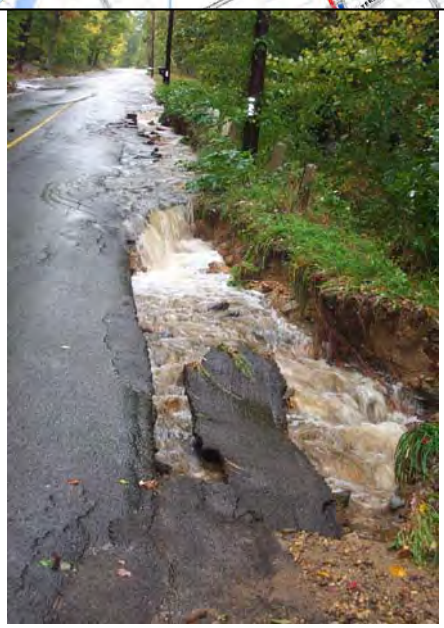
Stormwater Management Master Plan

Town of Auburn, MA



DECEMBER 30, 2009
UPDATED MARCH 5, 2010
UPDATED MARCH 22, 2010

Prepared for:

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104 Central Street
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SUPPLEMENTAL INFORMATION

STORMWATER MANAGEMENT MASTER PLAN

TOWN OF AUBURN, MASSACHUSETTS

MARCH 22, 2010

As a follow-up to the presentation to the Board of Selectmen on March 8th, the Stormwater Committee and CEI have re-evaluated the Stormwater Management Compliance Costs to determine the "bare minimum" requirements, recognizing the current economic constraints of the Town's residents and businesses.

The original Stormwater Compliance Cost summary (Section 5.0) accounted for existing NPDES Phase II Permit requirements, along with pending permit requirements that have been issued by EPA as draft permits. EPA expects to issue the draft NPDES Phase II Permit for the Town of Auburn and other communities in the Interstate South-Flowing Watershed in 2010. In order to establish a fiscally stable Stormwater Master Plan covering a 20 year planning period, as required by Massachusetts DEP, the potential costs associated with the pending permit requirements were included within the original Stormwater Compliance Cost summary.

Recognizing the current economic constraints and that the pending permit requirements have not been finalized, we re-evaluated the Stormwater Compliance Cost summary to determine the "bare minimum" funding necessary to comply with only the existing NPDES Phase II Permit requirements. Attached is a copy of a revised summary entitled "Minimum 5-Year Stormwater Compliance Costs" that reflects our efforts to date.

Major items/differences to note:

- Additional street sweeping of critical areas is not included, as street sweeping will be limited to current "annual" schedule.
- Construction of new BMPs and retrofitting of existing BMPs have been eliminated, since the implementation of BMPs for water quality improvement is not explicitly required by the existing permit.
- Proposed stormwater infrastructure projects to address flooding problems have been eliminated, since they are not explicitly required by the existing permit.
- Proposed chemical treatment of Leesville Pond for control of noxious aquatic plants has been eliminated, recognizing that the Town has started an annual program of winter water level drawdowns in an attempt to cost effectively control these noxious aquatic plants. Chemical treatment may be required in the future if the winter drawdowns are unsuccessful.
- Enhanced program for illicit discharge detection and elimination has been eliminated, since these activities are not explicitly required by the existing permit.

Additionally, the following Stormwater Compliance Costs are presently covered under the Town's existing General Fund:

- Indirect Costs
  (eliminated completely from "Minimum 5-Year Compliance Cost")
- Rehabilitation of Existing Stormwater Infrastructure
  (deduction shown for proposed value of the Storm Drain account)

In summary, the re-evaluation results in an average annual stormwater compliance cost of approximately $300,000 based upon complying with the minimum requirements of the existing NPDES Phase II permit only and considering the first 5 years only. For comparison, the original Stormwater Compliance Costs were estimated to be approximately $684,000 as an annual average for the first 5 years.

The following table provides the estimated annual stormwater charges that would be necessary for the Minimum Compliance Costs, for both the fee basis and the tax basis.

Revised Table 6-1. Summary of Estimated Impact

Classification	***Fee Basis***	***Tax Basis***
Residential	$23 per year $2 per month flat fee all residential properties	On average $35 per year based on property value
Non-Residential (average costs)	$525 per year $44 per month on average based on volume of runoff	On average $183 per year based on property value

Residential tax impact based upon a "typical" residential property with $255,000 valuation. Non-residential charges based upon "typical" non-residential property with 45,000 sf impervious area and $822,000 valuation. Note that these revised estimates are preliminary and therefore subject to further change.

Minimum 5-Year Stormwater Compliance Costs (O&M and Capital)
(See Note 1)

Stormwater Compliance Component	Annual Compliance Costs				
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
#1 Increase Infrastructure Maintenance	$140,000	$110,000	$110,000	$110,000	$110,000
#1a - 1d *Annual Catch Basin Cleaning (1635 structures), Existing BMP Maintenance (16 BMPs), Outfall Cleaning (64 with heavy sediment), Sediment Hauling and Disposal*					
Labor (including Benefits)	$50,000	$50,000	$50,000	$50,000	$50,000
Sediment Disposal (Hauling and Tipping Fees)	$70,000	$60,000	$60,000	$60,000	$60,000
Subcontractor	$20,000	$0	$0	$0	$0
#4 Improve Existing Infrastructure	$90,000	$120,000	$115,000	$110,000	$105,000
#4a Stabilize eroded outfalls - stabilize outfalls with observed heavy erosion (23 eroded outfalls at $5,000 per outfall)	$0	$15,000	$15,000	$15,000	$15,000
#4b Repair outfalls - repair outfalls with observed cracks, corroded pipes, undermined headwalls/pipes (30 deteriorated outfalls @ $5,000 per outfall)	$0	$20,000	$20,000	$20,000	$20,000
#4c Replace/rehabilitate deteriorated pipes and catch basins (1000+ feet per year including MH/CB @ $150 per foot)	$170,000	$170,000	$170,000	$170,000	$170,000
Deduction for Existing Storm Drain Funds (already accounted for within Town Engineer Budget)	($80,000)	($85,000)	($90,000)	($95,000)	($100,000)
#5 Control Noxious Aquatic Plants - Auburn Pond, Eddy Pond, Pondville Pond & Stoneville Pond	$31,000	$23,000	$23,000	$31,000	$23,000
Auburn Pond - chemical treatment	$3,000	$3,000	$3,000	$3,000	$3,000
Eddy Pond - chemical treatment (partial treatment, north of boat ramp to Route 20)	$8,000	$8,000	$8,000	$8,000	$8,000
Pondville Pond - chemical treatment ($20K first year, $12K second & third year, then repeat cycle)	$20,000	$12,000	$12,000	$20,000	$12,000
#6 Administration - GIS work, reviews, inspection	$30,000	$30,000	$30,000	$30,000	$30,000
#7 Public Education	$4,000	$4,000	$4,000	$4,000	$4,000
#7a Website enhancements and upkeep	$0	$0	$0	$0	$0
#7b Participate in pond cleanups (Phase II Program)	$1,000	$1,000	$1,000	$1,000	$1,000
#7c Implement public outreach program - press releases, flyers, brochures, newsletters, articles	$3,000	$3,000	$3,000	$3,000	$3,000
#8 Other Phase II	$4,000	$4,000	$4,000	$4,000	$4,000
#8a Perform annual stormwater training	$1,500	$1,500	$1,500	$1,500	$1,500
#8h Annual reporting	$2,500	$2,500	$2,500	$2,500	$2,500
Total Stormwater Compliance Components (not including Draft Permit Req'ts or Indirect Costs or Existing SW Budget)	$299,000	$291,000	$286,000	$289,000	$276,000

