Brownfields grants over the past several years. For 2005, the City of Lowell has been selected for two brownfields cleanup grants, totaling \$255,040, to conduct community involvement activities, excavate petroleum-contaminated soils, and remove underground storage tank sites at 101 and 115 Middlesex Street. The sites, originally part of Hamilton Mills were used for automobile sales, refueling, and maintenance from the 1920s to the 1970s.<sup>13</sup>

In the City of Marlborough, one brownfield cleanup grant, of \$199,200 has been awarded for 2005 to cleanup petroleum contamination at two parcels in the former Seymour Oil Storage property, now known as the Rail Trail-Kelleher Site. According to the EPA Fact Sheet on the grant, following remediation, the property is scheduled to become part of the Assabet River Rail Trail, providing parking, a bicycle rack area, and a picnic area.<sup>14</sup>

## 2.4 Demographic Data and Transportation Plans

Demographic data has been provided from a number of sources. 1990 and 2000 populations are from U.S. Census data. The Metropolitan Area Planning Commission, MAPC, has developed population forecasts for 2005 through 2025 for 33 of the SuAsCo towns in its region (does not include Boylston, Grafton, or Shrewsbury).<sup>15</sup> Table 2.1 lists the communities in the Watershed with census and projected populations.

<b>Table 2.1 Population of SuAsCo Communities</b>							
	<b>US Census Population</b>		<b>Projected Population, MAPC Analysis</b>				
<b>Towns</b>	<b>1990</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>
Acton	17,872	20,331	20,948	22,552	23,319	22,825	23,099
Ashland	12,066	14,674	15,102	16,289	17,174	17,751	17,959
Bedford	11,846	12,595	11,945	12,359	12,357	12,334	12,486
Berlin	2,293	2,380	2,290	2,301	2,277	2,202	2,218
Billerica	37,609	38,981	36,804	36,755	36,325	34,750	34,901
Bolton	3,134	4,148	4,762	5,511	6,147	6,624	6,774
Boxborough	3,343	4,868	5,261	5,890	6,293	6,397	6,528
Boylston	3,517	4,008					4,008
Carlisle	4,333	4,714	5,017	5,336	5,352	5,188	5,322
Chelmsford	32,383	33,858	32,174	32,301	32,117	31,126	31,377
Clinton	13,222	13,435	12,517	12,834	12,898	12,550	12,594
Concord	17,076	16,993	16,076	16,279	15,967	15,261	15,496
Framingham	64,989	66,910	63,291	64,308	65,048	65,102	65,372
Grafton	13,035	14,894					14,894
Harvard	12,329	5,981	6,785	7,970	9,178	10,192	10,301
Holliston	12,926	13,801	13,999	14,502	14,568	14,107	14,285
Hopkinton	9,191	13,346	15,114	17,319	19,065	20,470	21,013
Hudson	17,233	18,113	17,197	17,419	17,415	16,995	17,082
Lincoln	7,666	8,056	8,500	8,849	8,915	8,801	8,833
Littleton	7,051	8,184	8,036	8,265	8,315	8,039	8,145
Lowell	103,439	105,167	104,252	110,871	116,134	119,785	120,446
Marlborough	31,813	36,255	35,930	38,181	40,354	41,562	41,909
Maynard	10,325	10,433	10,016	10,169	10,230	10,061	10,133
Natick	30,510	32,170	30,252	30,455	30,161	29,345	29,562

<b>Table 2.1 Population of SuAsCo Communities</b>							
	<b>US Census Population</b>		<b>Projected Population, MAPC Analysis</b>				
<b>Towns</b>	<b>1990</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>
Northborough	11,929	14,013	14,258	15,061	15,515	15,645	15,875
Sherborn	3,989	4,200	4,262	4,314	4,220	3,912	4,007
Shrewsbury	24,146	31,640					31,640
Southborough	6,628	8,781	9,626	10,699	11,353	11,500	11,759
Stow	5,328	5,902	5,934	6,059	6,051	5,819	5,887
Sudbury	14,358	16,841	17,558	18,615	18,884	18,389	18,825
Tewksbury	27,266	28,851	27,851	28,271	28,390	27,852	28,052
Upton	4,677	5,642	5,990	6,500	6,926	7,170	7,309
Wayland	11,874	13,100	13,467	14,353	14,807	14,578	14,850
Westborough	14,133	17,997	18,088	19,516	20,544	21,141	21,469
Westford	16,392	20,754	22,689	25,135	26,747	27,489	28,097
Weston	10,200	11,469	11,415	12,048	12,428	12,250	12,513
<b>TOTAL</b>	<b>630,121</b>	<b>683,485</b>					<b>735,020</b>

The Watershed is expected to see continued growth over the next 20 years throughout its 36 cities and towns.

## **2.5 Sustainability**

The Massachusetts Sustainability Program was established by Executive Order No. 438 on July 23, 2002, which created a State Sustainability Coordinating Council. The purposes of the Council were to develop and maintain a State Sustainability Program, establish sustainability goals, recommend to the Executive Office of Environmental Affairs (EOEA) and the Executive Office for Administration and Finance (EOAF) priorities for the State Sustainability Program, assist in the development of sustainability guidance documents for state agencies and support efforts by state agencies toward sustainability.<sup>16</sup>

## **2.6 Low Impact Development**

Low Impact Development (LID) is a new, comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds.<sup>17</sup> LID methods seek to collect and treat stormwater closer to source areas and minimize impervious areas to reduce the need for very large and maintenance intensive detention basins and to improve overall stormwater quality.

Within the SuAsCo watershed, the town of Littleton has begun to implement LID methods. Beginning with a state-funded effort to restore and protect Long Lake, the town installed rain gardens and bioretention cells on town-owned property. This summer, the Town will fund the installation of 12 rain gardens on private properties around Long Lake to further enhance the restoration. In addition, Littleton along with other towns in Massachusetts is preparing to revise their subdivision regulations to encourage LID in new developments.

## **2.7 “Right to Farm” Bylaws**

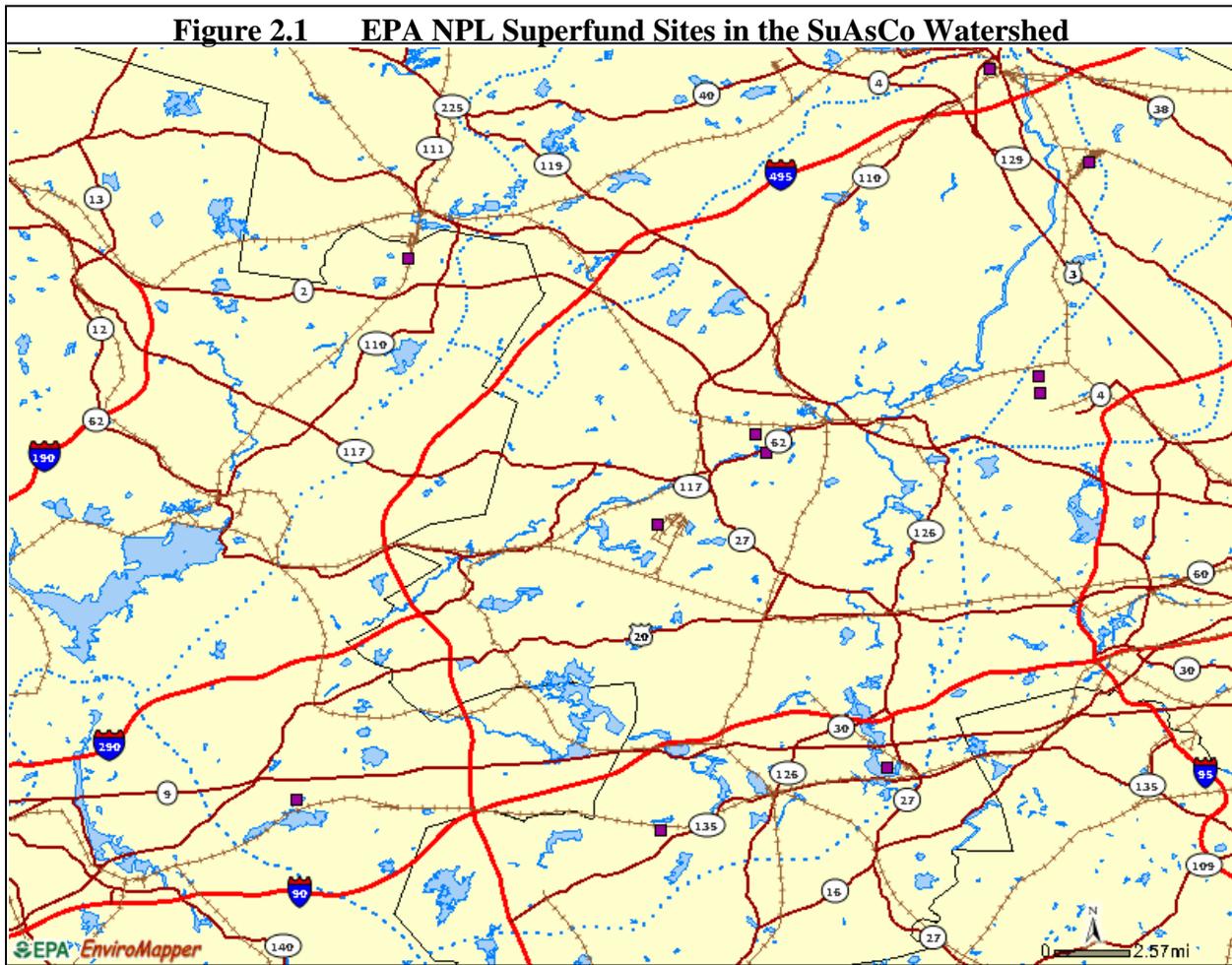
Massachusetts has developed regulations protecting citizens’ “right to farm” that can have effects on the Watershed. This right is protected under Article 97 of the Constitution as well as others including but not limited to Massachusetts General Laws Chapter 40A, Section 3, Paragraph 1; Chapter 90, Section 9, Chapter 111, Section 125A and Chapter 128 Section 1A.

The Massachusetts Department of Agricultural Resources Model Right To Farm Bylaw Section 3, Right To Farm Declaration, states that “The Right to Farm is hereby recognized to exist within the Town of [Farm-Town]. The above-described agricultural activities may occur on holidays, weekdays, and weekends by night or day and shall include the attendant incidental noise, odors, dust, and fumes associated with normally accepted agricultural practices. It is hereby determined that whatever impact may be caused to others through the normal practice of agriculture is more than offset by the benefits of farming to the neighborhood, community, and society in general. The benefits and protections of this By-law are intended to apply exclusively to those commercial agricultural and farming operations and activities conducted in accordance with generally accepted agricultural practices. Moreover, nothing in this Right To Farm By-law shall be deemed as acquiring any interest in land, or as imposing any land use regulation, which is properly the subject of state statute, regulation, or local zoning law.”<sup>18</sup>

## **2.8 Superfund and 21E Sites**

### **2.8.1 Superfund Sites**

There are currently 53 superfund sites of varying status in the 36 SuAsCo communities. Figure 2.2 shows the Superfund site locations.<sup>19</sup> Table 2.2 lists the Superfund sites and their status in the 36 SuAsCo communities.



<b>Table 2.2 Superfund Sites in the SuAsCo Watershed</b>		
<b>Community</b>	<b>Site Name</b>	<b>Status</b>
Acton	Acton Landfill	SAND
Acton	Agway/Kress Property	SAND
Acton	AIRCO Industrial	SAND
Acton	Rexnord Knife Division	SAND
Acton	W R Grace Daramic Plant	SAND
Acton and Concord	W. R. Grace & Co., Inc.(Acton Plant)	NPL
Ashland	Colonial Lacquer & Chemical Co	SAND
Ashland	Megunco Road	SHORT

<b>Table 2.2 Superfund Sites in the SuAsCo Watershed</b>		
<b>Community</b>	<b>Site Name</b>	<b>Status</b>
Ashland	Nyanza Chemical Waste Dump	NPL
Ashland	Timex Clock Co (Former)	SAND
Bedford, Concord, Lexington, and Lincoln	Hanscom Field/Hanscom Air Force Base	NPL
Bedford	Naval Weapons Industrial Reserve Plant	NPL
Bedford	Raytheon Missile Systems Division	SAND
Billerica	Roy Bros Haulers	SAND
Bolton	Genrad Inc.	RCRA
Chelmsford	Electrometals Inc (Former)	SAND
Chelmsford	Frequency Sources Inc.	SAND
Clinton	Clinton Rigby Brook	SAND
Clinton	Montachusett Regional Planning Commission (MRPC) Brownfields Program	BF
Clinton	National Perforating Corp	SAND
Concord	Nuclear Metals	NPL
Framingham	Commonwealth Gas Co	SAND
Framingham	Mann Industries	SAND
Grafton	CMEDA Brownfields Program	BF
Grafton	Duralite Company, Inc.	SAND
Grafton	Fisherville Mill	SHORT
Holliston	Bird Property (Prentice Street Property)	SAND
Hopkinton	Monson Chemical (Former)	SAND
Hudson	Hudson Light & Power	SAND
Lowell	Assets Building	BF
Lowell	Astro Circuits Corp (Former)	SAND
Lowell	City of Lowell Brownfields Program	BF
Lowell	Coalition For A Better Acre Brownfields Program	BF
Lowell	Costa's Landfill (Former)	SAND
Lowell	Davidson Street Properties	BF
Lowell	Jet-Line Services (GeoChem)	RCRA
Lowell	Lowell Landfill	SAND

**Table 2.2 Superfund Sites in the SuAsCo Watershed**

<b>Community</b>	<b>Site Name</b>	<b>Status</b>
Lowell	Raytheon Corp.	SAND
Lowell	Silresim Chemical Corp.	NPL
Lowell	Wells Metal Lowell	SHORT
Marlborough	City of Marlborough Brownfields Program	BF
Natick	Clean Harbors - Natick	RCRA
Natick	Natick Federal Savings & Loan	SAND
Natick	Natick Laboratory Army Research, Development and Engineering Center	NPL
Shrewsbury	CMEDA Brownfields Program	BF
Shrewsbury	Phalo Corp	SAND
Sudbury	Sudbury Laboratory Facilities (Former)	SAND
Sudbury, Maynard, Hudson and Stow	Fort Devens-Sudbury Training Annex	NPL
Tewksbury	Sutton Brook Disposal Area	NPL
Tewksbury	Wilmington Disposal Area	SHORT
Westborough	Hocomonco Pond	NPL
<b>Status</b>	<b>Definition</b>	
SAND	Sites Awaiting an NPL Decision (SAND) are sites for which site assessments have been performed, but a decision regarding NPL proposal has not been recorded. SAND sites include sites that have been assessed by the Superfund program, are now being addressed under state program authorities, or are in various stages of assessment and cleanup by federal or State agencies.	
NPL	In most cases, sites that require <a href="#">long-term cleanup</a> end up on the <a href="#">National Priorities List (NPL)</a> . The NPL is a published list of hazardous waste sites that are eligible for extensive, long-term cleanup actions under the Superfund Program.	
SHORT	Hazardous waste sites that do not require a <a href="#">long-term cleanup process</a> are considered short-term cleanups (also referred to as "removal actions"). Although the cleanup process for these sites may not be as lengthy as for long-term cleanups, these sites may still affect the health and environment of those who live near the site.	
RCRA	The <a href="#">RCRA Corrective Action (RCRA) program</a> requires treatment, storage, or disposal facilities to address the investigation and cleanup of these hazardous releases at their facilities, in accordance with state and federal requirements. The degree of investigation and subsequent corrective action necessary to protect human health and the environment varies significantly among facilities. Cleanup progress at these sites is measured, in part, by interim cleanup milestones known as Environmental Indicators (EIs).	
BF	Brownfields (BF) are defined as real properties, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.	

## 2.8.2 21E Sites

Chapter 21E of the Massachusetts General Laws is the Massachusetts Oil and Hazardous Material Release Prevention and Response Act. To implement this Chapter, Massachusetts developed the Massachusetts Contingency Plan (MCP). The MCP (310 CMR 40) complies with similar federal regulations and codifies the state's rules for cleaning up of contaminated sites.

MA DEP's Bureau of Waste Site Cleanup maintains a list of 21E/MCP sites and their status. There are approximately 3520 sites listed in the 36 SuAsCo communities as of April 4, 2005<sup>20</sup>. Table 2.3 lists the number of sites by community.

<b>Table 2.3 Reportable Releases, M.G.L. 21E, Massachusetts Contingency Plan</b>					
<b>Town</b>	<b>Number</b>	<b>Town</b>	<b>Number</b>	<b>Town</b>	<b>Number</b>
Acton	90	Framingham	388	Northborough	91
Ashland	71	Grafton	61	Sherborn	15
Bedford	115	Harvard	39	Shrewsbury	133
Berlin	22	Holliston	43	Southborough	78
Billerica	147	Hopkinton	88	Stow	25
Bolton	31	Hudson	97	Sudbury	54
Boxborough	27	Lincoln	52	Tewksbury	130
Boylston	76	Littleton	58	Upton	14
Carlisle	16	Lowell	341	Wayland	56
Chelmsford	145	Marlborough	198	Westborough	138
Clinton	94	Maynard	38	Westford	57
Concord	110	Natick	330	Weston	52

## 2.9 Climate Change

### 2.9.1 CLIMB Project

In 1999 a study was begun jointly by Tufts University, University of Maryland, Boston University, and the Metropolitan Area Planning Council to look at long term impacts of climate on the metropolitan Boston area. The study was called Climate's Long-term Impacts on Metropolitan Boston (CLIMB). It found that even though infrastructure systems and services (ISS) are designed according to socioeconomic and environmental conditions that are very sensitive to climate (for examples; energy and water demands, wind and water loads) and have interrelated impacts upon each other, there have been no major integrated assessments of the impacts of climate change on metropolitan ISS in the US. Several researchers have shown that the possible economic damages to ISS because of climate change are the same as or larger than damages to agriculture. Infrastructure systems last considerably longer than decades (some a century or more) and provide the footprint and direction for future ISS and related future socioeconomic activities and environmental quality. Hence it is important that decision-makers

understand the short- and long-term consequences of climate change on ISS. This includes both local and regional decision-makers because they make most infrastructure-related decisions and state and national decision-makers because they provide policy guidance.<sup>21</sup>

CLIMB research provides major conclusions related to anticipatory actions, land use, environmental impacts, socio-economic impacts, and adaptation impacts. The CLIMB study is based upon the hypothesis that the operation and services provided by urban infrastructure will be impacted by climate change as they are sensitive to climate. Using various indicators, the research has shown that compared to conditions of just population growth, climate change impacts are significant in many infrastructure sectors. It also identified some specific actions and policies that can be taken in the near-term future to lessen some of the negative impacts. These actions are not intended to be optimal in terms of timing, location, or even action, but they do show that taking anticipatory actions well before 2100 results in less total adaptation and impact costs to the region than taking no action. It has also shown that considering the joint or integrated effects of sectoral impacts and adaptation actions is beneficial.

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<sup>10</sup> EOE Web Site, [http://www.mass.gov/envir/water/publications/WAP\\_Guidance.pdf](http://www.mass.gov/envir/water/publications/WAP_Guidance.pdf)

<sup>11</sup> Sudbury Valley Trustees and Metropolitan Area Planning Council, Greenprint for Growth, August 2001

<sup>12</sup> MA DEP Bureau of Waste Site Cleanup, <http://www.mass.gov/dep/bwsc/brownfld.htm>

<sup>13</sup> EPA Brownfields 2005 Grant Fact Sheet, Lowell, MA [www.epa.gov/brownfields](http://www.epa.gov/brownfields)

<sup>14</sup> EPA Brownfields 2005 Grant Fact Sheet, Marlborough, MA [www.epa.gov/brownfields](http://www.epa.gov/brownfields)

<sup>15</sup> MAPC Population projections, [http://www.mapc.org/data\\_gis/data\\_center/data\\_center\\_data.html](http://www.mapc.org/data_gis/data_center/data_center_data.html)

<sup>16</sup> Massachusetts Executive Order No. 438, July 23, 2002

<sup>17</sup> Low Impact Development Center, <http://www.lowimpactdevelopment.org/index.htm>

<sup>18</sup> MA DAR Model Right To Farm Bylaw,

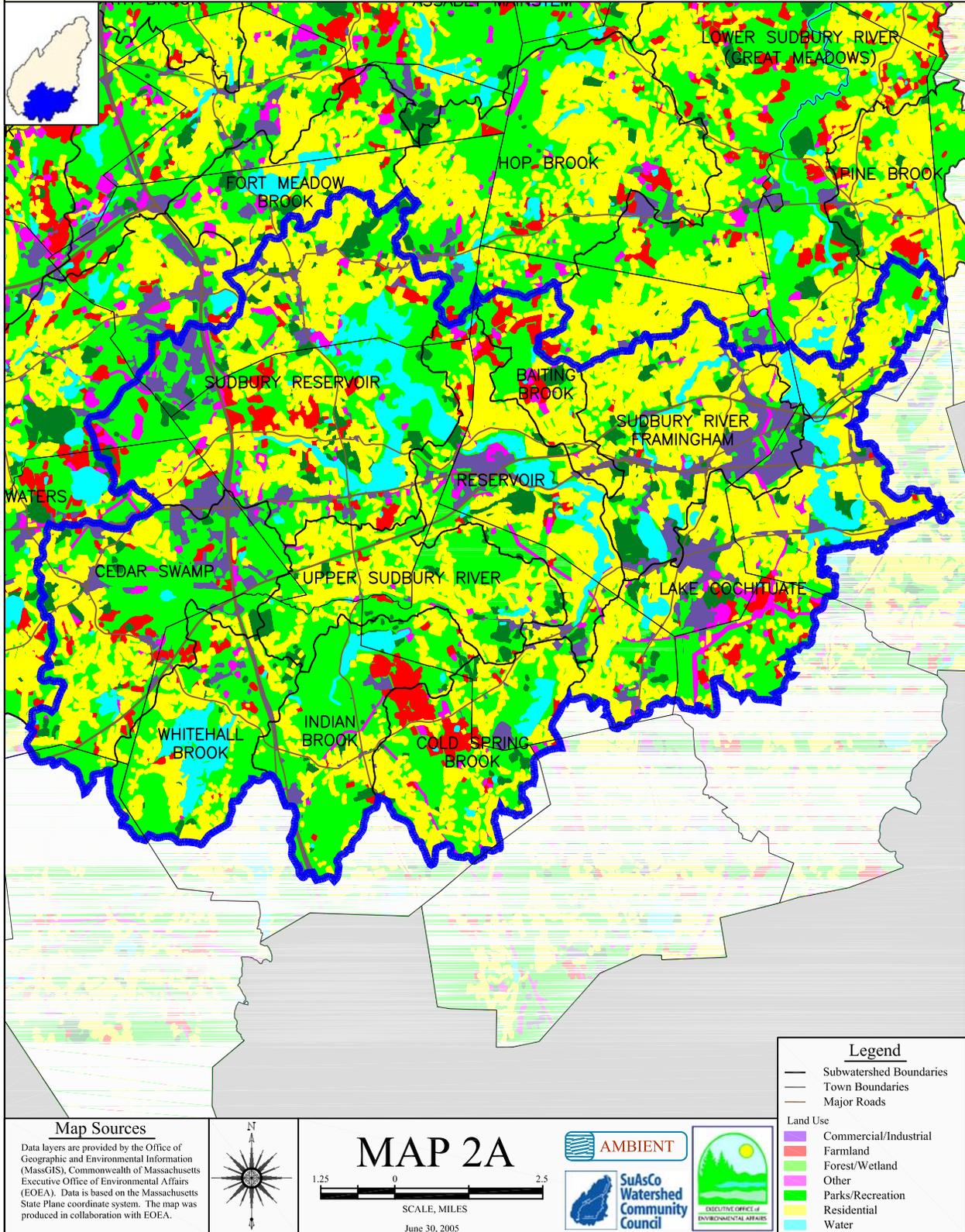
<http://www.mass.gov/agr/docs/farmbylaw.pdf#search='massachusetts%20right%20to%20farm'>

<sup>19</sup> EPA EnviroMapper, <http://134.67.99.113/sf/emsuperfund.asp?action=zoomByCatunit&code=01070005>

<sup>20</sup> MA DEP Bureau of Waste Site Cleanup Searchable Database, <http://www.mass.gov/dep/bwsc/sites/report.htm>

<sup>21</sup> Tufts University Civil and Environmental Engineering Department, University of Maryland School of Public Policy, Boston University Center for Transportation Studies, Metropolitan Area Planning Council, Climate's Long-Term Impacts on Metropolitan Boston (CLIMB), EPA Grant Number R.827450-01, August 13, 2004

# Growth and Development in the Upper Sudbury River



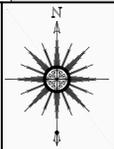
**Legend**

- Subwatershed Boundaries
- Town Boundaries
- Major Roads

Land Use

- Commercial/Industrial
- Farmland
- Forest/Wetland
- Other
- Parks/Recreation
- Residential
- Water

**Map Sources**  
 Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



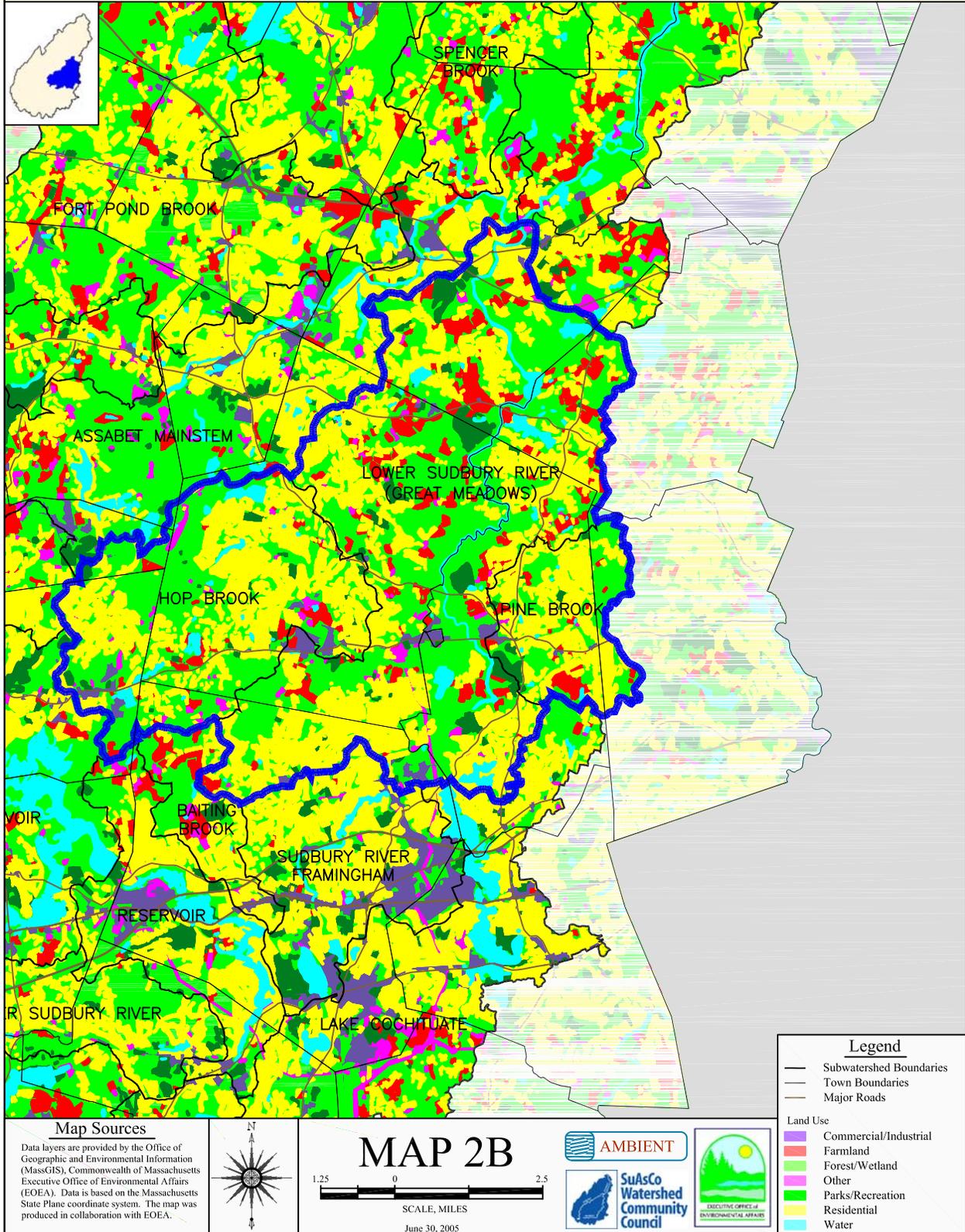
**MAP 2A**

1.25 0 2.5  
 SCALE, MILES

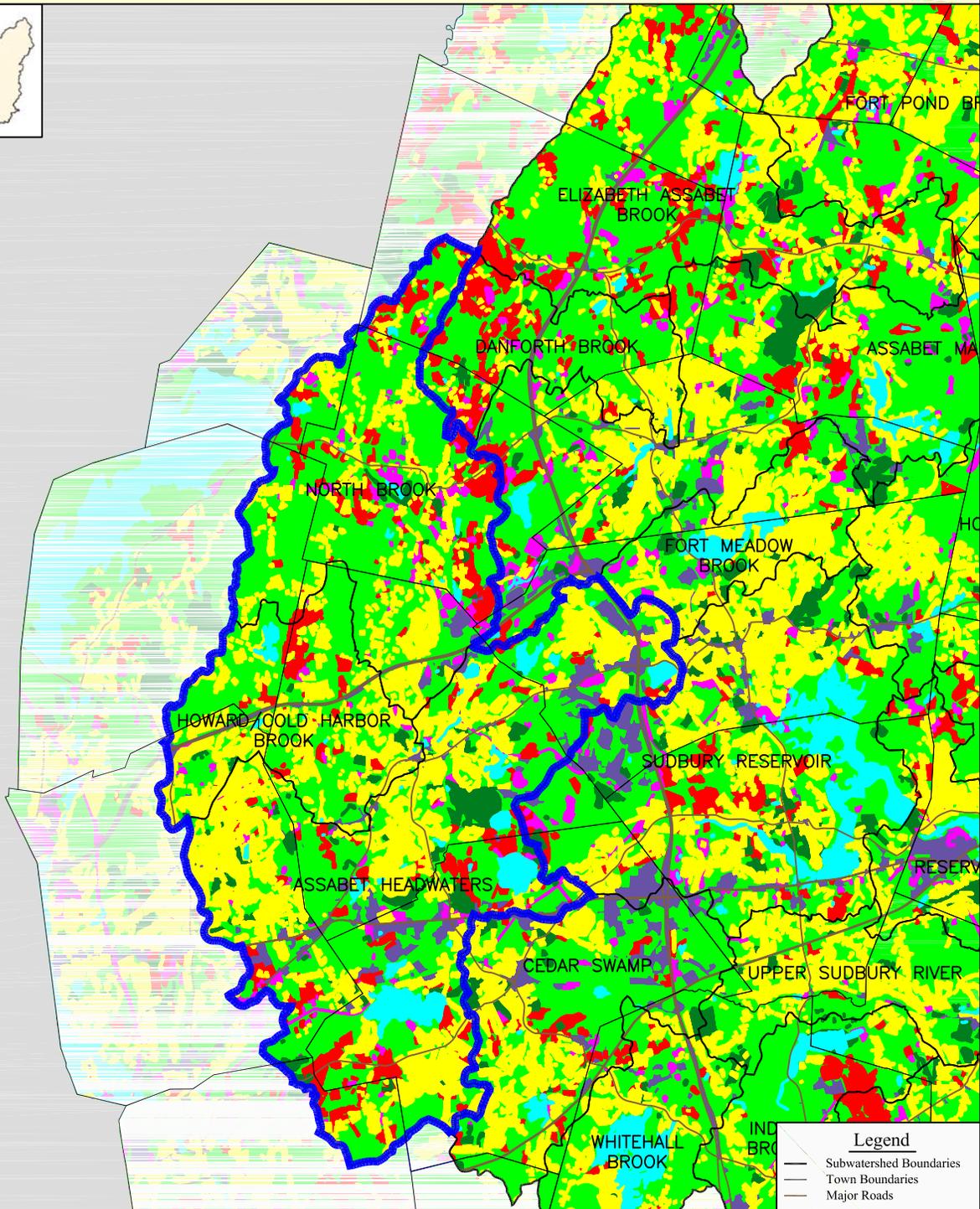
June 30, 2005



# Growth and Development in the Lower Sudbury River



# Growth and Development in the Upper Assabet River



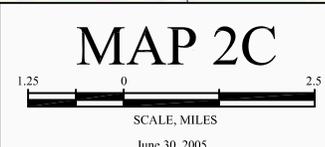
**Legend**

- Subwatershed Boundaries
- Town Boundaries
- Major Roads

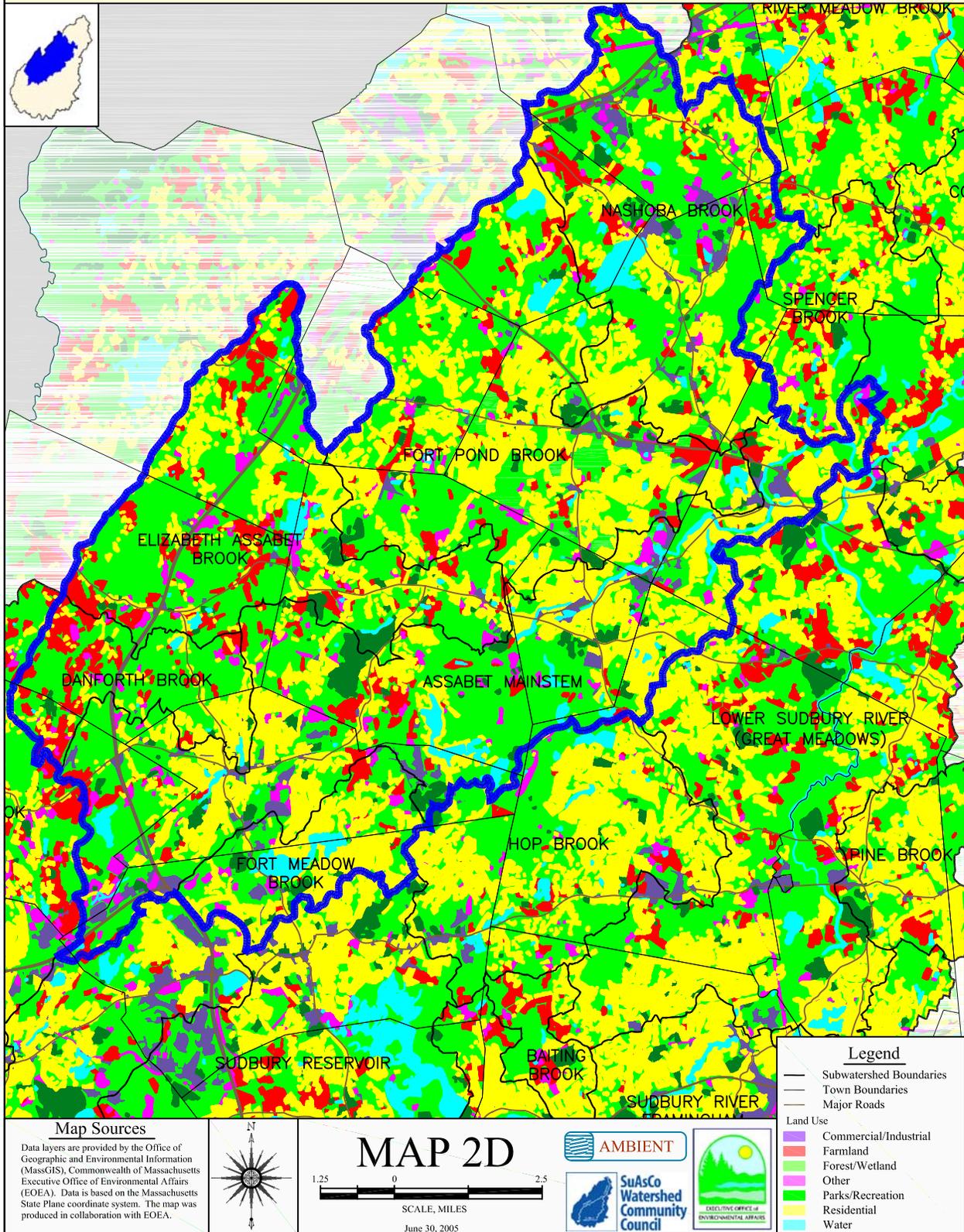
Land Use

- Commercial/Industrial
- Farmland
- Forest/Wetland
- Other
- Parks/Recreation
- Residential
- Water