Note 1: Minimum Stormwater Compliance Costs based upon Existing NPDES Phase II Permit Requirements. Future stormwater compliance costs anticipated to increase significantly due to pending re-issuance of NPDES Phase II Permit, based upon draft NPDES Phase II Permits issued to date by EPA (Region 1).

Table of Contents

Stormwater Master Plan

1.0 Introduction 1-1

2.0 Town Characteristics 2-1
2.1 Community Information 2-1
2.2 Land Use and Zoning 2-1
2.2.1 Land Use 2-1
2.2.2 Zoning 2-2
2.3 Demographics 2-2
2.4 Urbanized Area 2-3
2.5 Water Bodies 2-4
2.6 303(d) Impaired Waters and TMDLs 2-4
2.7 Water Supplies 2-6
2.8 Rare or Endangered Species, Critical Habitat and Essential Fish Habitat 2-6
2.9 Historic Properties 2-7
2.10 Personnel 2-8

3.0 Stormwater Infrastructure 3-1
3.1 Infrastructure Inventory 3-1
3.1.1 Infrastructure Age 3-2
3.1.2 Infrastructure Materials and Conditions 3-2
3.2 Drainage Issues – Localized Flooding 3-11
3.2.1 Flooding Sites 3-12
3.2.2 Maintenance Practices 3-12

4.0 Water Quality 4-1
4.1 Subwatersheds 4-1
4.2 Water Quality Problems 4-4
4.3 Existing Water Quality BMPs 4-5
4.4 Additional Water Quality Needs 4-8
4.4.1 BMP Site Selection 4-8
4.4.2 BMP Prioritization 4-8
4.5 Illicit Discharge Investigations 4-12

5.0 Recommendations 5-1

6.0 Stormwater Funding 6-1

Table of Contents

List of Tables

Table 2-1 Town of Auburn Demographics
Table 2-2 303d Listed Waters in Auburn
Table 3-1 Summary of Storm Sewer System Age
Table 3-2 Structural Outfall Characteristics
Table 3-3 Summary of Outfalls in Need of Stabilization
Table 3-4 Summary of Outfalls in Need of Repair
Table 3-5 Summary of Outfalls in Need of Cleaning
Table 3-6 Summary of Flooding Sites and Proposed Improvements
Table 3-7 Summary of Existing Maintenance Practices
Table 4-1 Subwatershed Prioritization Scheme
Table 4-2 Subwatershed Priority Summary
Table 4-3 Summary of Subwatershed Characteristics
Table 4-4 303d Listed Waters in Auburn
Table 4-5 Summary of Existing Water Quality BMPs
Table 4-6 Proposed BMP Summary Table & Priority Matrix
Table 4-7 BMP Ranking Criteria for Water Quality Characteristics
Table 4-8 Proposed BMP Summary Table & Priority Matrix
Table 4-9 Illicit Discharge Indicators
Table 5-1 20-Year Capital Improvement Plan
Table 5-2 Proposed Water Quality BMPs
Table 5-3 Water Quality Retrofits to Existing BMPs
Table 5-4 Recommended Flooding Improvements
Table 5-5 Recommended Controls for Invasive Species

List of Figures

Figure 2-1 Land Use
Figure 2-2 Zoning Districts
Figure 2-3 Urbanized Area
Figure 2-4 Resource Waters & Historic Places
Figure 2-5 Impaired Waters: 303d & TMDL
Figure 2-6 Water Supplies & Zone I/II Aquifers
Figure 3-1 Storm Drain Infrastructure
Figure 3-2 Storm Drain Infrastructure Age
Figure 3-3 Stormwater Outfalls in Need of Improvement
Figure 3-4 Flooding Sites
Figure 4-1 Subwatershed Boundaries
Figure 4-2 Existing Water Quality BMP Locations
Figure 4-3 Proposed Water Quality BMP Locations
Figure 4-4 Soils Classification
Figure 5-1 High Maintenance Street Sweeping Locations

Table of Contents

List of Appendices

Appendix A	Natural Heritage & Endangered Species Program (NHESP) Letter on Endangered Species in Auburn
Appendix B	Outfall Inspection Logs
Appendix C	TMDL Reports

1.0 Introduction

Auburn is one of 189 Massachusetts towns regulated under the Environmental Protection Agency's (USEPA) National Pollutant Discharge Elimination System (NPDES) Phase II rule (40 CFR 122) published as a final rule on December 8, 1999. The Phase II rule requires regulated operators of municipal separate storm sewer systems (MS4s) to develop a Stormwater Management Plan (SWMP) and Best Management Practices (BMPs) to reduce the impacts of stormwater discharges. This first five-year Phase II permit expired on April 30, 2008 but continues in effect until the revised permit is issued.

Stormwater Management Programs will vary from one community to another due to the existing level of effort and the unique stormwater handling procedures in each town. The Phase II rule leaves much of the implementation details up to the community to decide what fits best for them. The final result is that each program needs to be carefully tailored to the community's needs while meeting the intent and spirit of Phase II stormwater regulations.

The Town's tailored approach to Phase II compliance is documented in the "Phase II Stormwater Management Plan" dated July 2003, as prepared by Comprehensive Environmental, Inc. Although some aspects of this previous document are included herein for completeness, this document is intended solely as an implementation tool, recognizing the current staffing and budgetary constraints of the Town.

The stormwater master plan documented in this report identifies the specific tasks and projects that the Town should implement in order to meet the current and anticipated Phase II requirements. In addition to establishing the necessary operations and maintenance requirements, this report establishes a stormwater capital improvement plan, focusing on both infrastructure and water quality.

This report is structured as follows:

- Overview of Town Characteristics, focusing on those aspects related to stormwater and overall water quality.
- Description of the Town's existing stormwater infrastructure and its current condition.
- Description of the Town's water resources, their condition, existing stormwater treatment or controls, and recommended improvements to address existing water quality problems.

- Summary of Recommendations, including a 20-year master plan that encompasses operations/maintenance activities and proposed capital projects/expenditures.
- Overview of potential Stormwater Fee development.
- Description of the GIS database that was developed as part of the Town's ongoing Phase II compliance efforts.

Section 6.0 outlines the various alternatives for funding implementation of the Stormwater Master Plan, including a stormwater fee as a potential method of stormwater funding, in a fair and equitable manner.

The development of this program was funded with a subsidized loan through MassDEP under the Clean Water State Revolving Fund (CWSRF) Program.

2.0 Town Characteristics

This section provides some background information on the Town of Auburn, useful in understanding the Town's resources to develop a tailored Stormwater Master Plan. Town characteristics are described below.

2.1 Community Information

Auburn, MA is located in central Massachusetts in Worcester County between the City of Worcester and town's of Leicester, Oxford and Milbury. Community profile information is provided below:

- Size: 16 square miles *(source: MA Department of Housing and Community Development)*
- 2005 Population: 16,216 *(source: US Census Bureau, 2005 Census Estimate)*
- Registered Voters: 9,426 *(source: MA Department of Housing and Community Development)*
- 2007 School Enrollment: 2,232 *(source: MA Department of Education)*
- Miles of Roads: 159; 87 of which are Town accepted *(source: MassGIS)*
- Total Drainage Catch Basin Structures: 1,656 (*source: Highway Department)*
- Town Sewer Coverage: 80-85% *(source: Sewer Department)*
- 2007 Median Household Income: $67,011 *(source: US Census Bureau, 2008 Estimate)*
- FY08 Tax Rate: $11.77 Residential, $23.02 Commercial *(source: 2008 Auburn Town Report)*
- Town Operating Budget: $45.3 Million (*source: Auburn Selectmen's Office, FY 2009)*

2.2 Land Use and Zoning

2.2.1 Land Use

The land uses in Auburn are shown on Figure 2-1. General land use in Auburn is as follows:

- Residential (all types) – 34.4%
- Industrial – 3.42%
- Commercial – 4.45%
- Open Space (Forest, Open Land, Recreation Areas) – 51.85%
- Agriculture- 5.88%.
  (source: Town of Auburn Assessor's Office)

The Town is more densely developed along or near Route 290, Route 12, Route 90 and Route 20.

2.2.2 Zoning

The existing zoning districts in Auburn are shown on Figure 2-2. The land area covered by each zone is as follows:

- Residential- 82%
- Commercial – 9%
- Industrial - 8%
- Office- 1%.
  (source: Town of Auburn Assessor's Office)

Auburn also has several overlay districts that are protective of natural resources, including:

- Zone I, II and III Ground Water Protection Districts
- Aquifer and Watershed Protection Overlay District
- Flood Plain Overlay District
- Open Space Residential Development Overlay District.

2.3 Demographics

Town demographics play a role in developing a public education program that targets the appropriate audience through the most appropriate means. For example, only 3.5% of the population does not speak English "very well", indicating that public education materials in other languages is not necessary. Table 2-1 presents the general demographics of the Town of Auburn.

Table 2-1. Town of Auburn Demographics[1]		
	Population	**% of Population**
Age		
0-14 yrs	3,011	19
15-24 yrs	1,473	9
25-54 yrs	7,115	44
55-64 yrs	1,735	11
65+ yrs	2,882	18
Housing Tenure (units)		
Owner-occupied	5,219	82.2
Renter-occupied	1,127	17.8
Race[2]		
White	15,510	97.5
Black or African American	92	0.6
American Indian and Alaska Native	18	0.1
Asian	142	0.9
Native Hawaiian and Other Pacific Islander	4	0.0
Hispanic or Latino	166	1
Some other Race	37	0.2
Two or more races	98	0.6
Language Spoken at Home[3]		
English Only	14,159	94.1
Language other than English	888	5.9
Speak English Less than "Very Well"	532	3.5

1. US Census Bureau, 2005 Census Estimate, American FactFinder.
2. Total population by race is greater than actual population due to people reporting under more than one race.
3. Figures are based on the population 5 years old and over in Auburn.

2.4 Urbanized Area

Most of Auburn is considered an urbanized area. An Urbanized Area (UA) is defined by EPA as:

"a land area comprising one or more places – central place(s) – and the adjacent densely settled surrounding area – urban fringe – that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile."[1]

Approximately 13.7 square miles or 85.8% of the Town of Auburn is designated an Urbanized Area (UA) by the US Census Bureau (See Figure 2-3). The UA in Auburn encompasses almost the entire town.

[1] EPA Fact Sheet 2.2, Stormwater Phase II Final Rule – Urbanized Areas: Definition and Description, December 1999.

2.5 Water Bodies

The ultimate goal of this Stormwater Master Plan is to outline a program to effectively maintain the Town's stormwater infrastructure and to improve the water quality of receiving waters (waters which receive stormwater discharges) in compliance with the Federal Phase II Stormwater Management Program. This is consistent with Auburn's "Open Space and Recreation Plan" which details the town's commitment "to protect the town's recreational and drinking water resources, and to increase public awareness on the importance of water quality." Figure 2-4 shows the following resource waters in Auburn:

Dark Brook	*Kettle Brook*
Wellington Brook	*Leesville Pond*
Pondville Pond	*Stoneville Pond (Lower Stoneville Res.)*
Tinker Hill Pond	*Stoneville Reservoir (Upper Stoneville Res.)*
Auburn Pond	*Eddy Pond*
Dark Brook Reservoir	*Dark Brook (Dunns Brook)*

The protection and improvement of the Town's resources is essential to providing safe drinking water and recreational opportunities to residents and businesses.