**Map Sources**  
 Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



# Growth and Development in the Lower Assabet River



### Map Sources

Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



## MAP 2D



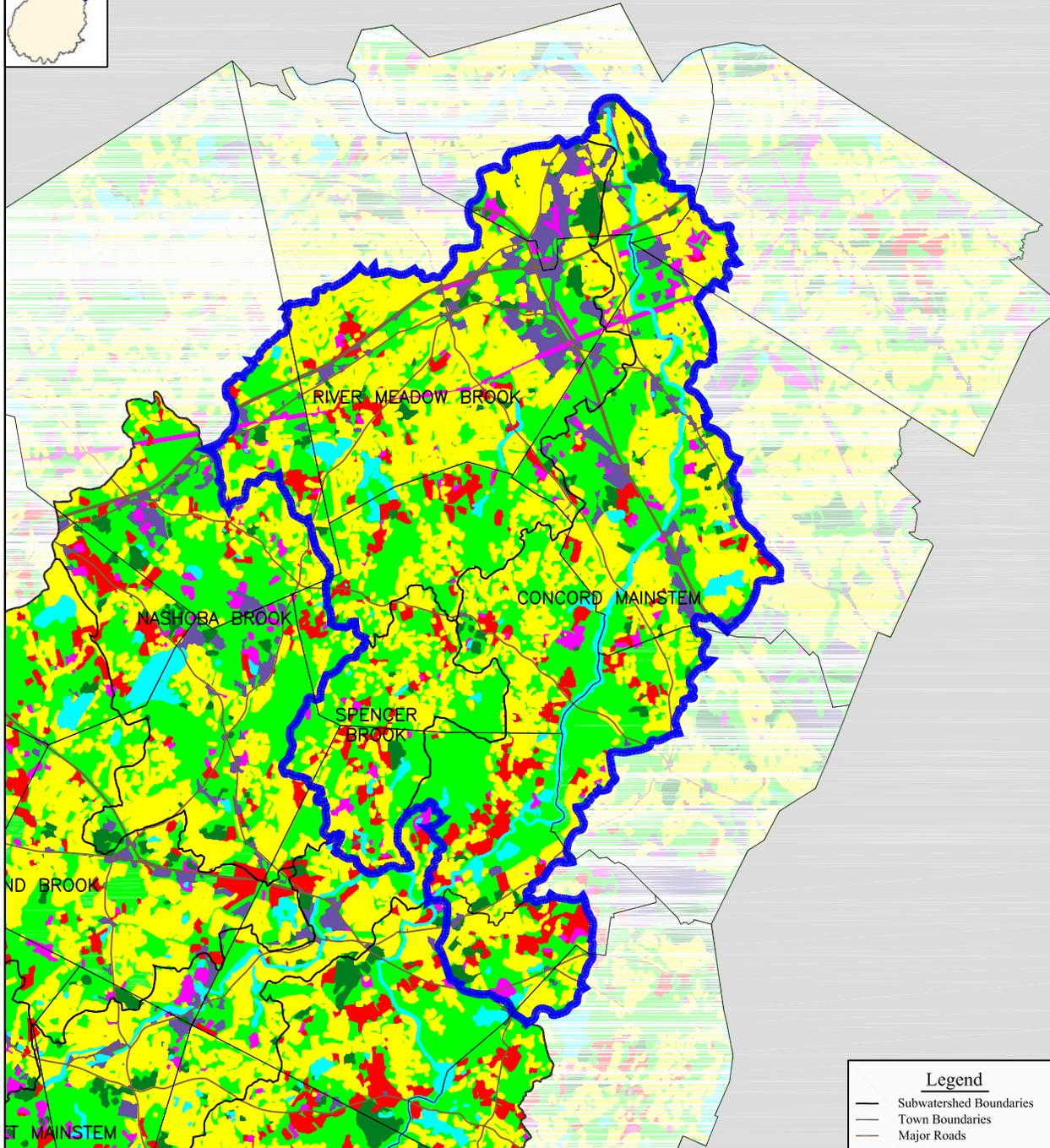
June 30, 2005



### Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Land Use
  - Commercial/Industrial
  - Farmland
  - Forest/Wetland
  - Other
  - Parks/Recreation
  - Residential
  - Water

# Growth and Development in the Concord River



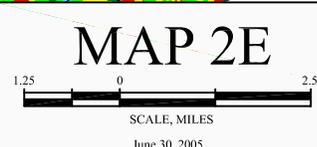
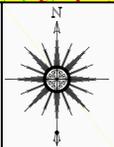
**Legend**

- Subwatershed Boundaries
- Town Boundaries
- Major Roads

Land Use

- Commercial/Industrial
- Farmland
- Forest/Wetland
- Other
- Parks/Recreation
- Residential
- Water

**Map Sources**  
 Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



### 3 WATER QUALITY

Chemical and biological parameters are the most commonly used indicators of water quality and consequently of river health.<sup>22</sup> A number of watershed-wide and subwatershed reports and programs have been identified as dealing with water quality issues. A DEP Water Quality Assessment Report for the SuAsCo Watershed was completed in April 2005. The Organization for the Assabet River (OAR) conducts its own water quality monitoring program. These are discussed separately and also referenced regarding specific water quality issues.

In this section some of the more significant water quality documents are discussed and some of the most important issues are summarized. These include the MA DEP 2001 Water Quality Assessment Report, the Organization for the Assabet River Water Quality Monitoring Program, sediment analysis, public health advisories, drinking water compliance data/violations, Clean Water Act 303(d) lists and TMDLs, NPDES permits, nonpoint source pollutants, well closures, perchlorate, wastewater, dam safety and dam removal, stormwater management, BMP implementation and Phase II compliance, sand/salt use and storage, manure management, and enforcement actions.

#### 3.1 DEP Water Quality Assessment Report

In April 2005 MA DEP finalized the SuAsCo Watershed 2001 Water Quality Assessment Report. The assessment report presents a summary of current water quality data and information used to assess the status of three designated uses as defined in the Massachusetts Surface Water Quality Standards for the SuAsCo Watershed. These uses include aquatic life, fish consumption, and primary and secondary contact recreation and aesthetics.

The Watershed was broken down into three subwatersheds and a fourth category of lakes within the Watershed. The four categories were reviewed in order to determine if the each of the four designated use was *supported* or *impaired*. If there was not enough information available, the use was considered *unassessed*. If a portion of the Watershed was not reviewed, the use was considered *not assessed*.

Approximately 86.8 miles of the Assabet River Subwatershed were assessed. Approximately 54.8 miles of the Sudbury River Subwatershed were assessed. Approximately 29.6 miles of the Concord River Subwatershed were assessed. Figure 3.1 shows the water body segments investigated for the Water Quality Assessment Report. Table 3.1 summarizes the results of the Water Quality Assessment Report.

**Figure 3.1 Water Body Segments Investigated**

<b>Table 3.1 Water Quality Assessment Report Results Summary</b>			
<b>Designated Use</b> Subwatershed Category	<b>Supported</b>	<b>Impaired</b>	<b>Not Assessed</b>
<b>Aquatic Life</b>			
Assabet River	24.5 miles (28%)	34.2 miles (39%)	28.1 miles (33%)

**Table 3.1 Water Quality Assessment Report Results Summary**

<b>Designated Use</b> Subwatershed Category	<b>Supported</b>	<b>Impaired</b>	<b>Not Assessed</b>
Sudbury River	27.7 miles (51%)	15.6 miles (28%)	11.5 miles (21%)
Concord River	0 miles (0%)	15.5 miles (52%)	21.8 miles (48%)
Lakes	130 acres (2%)	3,818 acres (58%)	2,634 acres (40%)
<b>Fish Consumption</b>			
Assabet River			86.8 miles (100%)
Sudbury River		24.5 miles (45%)	30.3 miles (55%)
Concord River		13.6 miles (46%)	16.0 miles (54%)
Lakes		3,483 acres (53%)	3,080 acres (47%)
<b>Primary Contact Recreation</b>			
Assabet River	0 miles (0%)	26.2 miles (30%)	60.6 miles (70%)
Sudbury River	0 miles (0%)	3.8 miles (7%)	51.0 miles (93%)
Concord River	0 miles (0%)	7.3 miles (25%)	22.3 miles (75%)
Lakes	1,129 acres (17%)	1,512 acres (23%)	3,943 acres (60%)
<b>Secondary Contact Recreation</b>			
Assabet River	6.4 miles (7%)	19.8 miles (23%)	60.6 miles (70%)
Sudbury River	0 miles (0%)	3.8 miles (7%)	51.0 miles (93%)
Concord River	0 miles (0%)	7.3 miles (25%)	22.3 miles (75%)
Lakes	1,129 acres (17%)	1,253 acres (19%)	4,209 acres (64%)
<b>Aesthetics</b>			
Assabet River	36 miles (41%)	19.8 miles (23%)	31 miles (36%)
Sudbury River	14.6 miles (27%)	0.6 miles (1%)	39.6 miles (72%)
Concord River	11.9 miles (40%)	7.3 miles (25%)	10.4 miles (35%)
Lakes	632 acres (10%)	1,253 acres (19%)	4,699 acres (71%)
<i>Note: Fish consumption is supported where there are no pollutants present that result in concentrations unacceptable for human consumption in edible portions. When the assessment was done, the Massachusetts Department of Public Health warned certain demographics against eating fish from all freshwater bodies. In addition, site-specific advisories were issued for portions of the Sudbury and Concord River subwatersheds, and these areas are shown as impaired.</i>			

### 3.2 Organization for the Assabet River Water Quality Monitoring Program

The Organization for the Assabet River (OAR) tests water quality at 15 mainstem sites distributed from the headwaters of the Assabet River in Westborough to the end of the Concord

River in Lowell. Water quality data and reports are available below and on the StreamWatch page (for each tributary stream). Water quality reports include measurements of flow; water temperature, pH, and conductivity; dissolved oxygen; nutrients and suspended solids; and stream health index readings.<sup>23</sup>

### 3.3 Sediment Analysis

Sediment analysis information on the Watershed is somewhat limited. A nutrient and limnological study of Lake Boon was conducted during the summer and fall of 1998. The study included in-lake water quality monitoring for DO, pH, temperature, total phosphorus, ammonia-nitrogen, and conductivity; aquatic weed mapping, and sediment analysis.<sup>24</sup>

### 3.4 Public Health Advisories

The Department of Public Health (DPH) performs risk assessments and issues public health advisories. DPH's Bureau of Environmental Health Assessment (BEHA) issues advisories in a number of Watershed-related areas, including freshwater fish advisories, mercury in fish advisories, and beach advisories. Table 3.2 shows the current fish advisories in place for Watershed water bodies.

<b>Town</b>	<b>Water Body</b>	<b>Fish Advisory</b>	<b>Hazard</b>
All towns between Ashland and Concord	Sudbury River <sup>(a)</sup>	P6	Mercury
Billerica	Nutting Lake	P1 (all species), P5	Mercury
Boxford	Baldpate Pond	P1 (all species), P2 (LMB), P4	Mercury
Chelmsford	Newfield Pond (a.k.a. Freeman Lake)	P1 (LMB), P3 (LMB)	Mercury
Concord	Walden Pond	P1 (LMB & SMB), P3 (LMB & SMB)	Mercury
Concord	Warner's Pond	P1 (LMB), P3 (LMB)	Mercury
Concord, Carlisle, Bedford, Billerica	Concord River	P1 (all species), P2 (LMB), P4	Mercury
Framingham, Natick, Wayland	Cochituate, Lake	P1 (all species), P2 (AE)	PCBs
Ft. Devens Sudbury Training Annex, Maynard	Puffer's Pond <sup>(b)</sup>	P6	Mercury
Ft. Devens, Harvard	Mirror Lake	P1 (LMB), P3 (LMB)	Mercury
Harvard	Bare Hill Pond	P1 (LMB), P3 (LMB)	Mercury
Holliston	Winthrop, Lake	P6	Dioxin
Hopkinton	Whitehall Reservoir	P1 (all species), P2 (YB), P4	Mercury
Hudson, Stow	Boon, Lake	P1 (LMB & BC), P3 (LMB & BC)	Mercury

<b>Table 3.2 Current Fish Advisories in SuAsCo Watershed</b>			
<b>Town</b>	<b>Water Body</b>	<b>Fish Advisory</b>	<b>Hazard</b>
Marlborough, Southborough	Sudbury Reservoir	P1 (all species), P2 (Bass)	Mercury
Milford	Cedar Swamp Pond	P1 (all species), P5	Mercury
New Salem, Shutesbury, Petersham, Hardwick, Ware, Pelham, Belchertown, Boylston, West Boylston, Sterling, Clinton	Quabbin & Wachusett Reservoirs <sup>(c)</sup>	See footnote c	Mercury
Tewksbury	Ames Pond	P1 (LMB), P3 (LMB)	Mercury
Wayland	Heard Pond	P6	Mercury
Westborough	Hocomonco Pond	P6	PAHs
Westborough above GH Nichols Dam	Mill Pond	P1 (all species), P2 (LMB)	Mercury
<b>The following are the MA DPH Bureau of Environmental Health Codes:</b>			
P1 (all species)	Children younger than 12 years or age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body.		
P1 ( <i>species</i> )	Children younger than 12 years or age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any of the affected fish species (in parenthesis) from this water body.		
P2 ( <i>species</i> )	The general public should not consume any of the affected fish species (in parenthesis) from this water body.		
P3 ( <i>species</i> )	The general public should limit consumption of affected fish species (in parenthesis) to two meals per month.		
P4	The general public should limit consumption of non-affected fish from this water body to two meals per month.		
P5	The general public should limit consumption of all fish from this water body to two meals per month.		
P6	The general public should not consume any fish from this water body.		
<b>Note (a):</b> The Sudbury River Fish Consumption Advisory pertains from Ashland to its confluence with the Assabet and Concord Rivers and includes the Stern and Bracket Reservoirs in Framingham.			
<b>Note (b):</b> U.S. Army Issued Advisory (MA DPH BEHA)			
<b>Note (c):</b> Children younger than 12 years, pregnant women, and nursing women should not consume fish except for lake trout less than 24 inches long and salmon. All other people should not eat smallmouth bass, largemouth bass, or lake trout greater than 24 inches long; may eat unlimited amounts of salmon and lake trout less than 24 inches long; and should limit consumption of all other Quabbin and Wachusett Reservoir fish species to one five-ounce meal per week. (MA DPH BEHA)			

In July 24, 2001, the Massachusetts Department of Public Health issued a statewide fish consumption advisory in response to growing information and concerns about mercury contamination.<sup>25</sup>

Table 3.3 shows the beaches in the Watershed with exceedances and indicator type in 2002 and 2003.<sup>26</sup>

**Table 3.3 Watershed Beaches with Exceedances in 2002 and 2003**

<b>Town</b>	<b>Beach</b>	<b>Exceedance</b>	<b>Indicator</b>	<b>Year</b>
Acton	Nara Beach	6	E.Coli.	2002
Acton	Nara Beach	4	E. coli	2003
Ashland	Ashland Reservoir-Main Beach	3	Enterococci	2002
Ashland	Ashland Reservoir-Main Beach	3	Enterococci	2003
Billerica	Nutting Lake (South) - Micozzi Beach	1	E.Coli.	2002
Billerica	Nutting Lake (North) - Micozzi Beach	3	E.Coli.	2002
Billerica	Nutting Lake - Micozzi Beach (South)	1	E. coli	2003
Bolton	Camp Virginia Beach	1	E. coli	2003
Chelmsford	Baptist Pond (Ramp)	1	E. Coli	2002
Chelmsford	Freeman Lake (Dam)	2	E. Coli	2002
Chelmsford	Freeman Lake (Dock)	2	E. Coli	2002
Chelmsford	Baptist Pond (Dock)	1	E. coli	2003
Chelmsford	Freeman Lake (Dam)	1	E. coli	2003
Chelmsford	Freeman Lake (Dock)	2	E. coli	2003
Chelmsford	Baptist Pond (Ramp)	3	E. coli	2003
Concord	Kennedy Pond	1	E.Coli.	2002
Concord	Walden Pond - Red Cross	1	E.Coli.	2002
Concord	Kennedy Pond	2	E. coli	2003
Concord	Silver Hill Assoc	3	E. coli	2003
Holliston	Stoddard	1	E. Coli	2002
Hopkinton	Sandy Beach - Outlet Pipe	1	E.Coli.	2002
Hopkinton	Hopkinton Reservoir-Main Beach	2	Enterococci	2002
Hopkinton	Hopkinton Reservoir-Upper Beach	2	Enterococci	2002
Hopkinton	Sandy Beach (outlet)	1	E. coli	2003
Hopkinton	Hopkinton Reservoir-Upper Beach	2	Enterococci	2003
Hudson	Hudson Centennial Beach	1	E.Coli.	2002
Hudson	Hudson Centennial Beach	1	E. coli	2003
Littleton	Littleton Town Beach	1	E.Coli.	2002
Marlborough	Memorial - Left	1	E. coli	2003
Marlborough	Memorial - Right	1	E. coli	2003
Natick	Cochituate Lake-North Beach	1	Enterococci	2002

**Table 3.3 Watershed Beaches with Exceedances in 2002 and 2003**

Town	Beach	Exceedance	Indicator	Year
Natick	Dug Pond - Diving	1	E.Coli.	2002
Natick	Cochituate Lake Beach-Unguarded Beach	3	Enterococci	2002
Natick	Cochituate Lake-South Beach	3	Enterococci	2002
Upton	Pratt Pond	1	E. coli	2003
Upton	Wildwood Bond Beach	1	E. coli	2003
Wayland	Lake Cochituate - Left Buoy (deep)	1	E.Coli.	2002
Wayland	Lake Cochituate - Middle	6	Enterococci	2003
Wayland	Lake Cochituate - Right Shallow	7	Enterococci	2003
Westford	Edwards Town Beach	1	E.Coli.	2002
Westford	North Beach - NIA Beach	1	E. coli	2003
Westford	Wymans Campers Beach	1	E. coli	2003
Westford	Forge Village Beach	2	E. coli	2003

### 3.5 Drinking Water Compliance Data/Violations

All community public water systems (PWS) are required to routinely monitor their water quality and report the results to the MADEP. The MADEP summarizes the finding in an Environmental Progress Report. In addition, the information is forwarded to the USEPA. The EPA database Safe Drinking Water Information System (SDWIS) lists all violations reported by each PWS. A search can be conducted at [http://oaspub.epa.gov/enviro/ef\\_home2.water](http://oaspub.epa.gov/enviro/ef_home2.water). A summary of public water supply sources for the towns in the SuAsCo watershed is presented in Table 3.4.

**Table 3.4 Public Water Supply Sources in SuAsCo Watershed<sup>27</sup>**

Towns	Public Water Supply		
	MRWA	Surface Water	Public Wells
Acton			X
Ashland			X
Bedford	X		X
Berlin			X
Billerica		Concord River	X
Bolton			X
Boxborough			X

<b>Table 3.4 Public Water Supply Sources in SuAsCo Watershed<sup>27</sup></b>			
<b>Towns</b>	<b>Public Water Supply</b>		
	<b>MRWA</b>	<b>Surface Water</b>	<b>Public Wells</b>
Boylston			
Carlisle			X
Chelmsford			X
Clinton	X		
Concord			X
Framingham	X		
Grafton			X
Harvard			X
Holliston			X
Hopkinton			X
Hudson		Gates Pond Reservoir	X
Lincoln		Flints Pond	X
Littleton			X
Lowell		Merrimack River	
Marlborough	X	Milham Reservoir	
Maynard			X
Natick			X
Northborough	X		X
Sherborn			X
Shrewsbury			X
Southborough	X		
Stow			X
Sudbury			X
Tewksbury		Merrimack River	
Upton			X
Wayland			X
Westborough		Westborough Reservoir	X
Westford			X
Weston	X		X

In addition, all community public water systems are required to prepare annual consumer confidence reports (CCR) on the quality of their drinking water. These reports are submitted to all customers of the PWS.

### **3.6 Clean Water Act 303(d) Lists and TMDLs**

The Clean Water Act requires each State to list polluted water bodies and to set priorities for their clean up. Water bodies qualify for these "impaired waters lists" when they are too polluted or otherwise degraded to support their designated and existing uses. The impaired waters list is also called the 303(d) list, named after the section in the Act that requires it. The states submit their lists to Congress every two years<sup>28</sup>.

States must develop a watershed restoration action plan called a "Total Maximum Daily Load" (TMDL) for each impaired water body. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

Water quality standards are set by States, Territories, and Tribes. They identify the uses for each water body, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use.

A TMDL is the sum of the allowable load of a pollutant from all contributing point sources and nonpoint sources. The calculation includes a margin of safety to ensure that the water body can be used for its designated purpose. The calculation also accounts for seasonal variation in water quality.<sup>29</sup>

#### **3.6.1 2001 Water Quality Assessment Report Findings**

Building upon information gathered to assess water quality conditions under the 305(b) requirements, the state submits a list of impaired water bodies to EPA as required under Section 303(d). States must develop Total Maximum Daily Loads (TMDLs) for each of these water bodies and establish pollution control strategies to restore these waters to meet water quality standards. The 303(d) list, subject to public review and comment, mirrors the segmentation used in the 305(b) report and is comprised of water resources that do not meet the State's Surface Water Quality Standards (SWQS). Establishing priorities and developing a targeted control plan/strategy that allows for a phased approach to solving pollution problems is the next step in the five year cycle of the Watershed Approach. A basin-wide action plan, resulting from a collaborative effort between the environmental agencies and the watershed community should be developed consistent with the 303(d) process to establish a strategy for achieving compliance with the SWQS.

##### **3.6.1.1 Assabet River**

MA DEP, in conjunction with the Army Corps of Engineers (ACOE), developed a nutrient (total phosphorus) TMDL for the Assabet River. The TMDL for the Assabet River (seven segments) was finalized and approved by EPA in 2004. The TMDL development process begins with assessment of the present condition of a water body and concludes with specification and implementation of a set of modified loadings deemed necessary to bring the water body into compliance with water quality standards. The steps of the TMDL can be divided into Assessment

(Steps 1 and 2); Analysis (Steps 3 and 4), often through numerical modeling; and Planning (Step 5). ENSR International, through funding from the former Massachusetts Watershed Initiative and the 104(b) grant program, conducted the field investigations and the review of previous water quality studies in support of the "Assessment" phase of the TMDL process, as well as developed and calibrated the HESP model. The assessment study found that the major source of nutrient loading to the river is point sources (municipal waste water treatment plants). Additionally, the role of sediment as a nutrient recycler, especially phosphorus, has been identified as a significant component promoting macrophyte growth, particularly in impounded sections of the Assabet River. The five major impoundments provide an optimum habitat for macrophyte growth and especially for the floating macrophytes (e.g., *Wolfia* and *Lemna*). While both phosphorus and nitrogen are nutrients, phosphorus is usually considered to be the limiting nutrient for biological growth in freshwater systems, since nitrogen is often extracted from the atmosphere. Therefore the TMDL was developed for total phosphorus.

The calculated TMDL for total phosphorus in the Assabet River is 27.5 lbs/day. In 1999 the total phosphorus load was 127.1 lbs/day (including a margin of safety), four times the TMDL. To achieve the TMDL, the Department is proposing a two-phased adaptive management approach. *"Phase 1 is to establish a total phosphorus effluent limit of 0.1 mg/l at all major WWTPs discharging to the Assabet River; allowing the communities sufficient time to fund and implement a detailed evaluation of impoundment sediment as a potential alternative to lower permit limits (MA DEP CN 201.0)."* [The minor WWTPs will be required to reduce their total phosphorus effluents to less than 0.5 mg/L during the growing season.] During the non-growing season, effluent limits for phosphorus will not presently be required; however, year round monitoring and reporting of effluent data for total and dissolved phosphorus will be required. This is due to concerns that particulate phosphorus could potentially settle in the impoundments during the non-growing season and become available for plant growth during the growing season. In addition, the WWTPs will be required to optimize the removal of particulate phosphorus during the non-growing season. *"Phase 2 limitations will be established in permits to be reissued in 2009 if sediment remediation, based upon the results of the sediment/dam evaluation, is not pursued, and/or new phosphorus criteria that may be developed in the interim by DEP and USEPA are applicable (MA DEP CN 201.0)."*

EPA issued draft 2004 NPDES permits for four major WWTPs in the Fall 2004 with the 0.1 mg/L seasonal limit (to be attained by 2009). Public meetings were held and a public comment period has recently been closed. EPA is working to address comments and will issue the final permits in the coming months.

The reduction in sediment phosphorus flux, which may occur naturally once the WWTP effluent concentration is reduced, can likely be expedited with measures such as dredging, encapsulating and/or dam removal. State funding was secured to quantify and qualify the sediments in the Assabet River, as well as to begin the process of evaluating management options (Dunn 2004). USGS, under contract to MA DEP, has completed sediment mapping and sampling and prepared a draft report. Federal funds are currently being sought to continue this process (Dunn 2004). It is anticipated that this will be an ongoing project to last several years. The study will include, but not necessarily be limited to, identifying options for sediment remediation, investigation of potential sediment transport issues and downstream impacts, evaluation of legal issues, and

recommendations for cost effective solutions to achieve water quality standards (MA DEP CN 201).

#### 3.6.1.2 Lake Boon

A phosphorus TMDL for Lake Boon in Hudson/Stow was developed by MA DEP and accepted by EPA in June 2002. The report concluded that excessive macrophyte growth is due to natural conditions and anthropogenic inputs. The TMDL recommended watershed management to limit development, that the Towns develop and implement a mandatory septic system inspection and maintenance program, public education and storm water runoff control programs, a macrophyte management program, and monitoring. Authority to regulate nonpoint source pollution is limited to local governments and implementation will require cooperation among local volunteers, watershed associations, and municipal officials (MA DEP 2002a). In December 2002 a watershed survey was conducted by the Lake Boon Association and Lake Boon Commission, which identified sources of nonpoint source pollution. In 2002 the Towns were also awarded a 319 grant to implement best management practices in the Lake Boon watershed.

#### 3.6.1.3 Other waters in the SuAsCo Watershed undergoing Phase I TMDL development

Additional work has begun on TMDLs for the Concord River and Hop Brook (Sudbury watershed). In 2001 ENSR was awarded a contract to collect data for the Assessment phase of the TMDL process for the Concord River. At this time the analysis phase has not yet commenced.

In 1998 ENSR was awarded a 104(b)(3) grant to provide a comprehensive, up-to-date evaluation of water quality problems in the Hop Brook watershed and to evaluate recommendations for in-lake and watershed remediation measures to alleviate chronic problems associated with excess algal growth and aquatic weed growth, particularly in Hager Pond, Carding Millpond, Grist Millpond, and Stearns Millpond. ENSR was subsequently awarded a contract to conduct a follow up investigation and to provide the technical basis for a TMDL for Hop Brook. This study was completed in 2003 (ENSR 2004b).<sup>30</sup>

### 3.7 NPDES Permits

NPDES stands for National Pollutant Discharge Elimination System. Under the NPDES program, all municipal, industrial and commercial facilities that discharge wastewater or stormwater directly from a point source (a discrete conveyance such as a pipe, ditch or channel) into a receiving water body (lake, river, ocean) are issued an NPDES permit. Facilities that discharge wastewater to a publicly owned treatment works (POTW), which in turn discharges into the receiving water body are controlled by the NPDES permit that governs the POTW discharges.<sup>31</sup> In Massachusetts NPDES permits are jointly issued by EPA Region 1 (New England) and the Massachusetts Department of Environmental Protection.

Table 3.5 is a partial listing of specific individual facility NPDES permits issued since January 1, 2000.<sup>32</sup> In addition to facility specific permits, EPA issues General Permits that cover multiple facilities within a specific category and geographic area. These include construction dewatering, non-contact cooling water, reject water from reverse osmosis units, stormwater discharges from small municipal separate storm sewer systems (MS4s) and water treatment plants.

<b>Table 3.5 NPDES Individual Facility Permits as of January 21, 2005</b>		
<b>Community</b>	<b>Date of Issuance</b>	<b>Facility Name</b>
Ashland	November 21, 2003	Ashland Sand and Stone, Inc.
Boston-MetroWest	October 31, 2002	Massachusetts Water Resources Authority Metrowest Tunnel
Clinton	October 25, 2002	Massachusetts Water Resources Authority Cosgrove Intake
Concord	March 3, 2005	Middlesex School Wastewater Treatment Plant
Hudson	May 26, 2005	Hudson Wastewater Treatment Facility
Marlborough	May 26, 2005	Marlborough Westerly Waste Treatment Works
Marlborough	January 16, 2004	City of Marlborough
Marlborough	July 16, 2002	Massachusetts Water Resources Authority Wachusett Lower Gatehouse and Wachusett Aqueduct
Maynard	May 26, 2005	Maynard Water Pollution Control Facility
Westborough	May 26, 2005	Westborough Wastewater Treatment Plant

### **3.8 Nonpoint Source Pollutants**

Nonpoint source pollution is a pervasive problem, affecting surface and groundwater quality in both urban and rural areas. It is diffuse and largely unregulated, and is caused primarily when rainwater and snowmelt flow over (and through) ground that has been disturbed by some sort of land use. This "runoff" carries contaminants from these sites and deposits them into nearby surface waters and/or washes them into groundwater. Nonpoint source pollution can also come from sediments deposited into streams, lakes, or coastal waters as well as from atmospheric (dry and wet) fallout. In short, nonpoint source pollution comes from a wide variety of sources, most of which are directly related to uses of land.

Municipal officials in Massachusetts have the authority to initiate and enact local land use bylaws and controls and provide the leadership needed to combat nonpoint sources of pollution in their community. The Massachusetts Nonpoint Source Management Plan (Volumes I-IV) sets forth an integrated strategy and identifies programs and resources to prevent, control, and reduce pollution from nonpoint sources to protect and improve the quality of the waters of the Commonwealth.<sup>33</sup>

### **3.9 Well Closures**

The US EPA maintains a national online database of water systems including wells and surface water supplies. The data is provided and updated by the DEP. Table 3.6 lists public water supplies in the SuAsCo watershed that have been closed. Typically, well closures occur when a well has dried up, when there are concerns about water quality, or when the well is no longer needed due to the development of an alternative water supply.

<b>Town</b>	<b>Public Water System Name</b>	<b>Population Served</b>	<b>Water Source</b>	<b>Date Closed</b>
Acton	Great Road Condominium	400	Groundwater	Aug 1, 2004
Acton	Richmond House Condominium	48	Groundwater	Sept 1, 2004
Acton	Village Arms Apartments/Spring Hill Condominiums	472	Groundwater	Oct 1, 1998
Acton	Nashoba Drive In	100	Groundwater	Nov 1, 1992
Ashland	Glacial Lake Charles Water Co	25	Groundwater	Dec 1, 1996
Ashland	Water Vend (Framingham)	25	Purchased Surface Water	Nov 1, 2000
Bedford	Bedford VA Hospital	25	Purchased Surface Water	Dec 1, 1996
Berlin	Spaulding Property (Restaurant)	200	Groundwater	Dec 1, 2004
Billerica	MCI Billerica	25	Groundwater	Mar 1, 1997
Bolton	Childrens Horizon Day Care	100	Groundwater	Oct 1, 1998
Bolton	Trinity Church Annex	50	Groundwater	Dec 1, 2004
Bolton	Silvesters Italian Restaurant	125	Groundwater	Oct 1, 2004
Bolton	Twin Springs Golf Course	130	Groundwater	Apr 1, 2003
Boxborough	Harvard Ridge Condos	24	Groundwater	June 1, 1992
Boxborough	Harvard Ridge Condos	36	Groundwater	June 1, 1992
Boxborough	Harvard Ridge Condos	72	Groundwater	June 1, 1992
Boxborough	Winthrop House	25	Groundwater	June 1, 1992
Boylston	Morningdale Water District	1,400	Groundwater	Sept 1, 2004
Boylston	Bay Path Barn	80	Groundwater	Nov 1, 1992
Boylston	Other Place Pub	25	Groundwater	Oct 1, 1999
Boylston	Camp Harrington	150	Groundwater	Aug 1, 1999

**Table 3.6 List of Closed Public Water Systems<sup>34</sup>**

<b>Town</b>	<b>Public Water System Name</b>	<b>Population Served</b>	<b>Water Source</b>	<b>Date Closed</b>
Boylston	Cyperian Keyes Golf Course	25	Groundwater	Apr 1, 2004
Boylston	Dragon 88 Restaurant	147	Groundwater	Aug 1, 1999
Boylston	Sewall Beach	25	Groundwater	Oct 1, 1999
Carlisle	Carlisle Fire Station	25	Groundwater	Dec 1, 1997
Carlisle	St. Irene Rectory	25	Groundwater	Dec 1, 1996
Carlisle	Carlisle State Park	25	Groundwater	Dec 1, 1992
Carlisle	Country	25	Groundwater	Dec 1, 1992
Concord	Crestfield Condominium	25	Groundwater	Aug 1, 2004
Concord	Aid Co	25	Groundwater	Dec 1, 1996
Concord	Crosbys Corner	25	Groundwater	Dec 1, 1996
Concord	Bennis Farm Stand	25	Groundwater	Dec 1, 1992
Concord	Nashawtue Country Club	25	Groundwater	Dec 1, 1992
Concord	Unicorn Green Stables	25	Groundwater	Dec 1, 1992
Concord	Verrill Farm Store	25	Groundwater	Dec 1, 1992
Framingham	Margaret Davitt Childrens Center	160	Groundwater	Apr 1, 2001
Framingham	Mass Emergency Management Agency	30	Groundwater	July 1, 1999
Grafton	Countryside Apartments	66	Groundwater	Aug 1, 2004
Grafton	Keith Hill Nursing Home, Inc	64	Groundwater	Oct 1, 1999
Holliston	Holliston Water Dept	13,200	Groundwater	Feb 1, 1993
Hopkinton	MTA Toll Plaza 11A	40	Groundwater	Sept 1, 1999
Hopkinton	Holokinton State Park	25	Groundwater	June 1, 1992
Littleton	Camp Nashoba	25	Groundwater	Apr 1, 1997

<b>Table 3.6 List of Closed Public Water Systems<sup>34</sup></b>				
<b>Town</b>	<b>Public Water System Name</b>	<b>Population Served</b>	<b>Water Source</b>	<b>Date Closed</b>
Littleton	Shaker Hill Golf Club	110	Groundwater	June 1, 2002
Lowell	Lowell General Hospital	1,200	Purchased Surface Water	Apr 1, 2001
Lowell	Great Bear Bottled Water	25	Groundwater	May 1, 1999
Lowell	Mass Dept Natural Resources	25	Groundwater	Dec 1, 1992
Maynard	Federal Regional Center	50	Groundwater	Nov 1, 1992
Natick	US Army Soldier Systems Command	1,000	Purchased Groundwater	Oct 1, 2004
Natick	CP Mary Day	25	Groundwater	June 1, 1992
Northborough	Chances Are Restaurant	25	Groundwater	Nov 1, 1999
Sherborn	Devitts Garage	25	Groundwater	Dec 1, 1996
Sherborn	McCarthurs Market	25	Groundwater	Mar 1, 1997
Sherborn	Paul Insurance Agency	25	Groundwater	Dec 1, 1996
Sherborn	Pilgrim Church	25	Groundwater	Mar 1, 1997
Sherborn	Sherborn Apothecary	25	Groundwater	Dec 1, 1996
Sherborn	Sherborn Highway Garage	25	Groundwater	Mar 1, 1997
Sherborn	Sunshine Dairy	25	Groundwater	May 1, 1999
Sherborn	Central Fire Station	25	Groundwater	Aug 1, 1992
Sherborn	5 Powerhouse Lane	25	Groundwater	Dec 1, 1999
Sherborn	Dowse Orchards	25	Groundwater	Dec 1, 1996
Sherborn	Kleins Garage	25	Groundwater	Dec 1, 1992
Shrewsbury	Rainbow Motel	25	Groundwater	Feb 1, 1998
Shrewsbury	Log Cabin Restaurant	200	Groundwater	Nov 1, 1992
Stow	First Parish Church of Stow and	25	Groundwater	June 1, 1992

**Table 3.6 List of Closed Public Water Systems<sup>34</sup>**

Town	Public Water System Name	Population Served	Water Source	Date Closed
	Acton			
Sudbury	Great Meadow NWR	29	Groundwater	Apr 1, 2001
Sudbury	Somerville Lumber Co	550	Groundwater	May 1, 2002
Sudbury	Camp Elbanobscot	25	Groundwater	Dec 1, 1992
Upton	DCR Upton State Forest	25	Groundwater	Oct 1, 1999
Wayland	Summer Adv Day Camp	25	Groundwater	Dec 1, 1996
Westborough	Comfort Inn	80	Groundwater	Sept 1, 1999
Westford	The Child Care Center Inc	25	Groundwater	Oct 1, 2004
Westford	Nashoba Tech Annex	25	Groundwater	Nov 1, 1992
Westford	BJS Restaurant	25	Groundwater	Feb 1, 2003
Westford	Rancho De Amigos	70	Groundwater	Dec 1, 2004
Westford	YMCA Camp Weetamo	180	Groundwater	July 1, 2002
Westford	Pegasus Farm, Inc	25	Groundwater	Nov 1, 1992
Westford	Tiki-Lau Restaurant	35	Groundwater	Nov 1, 1992
Weston	Camp Nonesuch	155	Groundwater	May 1, 1997

### 3.10 Perchlorate

Ammonium perchlorate ( $\text{NH}_4\text{ClO}_4$ ) is an inorganic chemical widely used as an oxidizer in solid propellants for rockets, missiles and fireworks. Perchlorate is thus found in surface and ground waters around military operations, defense contracting or manufacturing facilities. Perchlorate is highly mobile in water and can persist for many decades under typical ground and surface water conditions.

In 2001, perchlorate contamination was first identified in Massachusetts on Cape Cod. In February 2004, the MADEP issued a drinking water health advisory of 1 ppb. In March 2004 MADEP initiated the process of establishing an Maximum Contaminant Level (MCL) for perchlorate by requiring all PWS to test for perchlorate. Perchlorate was detected in water from

nine wells, three of those wells (in Boxborough, Tewksbury, and Westford) were within the SuAsCo Watershed.

In August 2004, Tewksbury detected perchlorate in drinking water at a concentration of 6 micrograms per liter ( $\mu\text{g/L}$ ). Since the level was above the State limit of 1  $\mu\text{g/L}$ , Tewksbury issued a public-health advisory, warning pregnant and nursing women, children under 12, and those with thyroid disorders not to drink the water. The source of the perchlorate was found to be C.R. Bard Company, a manufacturer of medical devices located in Billerica, who had been discharging the perchlorate into the Concord River. The Tewksbury water department draws its water from the Merrimack River, after the confluence with the Concord River. C.R. Bard stopped discharging perchlorate to the river on November 20, 2004, and the health advisory was lifted on December 21, 2004.<sup>35</sup>

### **3.11 Wastewater**

Wastewater is used water from homes, commercial facilities, and industry. Wastewater includes both sanitary waste (primarily human and food waste), and industrial and process wastewater.

Wastewater treatment systems are designed to reduce the level of pollutants in wastewater so that the treated effluent can be safely discharged to rivers, marine waters, or the ground. Wastewater can either be treated and disposed of on-site or collected in a sewer system and treated at a central wastewater treatment plant (WWTP).

#### **3.11.1 On-site Wastewater Disposal Systems**

Septic systems are on-site wastewater disposal systems that include conventional septic systems, cesspools, and innovative/alternative systems. They are individual systems that treat small wastewater flows, usually fewer than 10,000 gallons per day. Over 30% of homes in Massachusetts use on-site wastewater systems, as well as businesses and institutions in unsewered areas. On-site systems that are not properly sited or maintained contribute pathogens and nutrients to groundwater and surface water, endangering drinking water supplies, shellfish beds, and surface water bodies. In 1995, stricter state standards for the inspection, design and construction of septic systems went into effect. These standards, known as Title 5 of the State Environmental Code, 310 CMR 15.000, include criteria for designing new systems as well as inspecting and upgrading existing systems when a property is transferred or bedrooms are added on to an existing home. DEP, local Boards of Health, and system owners all share the responsibility for the proper siting, construction, upgrade, and maintenance of on-site systems.<sup>36</sup>

One of the advantages of on-site wastewater disposal systems is that water is treated and then recharged into the ground via a leaching field. Therefore properly sited and constructed systems can help offset water use losses within the watershed.

#### **3.11.2 Wastewater Treatment Plants**

Wastewater treatment plants range in size and complexity from satellite plants treating sanitary wastewater from homes to large regional facilities treating millions of gallons a day of sanitary and industrial wastewater. Treatment plants may be publicly or privately-owned. Plants owned by municipalities are commonly called Public-Owned Treatment Plants, or POTWs.

In cooperation with local and federal authorities, DEP regulates many types of wastewater treatment plants in Massachusetts:

- Over 200 large sanitary and industrial facilities discharging to groundwater.
- Almost 600 facilities discharging to surface waters.
- Approximately 1700 indirect dischargers (typically commercial and industrial facilities that treat their wastes before discharging it to wastewater treatment plants).

The Board of Certification of Wastewater Treatment Operators and DEP classify wastewater treatment plants based on their complexity. The Board also oversees training, exams, and issuing of licenses to approximately 6,600 wastewater treatment operators, in order to ensure that treatment plants are operated by qualified professionals.<sup>37</sup>

Table 3.7 lists the wastewater treatment facilities in Watershed towns with discharge to groundwater. Table 3.8 lists the wastewater treatment plants with discharges to surface water within the Watershed.

<b>Table 3.7 Wastewater Treatment Plants with Watershed Groundwater Discharges</b>		
<b>Town</b>	<b>Facility</b>	<b>Flow (GPD)</b>
Acton	NO ACTON TREATMENT CORP	200,000
Acton	FARMBROOK CONDO. TRUST	105,000
Acton	GREAT ROAD CONDOMINIUMS	27,720
Acton	ACORN PARK CONDO. TRUST	39,750
Acton	SUBURBAN MANOR REHAB & NURSING	24,500
Acton	ACTON RETIREMENT COMMUNITY	34,520
Acton	TOWN OF ACTON WWTF	250,000
Ashfield	TOWN OF ASHFIELD	25,000
Bolton	FUTURE ELECTRONICS	16,500
Bolton	THE INTERNATIONAL	40,000
Bolton	NASHOBA REG. HIGH SCHOOL	12,000
Boxborough	BOXBOROUGH EXECUTIVE CTR.	30,000
Boxborough	BOXBORO HOST HOTEL	40,000
Boxborough	TECH CENTRAL PARK	24,375
Boxborough	CISCO SYSTEMS - SITE II	80,000
Boxborough	BROOK VILLAGE CONDO	33,000
Boxborough	BOXBOROUGH MEADOWS	15,840
Boxborough	CISCO SYSTEMS - SITE I	25,000
Boxborough	HARVARD RIDGE CONDO. TRUST	33,130

<b>Town</b>	<b>Facility</b>	<b>Flow (GPD)</b>
Chelmsford	UNITED PARCEL SERVICE	15,000
Chelmsford	THE MEADOWS AT BRICK KILN ROAD	34,000
Concord	CAMP THOREAU	20,117
Concord	NASHAWTUC COUNTRY CLUB	14,955
Concord	CONCORD MIDDLE SCHOOL	18,400
Harvard	HARVARD PUBLIC SCHOOLS	23,000
Holliston	WOODLAND STREET SCHOOL COMPLEX	32,080
Holliston	WOODLAND STREET SCHOOL COMPLEX	32,080
Hopkinton	ABBOTTSWOOD CONDOMINIUM	26,400
Hopkinton	INDIAN BROOK CONDO COMPLEX	32,400
Hopkinton	EMC CORPORATION	83,500
Hudson	SIMRAH GARDENS	34,760
Lincoln	LINCOLN HOMES	26,000
Littleton	HEWLETT-PACKARD	40,000
Littleton	CISCO DEVELOPMENT CENTER	55,000
Littleton	PONDSIDE AT LITTLETON	23,000
Littleton	LITTLETON NURSING HOME	18,000
Littleton	LITTLETON PUBLIC SCHOOLS	17,600
Southborough	WEDGEWOOD CONDOS	31,680
Southborough	ST. MARK'S SCHOOL	35,000
Southborough	PARK CENTRAL	45,000
Stow	BOSE CORPORATION	30,000
Stow	STOW L.L.C. ELDERLY HOUSING	12,000
Sudbury	RAYTHEON	50,000
Sudbury	LINCOLN-SUDBURY HIGH	30,000
Sudbury	LINCOLN-SUDBURY HIGH	20,000
Wayland	WAYLAND/SUDBURY WWTP	25,000
Wayland	HILLS @ MAINSTONE CONDO.	36,000
Wayland	TRADITIONS WWTF	27,120
Wayland	MEADOWS @ MAINSTONE FARM	24,640
Westford	WESTFORD REGENCY INN	40,600

<b>Town</b>	<b>Facility</b>	<b>Flow (GPD)</b>
Westford	HILDRETH HILLS CONDO.	44,700
Westford	WESTFORD TECH PARK	90,000
Westford	HITCHIN' POST GREENS CONDO	80,500
Westford	WESTFORD MIDDLE SCHOOL	24,000
Westford	NASHOBA VIEW II	39,900
Westford	WESTFORD ACADEMY HIGH	32,000
Westford	PRIMROSE PARK	35,000
Westford	ONE WESTFORD TECH PARK WEST	18,750
Westford	VILLAGE AT STONE RIDGE	25,000
Westford	STONY BROOK CENTER	22,000
Westford	BROOKSIDE MILL	7,480
Westford	ABBOTT SCHOOL	13,120
Weston	THE VINEYARD	19,000
Weston	NORUMBEGA POINT	36,400
Weston	CENTER ST SAS	7,000
Weston	WESTON SCHOOLS	28,900
Weston	THE CORPORATE CENTER	34,000
Weston	JERICO VILLAGE CONDO.	21,000
Weston	RIVERS SCHOOL	12,000
Weston	LIBERTY MUTUAL	1,500
<b>Total Flow (GPD):</b>		<b>2,601,917</b>
<b>Total Flow (MGD):</b>		<b>2.602</b>

<b>Facility</b>	<b>Town</b>	<b>Receiving Water</b>	<b>Flow (MGD)</b>
Concord Wastewater Treatment Facility	Concord	Concord River	1.2
Hudson Wastewater Treatment Facility	Hudson	Assabet River	2.65
Marlborough Westerly Wastewater Treatment Facility	Marlborough	Assabet River	2.89

Maynard Wastewater Treatment Facility	Maynard	Assabet River	1.45
Middlesex School Wastewater Treatment Plant	Concord	Spencer Brook to Concord River	0.052
Westborough Wastewater Treatment Plant	Westborough	Assabet River	7.7
<b>Total Flow (MGD):</b>			<b>15.942</b>

### 3.12 Dam Safety and Dam Removal

The Office of Dam Safety in the Department of Conservation and Recreation (DCR) is responsible for inspecting and reporting the condition of approximately 3000 dams in Massachusetts. These dams were built for a multitude of purposes, including power generation, flood prevention, creating reservoirs, and irrigation. While they serve a useful and generally cost-effective purpose, dams also interrupt streamflow and can endanger wildlife that depends on uninterrupted waterflow and require regular maintenance to ensure safety and prevent unanticipated breaches.

The Massachusetts Department of Fish and Game Riverways Program has initiated the River Restore Program to evaluate the feasibility of repair versus removal for existing unsafe dams. Many of these dams were built before 1900 and were associated with particular industries which no longer exist or use the dam. The River Restore Program maintains funding sources and develops guidelines for dam removal.

Advantages of removing obsolete dams include:

- Improved fish passages
- Restores natural water temperatures and oxygen levels
- More paddling and less portaging for canoes and other watercraft
- Improves sediment transport, including beach nourishment in coastal areas
- Reduces liability concerns for dam owners, and may eliminate public safety hazards
- Prevents uncontrolled dam breaches ensuring public and environmental safety
- Revegetation of river beds and banks within one growing season following removal.<sup>38</sup>

### 3.13 Stormwater Management, BMP Implementation, & Phase II Compliance

The goal of the Stormwater Management Policy is to improve water quality and address water quantity problems by the implementation of performance standards for stormwater management. Urban runoff and discharges from stormwater outfalls are the single largest source responsible for water quality problems in the Commonwealth's rivers, lakes, ponds, and marine waters. The Stormwater Management Standards establish clear and consistent guidelines for stormwater management in Massachusetts. The Standards are designed for use under multiple statutory and regulatory authorities of the Department of Environmental Protection, including the Wetlands Protection Act, as amended by the Rivers Protection Act, and the Clean Water Act.

Rain or snow that falls either soaks into the ground to become groundwater, evaporates, or flows off over the land surface. The overland flow is called runoff or stormwater and is the primary water source for vernal pools, wetlands, streams, rivers, lakes, and water-supply reservoirs. (For an illustration of the water cycle, see <http://ga.water.usgs.gov/edu/watercyclegraphic.html>.)

Stormwater washes along or dissolves some of the materials in its path. Vegetative surfaces slow the flow, filter out sediments, and can break down or trap pollutants in the root zone. In contrast, buildings, roads, parking areas, and exposed bedrock increase the volume and speed of stormwater runoff since none can soak in and the hard surfaces present little resistance to flow. To prevent flooding and protect property in developed areas, stormwater drainage systems collect stormwater runoff and carry it away from roadways and structures to a discharge point. Most discharges are into natural waters. Stormwater drainage systems consist of curbs, gutters, storm drains, channels, ditches, pipes, and culverts and do not treat the stormwater.

Stormwater becomes a transportation system for pollutants. Soil that erodes from a construction site, cigarette butts and other litter from parking lots, antifreeze and oil dripped from cars, fertilizers and pesticides from turf management, and grit and salt left from de-icing operations on roadways can be deposited untreated into our waterways. Water can contain and transport sediments, metals (copper, cadmium, chromium, lead, and zinc), nutrients (nitrates, phosphates, and ammonia), salt, petroleum products and coliform bacteria among other materials. This is why stormwater is such a significant contributor to water pollution.

In Massachusetts, polluted stormwater runoff and discharges in urbanized areas cause serious water-quality problems. Polluted runoffs to water bodies have affected aquatic plant and animal life in streams and lakes, closed shellfish beds, reduced recreational activities such as boating and swimming, and increased existing flooding conditions caused by natural events.

Best Management Practice" (BMP) is a vague term, broadly used to describe the most effective, feasible method that does the job. In the context of storm water management, it is often used to mean a structure or technology used to manage or treat the water such as a hooded catch basin, detention basin, or a filter system. The term BMP is also used for behavioral practices such as timely cleaning of catch basins, or habitual closing of the lid on a dumpster (avoiding dumpster brew when it rains). A BMP can even be restraint of a specific behavior such as minimizing the use of lawn fertilizer, or of road salt and sand.

The Phase II Final Rule was published in the Federal Register on December 8, 1999, and requires expanded NPDES permit coverage for storm water discharges from certain regulated small municipal separate storm sewer systems (MS4s); and construction activity disturbing between 1 and 5 acres of land (i.e., small construction activities). Disturbance of land 5 acres and above was regulated under Phase I of the NPDES Storm Water program. In addition to expanding the NPDES Storm Water Program, the Phase II Final Rule revises the "no exposure" exclusion and the temporary exemption for municipal industrial facilities under Phase I of the NPDES Storm Water Program.<sup>39</sup>

### 3.14 Sand/Salt Use and Storage

Roadway deicing consists of the application of a road salt, usually sodium chloride, to minimize ice buildup and an abrasive, usually sand, to aid in traction. Salts applied to the road surface lower the melting temperature of ice, preventing snow from bonding to the pavement and aiding in snow removal operations. By far the most commonly used deicing material is sodium chloride because of its low cost and public acceptance. Public demand for safe, ice-free roadways is of major concern to local and state agencies.

The use of road salt has been the cause of contamination of ground and surface waters, often making them unusable as a drinking water source. High sodium concentrations are also causing habitat alterations, killing vegetation, causing public health problems, and corroding infrastructure. Sand also accumulates on roadways, blocking storm drains and swales, and increasing the sedimentation of streams and rivers. Many of the most severe salt contamination problems come from the improper storage of materials before their application on roads. Salt that is stored uncovered and the improper disposal of plowed snow both contribute to the salinity problem.

Salt should be stored in a covered building on an impervious surface. Drainage from the area should be designed to divert runoff away from the structure and to collect any contaminated material. These facilities should be constructed so that all handling of material is done in an enclosed area and should not be located in water supply watersheds.

Street cleaning is an effective way of removing excess sand and debris from the road. This is an important way of keeping sediment from entering rivers and streams through storm drains and drainage swales. Streets should be swept at a minimum in both spring and fall, and catch basins should be cleared of sand and debris.

There are several ways to limit the amount of salt used on roadways. Salt use can be reduced when by establishing "low salt areas" near sensitive environments or residential areas, or by using a higher percentage of sand in the salt/sand mix. Both timing of the application and wetting of the salt before application so that it sticks to the road lead to fewer applications. Vermont is using infrared sensors on the bottoms of snowplows to measure the actual temperature of the roadway as the trucks pass over allowing a more accurate calculation of the amount of salt needed. This has resulted in reductions of salt use by 20-30% saving \$2.2 million statewide.

The Department of Environmental Protection has issued an emergency snow disposal guidance to protect water resources from contamination. The guidance states that there should be no disposal in salt marsh or vegetated wetlands, rivers, shellfish beds, mudflats, drinking water sources or ACEC's. DEP also states that if waterways must be used because of no other alternative, the water should have adequate flow to provide mixing and the activity should conform to all town by-laws. Snow fences and trees can be used to keep snow from blowing onto the road, reducing the need for plowing.<sup>40</sup>

### 3.15 Manure Management

Animal waste from barnyards, manure pits and field application can pollute ground and surface water when not contained or applied properly. By making Best Management Practices (BMPs) part of a conservation plan, a farmer can greatly reduce the chances of contamination. BMPs can be managerial controls (manure management, rotational grazing, and conservation tillage) or structural controls (manure pits or lagoons, terraces and fencing).

Manure management can include applying manure appropriately taking into account timing, location, and mixing; testing soil to determine nutrient needs; composting; and creating buffer zones.<sup>41</sup>

### 3.16 Enforcement Actions

DEP uses its enforcement authority to compel compliance with environmental requirements, punish violators, deter environmental violations by others, and to foster and promote sustained environmental compliance and stewardship.

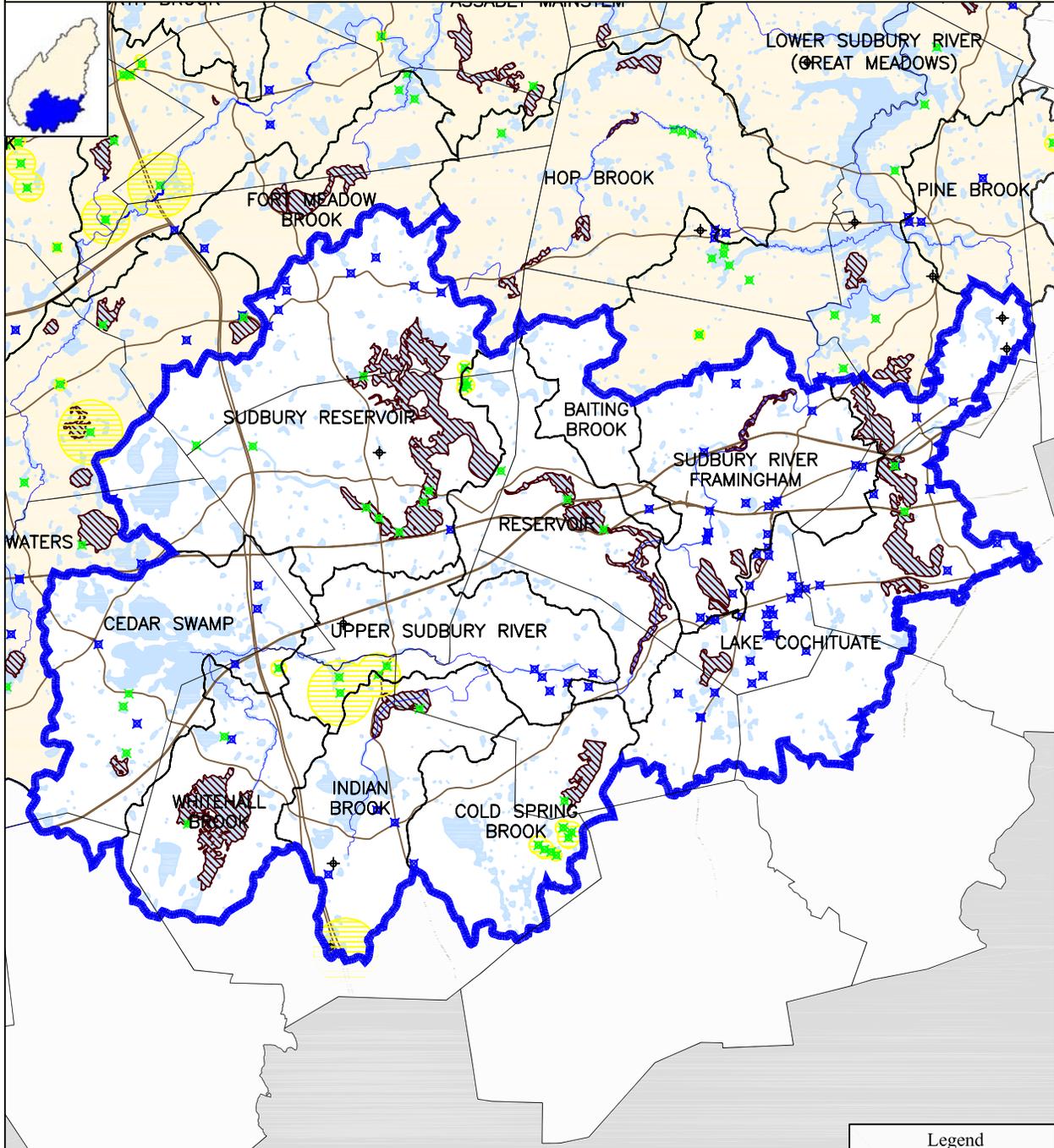
Enforcement data is broken down by DEP bureau and by type of action. Table 3.5 shows enforcement types in the Bureau of Resource Protection (BRP) across the state. A detailed description of DEP enforcement activities is available in the 2004 Compliance and Enforcement Annual Report.

<b>Table 3.9 MA DEP BRP Statewide Enforcement Action Results, 2000-2004<sup>42</sup></b>					
<b>Enforcement Action</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>
Compliance Inspections	2,688	3,015	2,387	1,949	2,329
Lower Level Enforcement	957	1140	772	706	673
Higher level Enforcement	220	174	210	227	247
Referrals	6	5	1	2	7
Agency-wide Penalty and Environmental Alternatives	\$6,211,655	\$4,237,218	\$6,667,278	\$8,999,109	\$12,658,213

**Compliance Inspections** included all announced or unannounced visits to a site.  
**Lower Level Enforcement** includes providing notice to a violator of noncompliance, and establishing a reasonable deadline for correction before the DEP escalates its enforcement response.  
**Higher Level Enforcement** includes a variety of enforcement responses including: administrative orders, penalty assessments, amendments to prior orders, demands for stipulated or suspended penalties, and permit and licensure sanctions such as suspensions or revocations.  
**Referrals** represent referrals to the Board of Registration of Licensed Site Professionals, U.S. EPA and the office of the Attorney General for civil or criminal prosecution.  
**Agency-wide Penalty and Environmental Alternatives** represent across the state and across all agency bureaus. From the MA DEP 2004 Compliance and Enforcement Annual Report.

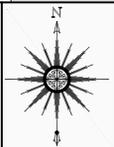
- 
- 22 EOE Web Site, [http://www.mass.gov/envir/water/publications/WAP\\_Guidance.pdf](http://www.mass.gov/envir/water/publications/WAP_Guidance.pdf)
  - 23 Organization for the Assabet River, <http://www.assabriver.org/wq/>
  - 24 ESS. 1999. A Nutrient and Limnological Investigation of Lake Boon Hudson/Stow, Massachusetts. Project No. L090 Environmental Science Services, Inc. Wellesley, MA.
  - 25 MA DPH Bureau of Environmental Health Assessment, <http://www.mass.gov/dph/media/2001/pr0724.htm>
  - 26 MA DPH Bureau of Environmental Health Assessment, <http://www.mass.gov/dph/beha/beha.htm>
  - 27 MA DEP Source Water Assessment Program (SWAP), July 2004, <http://www.mass.gov/dep/brp/dws/swap.htm>
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  - 29 US EPA, <http://www.epa.gov/owow/tmdl/intro.html>
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  - 31 US EPA, <http://www.epa.gov/region01/npdes/index.html>
  - 32 USEPA, [http://www.epa.gov/NE/npdes/permits\\_listing\\_ma.htm](http://www.epa.gov/NE/npdes/permits_listing_ma.htm)
  - 33 MA DEP Bureau of Resource Protection, <http://www.mass.gov/dep/brp/wm/nonpoint.htm>
  - 34 EPA – Envirofacts Warehouse – SDWIS, May 3, 2005
  - 35 Lowell Sun, May 3, 2005
  - 36 MA DEP, <http://www.mass.gov/dep/brp/wm/t5about.htm>
  - 37 <http://www.mass.gov/dep/brp/wwtp/aboutwtp.htm>
  - 38 Department of Fish and Game, Riverways Program, River Restore Fact Sheet <http://www.mass.gov/dfwele/river/pdf/rivdamremove.pdf>
  - 39 MA DEP <http://www.mass.gov/dep/brp/stormwtr/phiihelp.htm>
  - 40 Department of Fish and Game, Riverways Adopt-a-Stream Program, Fact Sheet <http://www.mass.gov/dfwele/river/rivdeicing.htm>
  - 41 Ma Dept of Agriculture Resources (MDAR), Agricultural Environmental Enhancement Program (AEEP), Manure Fact Sheet [http://www.mass.gov/agr/programs/aEEP/manure\\_factsheet.PDF](http://www.mass.gov/agr/programs/aEEP/manure_factsheet.PDF)
  - 42 <http://www.mass.gov/dep/enf/04enforce.htm>

# Water Quality in the Upper Sudbury River

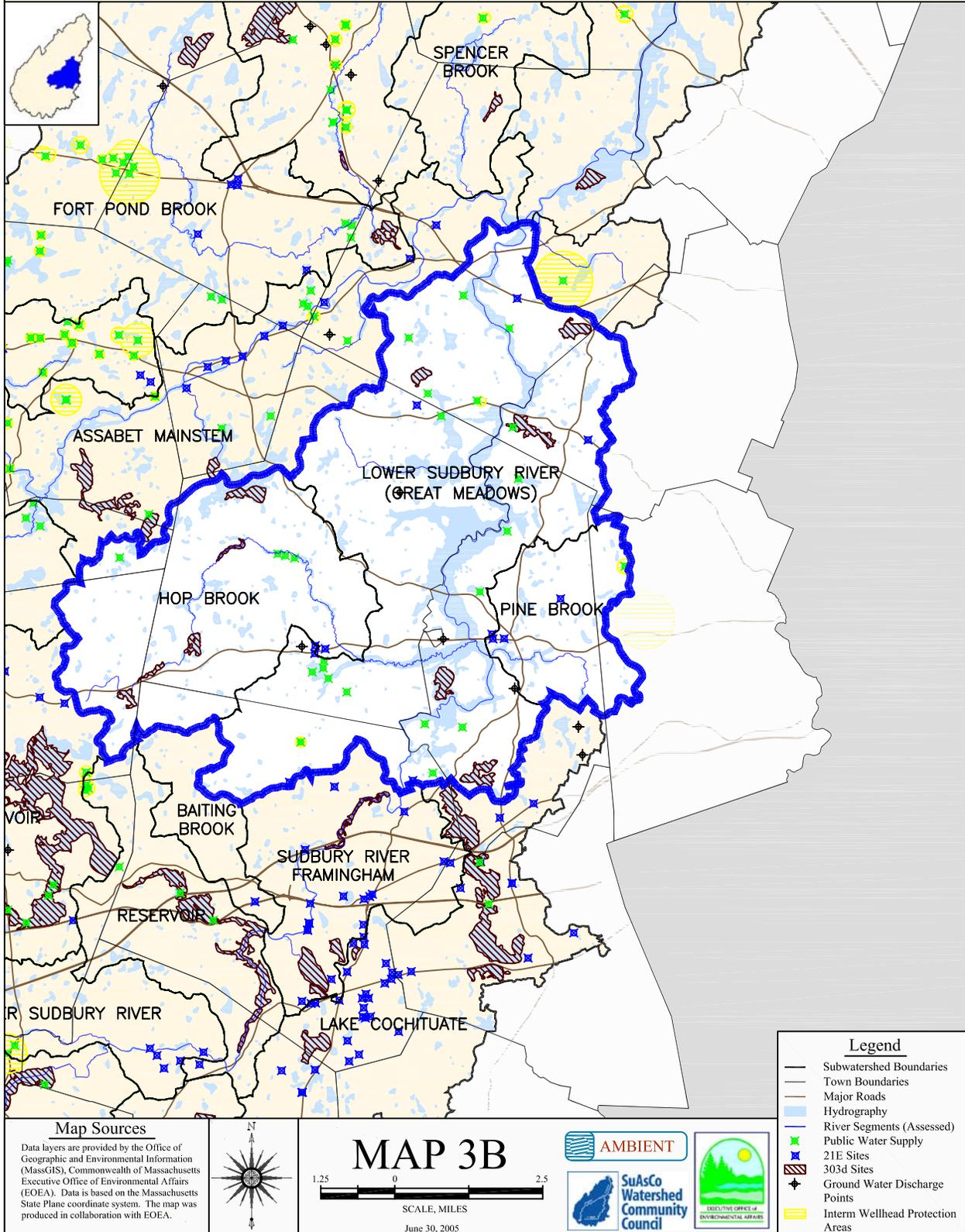


- Legend**
- Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - River Segments (Assessed)
  - Public Water Supply
  - 21E Sites
  - 303d Sites
  - Ground Water Discharge Points
  - Intern Wellhead Protection Areas

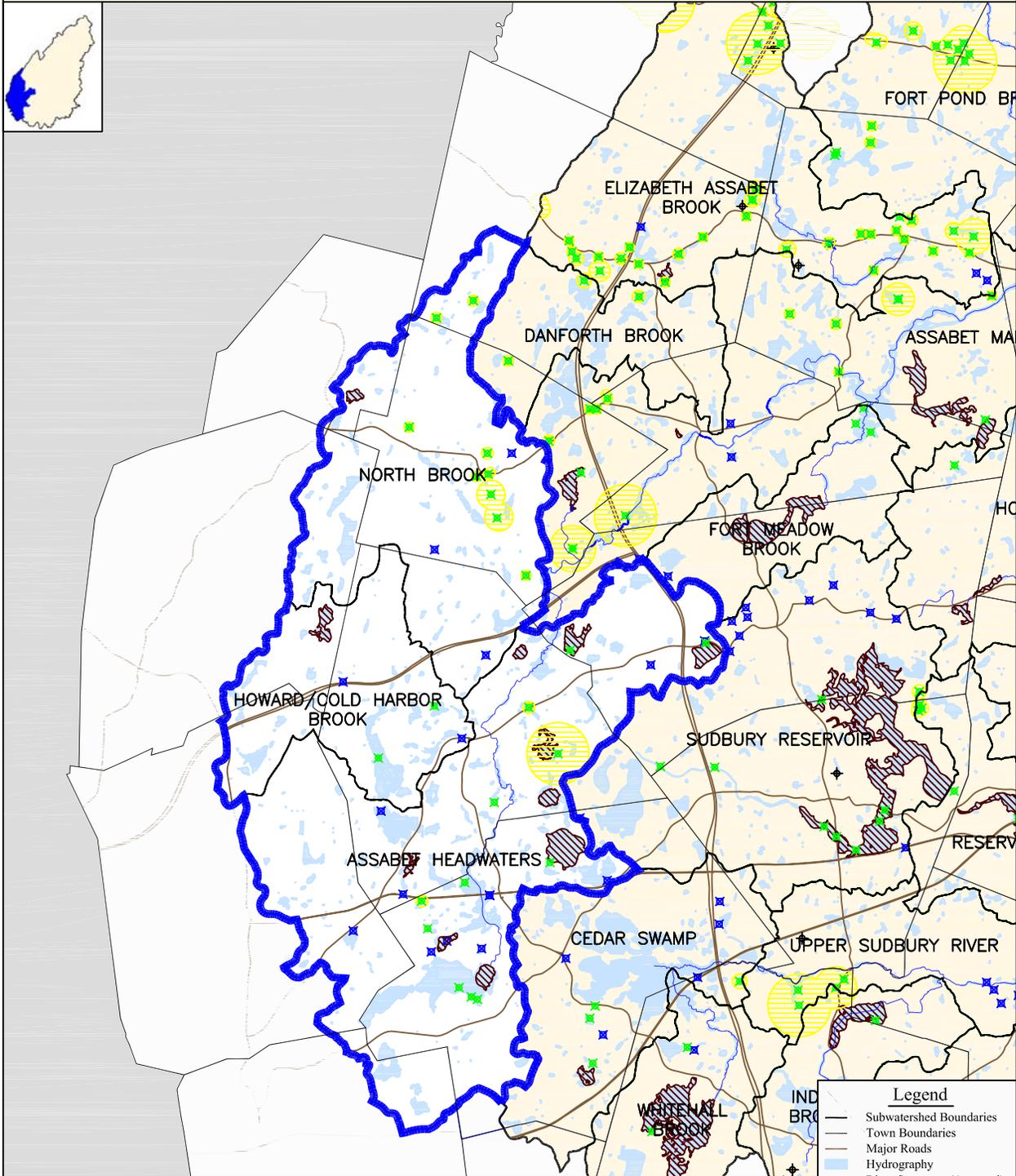
**Map Sources**  
 Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOE.