2.6 303d Impaired Waters & TMDLs

303d impaired waters are those surface waters identified by the MA DEP as priority waters that do not meet water quality criteria. The State has made the improvement of these waters a priority, requiring Towns to take actions to improve impaired waters, specifically those that have a completed Total Maximum Daily Load (TMDL) study, as part of a comprehensive Phase II Stormwater Management Program. In addition to the six minimum control measures required under the Phase II Program, this plan outlines specific BMPs to help address impaired waters. Table 2-2 provides a summary of the 303d waters in Auburn by category with information for known pollutants and TMDL status. These waters are shown in Figure 2-5.

Table 2-2. 303d Listed Waters in Auburn[1]			
Water Body	**Category**	**Impairment**	**TMDL**
Dark Brook (Outlet of Eddy Pond to confluence with Kettle Brook)	Category 5[2]	Unknown	Not Completed
Kettle Brook (Outlet of Waite Pond, Leicester, through Leesville Pond, Auburn, to inlet of Curtis Pond, Worcester)	Category 5	Nutrients, Organic Enrichment, Low DO, Flow Alteration, Pathogens	Not Completed
Auburn Pond	Category 4C[3]	Noxious Aquatic Plants and Exotic Species	Completed April 2002
Dark Brook Reservoir	Category 4C	Exotic Species	Not Completed
Eddy Pond	Category 4C	Noxious Aquatic Plants and Exotic Species	Completed April 2002
Pondville Pond	Category 4C	Noxious Aquatic Plants and Exotic Species	Completed April 2002
Stoneville Pond	Category 4C	Noxious Aquatic Plants and Exotic Species	Completed April 2002
Tinker Hill Pond	Category 4C	Exotic Species	Not Completed
Leesville Pond	Category 4C	Excess Nutrients, Organic Enrichment, and Low DO Levels	Completed May 2002

1. The information presented in this table is based on the *Massachusetts Year 2002 Integrated List of Waters, Proposed Listing of Individual Categories of Waters, October 2002*. Refer to Figure 2-4 for locations.
2. Category 5 - Waters requiring a TMDL.
3. Category 4C - Impairment not caused by pollutants.

As shown in Table 2-2, TMDLs have been completed for Auburn Pond, Eddy Pond, Pondville Pond, and Stoneville Pond as part of the study entitled *Total Maximum Daily Loads of Phosphorous for Selected Northern Blackstone Lakes, April 2002*. This TMDL Study covered seventeen lakes and ponds within the upper Blackstone River watershed. The TMDL Study recommended watershed management, septic system maintenance and in-lake macrophyte management to improve the water quality in these ponds.

A TMDL study has been completed on Leesville Pond. The report is dated May 14, 2002. Leesville Pond required a TMDL study because of excess nutrients, organic enrichment and low dissolved oxygen levels. The TMDL Study recommended watershed BMPs, improve flushing of the south basin and macrophyte management to improve water quality.

2.7 Water Supplies

Auburn's water supply consists of ten wells located near the Massachusetts Turnpike, Route 395 and South Street. Each of these wells has a Zone I and Zone II protection area. Zone I is defined as the area encompassing a maximum 400-foot radius around the wellhead (assuming a greater than 100,000 gpd withdrawal rate) and Zone II is the area of the supply well's capture zone, based on the predicted drawdown at the approved pumping rate. The Zone II wellhead protection areas encompass a large portion of Auburn, as shown on Figure 2-6. The 2000 Open Space and Recreation Plan identifies the water supply as a priority for protection.

2.8 Rare or Endangered Species, Critical Habitat and Essential Fish Habitat

As part of the Phase II stormwater permit program, the Town must certify that the stormwater drainage system is not impacting the habitat of any federally listed rare or endangered species or critical environmental locations. The national list of endangered species, published by EPA, shows three endangered species (listed below) in Worcester County.

Common Name	Scientific Name	Group
Eagle, Bald	*Haliaeetus Leucocephalus*	Bird
Pogonia, Small Whorled	*Isotria Medeoloides*	Plant
Indiana Bat	*Myotis Sodalis*	Mammal

The Massachusetts Natural Heritage & Endangered Species Program (NHESP), Division of Fisheries & Wildlife was contacted to determine if the above species are present in the Town of Auburn. NHESP determined that there is no occurrence of these species in Auburn, as discussed in a reply letter dated March 21, 2003 (see Appendix A). According to the endangered species assessment requirements included in Addendum A of the MS4 permit, the Town of Auburn meets the Endangered Species Act (ESA) Eligibility "Criterion A" and no further action is required at this time.

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) have identified two species of concern, the

short nosed sturgeon and the dwarf wedge mussel. The short nose sturgeon is present in portions of the Merrimack River and Connecticut River designated as Essential Fish Habitats. The dwarf wedge mussel is located in several rivers and brooks in western Massachusetts (refer to Addendum A of the MS4 permit for detailed listings). MS4s that discharge to these waters are required to consult with the FWS and NMFS to determine that discharges are not likely to adversely affect these species. This Phase II permit requirement does not apply to Auburn since there are no stormwater discharges to any of the waterways designated as Essential Fish Habitats or dwarf wedge mussel habitats.

Under the current permit, the Town is not required to evaluate potential stormwater impacts to sensitive or rare habitats identified by other agencies (state or local). However, this information is provided below to characterize Auburn in terms of other special habitats.

According to the state list of rare species from the Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP), there are two plant species that are listed as threatened and three reptile, one butterfly and two plant species that are listed as special concern species, as outlined below.

Threatened Species	Scientific Name
Bristly Buttercup	*Ranunculus pensylvanicus*
Great Laurel	*Rhododendron maximum*

Special Concern Species	Scientific Name
Spotted Turtle	*Clemmys guttata*
Wood Turtle	*Clemmys insculpta*
Eastern Box Turtle	*Terrapene Carolina*
Hessel's Hairstreak	*Callophrys hesseli*
Hemlock Parsley	*Conioselinum chinense*
Barren Strawberry	*Waldsteinia fragarioides*

Threatened species are those species that are likely to become endangered in the foreseeable future or are declining or rare as determined by biological research or inventory. Special concern species are those species that have suffered a decline that could threaten the species. NHESP builds its database of species using local data and the national database for endangered or threatened species.