# Water Quality in the Lower Sudbury River



# Water Quality in the Upper Assabet River



## Map Sources

Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOE.



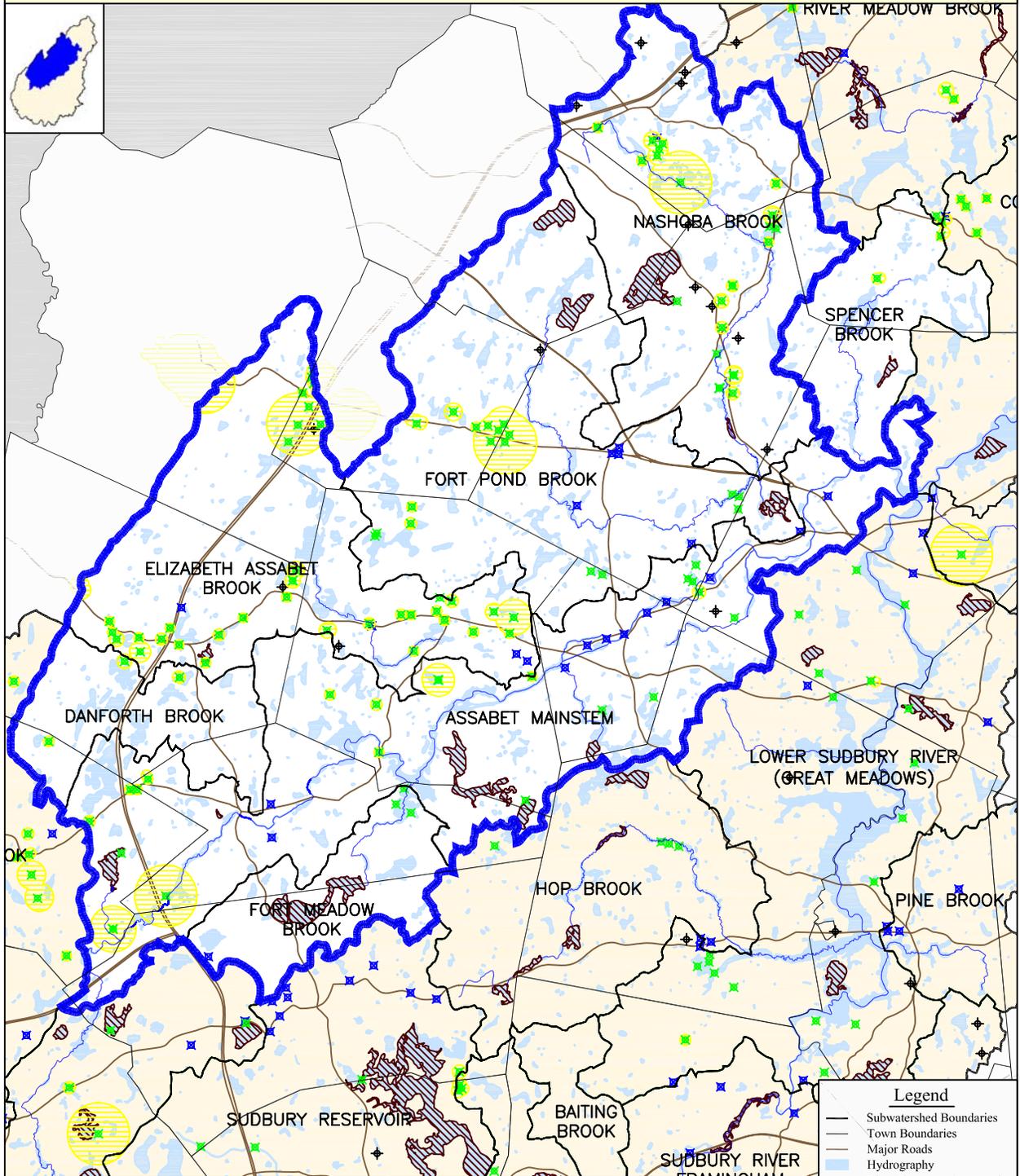
## MAP 3C



## Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- River Segments (Assessed)
- Public Water Supply
- 21E Sites
- 303d Sites
- Ground Water Discharge Points
- Interim Wellhead Protection Areas

# Water Quality in the Lower Assabet River



## Map Sources

Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



## MAP 3D

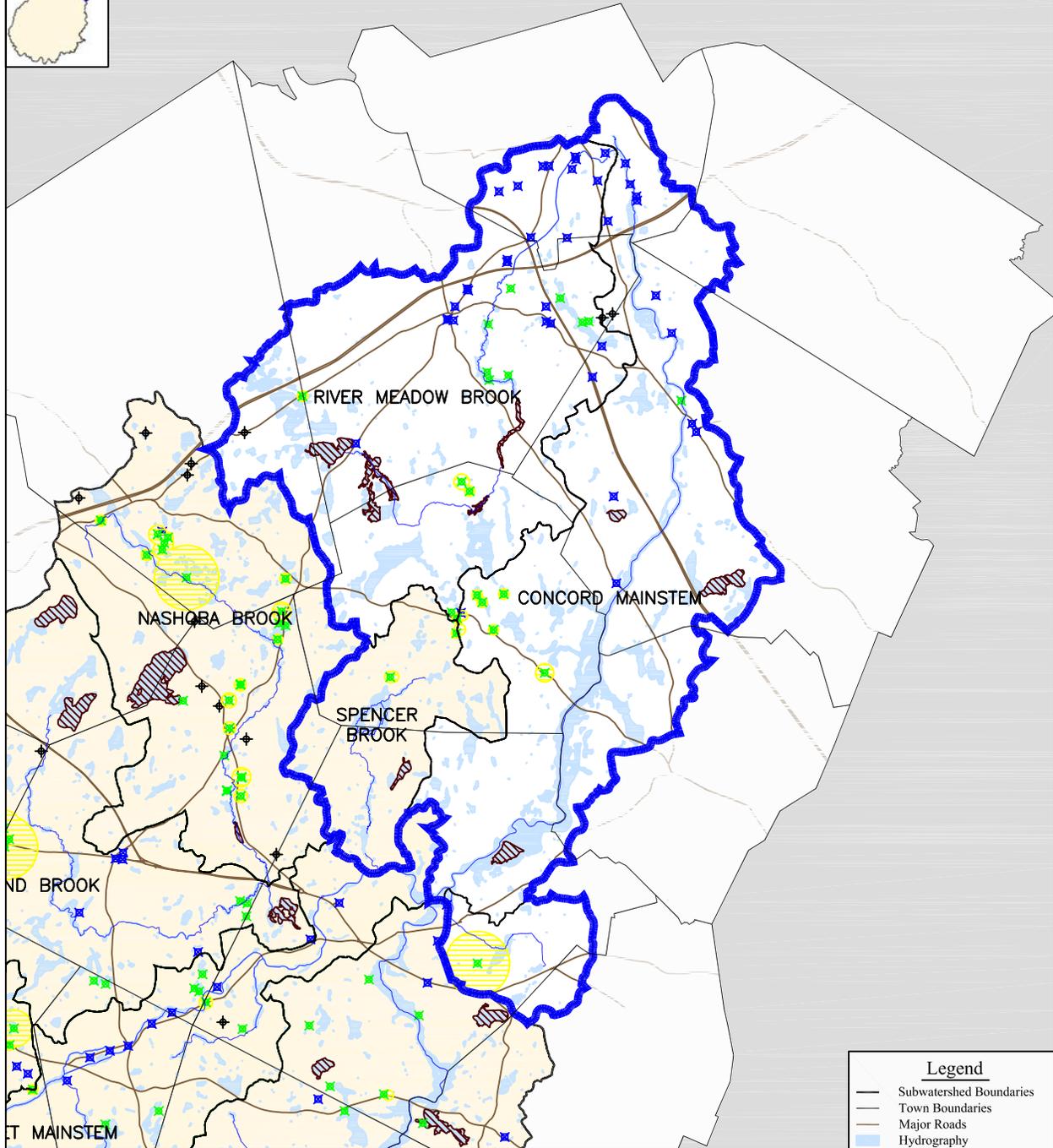
June 30, 2005



## Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- River Segments (Assessed)
- Public Water Supply
- 21E Sites
- 303d Sites
- Ground Water Discharge Points
- Interim Wellhead Protection Areas

# Water Quality in the Concord River



- Legend**
- Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - River Segments (Assessed)
  - Public Water Supply
  - 21E Sites
  - 303d Sites
  - Ground Water Discharge Points
  - Interm Wellhead Protection Areas

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## 4 WATER QUANTITY

“Without enough water in our streams, lakes and aquifers, our ecosystems will be parched and human activities will ultimately be restricted. To effectively manage our watersheds, especially in light of recent drought conditions, it is imperative that this issue is addressed first.”<sup>43</sup>

The SuAsCo Watershed receives approximately 44 inches of precipitation annually. Yet, many stream segments exhibit low flow conditions periodically. In this section some of the more important water quantity issues are summarized. They include low flow inventory, data collection and modeling, stream flow statistics, water withdrawals, and flood plain issues.

### 4.1 Low Flow Inventory

The Massachusetts Department of Fish and Wildlife Riverways Program Lowflow Inventory has documented a number of water quantity issues along the Watershed. The **Sudbury River** ran dry for about 200 feet near Fruit Street in Hopkinton during August and September of 1999 for a period of about 15 days.

In the Assabet River subwatershed, **Nashoba Brook** near Acton is listed by DEM as a “high stress” basin based on its low discharge per square mile of watershed compared to other rivers in the state.

#### Suspected Causes-Water Withdrawals

The no flow event on the **Sudbury River** near Fruit Street in Hopkinton may have been due to a combination of 1999 drought conditions and numerous groundwater wells nearby. All of the Town of Hopkinton’s wells plus the wells for a golf course are located in the Whitehall area near the Fruit Street section of the Sudbury River. The Town of Westborough has installed a monitoring well at Fruit Street to observe future water levels.

The Organization for the Assabet River is concerned that the operation of the Howard Street wells in Northborough is depleting stream flow in **Howard Brook** and possibly impacting the trout fishery there. A vernal pool site near a well field in Acton was also nearly dry in early spring of 2002, a season when this pool has been about five feet deep in the past.

**Elizabeth Brook**, a tributary of the Assabet River in Stow, Boxborough, and Harvard, was too low for water quality sampling during 1999 and members of the Organization for the Assabet River, among others, worry that stream flow in many tributaries of the Assabet suffer from frequent low flow problems. A quick comparison of withdrawals versus the amount of water in the tributaries during low flow periods revealed many stream sections where water withdrawals exceeded the estimated 7Q10 (lowest consecutive 7-day average streamflow likely to occur in a 10-year period): approximately 140% of the estimated 7Q10 is withdrawn from the A1 impoundment’s subwatershed in Westborough; approximately 85% of the estimated 7Q10 is



Sudbury River Running Dry August 1999 –  
Courtesy of Linda Hubley, Southborough MA,  
Sudbury River Watershed Organization

withdrawn from the **Howard/Cold Harbor Brook** subwatershed in Northborough; approximately 440% of the estimated 7Q10 is withdrawn from the **Fort Meadow Brook** subwatershed in Hudson; approximately 450% of the estimated 7Q10 is withdrawn from the Millham Reservoir subwatershed in Marlborough; and approximately 140% of the estimated 7Q10 is withdrawn from the **Taylor Brook** subwatershed in Maynard. The Organization for the Assabet River recently received an EPA EMPACT grant to study the effects of surface water withdrawals on stream flow in several of these tributaries.

**Jackstraw Brook** in Westborough was observed dry between Westborough's water supply wells on August 12, 2004. Several isolated pools near Upton Road were the last refuge for native brook trout, whose presence indicates that this brook was once a high quality cold water fishery. Low flows and heavy sediment loads from upstream development have degraded habitat for aquatic species and the trout to congregate in the few remaining pools for survival.

#### **Dam Management**

The **Assabet River** below the A1 impoundment (also known as Mill Pond) in Westborough runs dry for a length of about 1 mile during dry periods. When the structure was built for flood control purposes in the 1950's, there may have been a minimum flow release requirement of 3.5 cfs, but, partly because the impoundment is shallow and does not have much storage capacity to allow releases to improve stream flow, this minimum flow requirement has not been met. Further downstream, seven wastewater treatment plants discharge to the river and actually increase stream flow during dry periods above naturally occurring levels. The lowest seven day average flow at the USGS gaging station in Maynard was 11.6 cfs in August of 1999 and during this same month the average wastewater effluent discharge upstream was 12.6 cfs. Thus, the wastewater effluent constituted essentially the entire flow of the river at Maynard and was not diluted or augmented by any base flow in the river. This phenomenon of increased discharge during low flow periods due to wastewater effluent can be observed by noting the frequency and magnitude of low flow events on the USGS Water Resources webpage for historic stream flow data at the Maynard USGS gaging station (station #01097000).<sup>44</sup>

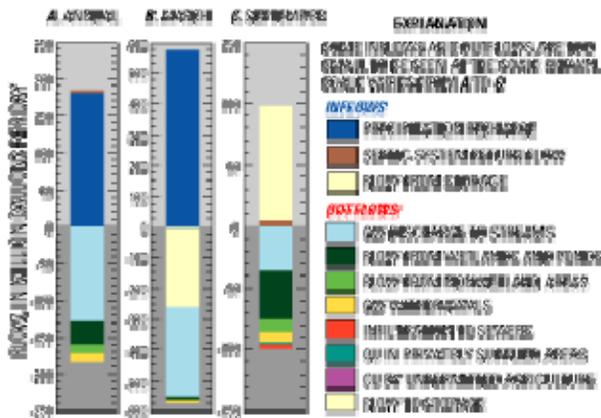


Low flows and heavy sediment loads from upstream development degrade habitat for coldwater fisheries in Jackstraw Brook, Westborough – Courtesy of MA DFW

### 4.2 USGS Assabet River Water Quantity Study

In 2005 the U.S. Geological Survey (USGS), in cooperation with the Massachusetts Department of Conservation and Recreation (MADCR) prepared a report providing an accounting of inflows, outflows, and uses of water in the Assabet River Basin, including all or part of 20 towns, to better understand the effects of current and future water withdrawals and wastewater discharges on streamflows in the Assabet River and its tributaries.

Annually, total nonstorm water flow through the study area averaged 195 Mgal/d. Recharge from precipitation (180 Mgal/d) and ground-water discharge to streams (129 Mgal/d) were the major inflow and outflow components of the hydrologic system, respectively (fig. 5). Evapotranspiration of ground water from wetlands (29 Mgal/d) and nonwetland areas (13 Mgal/d) also were important losses (outflows) from the hydrologic system. Basinwide, water-supply withdrawals (9.9 Mgal/d) were 5 percent of total annual outflows; septic-system return flows (4.3 Mgal/d, which includes septic-system return flow from imported public supply) accounted for 2 percent of total annual inflows.



Model-calculated water budgets for the ground-water-flow system in the Assabet River Basin. The budgets represent average annual, high-flow (March), and low-flow (September) conditions during 1997–2001. (GW, ground water; CU, consumptive use)

aquifer storage, as the water table declined and water was released from storage (93 Mgal/d, fig. 5; flow from aquifer storage is shown as an inflow). Outflows were about equal for ground-water discharge to streams (49 Mgal/d) and evapotranspiration of ground water from wetlands, ponds, and nonwetland areas (49 Mgal/d; fig. 5). Inflows and outflows from people’s activities were higher percentages of total flows in September than in March or annually, averaging 4 percent of total inflows for septic-system return flow (4.3 Mgal/d) and 9 percent of total outflows for water-supply withdrawals (10.5 Mgal/d).<sup>45</sup>

Seasonally, inflows and outflows to the hydrologic system varied substantially. In March, the highest flow month, total nonstorm water flow averaged 592 Mgal/d. Precipitation recharge (578 Mgal/d) was still the major inflow. Much of the recharge was stored in the aquifer, as the water table rose (261 Mgal/d, fig. 5; flow to aquifer storage is shown as an outflow, although it remains within the hydrologic system). Most of the remaining outflow was to ground-water discharge to streams (297 Mgal/d). Water-supply withdrawals were a smaller fraction of total outflows (1.6 percent, or 9.3 Mgal/d), as was infiltration to sewers (less than 1 percent of total flows, or 4.2 Mgal/d), although infiltration is larger in March than annually.

In September, the lowest flow month, total nonstorm water flow averaged 112 Mgal/d. The source of nearly all of the water flowing through the hydrologic system was

### 4.3 Data Collection and Modeling

Water quantity data collection and modeling is performed by a number of organizations. They include state and federal agencies such as the Massachusetts Riverways Program, United States Geological Survey, and the Massachusetts Department of Conservation and Recreation, which now includes the former MA Department of Environmental Management (DEM).

USGS, in cooperation with DEM, published an assessment of minimum stream flow requirements to sustain and protect habitat on reaches in tributaries to the Assabet Rivers in 2001. The Assabet River tributaries were Danforth Brook, Great Brook and Elizabeth Brook. The study yielded minimum streamflow requirements of 0.75 cubic feet per second per square mile ( $\text{ft}^3/\text{s}/\text{mi}^2$ ), using two different streamflow modeling methods.<sup>46</sup>

A new similar study that is currently underway on Whitehall Brook, a tributary to Sudbury River, is also being sponsored by the USGS.<sup>47</sup>

A USGS groundwater management modeling and assessment project is in progress for the Assabet watershed. This will provide a useful tool and recommendations for managing increasing demands to the area's groundwater resources into the future.<sup>48</sup>

### 4.4 Stream Flow Statistics

The United States Geological Survey composites statistics on stream flow in a number of categories. These include flood-flow frequency, low-flow frequency, flow duration, and August median flow. This data can be downloaded from the USGS web site, <http://ststdmamrl.er.usgs.gov/streamstats>.<sup>49</sup>

### 4.5 Water Withdrawals

Many rivers and streams across Massachusetts are being seriously degraded by low summer flows due to water withdrawals, interbasin transfers, and watershed development. In fact, the Massachusetts Water Resources Commission recently identified all or portions of many major Massachusetts rivers as "stressed" by low summer flows. These include the Sudbury, Assabet, and Concord Rivers.<sup>50</sup>

### 4.6 Floodplain

A flood, as defined by the United States Federal Emergency Management Agency (FEMA) National Flood Insurance Program is: "A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is your property) from:

- Overflow of inland or tidal waters,
- Unusual and rapid accumulation or runoff of surface waters from any source, or
- A mudflow."<sup>51</sup>

In order to reduce the risk of flood damage , the Federal Insurance and Mitigation Administration's Hazard Mapping Division maintains and updates the National Flood Insurance Program maps. These maps are used by insurance companies to establish flood risk as well as by other state, local and federal agencies to seeking to understand environmental risk potential in areas of proposed development near waterways.

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<sup>43</sup> EOE Web Site, [http://www.mass.gov/envir/water/publications/WAP\\_Guidance.pdf](http://www.mass.gov/envir/water/publications/WAP_Guidance.pdf)

<sup>44</sup> MA Department of Fish and Wildlife,

[http://www.mass.gov/dfwele/river/rivlow\\_flow\\_inventory/suasco.html#References](http://www.mass.gov/dfwele/river/rivlow_flow_inventory/suasco.html#References)

<sup>45</sup> USGS, *DeSimone, L.A., 2005, People and Water in the Assabet River Basin, Eastern Massachusetts, FS-2005-3034, 6 p.*

<sup>46</sup> USGS, Preliminary Assessment of Streamflow Requirements for Habitat Protection for Selected Sites on the Assabet and Charles Rivers, Eastern Massachusetts, Open-File Report 02-340, Northborough, MA 2001

<sup>47</sup> Cedar Swamp Conservation Trust, Sudbury Aquatic Habitat Study by USGS

<http://www.csctrust.org/projects/index.html>

<sup>48</sup> [http://www.assabriver.org/streamwatch/water\\_d.html](http://www.assabriver.org/streamwatch/water_d.html)

<sup>49</sup> USGS, <http://ststdmamrl.er.usgs.gov/streamstats/welcome1.htm>

<sup>50</sup> Mass Audubon Web Site, <http://www.massaudubon.org/rivers/impacts.php>

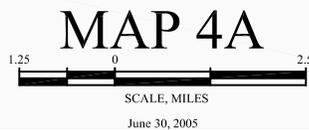
<sup>51</sup> US FEMA, <http://www.fema.gov/hazards/floods/>

# Water Quantity in the Upper Sudbury River



## Map Sources

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## MAP 4A

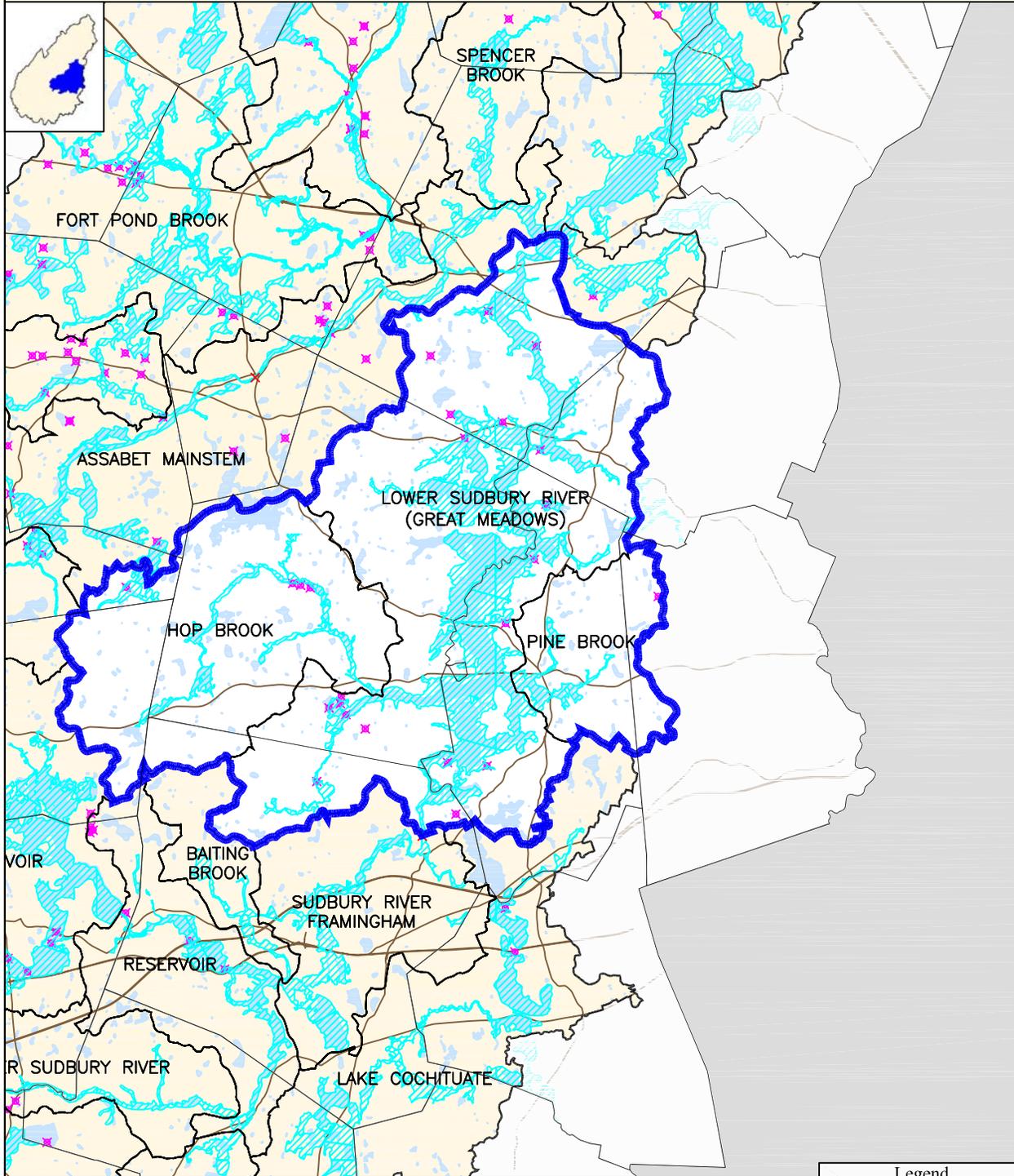
June 30, 2005



## Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- 100-Year Floodplain
- Public Water Supply
- Stream Gaging Stations

# Water Quantity in the Lower Sudbury River



## Map Sources

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## MAP 4B



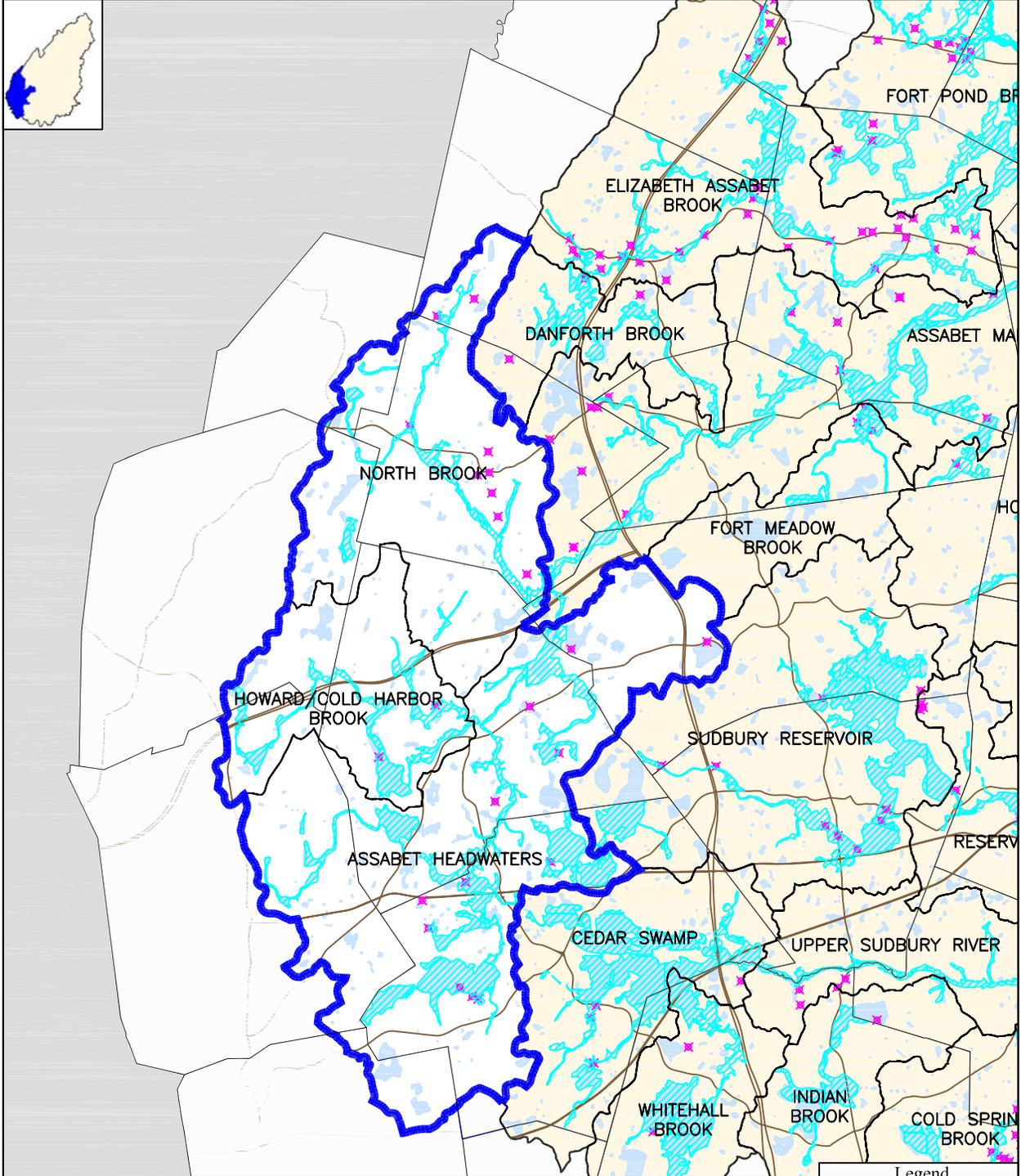
June 30, 2005



## Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- 100-Year Floodplain
- Public Water Supply
- Stream Gaging Stations