2.9 Historic Properties

As part of the Phase II stormwater permit, the Town must determine whether there are any listed historic properties in Auburn and whether stormwater is impacting those properties. The Massachusetts Historical Commission (MHC) maintains the state's historic properties list with state and federal databases. The MHC database shows that Auburn has two historic properties on the national register – the "Joseph Stone

House" on Stone Street and the "Goddard Rocket Launching Site" on Pakachoag Hill Road (refer to Figure 2-4). Stormwater drainage does not adversely affect either of these sites.

2.10 Personnel

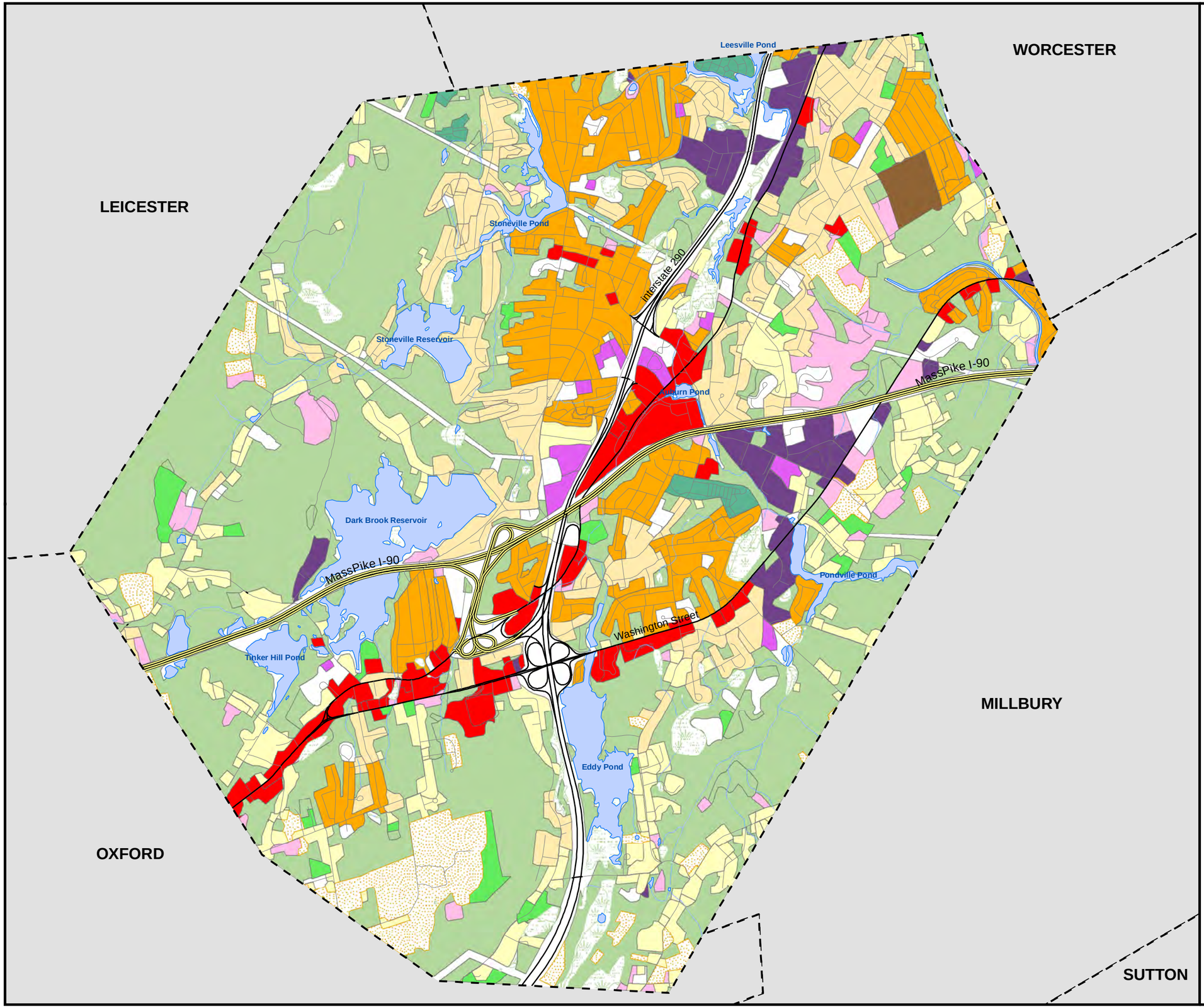
Key personnel involved in the preparation and implementation of this plan are:

- William Coyle, PE – Town Engineer
- Adam Burney, Town Planner – Planning Board
- Darleen Wood, Highway Surveyor – Highway Department
- Jeff Mitchell, Superintendent – Sewer Department
- Richard Weagle, Superintendent – Auburn Water District
- Andrew Pelletier R.S., Inspector – Board of Health
- Charles O'Connor, Interim Town Manager
- Edward Kazanovicz, Assistant Town Manager - Accountant
- Consultant – Comprehensive Environmental Inc.

Figure 2-1

Land Use

Auburn, MA



Legend

- Town Boundary
- Roads
- State Highways & Roads
- Turnpike
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Land Use

- Cemetery
- Commercial
- Cropland
- Forest
- Golf Course
- Industrial
- Open Land
- Pasture
- Recreation
- Residential <1/4 acre
- Residential 1/4 to 1/2 acre
- Residential >1/2 acre

Data Source: MassGIS, Town of Auburn, CEI

N W E S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 2-2

Zoning Districts

Auburn, MA

LEICESTER

WORCESTER

MILLBURY

OXFORD

SUTTON

Leesville Pond

Stoneville Pond

Stoneville Reservoir

Dark Brook Reservoir

Tinker Hill Pond

Auburn Pond

Pondville Pond

Eddy Pond

Interstate 290

Southbridge Street

MassPike I-90

Washington Street

Legend

- Town Boundary
- Roads
- State Highways & Roads
- Turnpike
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Zoning Districts

- General Industry
- Industrial District A
- Industrial Park
- Highway Business
- Local Business
- Residential Office
- Residence A: 10,000-19,999 sq. ft.
- Residence B: 20,000-39,999 sq. ft.
- Residence C: 40,000-59,999 sq. ft.
- Residence R: >60,000 sq. ft.

Data Source: MassGIS, Town of Auburn, CEI

N

W E

S

0 800 1,600 3,200 4,800 6,400 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

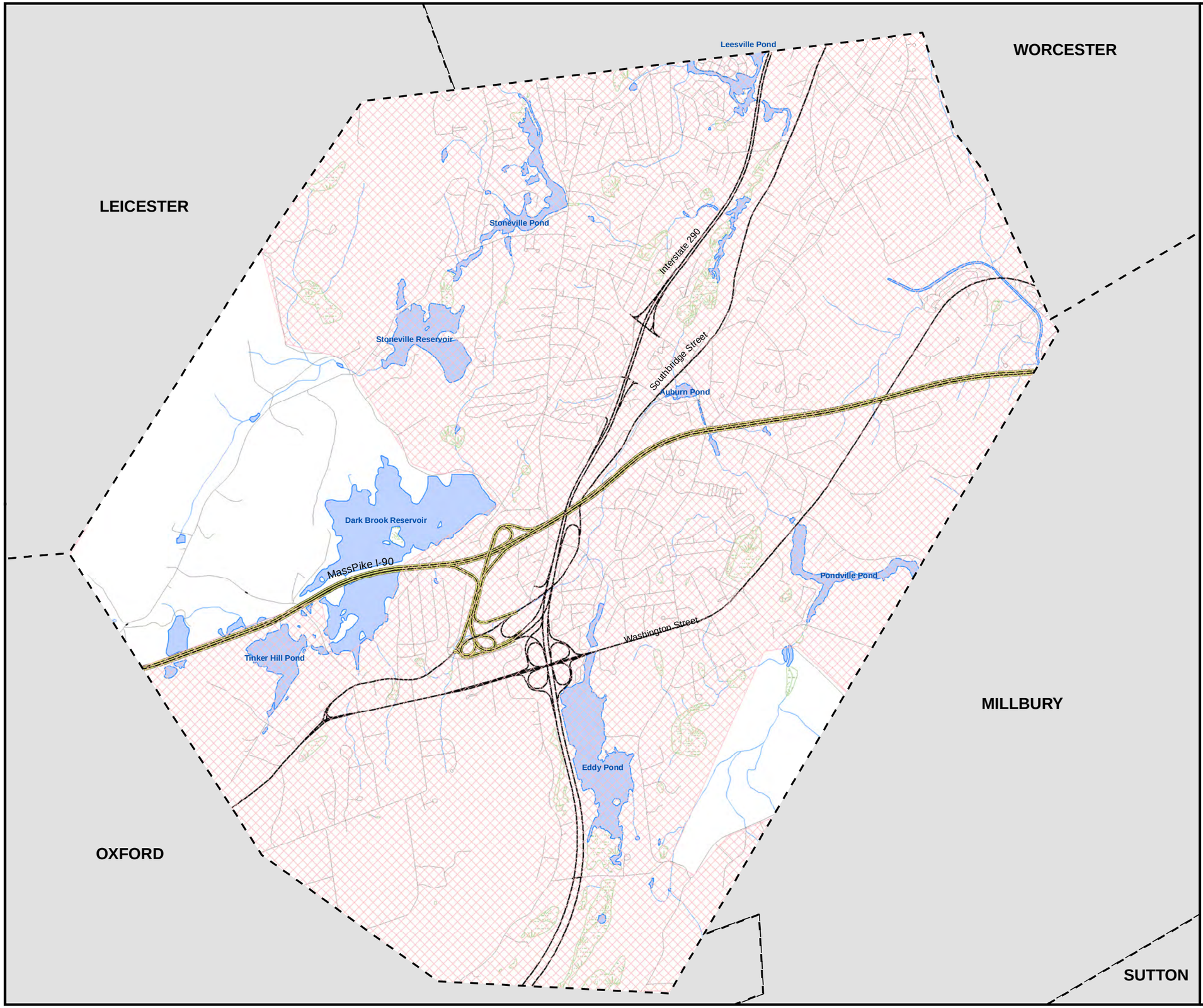


Figure 2-3

Urbanized Area

Auburn, MA

Legend

- Town Boundary
- Urbanized Area
- Roads
- State Highways & Roads
- Turnpike
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

N
W E
S

0 750 1,500 3,000 4,500 6,000 Feet

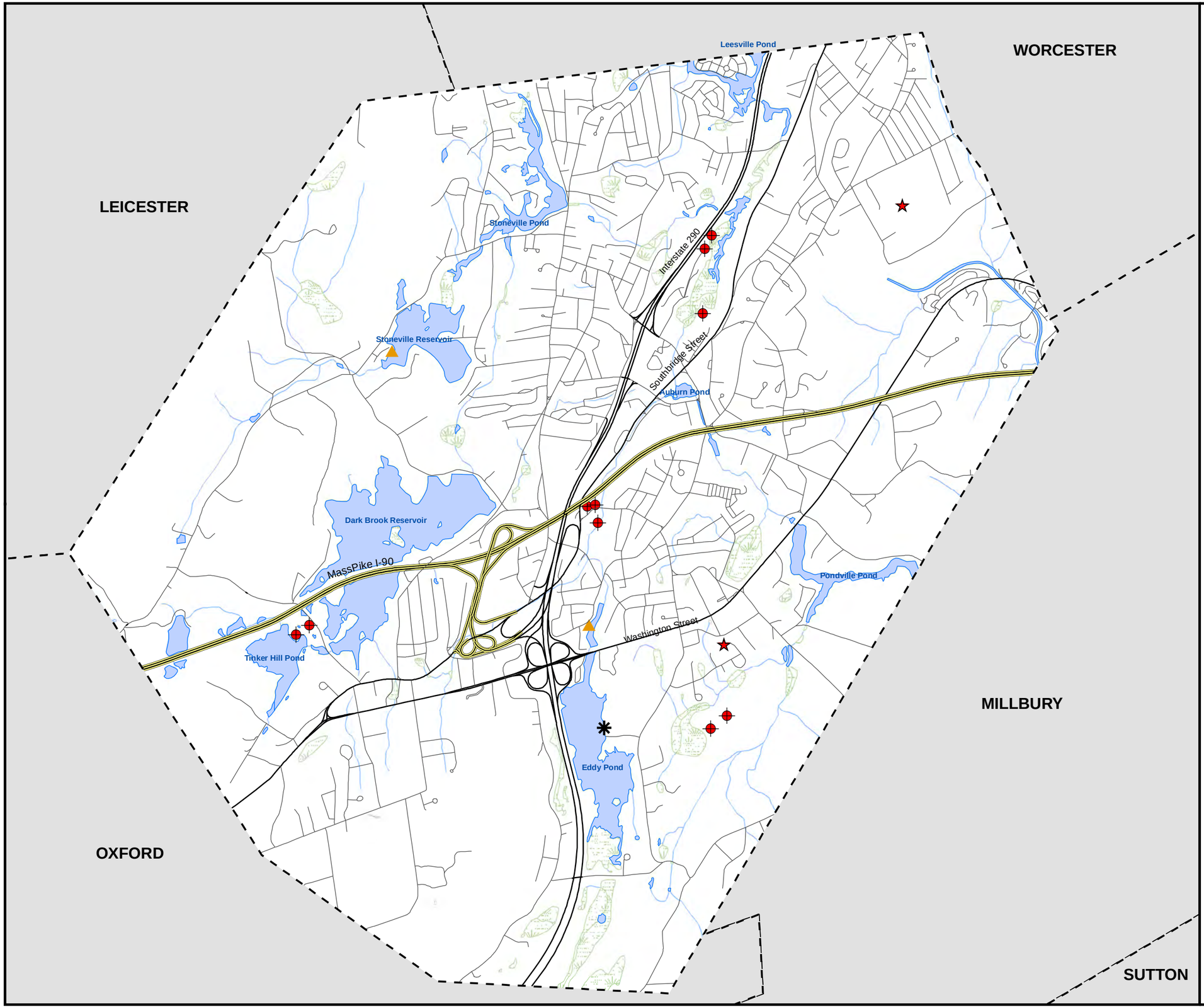
0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 2-4