# Water Quantity in the Upper Assabet River



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## MAP 4C



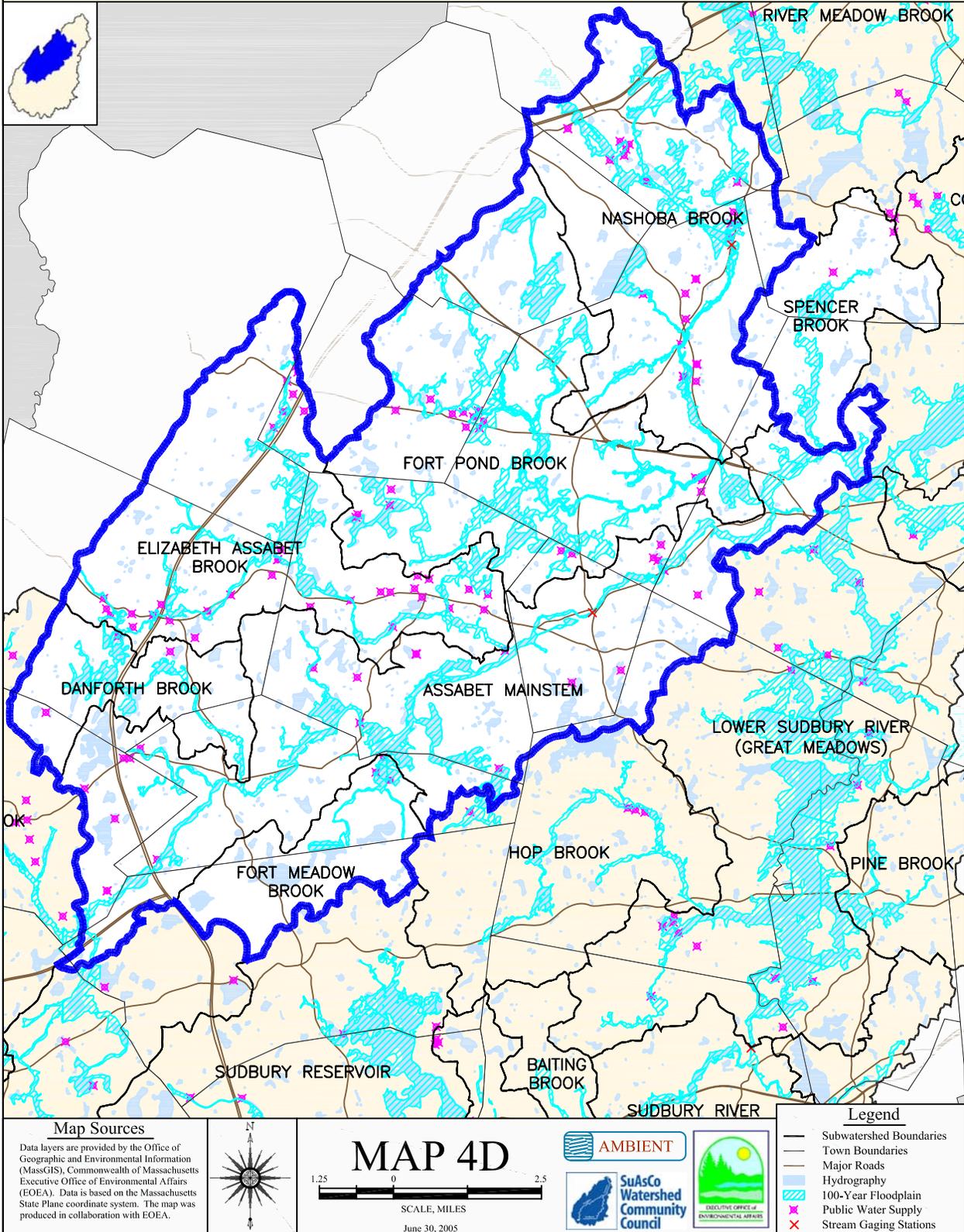
June 30, 2005



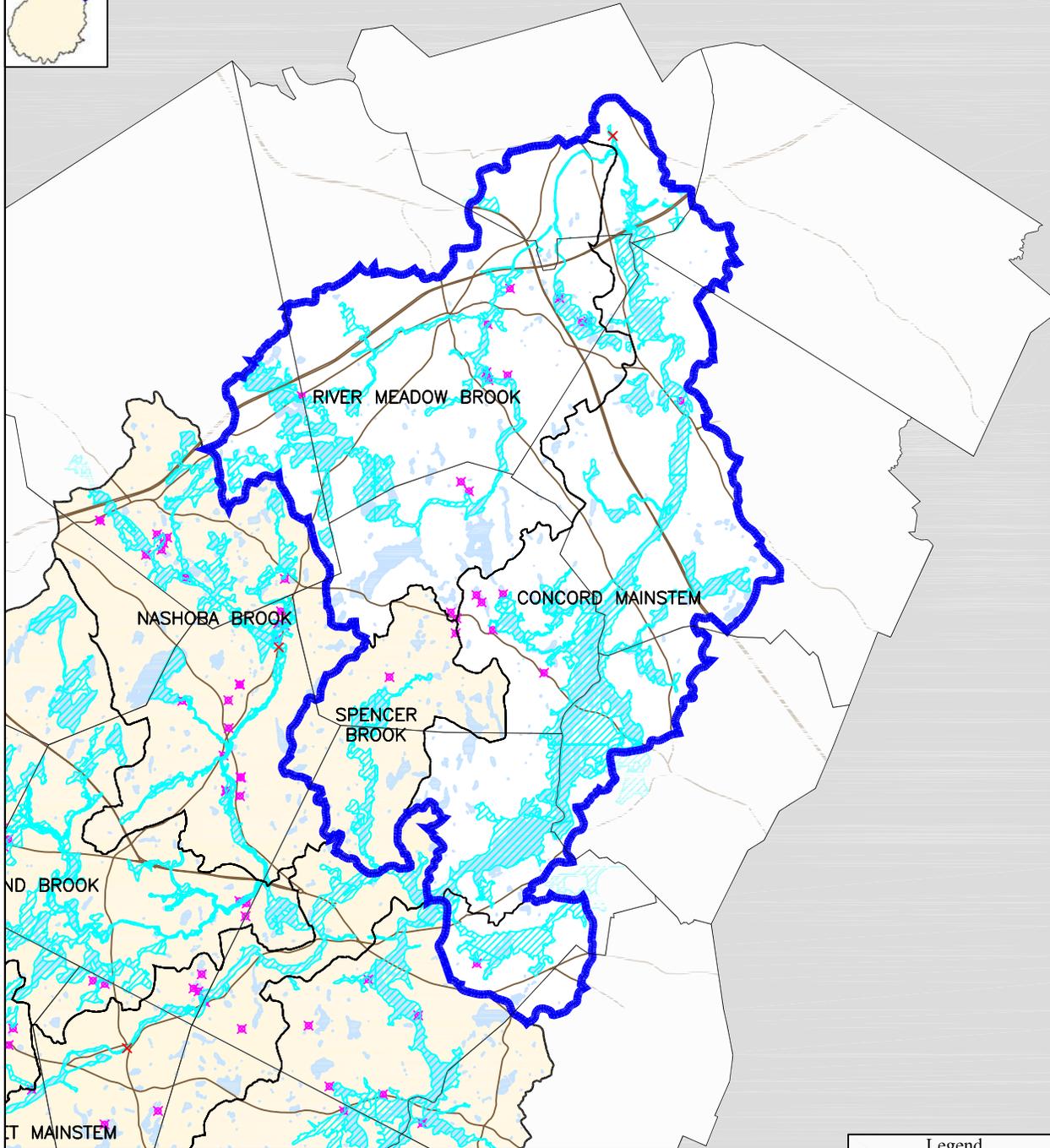
## Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- 100-Year Floodplain
- Public Water Supply
- Stream Gaging Stations

# Water Quantity in the Lower Assabet River



# Water Quantity in the Concord River

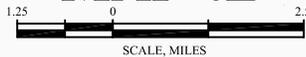


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## MAP 4E



SCALE, MILES  
June 30, 2005



## Legend

- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- 100-Year Floodplain
- Public Water Supply
- Stream Gaging Stations

## **5 LAND PROTECTION/OPEN SPACE**

This section summarizes issues and programs related to land protection and open space in the Watershed. They include local and regional open space plans, the Community Preservation Initiative, Chapter 61 and Article 97.

### **5.1 Open Space Plans (Local and Regional)**

Many communities in the Watershed have Open Space Plans. Communities that have plans include Acton, Bedford, Carlisle, Chelmsford, Framingham, Marlborough, Southborough, and Weston.

Local efforts have been loosely coordinated with state efforts through the Executive Office of Environmental Affairs (EOEA) Open Space Protection Program. The main goal of this program is to protect 200,000 acres of open space in Massachusetts by 2010. As of 2001, the state open space was primarily protected by fee simple acquisition, Conservation Restriction acquisition, or Agricultural Preservation Restriction acquisition.<sup>52</sup>

### **5.2 Community Preservation Initiative**

In order to help preserve the character of Massachusetts as significant development occurs, the state in 1999 launched the Community Preservation Initiative through the Executive Office of Environmental Affairs. Through the Community Preservation Initiative, the Executive Office of Environmental Affairs (EOEA) is providing communities with a set of three integrated tools and programs to help plan for their future: buildout maps and analyses, professional planning assistance to complete and implement Community Development Plans (E.O. 418), information about the Community Preservation Act, and coursework in planning and growth through the Community Preservation Institute, among others.<sup>53</sup>

#### **5.2.1 Buildout Maps and Analysis**

To help communities consider and address questions such as these, EOEA sponsored the creation of a set of buildout maps and analyses for all 351 cities and towns within the Commonwealth of Massachusetts. The maps and analyses depict currently developed and protected land within a community and what a community would look like if remaining undeveloped land was completely developed in accordance with local zoning.<sup>54</sup>

Of the 36 SuAsCo communities, 20 are part of the 27-community I-495 Corridor Region. This was the fastest growing region in the state in the last decade. The buildout analyses aid in identifying and characterizing the issues of open space preservation, affordable housing, and the preservation of historic community character in the Watershed.

#### **5.2.2 Community Preservation Act**

The Community Preservation Act (CPA) was signed into law on September 14, 2000. The CPA allows communities to create a local Community Preservation Fund through a surcharge of up to 3% of the real estate tax levy on real property to be used for open space, historic preservation and low and moderate housing. The act also creates a significant state matching fund of more

than \$25 million annually, which serves as an incentive to communities to take advantage of the provisions of this legislation. The local municipalities must adopt the Act by ballot referendum.

The CPA is an innovative tool for communities to address important community needs. Once adopted locally, the Act would require at least 10% of the monies raised to be distributed to each of three categories: historic preservation, open space protection and low and moderate income housing, allowing the community flexibility in determining how to distribute the remaining 70%.<sup>55</sup>

Three exemptions are allowed: (1) Property owned and occupied by a person who would qualify for low income housing or low or moderate income senior housing; (2) the first \$100,000 of taxable value of residential real estate; and (3) class three commercial or class four industrial properties in cities or towns with classified tax rates.

To date, 19 of the 36 communities in the Watershed have passed the Community Preservation Act. This is a higher percentage than the state average. Table 5.1 shows the status of Community Preservation Act in the Watershed communities.

<b>Community</b>	<b>Status</b>	<b>Surcharge</b>	<b>Exemptions</b>	<b>Date</b>
Acton	Passed	1.5%	Low Income, first \$100,000	11/5/02
Ashland	Passed	3%	First \$100,000	5/7/02
Bedford	Passed	3%	Low income, first \$100,000	3/10/01
Berlin	Failed			5/14/01
Billerica	Failed			NA
Bolton	Failed			NA
Boxborough	Failed			NA
Boylston	None			
Carlisle	Passed	2%	Low income, first \$100,000	5/22/01
Chelmsford	Passed	0.5%	First \$100,000	4/3/01
Clinton	None			
Concord	Passed	1.5%	Low income, first \$100,000	11/2/04
Framingham	Failed			4/3/01
Grafton	Passed	1.5%	Low income, first \$100,000	5/6/02
Harvard	Passed	1.1%	None	4/3/01
Holliston	Passed	1.5%	Low income, first \$100,000	5/22/01
Hopkinton	Passed	2%	Low income, first \$100,000	5/21/01
Hudson	Failed			5/13/02

**Table 5.1 Current Status of CPA in SuAsCo Communities<sup>56</sup>**

Community	Status	Surcharge	Exemptions	Date
Lincoln	Passed	1.5%	Low income, first \$100,000	11/5/02
Littleton	None			
Lowell	None			
Marlborough	None			
Maynard	None			
Natick	None			
Northborough	Passed	1.5%	Low income, first \$100,000	11/2/04
Sherborn	Failed			5/14/02
Shrewsbury	None			
Southborough	Passed	1%	Low income, first \$100,000	5/12/03
Stow	Passed	3%	Low income, first \$100,000	5/15/01
Sudbury	Passed	3%	All three	3/25/02
Tewksbury	None			
Upton	Passed	3%	Low income, first \$100,000	5/5/03
Wayland	Passed	1.5%	Low income, first \$100,000	4/24/01
Westborough	None			
Westford	Passed	3%	Low income, first \$100,000	5/1/01
Weston	Passed	3%	Low income, first \$100,000	5/5/01

### 5.3 Chapter 61

The forest land classification program under Massachusetts General Laws Chapter 61 is designed to encourage the preservation and enhancement of the Commonwealth's forests. It offers significant local tax benefits to property owners willing to make a long term commitment to forestry. In exchange for these benefits, the city or town in which the land is located is given the right to recover some of the tax benefits afforded the owner when the land is removed from classification and an option to purchase the property should the land be sold or used for non-forestry uses.<sup>57</sup>

### 5.4 Article 97

Article 97 of the Constitution of the Commonwealth of Massachusetts states that:

“The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and esthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the

agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose.

The general court shall have the power to enact legislation necessary or expedient to protect such rights.

In the furtherance of the foregoing powers, the general court shall have the power to provide for the taking, upon payment of just compensation therefore, or for the acquisition by purchase or otherwise, of lands and easements or such other interests therein as may be deemed necessary to accomplish these purposes.

Lands and easements taken or acquired for such purposes shall not be used for other purposes or otherwise disposed of except by laws enacted by a two thirds vote, taken by yeas and nays, of each branch of the general court.”

The Department of Conservation and Recreation is charged with the care and oversight of the natural resources of the Commonwealth of Massachusetts (Article 97 of the Constitution of the Commonwealth of Massachusetts). One of the methods by which DCR acts as a steward for the state’s natural resources is through the direct acquisition of land and property interests. Since the first park was created in 1898, DCR’s Division of State Parks and Recreation has continually acquired additional open space lands to protect and enhance Massachusetts’ natural, historic, and recreational resources.

Using the Land Acquisition and Protection Strategic Plan as a guide, the Department’s land protection team works to identify, evaluate, acquire and protect the vast array of natural and cultural resources across the state. e from the Berkshire Highlands to the Connecticut River Valley to Cape Cod and the Islands.

Table 5.2 lists the properties protected under Article 97 within the Watershed from 1999 to 2003.

<b>Table 5.2 Properties Protected Under Article 97</b>				
<b>Project</b>	<b>Town</b>	<b>Year</b>	<b>Significance</b>	<b>Size (acres)</b>
Goose Pond	Concord	2003	Adds significantly to Walden Pond	26.4
Bugley	Framingham	2001	Creates much-needed headquarters for Callahan State Park	9
Erickson	Carlisle	2000	Preserves the scenic landscape of Great Brook Farm State Park	8.5
Wittenborg	Framingham	1999	Protects Bay Circuit Trail	83

<sup>52</sup> MA EOEA Open Space Program, Protection of 100,000 Acres of Open Space, Spring 2002

<sup>53</sup> MA EOEA Community Preservation Initiative, <http://commpres.env.state.ma.us/index.asp>

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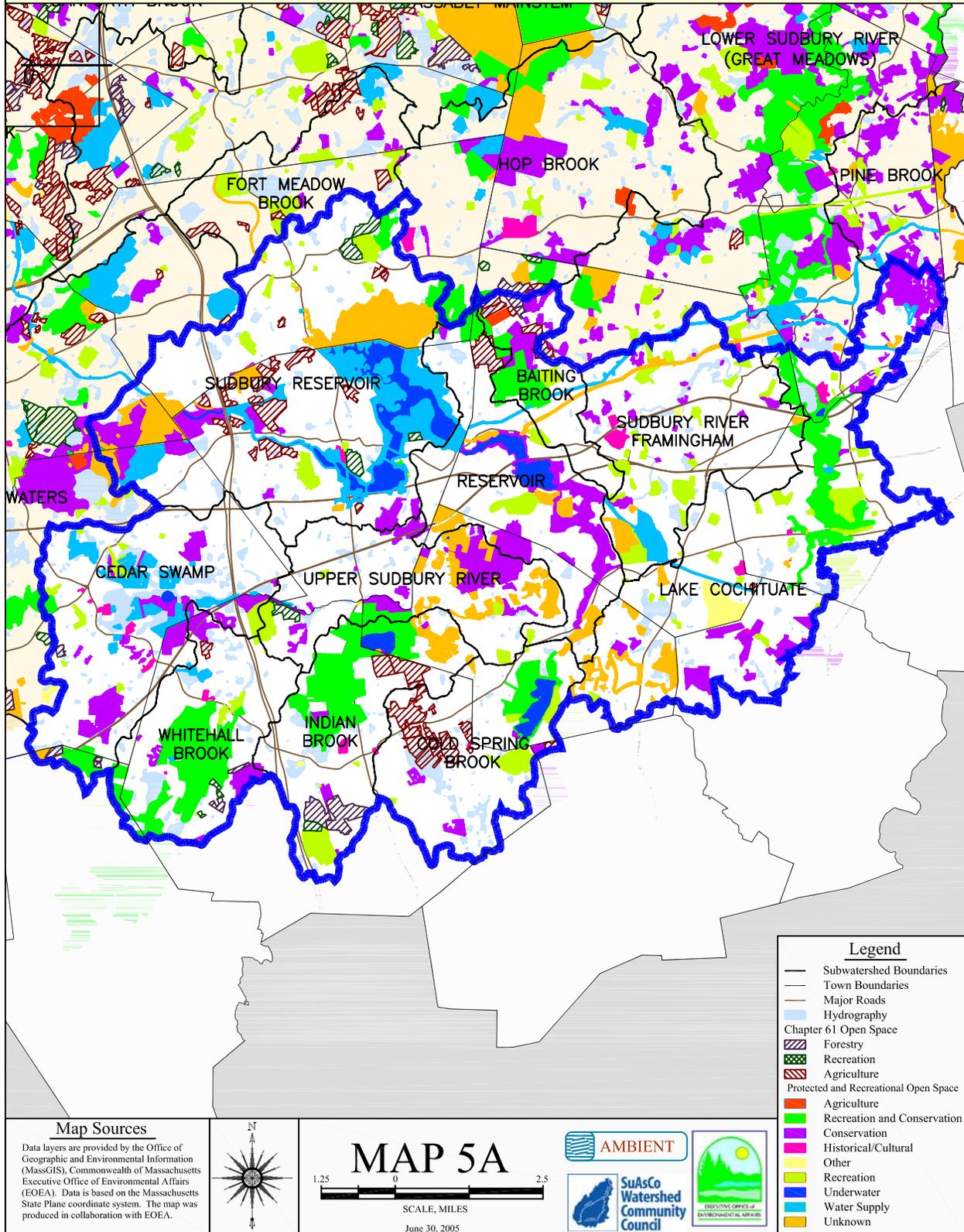
<sup>54</sup> MA EOEIA Community Preservation Initiative Buildout Maps and Analyses,  
<http://commpres.env.state.ma.us/content/buildout.asp#>

<sup>55</sup> Massachusetts Executive Office of Environmental Affairs Community Preservation Initiative,  
<http://commpres.env.state.ma.us/content/cpa.asp#>

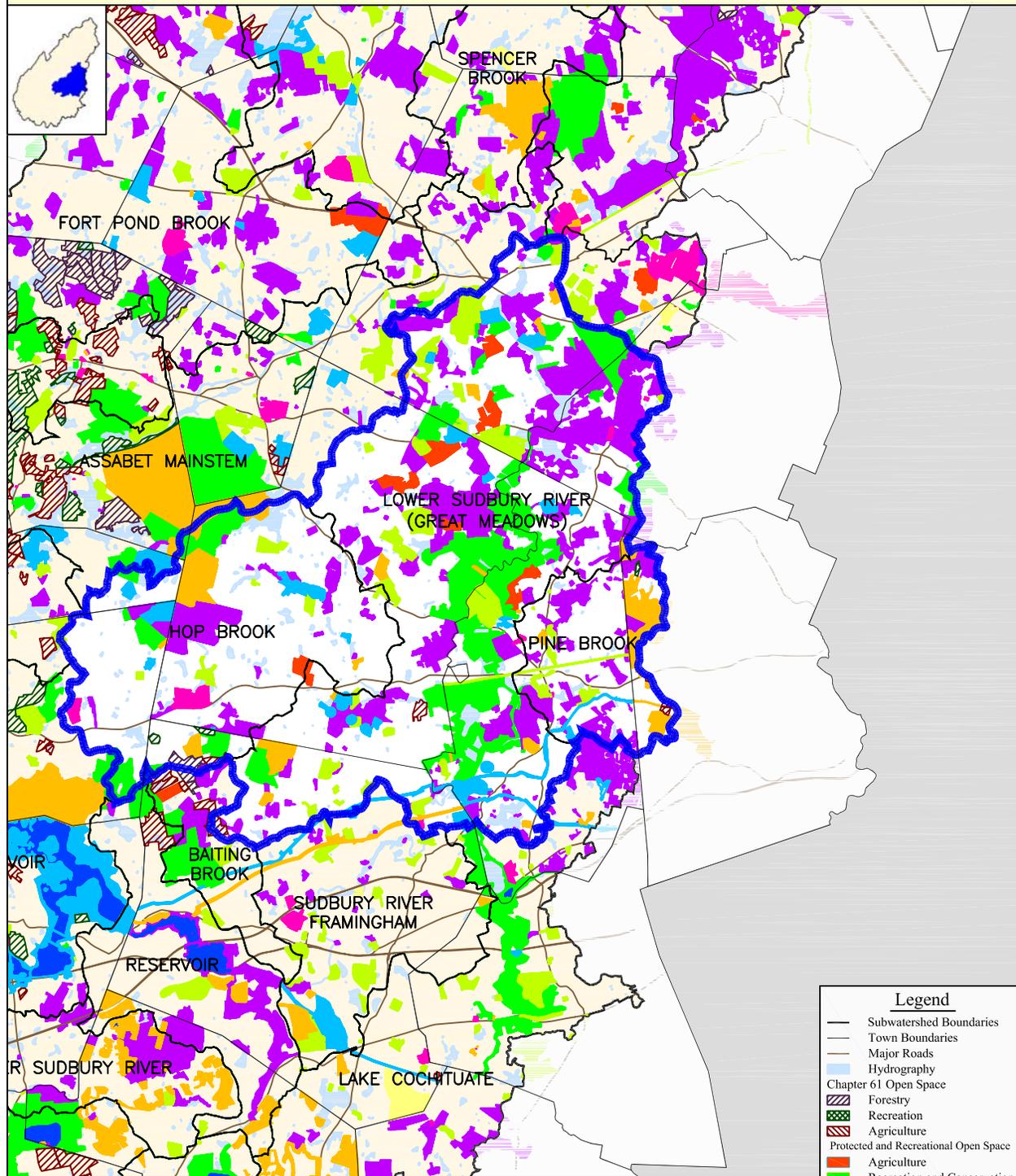
<sup>56</sup> Massachusetts Community Preservation Coalition, <http://www.communitypreservation.org/CPAVotes.cfm>

<sup>57</sup> MA Department of Revenue, Division of Local Services, Property Tax Bureau, Taxpayer's Guide to Classification and Taxation in Massachusetts, Chapter 61 Forest Land,  
<http://www.dls.state.ma.us/Ptb/pdfs/Ch61.pdf#search='massachusetts%20chapter%2061'>

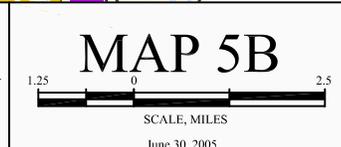
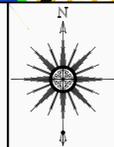
# Land Protection/Stewardship in the Upper Sudbury River



# Land Protection/Stewardship in the Lower Sudbury River

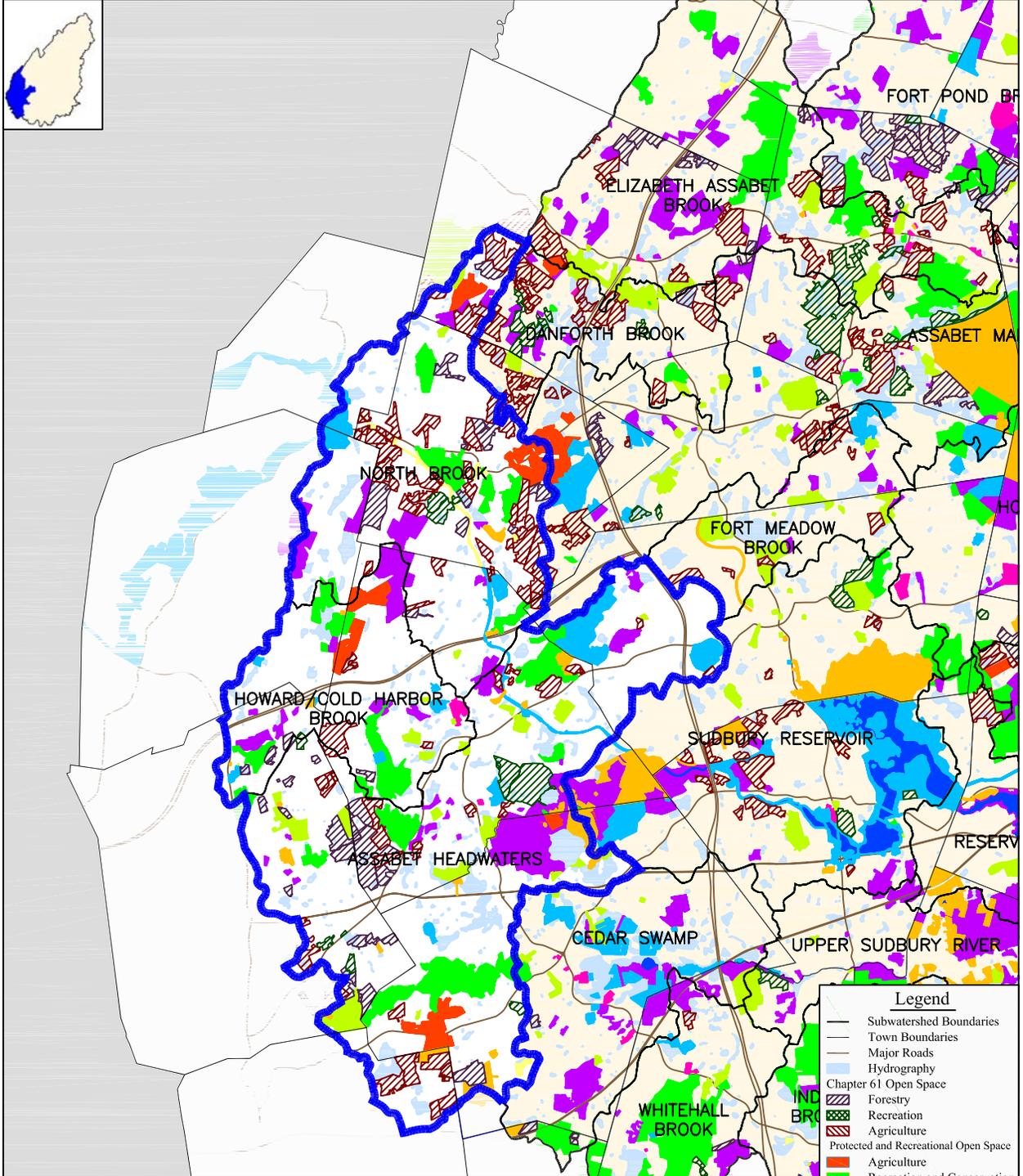


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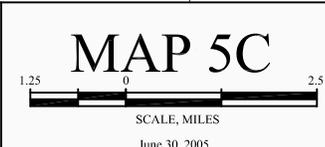
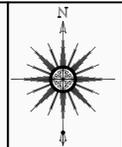


- Legend**
- Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - Forestry
  - Recreation
  - Agriculture
  - Protected and Recreational Open Space
  - Agriculture
  - Recreation and Conservation
  - Conservation
  - Historical/Cultural
  - Other
  - Recreation
  - Underwater
  - Water Supply
  - Unknown

# Land Protection/Stewardship in the Upper Assabet River

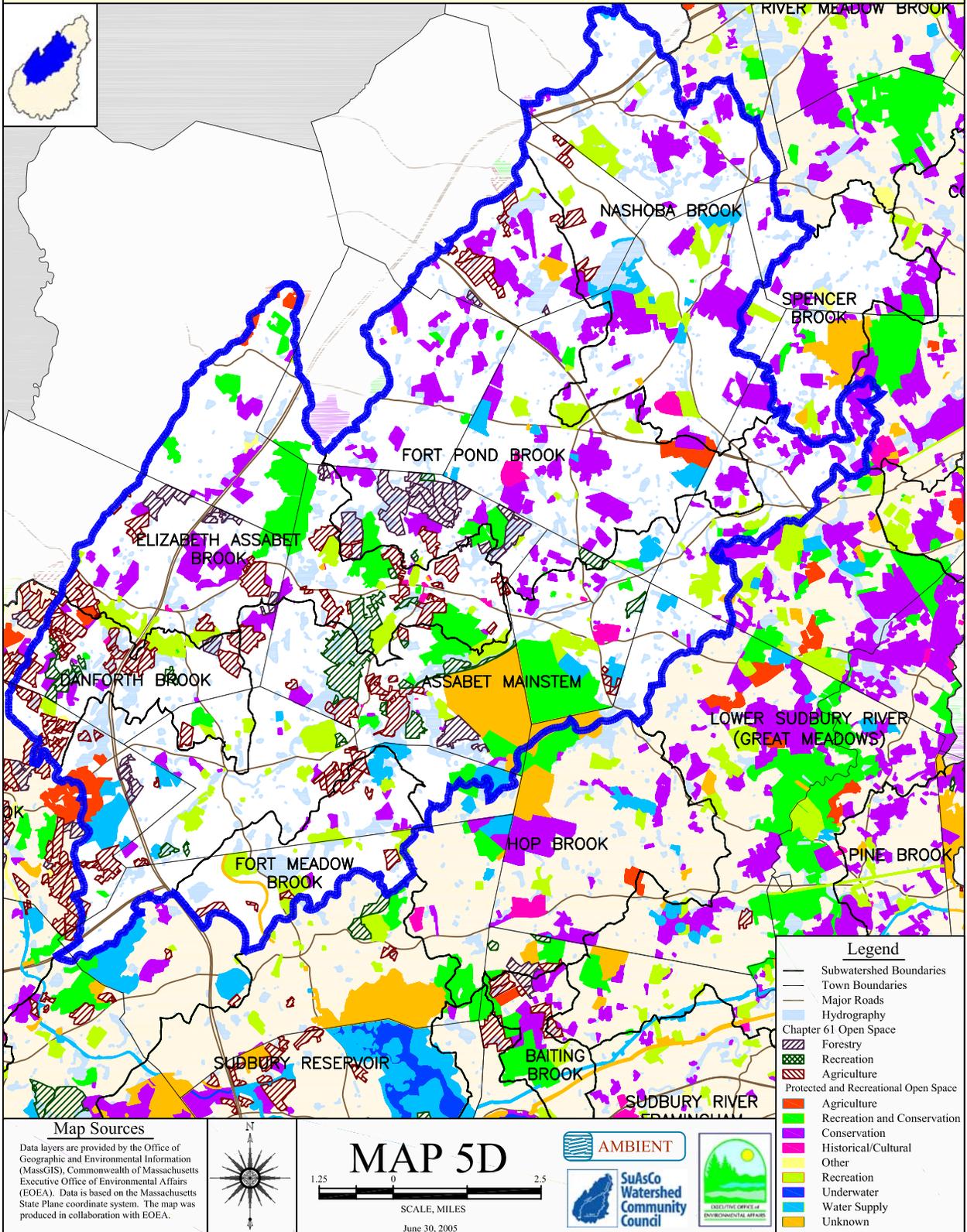


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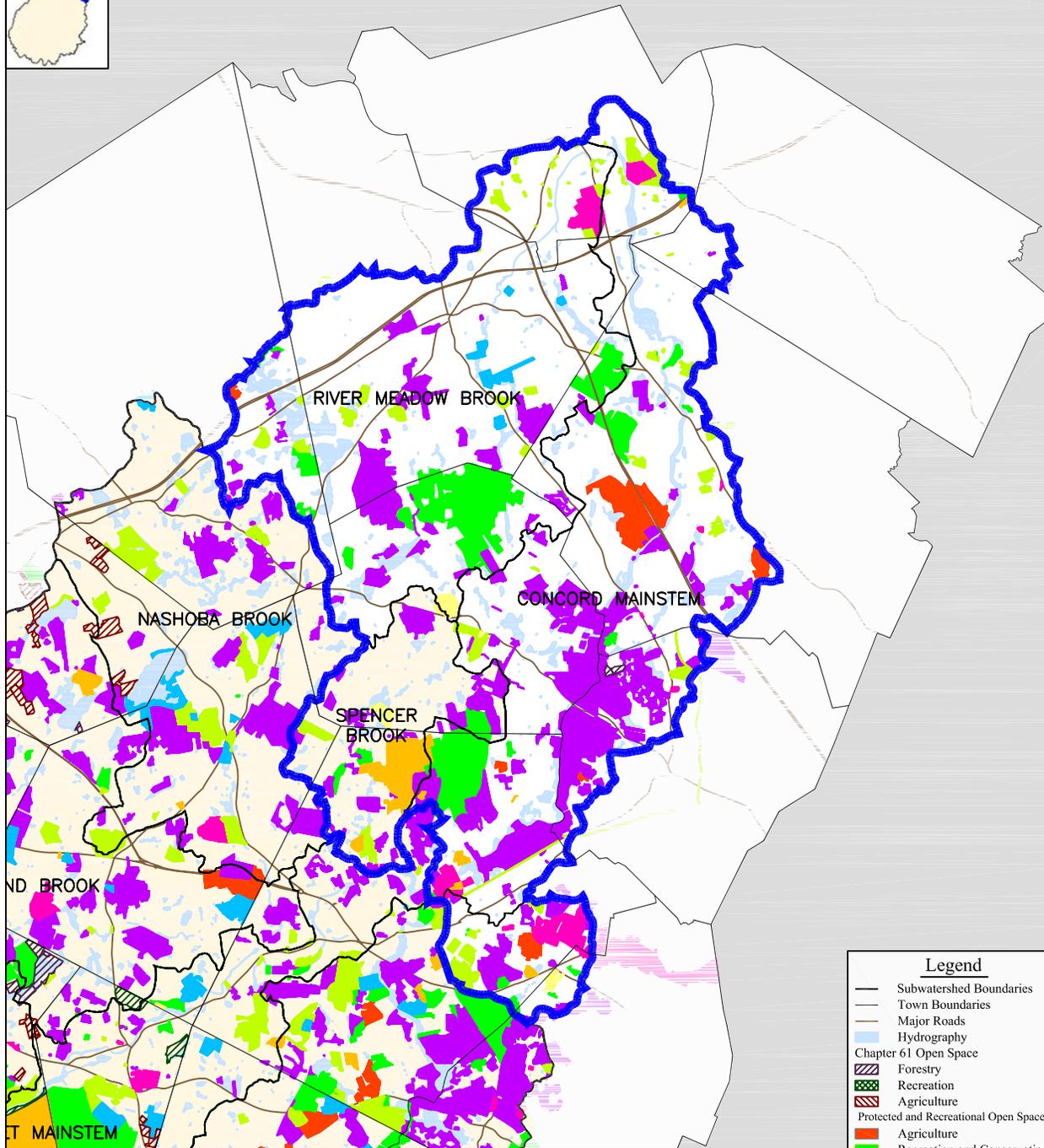


- Legend**
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  - Forestry
  - Recreation
  - Agriculture
  - Protected and Recreational Open Space
  - Agriculture
  - Recreation and Conservation
  - Conservation
  - Historical/Cultural
  - Other
  - Recreation
  - Underwater
  - Water Supply
  - Unknown

# Land Protection/Stewardship in the Lower Assabet River



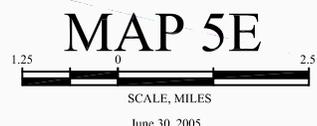
# Land Protection/Stewardship in the Concord River



- Legend**
- Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - ▨ Forestry
  - ▨ Recreation
  - ▨ Agriculture
  - Protected and Recreational Open Space
  - Agriculture
  - Recreation and Conservation
  - Conservation
  - Historical/Cultural
  - Other
  - Recreation
  - Underwater
  - Water Supply
  - Unknown

**Map Sources**

Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



## **6 BIODIVERSITY/HABITAT**

Aquatic biota is often used as the litmus test that identifies structural or functional integrity of riparian ecosystems.<sup>58</sup> A number of significant documents have been written that deal with biodiversity and habitat issues. They include the SuAsCo Biodiversity and Stewardship Plan and the Greenways Plan for the SuAsCo Watershed. These are briefly summarized in the following paragraphs and recommended as primary sources for the Watershed on these issues. This section also discusses invasive species.

### **6.1 SuAsCo Biodiversity Protection and Stewardship Plan**

Under the oversight of the SuAsCo Watershed Community Council, the SuAsCo Biodiversity Protection and Stewardship Plan was prepared in 2000 by a number of groups including state agencies and environmental organizations. The purpose of the project was to empower the 36 communities of the Watershed to conserve and restore natural biodiversity in the Watershed.

The report is broken into six sections covering the following areas:

- Section I: SuAsCo Focal Species
- Section II: Natural Communities
- Section III: Biodiversity Sites
- Section IV: Stewardship Issues
- Section V: Biodiversity Sites by Town
- Section VI: Protection and Stewardship Strategy

The goal of the Plan is to conserve and restore natural biodiversity in the watershed by protecting and managing natural communities and focal species habitat and by motivating and involving land trusts, conservation commissions, conservation organizations, and concerned citizens in accomplishing this goal.<sup>59</sup>

### **6.2 Greenways Plan for the SuAsCo Watershed**

The Greenways Plan for the SuAsCo Watershed was prepared in 2000 by the Sudbury Valley Trustees, with assistance from the SuAsCo Watershed Community Council. The purpose of the report was to propose greenways to link together many of the parks, wildlife refuges, and other protected lands of the Watershed.

The report is broken into five sections covering the following areas:

- Background
- Greenways for the SuAsCo Watershed
- Implementing Greenways
- Shaping the Growth of the SuAsCo Watershed
- What the Future Holds

The goals of the plan are the following:

- Mitigate barriers such as roadways that divide protected lands. Both wildlife and people benefit from measures that allow for unobstructed movement among the parks, wildlife refuges, and other protected lands of the SuAsCo watershed.
- Establish a voluntary environmental auditing program for proposed developments. Using tools such as CityGreen, GIS software, reviewers could offer a useful critique of development plans that would result in both cost savings and environmental benefits.
- Improve environmental education, using a watershed and greenways approach, at all levels. School curricula, public meetings, and professional workshops are all opportunities to raise participants to a common level of understanding.<sup>60</sup>

### 6.3 Invasive Species

#### 6.3.1 Plant Species

In April 2005 the Massachusetts Invasive Plant Advisory Group published “The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts”. The Massachusetts Invasive Plant Advisory Group is a voluntary collaboration between public and private organizations concerned about the problem of invasive plants in Massachusetts. Eighteen entities are represented including state and federal governmental agencies in fish and wildlife, agriculture, and natural resources; the horticulture industry; academic science institutions; land management and nonprofit conservation organizations. Its members affirm their commitment to working within their individual organizations to substantially address the impact of species determined by scientific criteria to be Invasive, Likely Invasive, or Potentially Invasive in the Commonwealth of Massachusetts. The Executive Office of Environmental Affairs recognized it as part of the Massachusetts Council on Invasive Species.

The Group evaluated 85 non-native species and identified them as “invasive”, “likely invasive”, “potentially invasive” or “Evaluated Plants not Meeting Criteria”. (Please note that the State has not as of yet accepted these classifications.) Table 6.1 lists the category and the number of plants identified.<sup>61</sup>

<b>Category</b>	<b>Description</b>	<b>Number</b>
Invasive	"Invasive plants" are non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.	33
Likely Invasive	"Likely Invasive plants" are non-native species that are naturalized in Massachusetts but do not meet the full criteria that would trigger an "Invasive plant" designation. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven	29

<b>Category</b>	<b>Description</b>	<b>Number</b>
	otherwise by a process of scientific evaluation.	
Potentially Invasive	"Potentially invasive plants" are non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.	4
Evaluated but did not Meet Criteria	The following plants were evaluated for invasiveness by the Massachusetts Invasive Plant Advisory Group. They did not meet the necessary criteria to list them as Invasive, Likely Invasive or Potentially Invasive at the time of evaluation.	19

<sup>58</sup> EOE Web Site, [http://www.mass.gov/envir/water/publications/WAP\\_Guidance.pdf](http://www.mass.gov/envir/water/publications/WAP_Guidance.pdf)

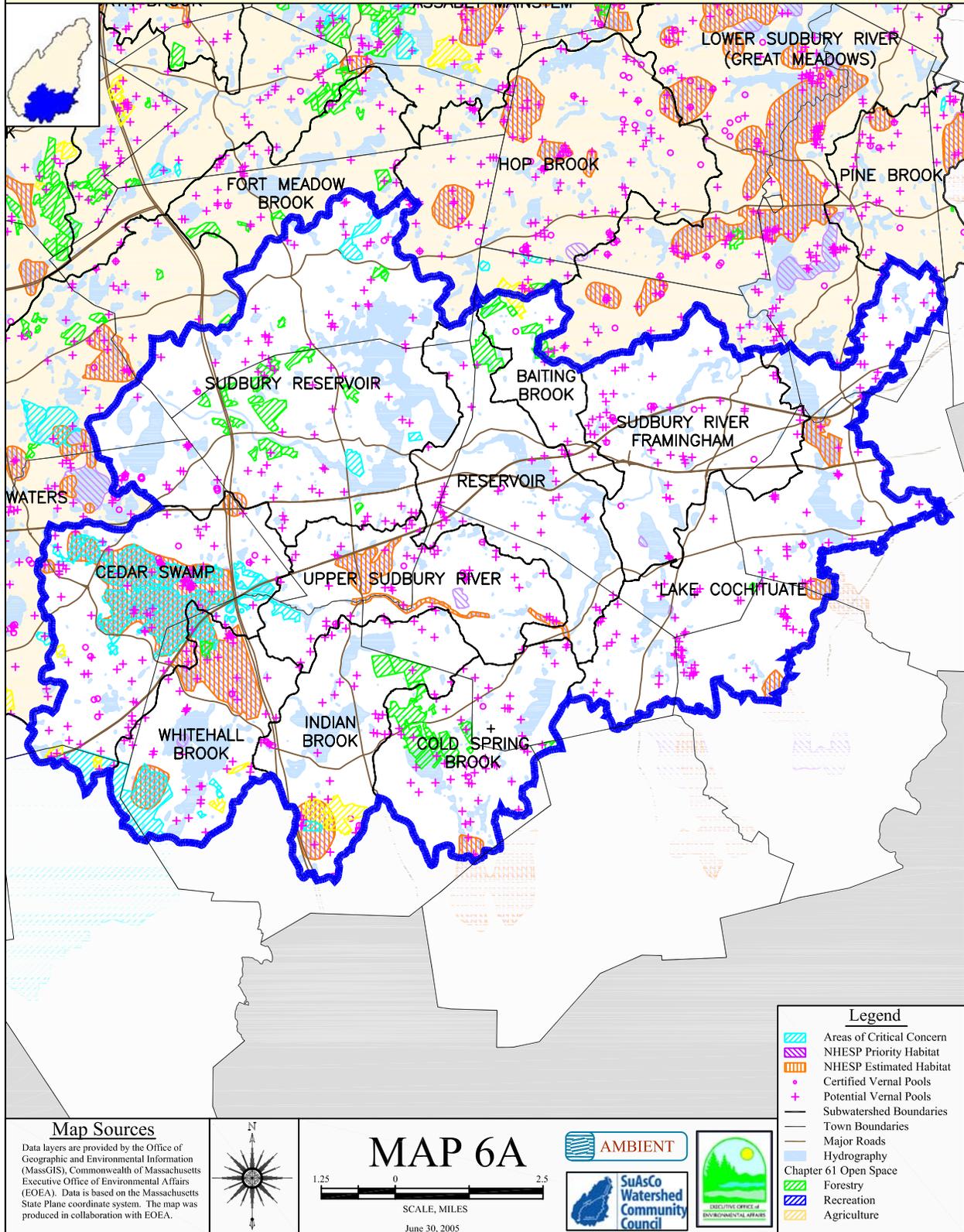
<sup>59</sup> Clark, Francis, MA Riverways Program, MA Watershed Initiative, Executive Office of Environmental Affairs, Biodiversity Protection and Stewardship Plan, August 2000

<sup>60</sup> Sudbury Valley Trustees, Greenways Plan for the SuAsCo Watershed, April 2000

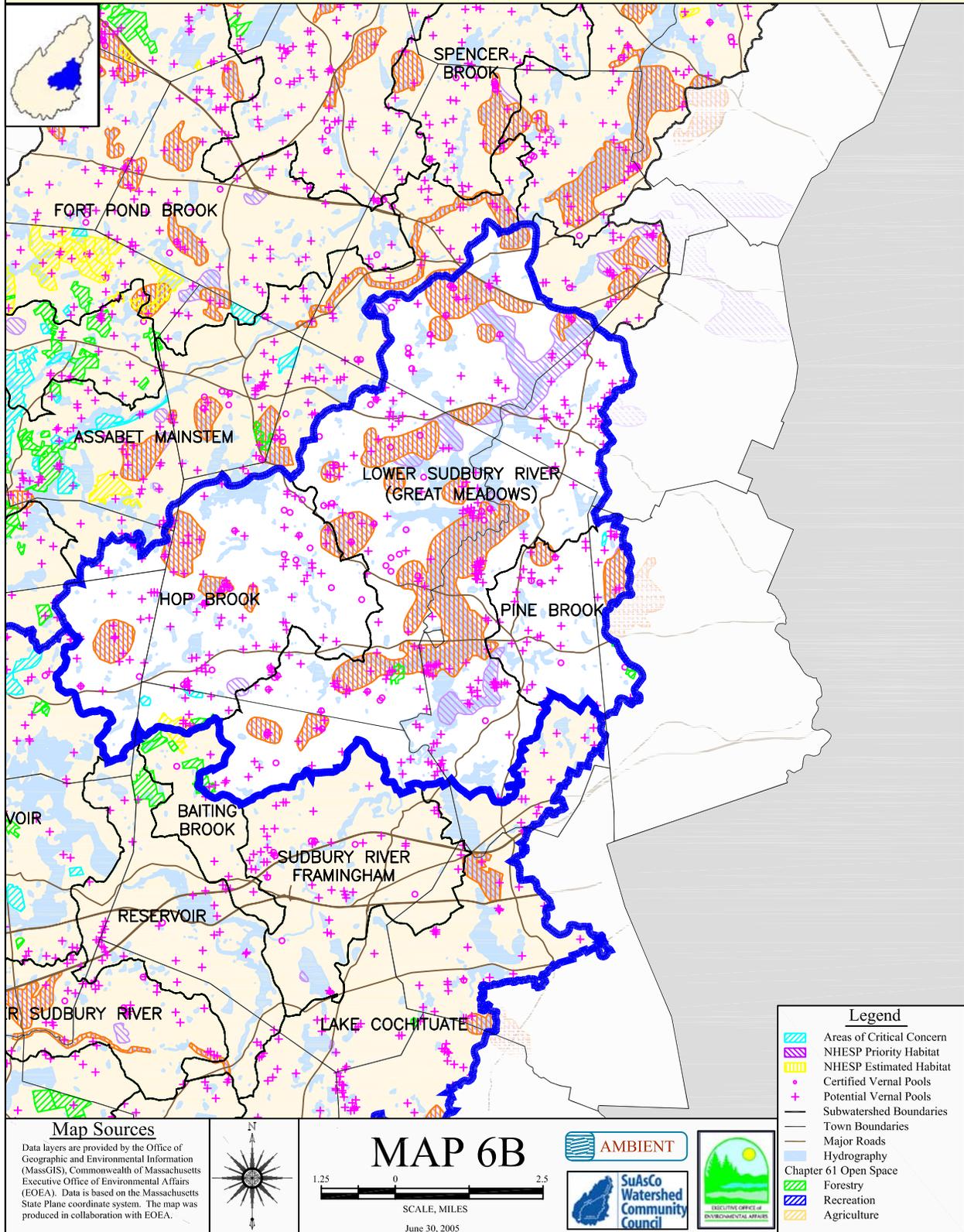
<sup>61</sup> Massachusetts Invasive Plant Advisory Group, The Evaluation of Non-Native Species for Invasiveness in Massachusetts (with Annotated List), April 1, 2005

<sup>62</sup> Massachusetts Invasive Plant Advisory Group, The Evaluation of Non-Native Species for Invasiveness in Massachusetts (with Annotated List), April 1, 2005

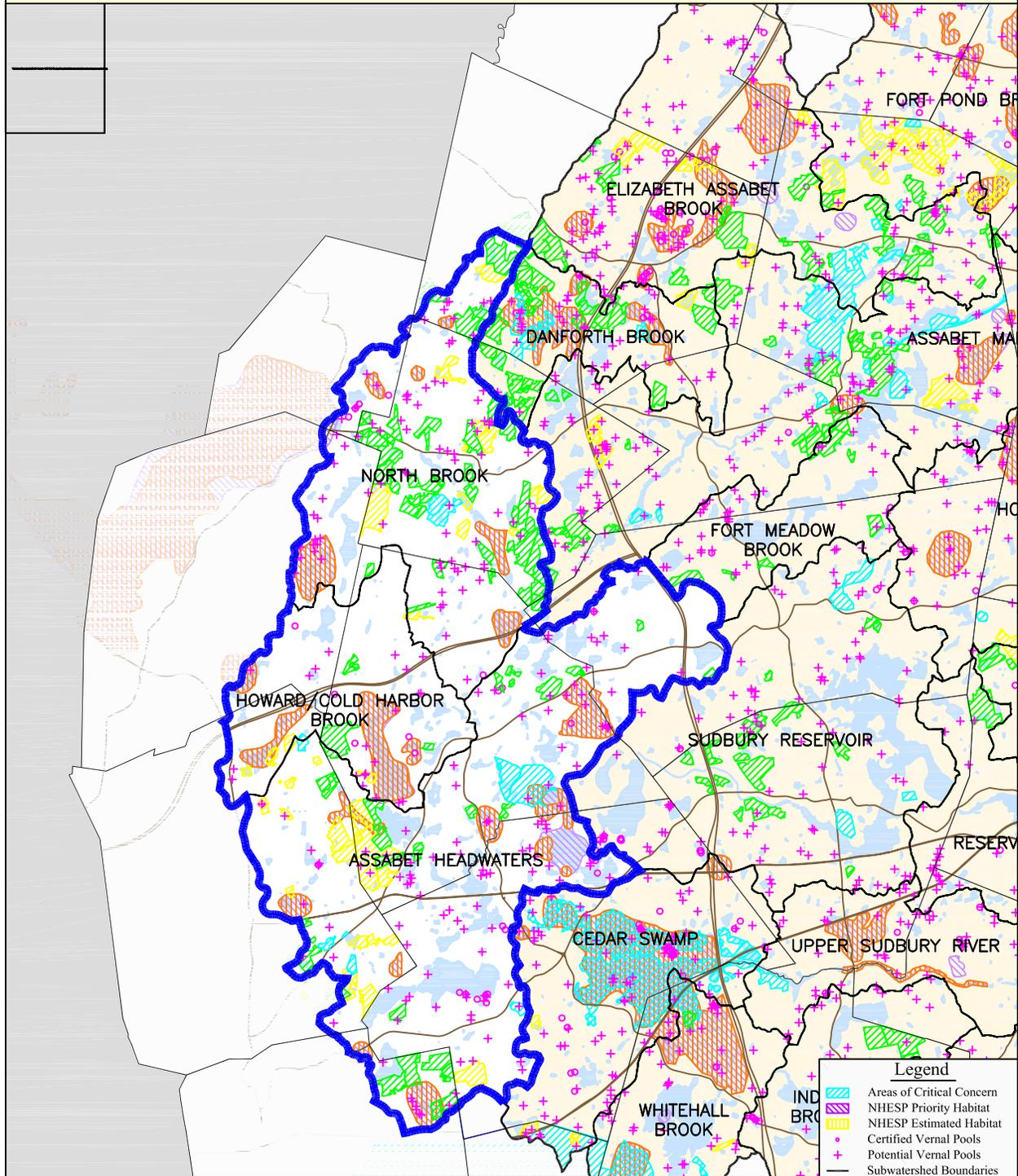
# Habitat/Biodiversity in the Upper Sudbury River



# Habitat/Biodiversity in the Lower Sudbury River



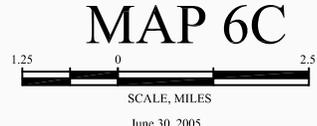
# Habitat/Biodiversity in the Upper Assabet River



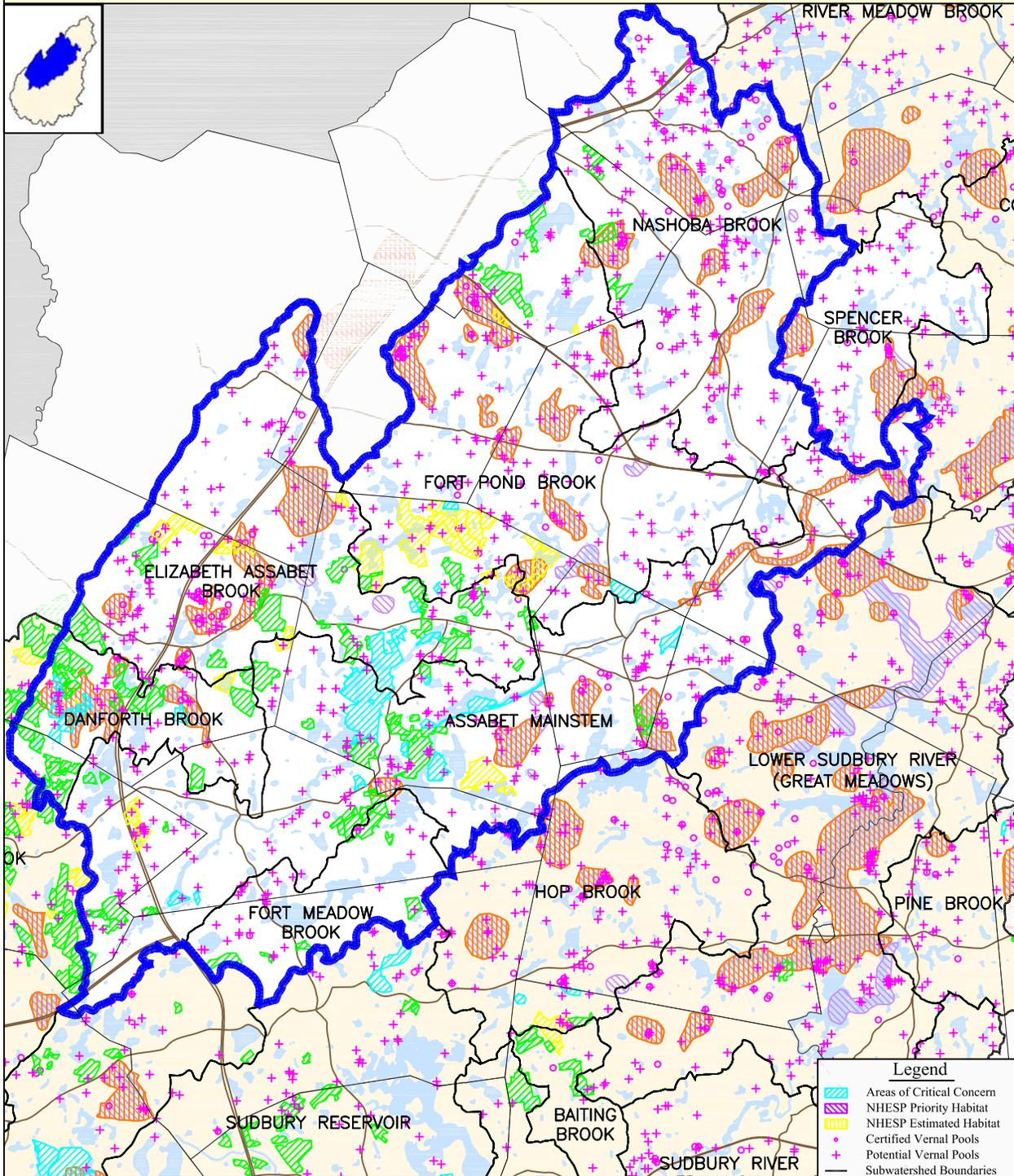
- Legend**
- Areas of Critical Concern
  - NHESP Priority Habitat
  - NHESP Estimated Habitat
  - Certified Vernal Pools
  - Potential Vernal Pools
  - Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - Forestry
  - Recreation
  - Agriculture

**Map Sources**

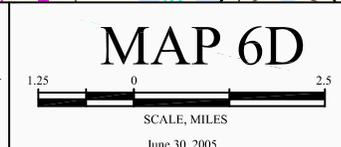
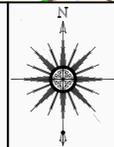
Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



# Habitat/Biodiversity in the Lower Assabet River

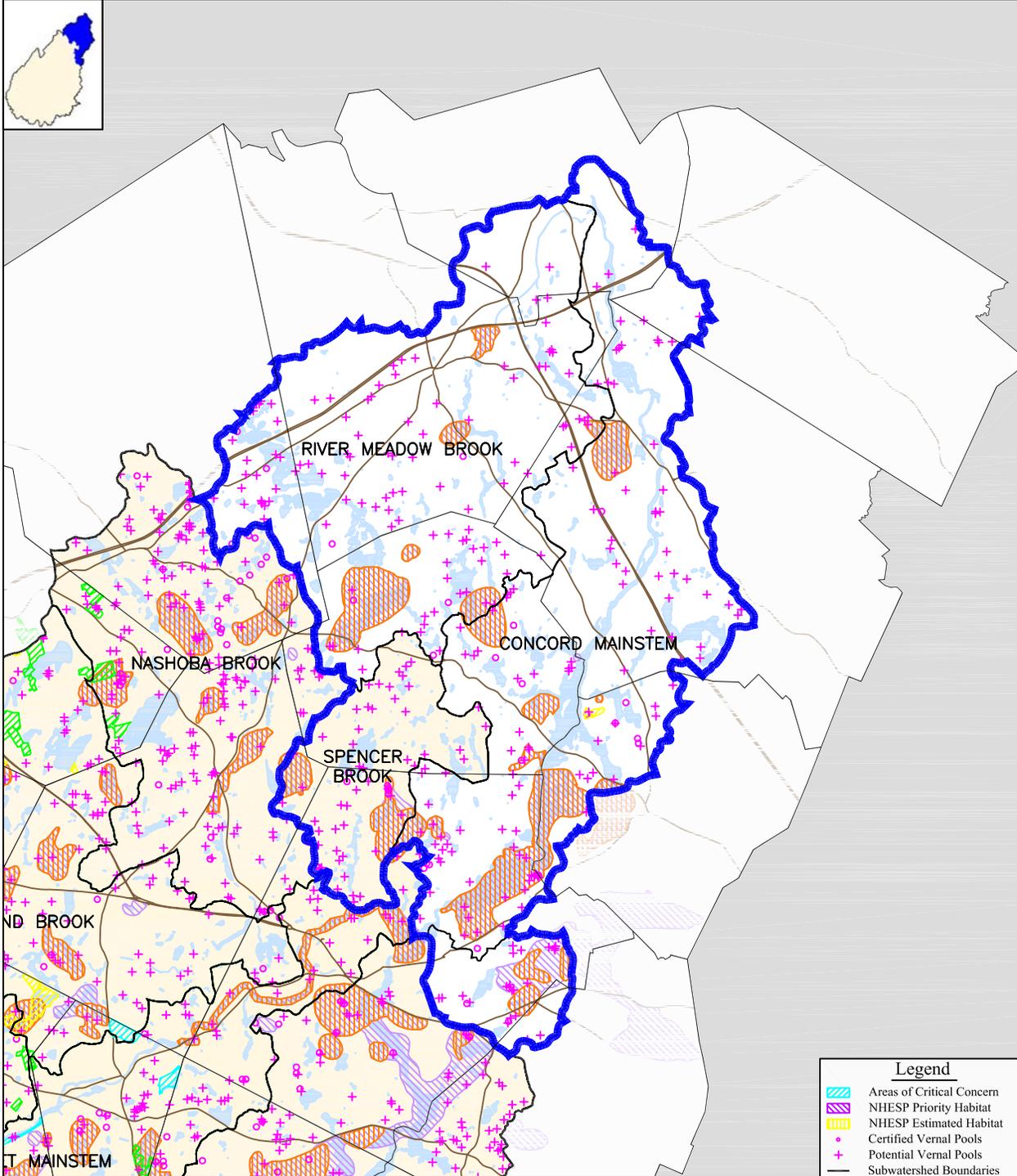


**Map Sources**  
 Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.

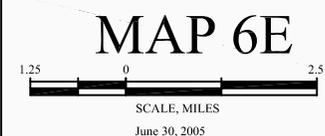


- Legend**
- Areas of Critical Concern
  - NHESP Priority Habitat
  - NHESP Estimated Habitat
  - Certified Vernal Pools
  - Potential Vernal Pools
  - Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - Forestry
  - Recreation
  - Agriculture

# Habitat/Biodiversity in the Concord River



**Map Sources**  
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- Legend**
- Areas of Critical Concern
  - NHESP Priority Habitat
  - NHESP Estimated Habitat
  - Certified Vernal Pools
  - Potential Vernal Pools
  - Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - Forestry
  - Recreation
  - Agriculture

## 7 RECREATION

This section discusses some of the more prominent recreation issues in the Watershed including public access sites, fish stocking data, and white water rafting.

### 7.1 Public Access Sites

The Public Access Board provides boat and canoe access sites at more than 200 locations on coastal waters, great ponds and rivers throughout Massachusetts. The Board acquires property and easements for the purpose of providing access and designates roads and facilities to be built, improved, operated and maintained. Boat launching facilities are managed by staff from the Division of Fisheries & Wildlife (DFW), the Department of Environmental Management (DEM), or municipal employees. Table 6.1 lists public access sites in the Watershed.<sup>63</sup>

<b>Table 7.1 Public Access Locations in the Watershed<sup>64</sup></b>						
<b>Community</b>	<b>Facility Name</b>	<b>Facility Type</b>	<b>No. of Ramps</b>	<b>No. of Lanes</b>	<b>Ramp Type</b>	<b>Managing Authority</b>
Ashland	Ashland Reservoir	B	1	1	Gravel	DEM
Ashland	Hopkinton Reservoir	B	1	20	Concrete	DEM
Chelmsford	Merrimack River	B	1	1	Concrete Pad	Town
Concord	Walden Pond	C	1	1	Cartop	DEM
Concord	White Pond	C	1	1	Cartop	DFW
Framingham	Farm Pond	C	0	1	Cartop	Town
Framingham	Sudbury River	D	0	1	Canoe	Town
Framingham	Sudbury River	D	0	0	Canoe	Town
Holliston	Lake Winthrop	B	1	1	Concrete Pad	Town
Holliston	Lake Winthrop Shore Fishing Area	F	0	0		Town
Hopkinton	Hopkinton Reservoir	C	0	1	Cartop	DEM
Hopkinton	North Pond	C	1	1	Cartop	DEM
Hopkinton	Whitehall Reservoir	A	1	2	Concrete	DEM
Hudson	Assabet River	D	0	1	Cartop	Town
Littleton	Long Pond	B	1	1	Concrete	Town

**Table 7.1 Public Access Locations in the Watershed<sup>64</sup>**

Community	Facility Name	Facility Type	No. of Ramps	No. of Lanes	Ramp Type	Managing Authority
					Pad	
Marlborough	Fort Meadow Reservoir	C	0	1	Cartop	City
Northborough	Bartlett Pond	B	1	1	Concrete Pad	Town
Northborough	Little Chauncy Pond	C	1	1	Cartop	DFW
Shrewsbury	Lake Quinsigamond	A	2	2	Concrete	Town
Shrewsbury	Lake Quinsigamond (Flint Pond)	A	1	2	Concrete	Town
Stow	Delaney Pond	B	1	1	Concrete	DFW
Wayland	Lake Cochituate	A	VARIABLES	30	Concrete	DEM
Wayland	Lake Cochituate	C	0	1	Cartop	DEM
Westborough	Lake Chauncy	B	1	1	Bit. Concrete	DFW
Facility Type	Access Category	Description				
A	General Access	Concrete boat ramp and parking for boat trailers.				
B	Fisherman Access	Small concrete ramp, concrete pad ramp system or gravel ramp designed for smaller boats and parking for boat trailers.				
C	Cartop Access	Access to lakes, ponds and rivers for small boats, canoes and kayaks.				
D	Canoe Access	Access to rivers most suitable for canoes and kayaks.				
E	Sport Fishing Pier	Pier that provides fishing area for recreational anglers - barrier free.				
F	Shore	Minimally improved property that provides shore fishing access.				

## 7.2 Fish Stocking Data

The Department of Fish and Game, Division of Fisheries and Wildlife (a.k.a. MassWildlife), stock numerous ponds and streams in the Watershed with brook, brown, rainbow, and tiger trout. The stocking is usually conducted in the Spring, but several water bodies are also stocked in the Fall. The purpose of the fish stocking activities is to provide game fish for anglers. The following table lists the ponds and streams stocked in the Watershed.<sup>65</sup>

**Table 7.2 List of Water Bodies Stocked with Trout**

<b>Town</b>	<b>Stocked Waters</b>
Acton	Nashoba Brook, Fort Pond Brook
Ashland	<u>Ashland Reservoir</u> , Sudbury River
Bedford	Shawsheen River
Berlin	North Brook
Billerica	Shawsheen River
Bolton	Great Brook, Danforth Brook, Still River
Boxborough	Guggins Brook
Boylston	
Carlisle	River Meadow Brook
Chelmsford	River Meadow Brook, Stony Brook, Crooked Spring Brook
Clinton	Mossy Pond, Wachusett Reservoir
Concord	<u>Walden Pond</u> , <u>White Pond</u>
Framingham	<u>Lake Cochituate</u>
Grafton	Quinsigamond River
Harvard	Bowers Brook
Holliston	Boggastow Brook
Hopkinton	<u>Hopkinton Reservoir</u> , Whitehall Reservoir, Sudbury River
Hudson	Hog Brook, Danforth Brook
Lincoln	
Littleton	Beaver Brook, Bennett Brook
Lowell	
Marlborough	

**Table 7.2 List of Water Bodies Stocked with Trout**

<b>Town</b>	<b>Stocked Waters</b>
Maynard	
Natick	Charles River, Dug Pond, <u>Lake Cochituate</u>
Northborough	Cold Harbor Brook, Assabet River
Sherborn	
Shrewsbury	<u>Lake Quinsigamond</u> , Jordan Pond
Southborough	
Stow	Assebet Brook
Sudbury	
Tewksbury	Shawsheen River, Strongwater Brook
Upton	Center Brook, Pratt Pond, West River
Wayland	
Westborough	
Westford	<u>Long Sought for Pond</u> , Stony Brook
Weston	Stony Brook, Cherry Brook

Note: Water bodies that are underlined are stocked in the Spring and the Fall.