Resource Waters & Historic Places

Auburn, MA



Legend

- Town Boundary
- Roads
- State Highways & Roads
- Turnpike
- State Register of Historic Places
- Beach Location
- Boat Launch
- Public Wells
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

N W E S

0 750 1,500 3,000 4,500 6,000 Feet

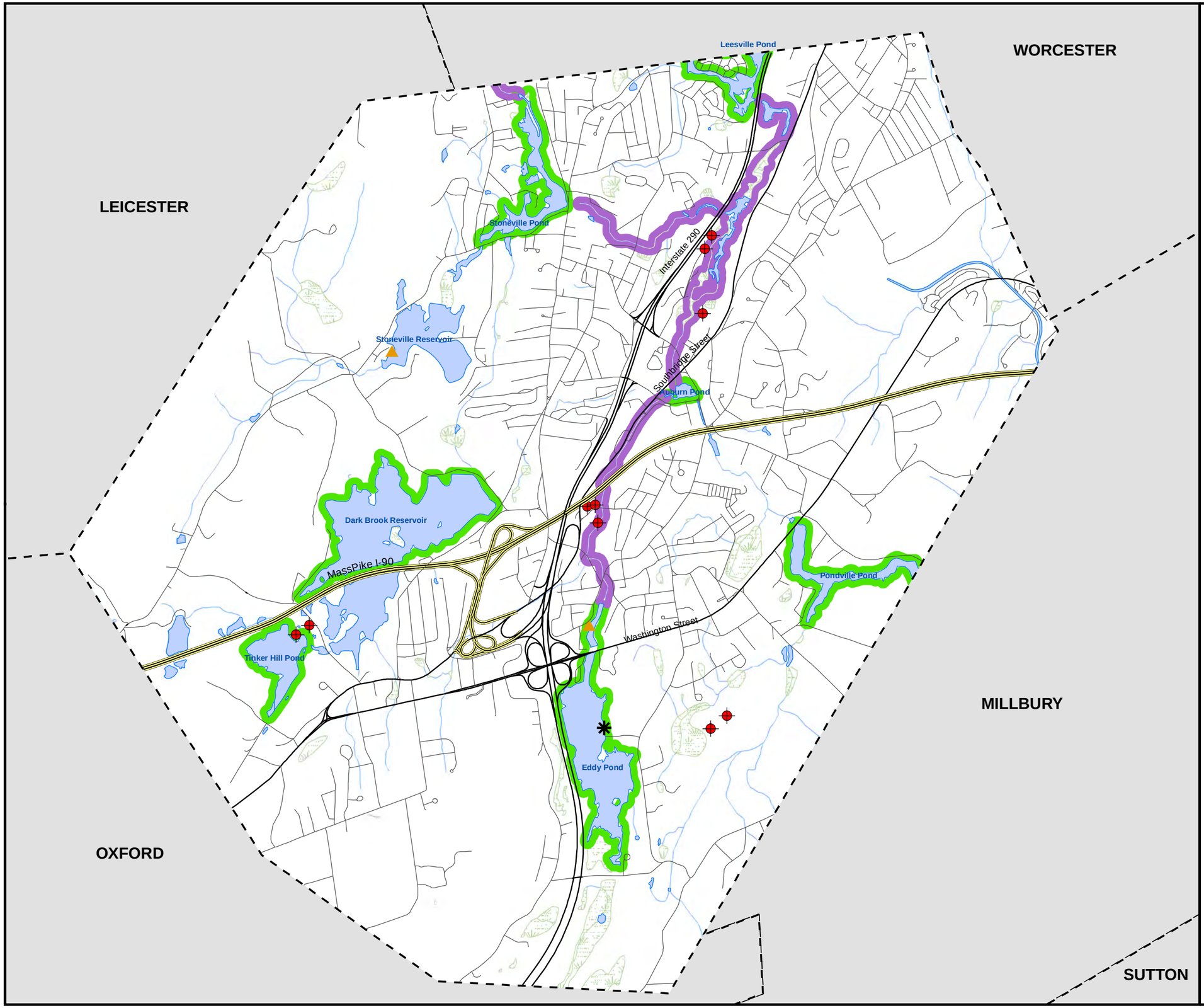
0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 2-5

Impaired Waters: 303d & TMDL

Auburn, MA



Legend

- Town Boundary
- Roads
- State Highways & Roads
- Turnpike
- Beach Location
- Boat Launch
- Public Wells
- Lakes, Ponds

303d Listed Waters

- 4c: Impairment Not Caused by a Pollutant
- 5: Waters Requiring a TMDL
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

Category 4c Waters:
Auburn Pond, Dark Brook Reservoir, Eddy Pond, Pondville Pond, Stoneville Pond, Tinker Hill Pond, Leesville Pond

Category 5 Waters:
Kettle Brook, Dark Brook

Waters with an existing TMDL:
Leesville Pond (May 14, 2002); Auburn Pond, Eddy Pond, Pondville Pond, Stoneville Pond (April 2002).