### Anadromous Fish

In May 2000 a team from the U.S. Fish and Wildlife Service, the Massachusetts Riverways Program, and volunteers from groups like the Sudbury Valley Trustees (SuAsCo) released 7,000 adult River Herring, or alewife, to the Concord River. Like salmon, alewife are anadromous fish. They breed in fresh water rivers then, after a period of juvenile growth, the young fish swim downriver to spend their adult life in the ocean. After about 3 to 5 years in the ocean the now mature alewife return to the river in which they were born. Unlike the trout fish stocking above, the purpose of the alewife stocking is to try to restore the Concord River as a natural fishery.<sup>66</sup>

### 7.3 White Water Rafting

Every spring the Concord River belies its tranquil name and turns into a mass of roiling foam waves to form Class III and IV white water through the city of Lowell. The Lowell Parks & Conservation Trust (LPCT) takes advantage of this spring phenomenon to offer one of the most unique white water rafting trips in the country and the only white water rafting opportunity in the Boston area. Led by expert guides from Zoar Outdoor, participants navigate twice through three sets of rapids, “Twisted Sister”, “Three Beauties”, and “Middlesex Dam(n)”, on a one mile reach through the heart of the city. The Concord River drops 50 vertical feet through the city of Lowell and is the location of the earliest mill sites in the area. Trips on the river conclude by being lifted up 17 feet through an 1850s lock chamber which is a National Historic Landmark located in both the Lowell Heritage State and Lowell National Historic Park. The LPCT Concord River White Water trips received a 1997 Best of Boston Award for the best urban adventure in greater Boston.<sup>67</sup>

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<sup>63</sup> Massachusetts Public Access Board, [http://www.mass.gov/dfwele/pab/pab\\_toc.htm#Overview](http://www.mass.gov/dfwele/pab/pab_toc.htm#Overview)

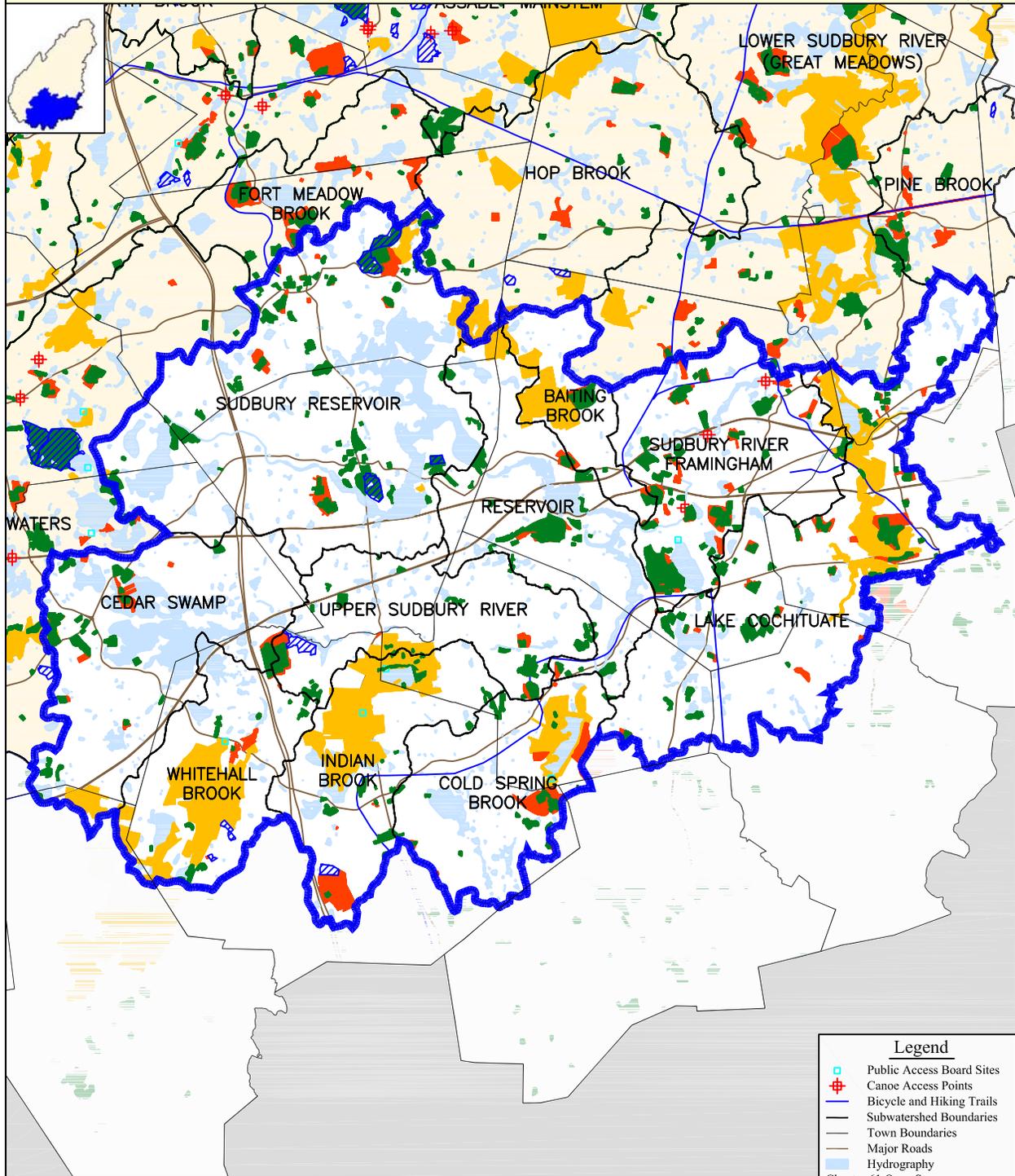
<sup>64</sup> Massachusetts Public Access Board, [http://www.mass.gov/dfwele/pab/pab\\_toc.htm#Overview](http://www.mass.gov/dfwele/pab/pab_toc.htm#Overview)

<sup>65</sup> MassWildlife [www.mass.gov/dfwele/dfw/dfw\\_trout\\_waters.htm](http://www.mass.gov/dfwele/dfw/dfw_trout_waters.htm)

<sup>66</sup> Lowell Land Trust, [http://www.lowelllandtrust.org/Alewife\\_restoration.html](http://www.lowelllandtrust.org/Alewife_restoration.html)

<sup>67</sup> [www.lowelllandtrust.org/Concord\\_river.html](http://www.lowelllandtrust.org/Concord_river.html)

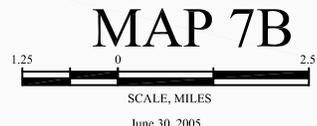
# Recreation in the Upper Sudbury River



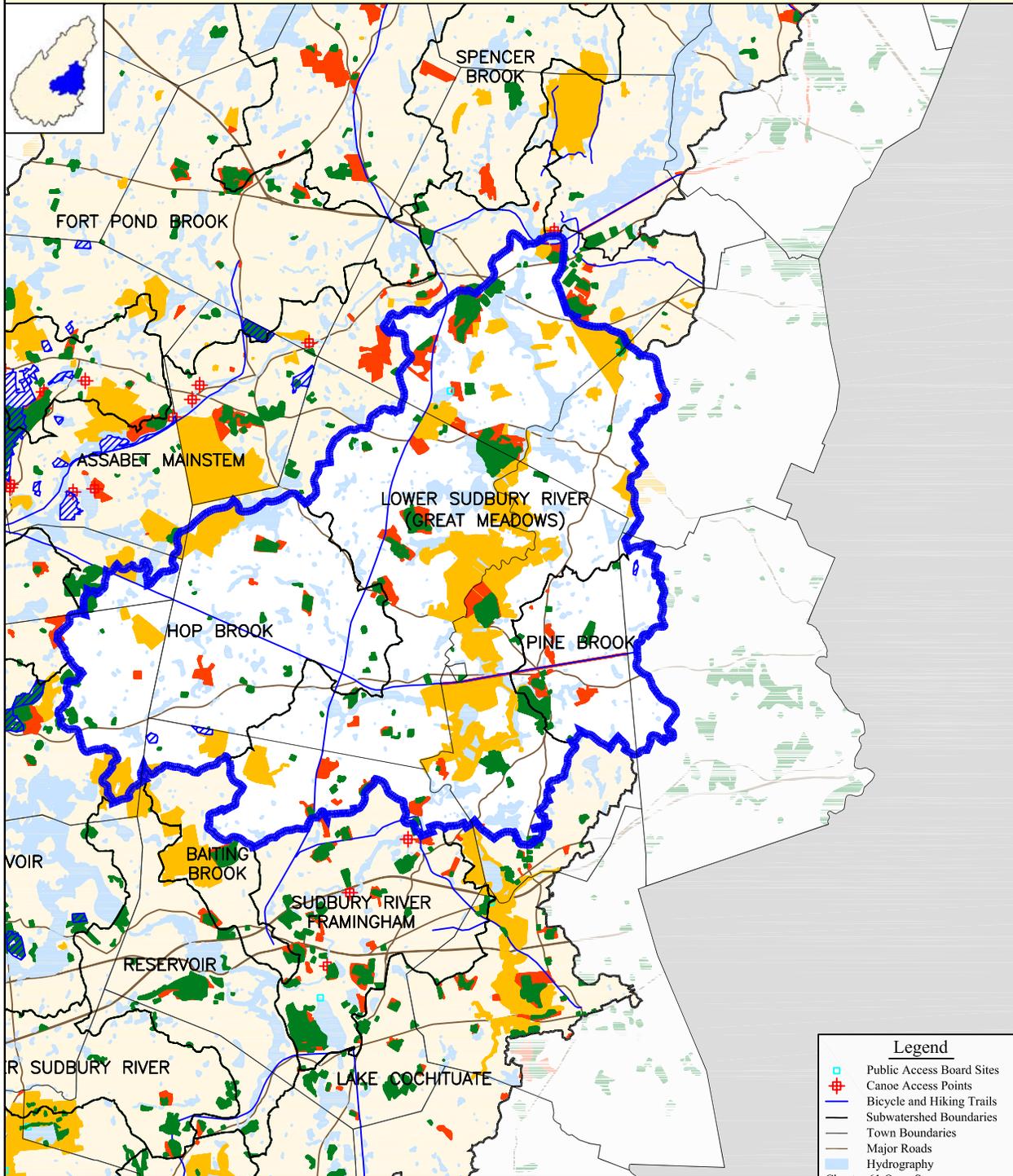
- Legend**
- Public Access Board Sites
  - Canoe Access Points
  - Bicycle and Hiking Trails
  - Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - Recreation
  - Protected and Recreational Open Space
  - Recreation and Conservation
  - Recreation
  - Land Use
  - Recreation/Parks

**Map Sources**

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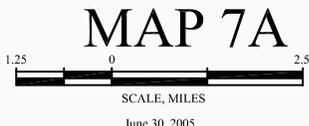


# Recreation in the Lower Sudbury River



## Map Sources

Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



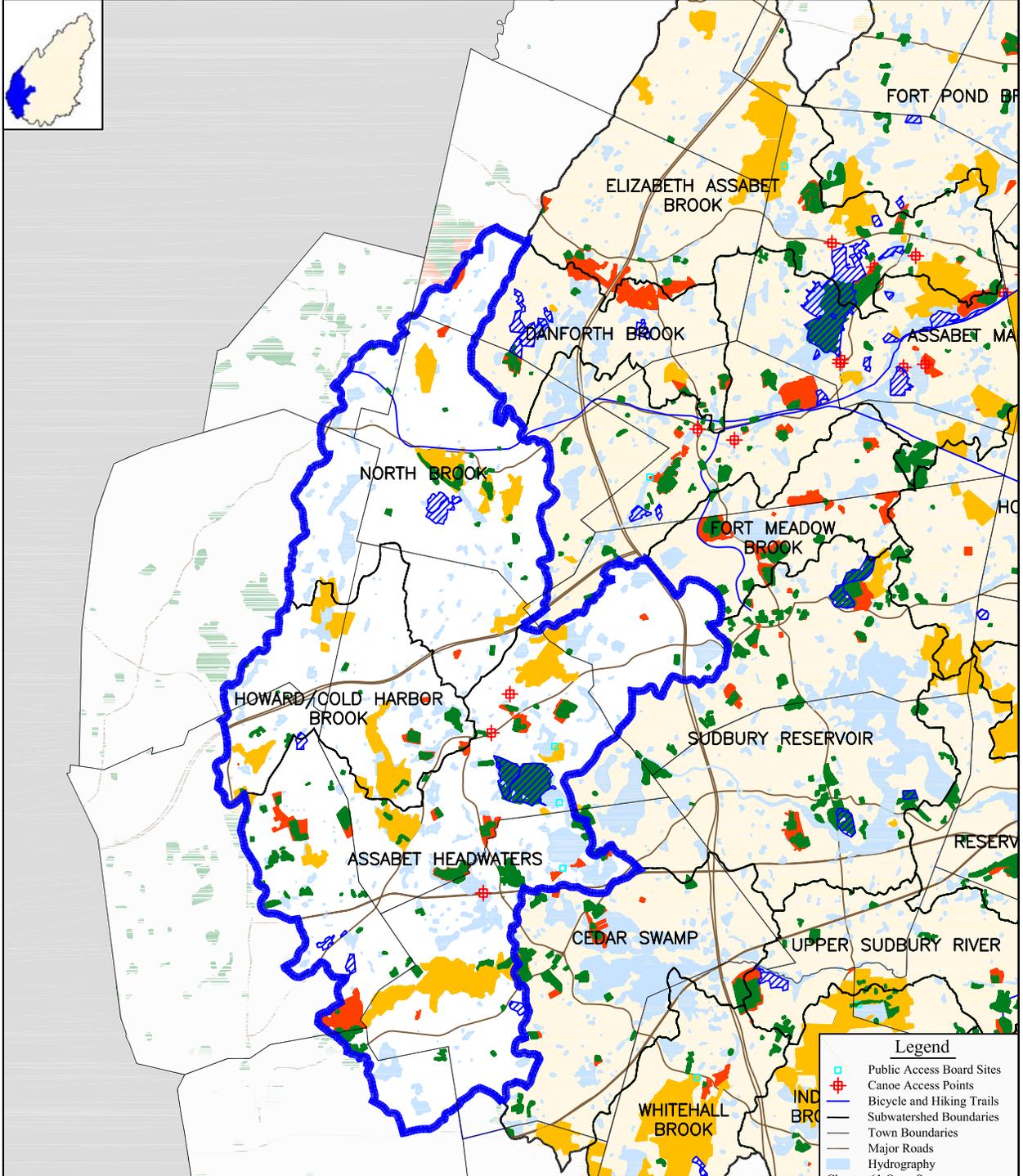
June 30, 2005



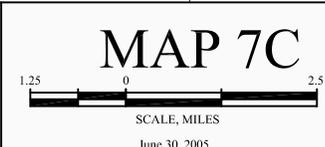
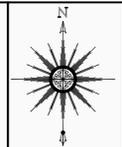
## Legend

- Public Access Board Sites
- Canoe Access Points
- Bicycle and Hiking Trails
- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- Chapter 61 Open Space
- Recreation
- Protected and Recreational Open Space
- Recreation and Conservation
- Recreation
- Land Use
- Recreation/Parks

# Recreation in the Upper Assabet River

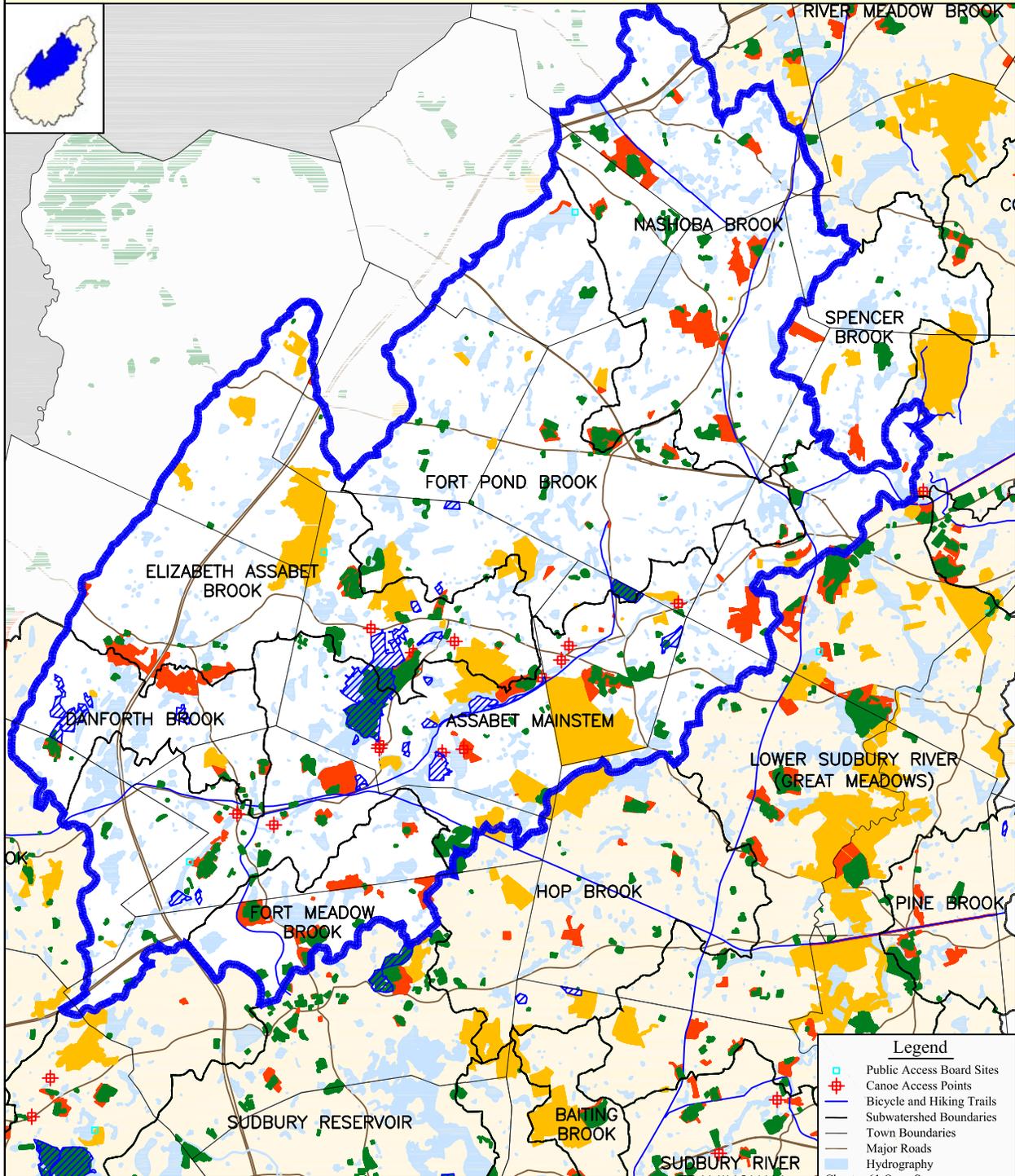


**Map Sources**  
 Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



- Legend**
- Public Access Board Sites
  - Canoe Access Points
  - Bicycle and Hiking Trails
  - Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - Recreation
  - Protected and Recreational Open Space
  - Recreation and Conservation
  - Recreation
  - Land Use
  - Recreation/Parks

# Recreation in the Lower Assabet River

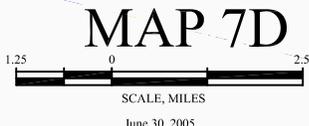


**Legend**

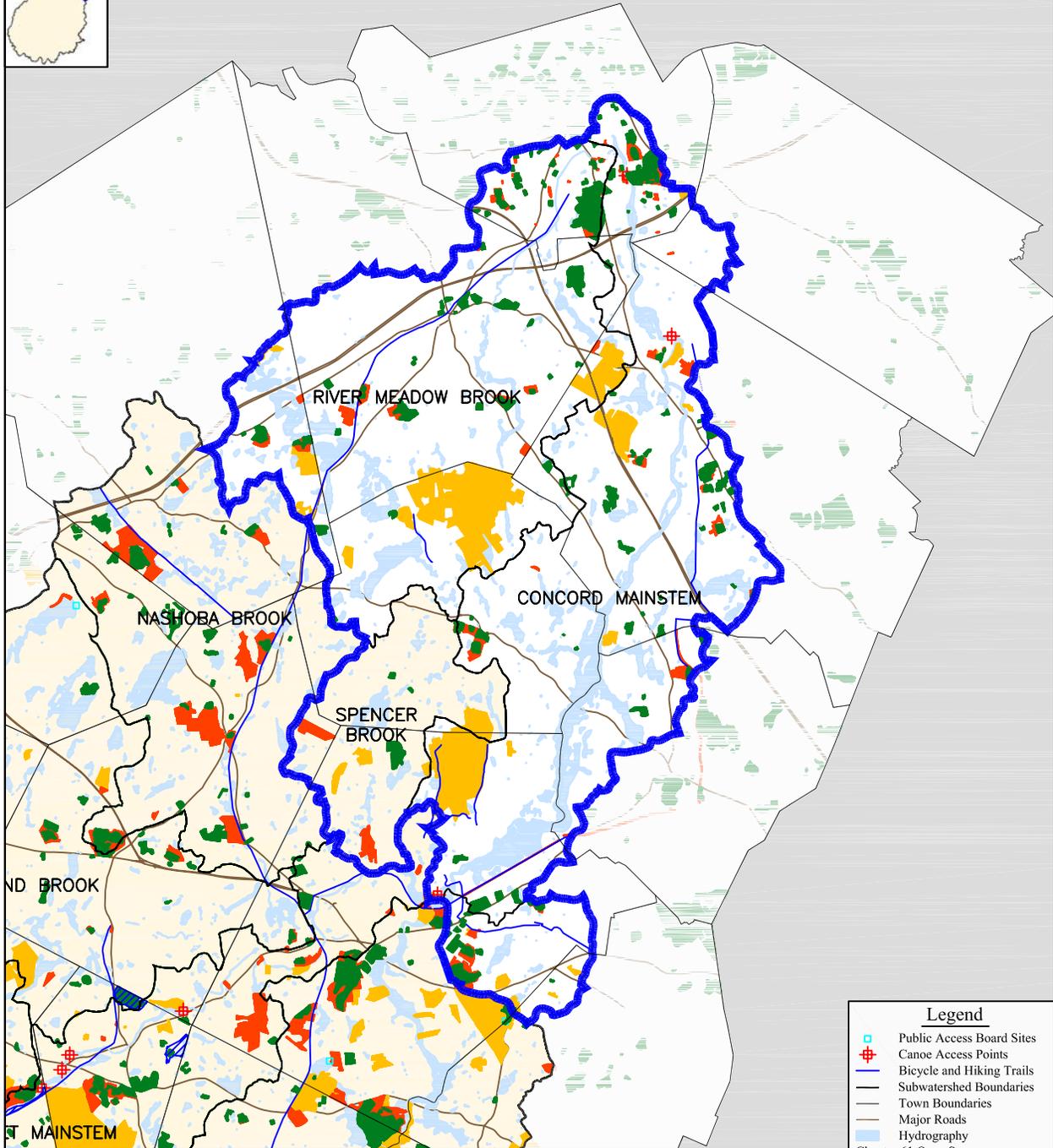
- Public Access Board Sites
- Canoe Access Points
- Bicycle and Hiking Trails
- Subwatershed Boundaries
- Town Boundaries
- Major Roads
- Hydrography
- Chapter 61 Open Space
- Recreation
- Protected and Recreational Open Space
- Recreation and Conservation
- Recreation
- Land Use
- Recreation/Parks

**Map Sources**

Data layers are provided by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs (EOEA). Data is based on the Massachusetts State Plane coordinate system. The map was produced in collaboration with EOEA.



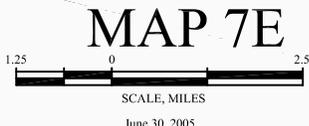
# Recreation in the Concord River



- Legend**
- Public Access Board Sites
  - Canoe Access Points
  - Bicycle and Hiking Trails
  - Subwatershed Boundaries
  - Town Boundaries
  - Major Roads
  - Hydrography
  - Chapter 61 Open Space
  - Recreation
  - Protected and Recreational Open Space
  - Recreation and Conservation
  - Recreation
  - Land Use
  - Recreation/Parks

**Map Sources**

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**MAP 7E**

June 30, 2005



## 8 OUTREACH AND EDUCATION

This section discusses the more prominent outreach and education efforts ongoing in the Watershed. These include collaboration through the SuAsCo Watershed community Council, the SuAsCo Stormwater Community Assistance Program, environmental organizations in the Watershed, events and grant programs.

### 8.1 Collaboration Among SuAsCo Groups

Currently there is significant collaboration among diverse interest groups in the Watershed. These are primarily coordinated through the SuAsCo Watershed Community Council. The Council has a 56 member steering committee, representing municipalities; state, federal, regional and legislature; industry/business; and environmental organizations. Steering committee members are listed in Table 8.1.

<b>Table 8.1 SuAsCo Watershed Community Council Steering Committee</b>			
<b>Municipal</b>	<b>At-Large State, Federal, and Regional Agencies</b>	<b>Industry/Business</b>	<b>Environmental Organizations</b>
Acton Board of Health	Dept. of Environmental Management	Ambient Engineering	Acton Land Stewardship Comm.
Billerica Board of Selectmen	Department of Environmental Protection- NERO	BHO Associates	Concord River Environmental Stream Team
Framingham Planning Department	Dept. of Fish & Game Riverways Program	Boyd Coatings Research Company	Earthwatch Institute
Grafton Dept. of Public Works	Great Meadows National Wildlife Refuge	Clock Tower Place	Fort Meadow Watershed Association
Hudson Economic Development Committee	Leadership MetroWest	Earth Tech	Hop Brook Protection Association
Lincoln Land Conservation Trust	MA House of Representatives - Susan Pope	Gustafson Associates	Hop Brook Protection Association
Marlborough Planning Board	MA House of Rep. – Pat Walrath	Lombardo Associates	Lowell Parks & Conservation Trust
Maynard Conservation Commission	MA Senate – Pam Resor	MA Assoc. of Lawn Care Professionals	Mill Brook Task Force
Sherborn Groundwater Protection Committee	Metropolitan Area Planning Council	NSTAR Gas & Electric	Organization for the Assabet River
Southborough Open Space Preservation Committee	MetroWest Growth Management Committee	Raytheon Corporation	River Meadow Brook Association
Stow Board of Selectmen	Middlesex Conservation District	Russell's Garden Center	SuAsCo Watershed Association

<b>Table 8.1 SuAsCo Watershed Community Council Steering Committee</b>			
<b>Municipal</b>	<b>At-Large State, Federal, and Regional Agencies</b>	<b>Industry/Business</b>	<b>Environmental Organizations</b>
Sudbury Board of Selectmen	National Park Service	SEA Consultants	Sudbury River Watershed Organization
Town of Concord	Northern Middlesex Regional Planning Council	Utility Contractors Association of New England	Sudbury Valley Trustees
Westborough Water Resources Management Committee	Wild and Scenic River Stewardship Council	Woodard and Curran	Walden Woods Project

In addition, many groups have collaborated on reports, plans, and maps of the Watershed. Many of these documents are listed in Section 10, List of Documents Collected and Reviewed.

## **8.2 SuAsCo Stormwater Community Assistance Program**

On December 8, 1999, the Phase II Rule of the US Environmental Protection Agency (EPA)'s National Pollutant Discharge Elimination System (NPDES) storm water program was published to expand the Phase I program to Municipal Separate Storm Sewer Systems (MS4s) within urban areas of populations less than 100,000 that were not addressed under the Phase I program. Objectives of the Phase II rule are to reduce the discharge of storm water pollutants to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act. In order for an MS4 to meet these objectives, EPA has defined the following six "minimum control measures" that are to be addressed:

1. Public Education and Outreach
2. Public Participation and Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention/Good Housekeeping for Municipal Operations

The SuAsCo Watershed Community Council's Storm Water Community Assistance Program (SWCAP) provides municipalities with assistance on control measures #1 and #2: public education and outreach and public participation and involvement. The SWCAP program currently has 24 member communities, including 21 SuAsCo communities. This program continues to grow, offering stormwater education and participation services to an ever-increasing public.

### 8.3 Watershed Organizations in the SuAsCo Watershed

The Watershed has numerous organizations established over the last 50 years. Table 8.2 lists many of the Watershed organizations that have been identified as currently having an active interest in the Watershed.

<b>Table 8.2 Watershed Organizations in the SuAsCo Watershed</b>	
<b>Organization</b>	<b>Description</b>
<u>Acton Land Stewardship Committee</u> lsc@town.acton.ma.us	a group of citizen volunteers responsible for the stewardship of over 1650 acres of Acton's conservation lands
<u>Cedar Swamp Conservation Trust</u> www.cstrust.org	CSCT currently monitors Whitehall Brook for the USGS Sudbury Aquatic Study and would like to gain access to monitor the Piccadilly Brooks in the heart of Cedar Swamp and also for Educational outings.
<u>Concord River Environmental Stream Team</u> www.state.ma.us/dfwele/RIVER/rivConcord.htm	As implied by their motto, "Rivers Connect Us," one of their main roles has been to serve as a bridge for watershed education, monitoring, recreation, and conservation between upstream (Concord, Bedford, and Carlisle) and downstream (Lowell and Chelmsford) river communities
<u>Friends of Assabet River NWR</u> P.O. Box 5729 Marlborough, MA 01752 (978) 443-4661 www.farnwr.org	The Friends of the Assabet River National Wildlife Refuge is a non-profit organization established to work with the U.S Fish and Wildlife Service to protect the refuge's valuable resources for future generations of wildlife and humans through stewardship and education.
<u>Hop Brook Protection Association</u> P.O Box 707 157 Wayside Inn Road Sudbury, MA 01776\ www.hopbrook.org	A nonprofit organization whose goal is to stop the excessive nutrient discharge into Hop Brook by the Marlboro Easterly Wastewater Treatment Plant, restore the Hop Brook System to Class B water standards and protect the ponds, streams & wildlife from further pollution.
<u>Lowell Parks and Conservation Trust</u> PO Box 7162 Lowell, MA 01852 978-934-0030 www.lowelllandtrust.org	A private non-profit land trust located in the city of Lowell, Massachusetts. Their mission is to improve the quality of life for the people of Lowell through the conservation, creation, and preservation of parks, open space, and special places.
<u>MA Audubon Society</u> 208 South Great Road Lincoln, MA 01773 781-259-9500 www.massaudobon.org	Mass Audubon protects more than 30,000 acres of conservation land, conducts educational programs, and advocates for sound environmental policies at the local, state, and federal levels. Mass Audubon maintains 43 wildlife sanctuaries that are open to the public and serve as the base for its conservation, education, and advocacy work across the state.

**Table 8.2 Watershed Organizations in the SuAsCo Watershed**

<b>Organization</b>	<b>Description</b>
<u>Mill Brook Task Force</u> www.concordnet.org/dplm/millbrook.html)	The Task Force has a Mill Brook self-guided historic tour; the brochure and map is available on their webpage.
<u>Organization for the Assabet River</u> 9 Damon Mill Square, Suite 1E Concord, MA 01742 978-369-3956 www.assabriver.org	A nonprofit group whose mission is to preserve, protect, and enhance the Assabet River, its tributaries, and watershed
<u>River Meadow Brook Association</u> http://groups.msn.com/RiverMeadowBrookAssoc/info.msnw	River Meadow group came together with an interest in tracking animals along the river corridor and concerns about a new well field going in. The group is concerned with water quality, streamflow, buffer strip protection, and preservation of animal passage along the river corridor
<u>SuAsCo River Stewardship Council</u> www.sudbury-assabet-concord.org	The Council functions as an official advisory committee to the National Park Service on federal permits affecting the rivers' outstanding resources. The Council also raises awareness of the rivers through events and publications, including RiverFest, an annual celebration of the Sudbury, Assabet, and Concord Rivers, and facilitates efforts to preserve and improve river resources
<u>SuAsCo Watershed Community Council</u> 978-461-0735 www.suasco.org	A community-based alliance that promotes the sustainable economic and environmental well-being of the Sudbury-Assabet-Concord River Watershed
<u>Sudbury Valley Trustees</u> 18 Wolbach Road Sudbury, MA 01776 978-443-5588. www.sudburyvalleytrustees.org	A nonprofit whose mission is to protect wildlife habitat and the ecological integrity of the Sudbury, Assabet, and Concord Rivers Valley for the benefit of present and future generations through land acquisition and stewardship, advocacy and education, in partnership with towns, watershed associations, and other environmental organizations within the greater Concord River Basin, as well as with individuals and businesses.
<u>Sudbury River Watershed Organization</u> 78 Southville Road Southborough, MA 01772 Fg481@sudbury.net	

**Table 8.2 Watershed Organizations in the SuAsCo Watershed**

<b>Organization</b>	<b>Description</b>
<u>Walden Woods Project</u> 44 Baker Farm Lincoln, MA 01773 781/ 259-4721 www.walden.org	The Walden Woods Project preserves the land, literature, and legacy of Henry David Thoreau to foster an ethic of environmental stewardship and social responsibility. The Project achieves this mission through the integration of conservation, education, and research

#### **8.4 Events**

The SuAsCo Watershed Community Council holds an annual watershed-wide conference called the River Visions Forum. The conference attracts an audience from all across the watershed representing a diversity of interest groups from businesses to environmental groups, from state and federal government to municipal officials, and from academia to concerned citizens. The River Visions Forum was held on May 11, 2005, hosted by Intel Massachusetts, in Hudson, MA. Other SuAsCo watershed events are held throughout the watershed by a variety of community organizations. The events are posted on their website calendar at <http://www.suasco.org/calendar/>.

#### **8.5 Grant Programs**

A number of grant programs exist that can be used by lake and pond associations, river and watershed organizations, and municipalities. As of the publication of this assessment, these include the Watershed Initiative: Volunteer Monitoring Grants from MA EOEA; Directed Grants Program, Environmental Education Program, and Environmental Monitoring Program from the Massachusetts Environmental Trust; 319 Nonpoint Sources Pollution (NSP) Grant Program, 604(b) Water Quality Management Planning Grant, and Research and Demonstration Projects from MA DEP; and Lakes and Pond Grant Program, Recreational Trails Program, and Rivers and Harbors Grant Program from MA DCR.



In addition the SuAsCo Community Council prepared a strategic action plan.

**Table 9.2 SuAsCo Watershed Community Council Action Plan 2001-2002**

<b>Objective</b>	<b>Activity</b>	<b>Measurable Outcome</b>
Watershed Influence - Communication and cooperation across constituencies	Provide input to EOEAs watershed work plan Lobby for more regional funds Identification of watershed issues and priorities 4-6 meetings of Steering Committee Work with other organizations	Project ideas included and funded in EOEAs work plan X\$ received per year Projects identified and supported Steering Committee meetings well-attended Good working partnerships formed
Outreach and Education	Annual River Visions Forum  Issues forums  Slide show on watershed issues  Monthly Calendar of Events  Web site updated regularly  Newsletter articles, press releases  Dissemination of information and project reports	Conference successful: enrollment exceeds 150; positive evaluations 2-4 sessions per year 5-10 presentations/year  Calendar distributed widely  Web site in place, updated regularly and used regularly  Six articles/press releases printed per year  Distribution of notices and watershed project reports(see below)
Watershed Projects (through task forces)		
Biodiversity	Implementation of Biodiversity Protection and Stewardship Plan	Report completion and dissemination
Land Use/Open Space	Greenprint for Growth	Report completion and dissemination Brochure completion
Water Quality/Quantity	Water Quality Brochure Storm Water Phase II – Community Assistance Plan	Creation/implementation of StormWater Phase II education/outreach plan
Outreach and Education	Establish Website	Website created and accessible

Between 1998 and 2003 the Watershed Initiative Watershed Team compiled work plans with issues, priorities, and actions. Table 9.2 lists the issues and actions identified by the Watershed Team.<sup>68</sup>

**Table 9.3 FY 2004 Watershed Team Issues and Actions**

Category	Issue	Actions
Water Quality	Water Quality Data needed for restoration of water quality in rivers, lakes and ponds which includes continued need for data collection and interpretation / integration into decision making	<ul style="list-style-type: none"> <li>• address decreasing water quality</li> <li>• complete Assabet River TMDL</li> <li>• start Sudbury and Concord Sub-basins TMDLs</li> <li>• participate on Comprehensive Water Resources Management Planning process</li> <li>• participate in NPDES permit review process</li> <li>• publish DEP “SuAsCo Water Quality Assessment Report”</li> <li>• address sediments and nonpoint sources</li> </ul>
Water Quantity	Water Quantity Data needed for restoration of flow and water levels which includes continued need for data collection and interpretation / work towards integration into decision making, decreasing flow, and need to restore water flow and water levels	<ul style="list-style-type: none"> <li>• participate in Water Management Act and Inter-basin Transfer Act review process</li> </ul>
Habitat	Need to maintain, protect, and restore healthy water quality and seasonal variability of stream flow to sustain aquatic biodiversity which includes continued need for data collection and interpretation / work towards integration into decision making	<ul style="list-style-type: none"> <li>• implement “SuAsCo Biodiversity Protection and Stewardship Plan”</li> <li>• publish Div. of Fisheries and Wildlife “SuAsCo Watershed Fisheries Survey Report”</li> <li>• address aquatic invasive species</li> </ul>
Land Use/ Open Space	Need to address impacts from heavy development activities on growth in the watershed which includes: increased impervious surfaces and runoff, decreased water quality and flow, and decreased number of large tracts of open space and loss of linkage of open space needed for biodiversity protection	<ul style="list-style-type: none"> <li>• implement “Greenways Plan for the SuAsCo Watershed”</li> <li>• implement “Greenprint for Growth / SuAsCo Watershed”</li> <li>• encourage local and regional participation in smart growth activities (i.e. – CPI, EO 418, EO385)</li> <li>• encourage recreational access to rivers, lakes and ponds</li> </ul>
Outreach and Education	Outreach and education needs of the SuAsCo Watershed Community	<ul style="list-style-type: none"> <li>• encourage innovative wastewater and water supply, reuse and recharge strategies town by town</li> <li>• through a regional approach</li> </ul>

**Table 9.3 FY 2004 Watershed Team Issues and Actions**

Category	Issue	Actions
		<ul style="list-style-type: none"> <li>• wastewater / stormwater - nutrients (detergents / fertilizers) &amp; BMPs</li> <li>• water conservation &amp; summer water use (peak demand)</li> <li>• local / regional planning</li> <li>• land and water stewardship</li> <li>• GIS support</li> </ul>

## 9.2 Growth and Development

The SuAsCo Watershed has seen significant growth during the last fifteen years and is poised to see continued growth in the near future. Most towns and cities in the Watershed have developed open space plans to address issues of growth and development. Environmental organizations have created documents such as the Greenprint for Growth in order to help guide development in the Watershed in an environmentally sensitive manner.

Approaches such as Smart Growth and Low Impact Development are starting to be seen as potential ways to control growth in SuAsCo communities.

## 9.3 Water Quality

The 2001 Draft Water Quality Assessment Report evaluation of current water quality conditions in the SuAsCo Watershed has revealed the need for the following:<sup>69</sup>

- Monitor bacteria levels to document effectiveness of bacteria source reduction activities associated with sewer collection improvements, Title V (septic system) improvements/upgrades, treatment of storm water discharges, sewerage and/or Phase II community storm water management programs to assess the status of the *Primary* and *Secondary Contact Recreation* uses.
- Coordinate with DCR and/or other groups conducting lake surveys to generate quality assured lakes data. Conduct more intensive surveys to better determine the lake trophic and use support status and identify causes and sources of impairment. As sources are identified within lake watersheds they should be eliminated or at least minimized through the application of appropriate point or non-point source control techniques.
- Prevent spreading on non-native, invasive aquatic macrophytes.
- Implement the recommendations from the Assabet River Nutrient TMDL.
- Monitor dissolved oxygen, nutrients, and plant biomass in the Assabet River Watershed to document the effectiveness of the Assabet TMDL.

- To the extent possible, flows released from impoundments throughout the watershed should mimic natural hydrographs. Minimum flows should be released, particularly during low flow periods, to protect aquatic life and enhance habitat quality.
- Continue to conduct water quality monitoring to better evaluate the status of the *Aquatic Life Use*. At a minimum continuous dissolved oxygen and temperature data, as well as pH and total phosphorus data should be collected and biological (benthic macroinvertebrate, habitat assessment, and fish population) sampling should be conducted.
- Conduct shoreline surveys to assess the *Aesthetics Use*.
- MDFW has recommended that a number of streams throughout the SuAsCo Watershed be protected as coldwater fishery habitat based on surveys they have conducted. Additional monitoring of the fish population, DO, and temperature is needed to evaluate MDFW's proposal to list this segment as a cold water fishery in the next revision of the Surface Water Quality Standards.

#### **9.4 Water Quantity**

Portions of rivers in the Watershed have run dry during the last ten years. Other portions have been fed primarily by wastewater treatment plant discharges during dry months. Although there has been some water quantity data collected for the Watershed, particularly in the Assabet River, very little research on water balance within and between subwatersheds has been conducted.

How communities use their water has been shown to have a significant effect on water balances in adjacent waterways.

#### **9.5 Land Protection/Open Space**

Many documents exist, such as the Biodiversity Plan and Greenprint for Growth, that identify priority lands. In addition, initiatives such as the Community Preservation Act provide a mechanism for purchase and protection of such land. Sources of funding for strategic purchases continue to be sought.

#### **9.6 Biodiversity/Habitat**

A number of reports exist regarding biodiversity and habitat, including the SuAsCo Biodiversity Protection and Stewardship Plan and the Greenways Plan. They identify the concerns of invasive fauna and flora as well as barriers to species movement through the Watershed.

#### **9.7 Recreation**

There are many locations designated as recreation areas as well as access points for the Watershed. However, there are still many gaps in trails, and some recreational uses have had impacts on the Watershed.

## **9.8 Outreach and Education**

There are many groups in the Watershed that provide information about the Watershed. Groups such as the SuAsCo Watershed Community Council provide excellent resources for educating the public about issues affecting the Watershed.

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<sup>68</sup> Massachusetts Watershed Initiative Draft Watershed Action Plan, FY 2004

<sup>69</sup> MA DEP Division of Watershed Management SuAsCo Watershed 2001 Water Quality Assessment Report Executive Summary Recommendations

**APPENDICES**

**APPENDIX A**

**LIST OF ORGANIZATIONS CONTACTED**

Project letters requesting documents were sent out to the following 43 communities and organizations:

City of Lowell	Town of Grafton
City of Marlborough	Town of Harvard
Hop Brook Protection Association	Town of Holliston
Metropolitan Area Planning Council	Town of Hopkinton
Metrowest Growth Management Committee	Town of Hudson
Minuteman Advisory Group on Interlocal Coordination	Town of Lincoln
Organization for the Assabet River	Town of Littleton
Sudbury River Watershed Organization	Town of Maynard
Sudbury Valley Trustees	Town of Natick
Town of Acton	Town of Northborough
Town of Ashland	Town of Sherborn
Town of Bedford	Town of Shrewsbury
Town of Berlin	Town of Southborough
Town of Billerica	Town of Sudbury
Town of Bolton	Town of Stow
Town of Boxborough	Town of Tewksbury
Town of Boylston	Town of Upton
Town of Carlisle	Town of Wayland
Town of Chelmsford	Town of Westborough
Town of Clinton	Town of Westford
Town of Concord	Town of Weston
Town of Framingham	

The following organizations were contacted via telephone:

MA Executive Office of Environmental Affairs

MA Department of Conservation and Recreation

**APPENDIX B**

**LIST OF DOCUMENTS COLLECTED AND REVIEWED**

**Document Category****Document Name**

Document Description

Document  
Author

Document Date

Document Type

**1. Growth and Development****Agency Sustainability Planning and Implementation Guide**

Agency Sustainability Planning and Implementation Guide

State Sustainability  
Coordinating Council2004  
Guidance**Carlisle General Bylaws**

General Bylaws

Town of Carlisle

10/2000  
Municipal Bylaws**Carlisle Zoning Bylaws**

Zoning Bylaws

Town of Carlisle

9/2002  
Municipal Bylaws**Erosion Bylaw**

Erosion bylaw

Town of  
Framingham2004  
Municipal Bylaws**Greenprint for Growth**

Greenprint for Growth

SVT &amp; MAPC

8/2001  
Report**Greenways Plan for the SuAsCo Watershed**

Greenways Plan for the SuAsCo Watershed

Sudbury Valley  
Trustees4/2000  
Report**Low Impact Development Report LID Overview and Methods**

Low Impact Development Report LID Overview and Methods

2005  
Report**MetroPlan**

Planning document for MAPC area

MAPC

2000  
Report**Model Right to Farm Bylaw**

model bylaw for farming rights

MA DAR

12/29/2004  
Other**Model Right To Farm Bylaw**

model bylaw for towns to adopt

MA DAR

Municipal Bylaws

**Proposed Right To Farm Bylaw**

Proposed Right To Farm Bylaw for Westford

Westford  
Conservation  
Commission4/4/05  
Pamphlet/Brochure/Loose Pages**SuAsCo QAPP**Quality Assurance Project Plan Proposal for SuAsCo Phased  
TMDL Study

ACOE/HNTB

1/18/2000  
Report**SuAsCo Watershed Archaeological Inventory Project: Exploring  
the Clultural Resources of A Suburban A**GIS-based model for predicting where important cultural  
resources may be expected to be locatedDr. Curtiss Hoffman  
and Adrienne  
Edwards

Report

**Waste Site Cleanup & Reuse in New England**

List of Brownfields in SuAsCo Watershed

US EPA

6/3/2005  
Report

**2. Water Quality**

<b>1990 Concord River Survey</b> Water Quality Data and Analysis, Wastewater Discharge Data	EOEA	1990 Report
<b>Algae Harvesting Experiment on Grist Mill Pond Sudbury, Massachusetts June-August 1995</b> Report on algae harvesting summer 1995	Hop Brook Protection Association	October 23, 1995 Report
<b>Algae Harvesting Experiments Report on Grist Mill Pond, Sudbury, Massachusetts</b> Report on harvesting algae from Grist Mill Pond, summer 1994	Francis Lyons and Mike Meixsell	September 18, Report
<b>An Algae Harvesting System for the Hop Brook Protection Association, Inc. Part I: September 13,1994 - October 18, 1994</b> Description of a system for algae harvesting on Grist Mill Pond	MIT Environmental Engineering Clinic	Undated Report
<b>Appendices Watershed Protection Plan Sudbury Reservoir and Framingham Reservoir #3</b> Appendices Watershed Protection Plan Sudbury Reservoir and Framingham Reservoir #3	Comprehensive Environmental, Inc. MDC, MWRA	June 1997 Report
<b>Assessing the Role of Sediments as a Phosphorus Source in the Eutrophication of Ponds Along Hop Brook, Sudbury MA</b> Study on the role of sediments in releasing phosphorus to the water	MIT Environmental Engineering Clinic	May 15, 1997 Report
<b>Assorted notes on Hop Brook</b> Varies	Varies	Varies Pamphlet/Brochure/Loose Pages
<b>Comprehensive Water Resources Management Plan Phase I</b>	Woodard & Curran	1/6/2003 Plan
<b>DEP 2004 Compliance and Enforcement Annual Report</b> Enforcement statistics for DEP	MA DEP	11/23/2004 Report
<b>Draft Nutrient Impact Evaluation of Hop Brook in Marlborough and Sudbury, Massachusetts</b> Nutrient Impact Evaluation of Hop Brook in Marlborough and Sudbury	ENSR	May 2000 Report
<b>DRAFT SuAsCo Watershed 2001 Water Quality Assessment Report</b> SuAsCo water quality assessment report	DEP DWM	2/2004 Report
<b>Draft Water Quality Assessment Executive Summary</b> Executive summary with graphics	DEP DWM	Report
<b>Improving the Water Quality of the Hop Brook Watershed Through Aggressive Algal Harvesting</b> Report to identify short term solution to algae growth on Grist Mill Pond	MIT Environmental Engineering Clinic	May 18, 1994 Report
<b>Indoor &amp; Outdoor Residential Water Conservation Checklist</b> Indoor & Outdoor Residential Water Conservation Checklist	Massachusetts Association of Lawn Care Professionals	undated Pamphlet/Brochure/Loose Pages
<b>In-Stream Phosphorus Reduction and Restoration of the Hop Brook Ponds System</b> Review of corrected 1989 Whitman and Howard data and	Hop Brook Ponds Study Committee	September 29, Report

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additional data from 1989-1992 regarding phosphorus reduction

<b>Lake Cochituate Nonpoint Source Pollution Management Plan Draft</b> Ashland, Framingham, Natick, Sherborn and Wayland	Metropolitan Area Planning Council	May 2004 Plan
<b>Lake Cochituate Nonpoint Source Pollution Water Quality Management Plan</b> Lake Cochituate Nonpoint Source Pollution Water Quality Management Plan	Metropolitan Area Planning Council	July 2004 Plan
<b>Lawn and Sports Turf Benefits</b> Lawn and Sports Turf Benefits	Massachusetts Association of Lawn Care Professionals	undated Report
<b>MA Regulated MS4 Map</b> Map of MS4a in New England	EPA New England	9/30/2002 Map
<b>Marlborough (CoMag Process) Phosphate Removal Project Status</b> Review of CoMag phosphorus removal process	Varies	Undated Report
<b>Marlborough/Sudbory Pilot Study Phosphorus Removal Project Update &amp; Extension Proposal for the Marlborough Easterly Wastewater Treatment Plan</b> Summary of research regarding removal of inorganic phosphorus from the Marlborough Wastewater Treatment Plant	Umass Amherst Department of Plant and Soil Sciences	February 1998 Report
<b>Massachusetts River and Stream Crossing Standards: Technical Guidance</b> Technical standards for river and stream crossings	MRP, MWI Sweetwater Trust	August 6, 2004 Guidance
<b>MDC-MWRA Long Range Water Supply Study and Environmental Impact Report - 2020 Phase II Report</b> MDC-MWRA Long Range Water Supply Study and Environmental Impact Report - 2020 Phase II Report	MWRA	October, 1990 Report
<b>Mechanical Harvesting to Control Blooms of the Green Algae Hydrodictyon Reticulatum, Grist Mill Pond</b> Report on the mechanical harvesting of algae in Grist Mill Pond	Richard Haywood	February 5, 1997 Report
<b>NonPoint Source Action Strategies</b> Contains actions for watershed; SuAsCo starts on page 194	MA DEP	7/5/2001 Study
<b>NonPoint Source Action Strategies Front End</b> description to non-point source action strategies appendix	MA DEP	2005 Report
<b>NPDES Maps for SuAsCo MS4 Communities</b>		Map
<b>OSC Report Nyanza Site Ashland, MA</b> OSC Report Nyanza Site Ashland, MA	On-Scene Coordinator	July 9, 1992 Report
<b>Problems and Solutions for Hop Brook</b> Summary of problems and solutions of eutrophication in Hop Brook	Tara Cargill	Undated Report
<b>Regulations for the Storage of Petroleum Products</b> Regulations for the Storage of Petroleum Products	Town of Carlisle	1998 Pamphlet/Brochure/Loose Pages

<b>Remediation Options for Elodea dominated Ponds along Hop Brook</b> Report on emergence of elodea canadensis and strategies for eradication	MIT Environmental Engineering Clinic	Spring 1998 Report
<b>Safe Drinking Water Information System Well Closures</b> List of Water Systems in SDWIS database	US EPA	5/3/2005 Report
<b>Sherborn Town Water Risk Summary, Town Bylaws on Water, Groundwater Protection Study w/Maps</b> Sherborn Town Water Risk Summary, Town Bylaws on Water, Groundwater Protection Study w/Maps	Woodard & Curran	3/28/05 Municipal Bylaws
<b>Storm Ends-and the piling begins</b> Lowell DPW dumps snow in the Concord River	Lowell Sun	1/25/2005 Pamphlet/Brochure/Loose Pages
<b>SuAsCo 2001 Water Quality Assessment Report Appendix</b> Water quality assessment report appendix	DEP DWM	2/2005 Report
<b>SuAsCo River Basin</b>  Water Quality Management Plan	DEP Division of Water Pollution Control	1981 Plan
<b>Supplemental Nutrient Loading Evaluation of Hop Brook</b> Evaluation of phosphorus loading from sediments of Hop Brook impoundments	ENSR	April 2004 Report
<b>Supplementary Regulations for Sewage Disposal Systems</b> Supplementary Regulations for Sewage Disposal Systems	Town of Carlisle	7/1998 Pamphlet/Brochure/Loose Pages
<b>SWAP Hopinton</b> Water Assessment Report	Earth Tech	June 2000 Report
<b>SWAP Westborough</b> Water Assessment Program Study	Earth Tech	January 2000 Report
<b>The Effect of Nutrients &amp; Pesticides Applied to Turf on the Quality of Runoff and Percolating Water</b> The Effect of Nutrients & Pesticides Applied to Turf on the Quality of Runoff and Percolating Water	PennState Environmental Resource Research Institute	undated Report
<b>The Role of Turfgrasses in Environmental Protection and Their Benefits to Humans</b> The Role of Turfgrasses in Environmental Protection and Their Benefits to Humans	Beard, James and Green, Robert	undated Report
<b>Town of Carlisle Manure Management Plan</b> Town of Carlisle Manure Management Plan	Town of Carlisle	2005 Pamphlet/Brochure/Loose Pages
<b>Town of Carlisle Water Supply Development Plan Narrative</b>  Town of Carlisle Water Supply Development Plan Narrative	Carlisle Board of Health	2002 Pamphlet/Brochure/Loose Pages
<b>Town of Carlisle Water Supply Regulations</b> Town of Carlisle Water Supply Regulations	Town of Carlisle	2/11/1997 Pamphlet/Brochure/Loose Pages
<b>Use of Barley Straw as an Algal Inhibitor to Improve Pond Water Quality</b>	MIT Environmental Engineering Clinic	May 15, 1996 Report

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### **Watershed Protection Plan Sudbury Reservoir and Framingham Reservoir #3**

Watershed Protection Plan Sudbury Reservoir and Framingham Reservoir #3

Comprehensive Environmental, Inc.  
MDC, MWRA  
June 1997  
Report

## **3. Water Quantity**

### **Acton, Massachusetts Comprehensive Water Resources Management Plan Phase I**

Existing Conditions, Future Requirements and Problems Identification (Definition of Needs)

Woodard and Curran  
June 2003  
Pamphlet/Brochure/Loose Pages

### **Alternative Water Source Study (Hopkinton)**

Alternative Water Supply Study for Hopkinton

Earth Tech  
December 1996  
Report

### **Concord River Basin Inventory and Analysis of Current and Projected Water Use**

Concord River Basin Inventory and Analysis of Current and Projected Water Use

MADEM Division of Water Resources  
June 1989  
Report

### **EOEA Water Assets Study Community Report**

Water assets study

Earth Tech  
6/2004  
Report

### **Estimated Availability of Water From Stratified-Drift Aquifers in the Concord River Basin**

Water Quantity simulation model

USGS,  
Massachusetts DEM  
Office of Water Resources  
1995  
Report

### **Method for Measuring Interbasin Transfer**

Martha Horn  
Report

### **Multiple Hazard Mitigation Plan**

Multiple Hazard Mitigation Plan

Rizzo Associates  
June 2004  
Pamphlet/Brochure/Loose Pages

### **People and Water in the Assabet River Basin, Eastern Massachusetts**

An accounting of the inflows, outflows, and uses of water in the Assabet River Basin

Leslie DeSimone  
2005  
Report

### **Preliminary Assessment of Streamflow Requirements for Habitat Protection for Selected Sites**

Streamflow Requirements for Habitat Protection

USGS  
2001  
Report

### **Simulation of Ground-Water Flow and Evaluation of Water-Management Alternatives in the Assabet River Basin, Eastern Massachusetts**

Simulation of Ground-Water Flow and Evaluation of Water-Management Alternatives in the Assabet River Basin, Eastern Massachusetts

L.DeSimone, USGS  
2004  
Report

### **Stormwater Management Techniques**

Pamphlet/Brochure/Loose Pages

### **Sudbury Aquatic Habitat Study**

Proposal to monitor Whitehall Brook

Undated  
Pamphlet/Brochure/Loose Pages

## **4. Land Protection/Open Space**

### **100,000 Acres Protection of Open Space**

Description of 100,000 acres of open space protected through 2001

EOEA  
Spring 2002  
Report

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**Bedford Open Space 5-Year Action Plan**

Draft actions for open space plan

Town of Bedford

Report

**Bedford Open Space and Recreation Master Plan**

Bedford Open Space and Recreation Master Plan

Environmental  
Collaborative

Plan  
Plan

**Boxborough Shapefiles**

Boxborough Shapefiles

Town of  
Boxborough

GIS Data  
GIS Data

**Cochituate State Park Management Plan Guidelines for Operations and Land Stewardship**

Cochituate State Park Management Plan Guidelines for Operations and Land Stewardship

Commonwealth of  
Massachusetts/EOEA  
/DEM

May 2002  
Plan

**Draft Bedford Open Space and Recreation Plan Update**

Open space and recreation plan update

Town of Bedford

2004  
Report

**Excerpts from Draft Bedford Open Space and Recreation Plan**

Excerpts from Draft Bedford Open space and Recreation Plan

Town of Bedford

Plan

**GIS Shapefiles**

Town of  
Boxborough

3/16/2005  
GIS Data

**GIS Shapefiles**

Town of Wayland

3/14/2005  
GIS Data

**GIS Shapefiles**

Town of Weston

3/14/2005  
GIS Data

**Marlborough Open Space Plan**

Open Space Plan

City of Marlborough

2003  
Report

**Open Space and Recreation Plan for Southborough**

Open Space and Recreation Plan for Southborough

The Open Space  
Preservation  
Commission

1999  
Plan

**Open Space Plan**

Town of Weston

1996  
Plan

**Open Space Plan**

Town of Acton

2002  
Plan

**Properties Protected, Fiscal Years 1999-2003**

Statewide list of properties protected through Article 97 process for fiscal years 1999-2003

MA DCR

6/10/2005  
Report

**River System Study The Sudbury, Assabet and Concord Rivers Volume 6C**

Open Space and Recreation Program for Metropolitan Boston

Metropolitan Area  
Planning Council

August 1976  
Report

**Southborough Action Plan Map**

Protected Open Space

Cartographic  
Associates, Inc.

Unknown  
Map

# SuAsCo River Watershed Assessment Report

June 30, 2005

## Southborough Open Space Map

Cartographic  
Associates, Inc.

January 1999  
Map

Protected Open Space

## Southborough Special Features Map (Hills, Reservoir, Stone walls, Trees, Chapter 61, Structures)

Cartographic  
Associates, Inc.

January 1, 1996  
Map

Southborough Special Features Map (Hills, Reservoir, Stone walls, Trees, Chapter 61, Structures)

## Southborough Special Features Map 100 Year Floodplain, 500 Year Floodplain

Cartographic  
Associates, Inc.

January 1, 1996  
Map

Southborough Special Features Map 100 Year Floodplain, 500 Year Floodplain

## Southborough Wetlands Map

DEP/DEM

Map

Southborough Wetlands Map

## Stewardship Plan Sawink Farm and Cedar Hill Reservations and Adjacent Conservation Lands

Frances Clark

11/00  
Report

Documents major habitats and associated wildlife on the Sawink Farm

## Sudbury, Assabet, and Concord Wild and Scenic River Study

NPS SuAsCo Wild  
and Scenic Study  
Committee and

March 16, 1995  
Plan

Vision for cooperative protection of 29 miles of SuAsCo system

Division of Rivers  
and Special Studies

## Sudbury, Assabet, and Concord Wild and Scenic Rivers: Unprotected Land Inventory

Sudbury Valley  
Trustees

1/2003  
Report

Sudbury, Assabet, and Concord Wild and Scenic Rivers: Unprotected Land Inventory

## Town of Acton Open Space and Recreation Plan 2002-2007

Town of Acton

2002  
Pamphlet/Brochure/Loose Pages

Town of Acton Open Space and Recreation Plan 2002-2007

## Town of Carlisle Open Space and Recreation Plan

Open Space and  
Recreation  
Committee

2000  
Report

Town of Carlisle Open Space and Recreation Plan

## Town of Chelmsford Open Spaces Plan

Andrew Sheehan

Plan

Town of Chelmsford Open Spaces Plan

## Town of Framingham Open Space and Recreation Plan

Open Space and  
Recreation Plan  
Committee

August 2003  
Plan

Department of Park and Recreation and Department of Planning and Economic Development

## Town of Hudson Shapefiles

Town of Hudson

GIS Data

Town of Hudson Shapefiles

## Upper Assabet Riverway Plan

Collaboration

1/2003  
Report

planning tools – maps, suggested bylaws, and recommendations -- to help protect the upper Assabet River and its watershed

## Wayland GIS 2004

Town of Wayland

2004  
GIS Data

Wayland GIS 2004

**5. Biodiversity/Habitat**

<b>Biodiversity and Stewardship, Greenways Shapefiles</b> GIS Shapefiles	SVT	GIS Data
<b>Brief Survey of Hop Brook's (and Sudbury's) Flora and Fauna from the years 1997-1999</b> Listing of species found along Hop Brook between 1997 and 1999	Ed Cavallerano	1999 Report
<b>Climate Report</b>	MAPC	Report
<b>Climate Report Summary</b>	MAPC	Report
<b>Preliminary Assessment of Streamflow Requirements for Habitat Protection for Selected Sites on the Assabet and Charles Rivers, Eastern Massachusetts</b> Preliminary Assessment of Streamflow Requirements for Habitat Protection for Selected Sites on the Assabet and Charles Rivers, Eastern Massachusetts	United States Geological Survey	2001 Report
<b>SuAsCo Biodiversity Protection and Stewardship Plan</b> SuAsCo Biodiversity Protection and Stewardship Plan	Carex Associates	8/2000 Report
<b>The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts (with Annotated List)</b> Listing of plants investigated and categorized as invasives	Multiple	April 1, 2005 Report
<b>Weston Open Space Plan</b> Weston Open Space Plan	Town of Weston	1996 Pamphlet/Brochure/Loose Pages

**6. Recreation**

<b>Public Access Plan for the MDC Sudbury Watershed</b> Public Access Plan for the MDC Sudbury Watershed	Metropolitan District Commission	June 1994 Plan
<b>Sudbury, Assabet and Concord Wild and Scenic River Study</b> Division of Rivers and Special Studies	SuAsCo Wild and Scenic Study Committee	March 16, 1995 Plan
<b>Sudbury, Assabet, and Concord Wild and Scenic River Study</b> Report identifying portions of SuAsCo for wild and scenic designation	USDI NPS New England System Support Office Rivers  Program	September 1996 Report

**General**

<b>1990 Water Use for 01070005-Concord</b> List of statistics compiled in 1990 for SuAsCo Watershed	USGS	5/9/2005 Report
<b>1995 to 2020 Vision for the Nashua River Watershed</b> Planning document for Nashua River Watershed	Nashua River Watershed Association	December 1995 Plan
<b>5-Year Watershed Action Plan Guidance</b> WAP guidance document	Executive Office of Environmental Affairs	Report

SuAsCo River Watershed Assessment Report  
**Callahan State Park & The Nobscot Hill Parcel Report**  
 Callahan State Park & The Nobscot Hill Parcel Report

June 30, 2005

		Report
<b>Connecticut River Watershed Action Plan</b> WAP for Connecticut River		2003 Report
<b>Draft 2005 Open Space and Recreation Plan Excerpts</b> Draft 2005 Open Spae and Recreation Plan Excerpts	Town of Bedford	Report
<b>Effects of Phosphorus Contamination on Species Diversity in Hop Brook</b> Assessment of aspects of health of Hop Brook	Ed Cavallerano	1999 Report
<b>Hop Brook Protection Association Annual Reports, 2001-2004</b>  Annual Reports 2001-2004	Hop Brook Protection Association	Varies Other
<b>Land Management Plan for the Watershed of the Sudbury Reservoirs</b> Land Management Plan for the Watershed of the Sudbury Reservoirs	DCR OWM	12/17/2004 Report
<b>Massachusetts Watershed Initiative Mission Statement</b>  Massachusetts Watershed Initiative Mission Statement	Massachusetts Watershed Initiative	Pamphlet/Brochure/Loose Pages
<b>Millers River Watershed Action Plan</b> WAP for Millers River		2004 Report
<b>Nashua River Watershed 5 Year Action Plan 2003-2007</b> Nashua River Watershed 5 Year Action Plan 2003-2007	NRWA	2003 Plan
<b>Publications of the Division of Watershed Management</b> A listing of DEP Division of Watershed Management documents	MA DEP	2004 Report
<b>Publications of the Division of Watershed Management Watershed Planning Program</b> Index of Technical Reports	Mass DEP	2003 Guidance
<b>Shawsheen River Watershed Assessment Report</b>  Watershed assessment report for shawsheen river	Executive Office of Environmental Affairs	7/11/2003 Report
<b>Sherborn General Plan 10-31-01, Community Development Plan 6-30-04</b> Sherborn General Plan 10-31-01, Community Development Plan 6-30-04	Town of Sherborn	October 2001, Plan
<b>Shoreline Summary Survey, State of the Hop Brook, 1994-1995</b>  Results of shoreline survey of 9.4 miles ofHop Brook	Hop Brook Protection Association,  Sudbury Conservation Commission, and Massachusetts Riverways, Adopt-A- Stream Program	June 26, 1995 Report

**SuAsCo River Watershed Assessment Report  
Southborough Soil Suitability Composite & Zoning Map**

Southborough Soil Suitability Composite & Zoning Map

**June 30, 2005**

Cartographic  
Associates, Inc.

January 1, 1996  
Map  
Map

**SuAsCo MWI Work Plans/ Projects/ Priorities/ Survey 1998-2004  
Plans/ Projects/ Priorities/ Survey for MWI Program**

Mike Fleming, DCR

3/1/2005  
Guidance

**Sudbury Assabet Concord River Basin Study**

Sudbury Assabet Concord River Basin Study

SuAsCo River Basin  
Group of League of  
Women Voters

December 1963  
Report  
Report

**Town of Chelmsford Wellhead Project**

Town of Chelmsford Wellhead Project- body nd inserts

Andrew Sheehan

Study

**Walden Pond Environmental Setting and Current Investigations  
Walden Pond Environmental Setting and Current Investigations**

USGS

6/1998  
Pamphlet/Brochure/Loose Pages

**Walden Woods Newsletter, 2004-2005**

Walden Woods Newsletter, 2004-2005

Walden Woods  
Project and Thoreau  
Institute

2005  
Pamphlet/Brochure/Loose Pages

**APPENDIX C**

**ACRONYMS AND ABBREVIATIONS**

### Appendix C Acronyms and Abbreviations

<b>Term</b>	<b>Description</b>	<b>Term</b>	<b>Description</b>
cfs	cubic feet per second	mg/l	milligrams per liter
CMR	Code of Massachusetts Regulations	mi <sup>2</sup>	square miles
ACOE	Army Corps of Engineers	MS4s	Municipal Separate Storm Sewer Systems
CPA	Community Preservation Act	MWI	Massachusetts Watershed Initiative
DO	Dissolved Oxygen	MWRC	Massachusetts Water Resource Commission
EOEA	Massachusetts Executive Office of Environmental Affairs	MWQS	Massachusetts Water Quality Standards
FEMA	Federal Emergency Management Agency	msl	Mean Sea Level
FERC	Federal Energy Regulatory Commission	NPDES	National Pollution Discharge Elimination System
ft/mi	feet per mile	ntu	Nephelometric Turbidity Units
gpd	gallons per day	ppm	parts per million
gpm	gallons per minute	SWQS	Surface Water Quality Standards
IWPA	Interim Wellhead Protection Area	TMDL	Total Maximum Daily Loads
LID	Low Impact Development	µg/l	microgram per liter
DCR	Massachusetts Department of Conservation and Recreation	USFWS	United State Fish and Wildlife Service
DEM	Massachusetts Department of Environmental Management (now part of DCR)	USGS	United States Geological Survey
DEP	Massachusetts Department of Environmental Protection	WAP	Watershed Action Plan
DFW	Massachusetts Department of Fish and Wildlife	WMA	Water Management Act
DPH	Massachusetts Department of Public Health	WMZ	Waste Management Zones
MCL	Maximum Contaminant Level	7Q10	Lowest 7-day average flow over a 10 year period
mgd	Million gallons per day		

**APPENDIX D**

**GLOSSARY**

**Aquifer** – an underground permeable geological formation capable of storing and yielding groundwater to wells and springs.

**Best management practices (BMPs)** - devices and/or management practices designed to slow the speed of stormwater runoff and to temporarily store and/or to treat stormwater runoff in order to mitigate flooding and reduce pollution to receiving waters. BMPs include activities or structural improvements that help reduce the quantity and improve the quality of stormwater runoff. Examples of BMPs include hay bales, silt fencing, vegetative buffers, infiltration beds, riprap (crushed rock), detention basins, grass channels, and street sweeping.

**Catch basin** - a device that collects stormwater and traps some material before the stormwater flows into a stormwater drainage system.

**Culvert** - a drain or conduit under a road or embankment.

**Drainage basin** – see “watershed”.

**Erosion** - the process by which a material is worn away by water or air.

**Evaporation** - the process of liquid water becoming water vapor, including vaporization from water surfaces and land surfaces.

**Evapotranspiration** – the production and release of water vapor by living plants.

**Fertilizer** - any organic or inorganic material of natural or synthetic origin that is added to soil to supply elements essential to plant growth.

**Groundwater** - water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper layer of the saturated zone is called the water table.

**Herbicide** – a chemical or mix of chemicals used to kill weeds or particular plants

**Hydrologic cycle** – see “water cycle”.

**Impervious** - the property of a material that does not allow, or allows with great difficulty, the movement or passage of water. Pavement, rock, and clay are examples of impervious substances.

**Non-point source pollution** – water pollution coming from many diffuse sources, such as stormwater.

**Nutrients** - any substance that is taken in by organisms and promotes growth. For example, phosphorus, nitrogen, and potassium are essential to plant growth and are therefore referred to as “nutrients”.

**Outfall** - the outlet or structure where a stormwater drainage system or effluent pipe discharges to a receiving water body.

**Percolation** - the movement of water through the openings in rock and soil.

**Pervious** – the property of a material that allows the passage of water. Gravel and sand are examples of pervious substances.

**Pesticide** – a chemical or mix of chemicals used to kill pests or particular insects

**Pet waste** - waste from pets, particularly dogs and cats.

**Point-source pollution** - water pollution coming from a single point, such as a sewage outflow pipe.

**Pollution** – the degradation or impairment of a natural resource.

**Precipitation** - rain, snow, hail, sleet, dew, fog and frost.

**Recharge** - water absorbed into an aquifer. Rainfall seeping or percolating into the ground is an example of recharge.

**Reservoir** - a place where water is collected and stored for use.

**Runoff** – precipitation or snow melt that does not percolate into the ground but instead flows over the ground directly into streams, lakes or other water bodies or flows indirectly into such water bodies through a storm drainage system.

**Sediment** – a material that is suspended in water or deposited from suspension on the bottom surface of a water body.

**Storm drain** - a drain, grated cover or curb opening that carries stormwater away from the land into the underground piping of a storm drain system.

**Storm drain system** – a system that collects, conveys, channels, holds, inhibits, retains, detains, infiltrates and/or diverts stormwater.

**Stormwater** – the runoff water after it rains or snows.

**Surface water** - water that is visible from the land surface (for example: streams, rivers, lakes, ponds, wetlands).

**Water body** – a stream, river, lake, pond, wetland, ocean or other body of water.

**Water cycle** - the cyclical transfer of water from the Earth's surface via evaporation and evapotranspiration into the atmosphere, from the atmosphere via precipitation back to earth.

Once on the earth, water may recharge into the groundwater ultimately feeding streams, rivers and lakes or water may runoff directly into streams, rivers, lakes and ultimately into the oceans. Also called the “hydrologic cycle”.

**Water quality** - the chemical, physical, and biological characteristics of water.

**Watershed** - the land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevation between two areas on a map, often along a ridge. Large watersheds, like the Mississippi River Watershed, contain thousands of smaller watersheds. Also called a “drainage basin”.

**Well** - an artificial excavation for withdrawing water from an aquifer.

**Wetlands** - areas characterized by saturated soils most of the year that form an interface between land-based and aquatic environments; including freshwater marshes around ponds and streams.