N W E S

0 750 1,500 3,000 4,500 6,000 Feet

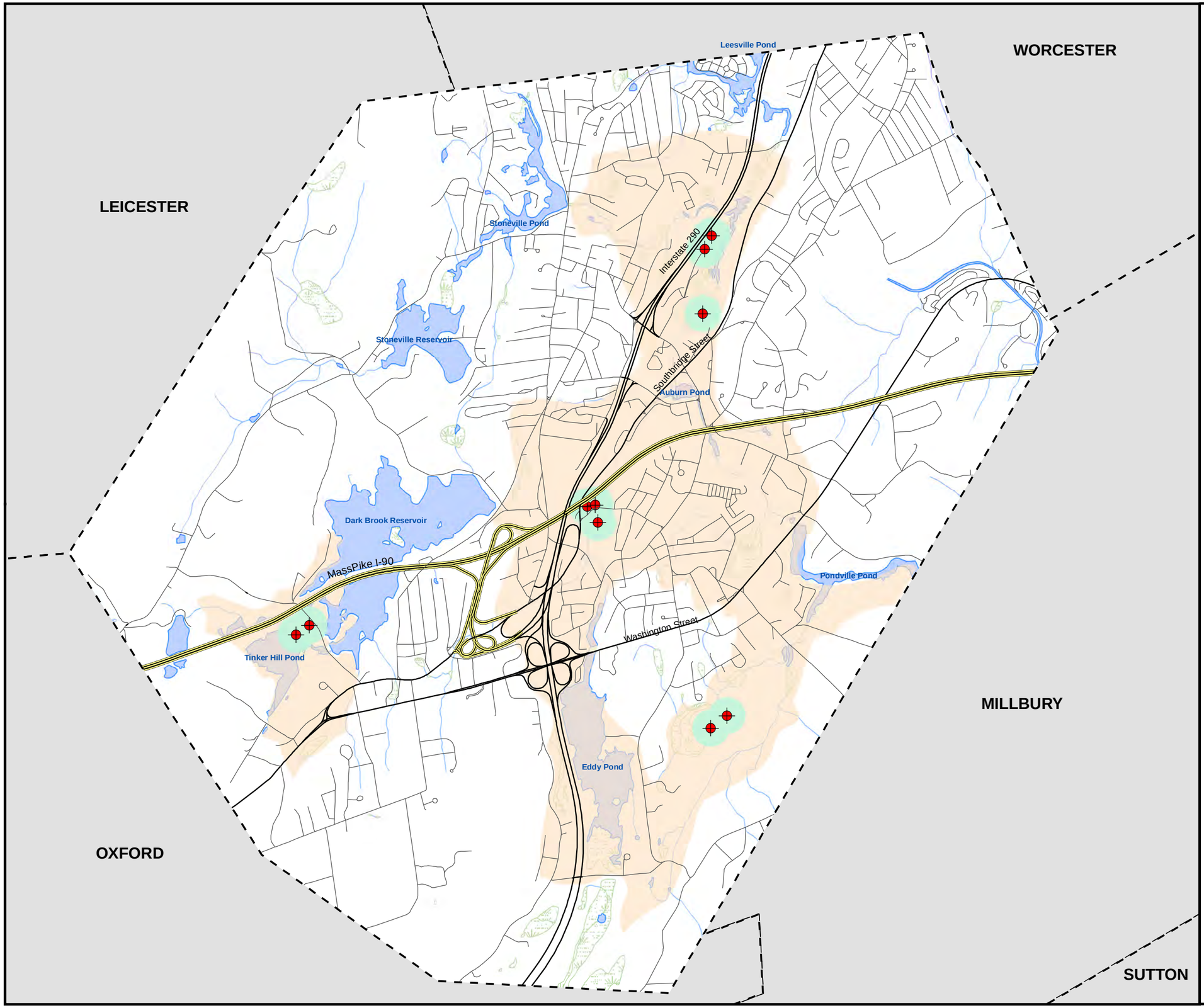
0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 2-6

Water Supplies & Zone I/II Aquifers

Auburn, MA



Legend

- Town Boundary
- Roads
- State Highways & Roads
- Turnpike
- Public Wells
- Zone I Aquifer
- Zone II Aquifer
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

N
W E
S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

3.0 Stormwater Infrastructure

The extent and condition of Auburn's stormwater infrastructure was assessed to evaluate existing and future needs for incorporation into the Stormwater Management Plan, Capital Improvement Plan. Refer to Figure 3-1 for a map of Auburn's existing storm drain network.

3.1 Infrastructure Inventory

A combination of review of existing site plans, visual field inspections, GPS mapping and interviews with Town personnel were used to map Auburn's stormwater infrastructure. The extent of the stormwater infrastructure as determined through this process is summarized below (not including major highways – Routes 90, 290, 395):

- Total Catch Basin Structures = 1,897
  (1,635 belong to Auburn, 262 belong to MassDOT)
- Total Drainage Manhole Structures = 607
  (469 belong to Auburn, 138 belong to MassDOT)
- Total Drainage Outfall Structures = 328
- Total Detention Ponds = 15
- Total Mileage of Piping = 40 miles
  (34 miles belong to Auburn, 6 miles belong to MassDOT)

It is important to note that MassDOT maintains state roads, which include Route 12 and Route 20 in Auburn. These two major routes bisect the Town and contain significant stormwater infrastructure. MassDOT maintains these roads as well as the stormwater infrastructure contained within. About 262 out of the total 1,897 drainage catch basins in the Town of Auburn are on Route 12 or Route 20. Additionally, about 138 of the 607 drainage manhole structures lay within these State roads.

Interstates 90, 290, and 395 also run through Auburn and are the responsibility of MassDOT to maintain. A significant portion of the stormwater drainage structures on these interstates has been mapped. In addition, surficial drainage structures including swales and culverts have been mapped in association with these highways. The mapping reveals that some of the highway stormwater drainage infrastructure ties into Auburn's infrastructure, which may require coordination between Auburn and MassDOT to address water quality problems associated with the combined systems. Generally, each entity is responsible for its contribution to the water quality problem.

The inventory included an evaluation of the condition of the existing stormwater infrastructure based on age, materials and observed conditions as presented below.

3.1.1 Infrastructure Age

The age of stormwater infrastructure was approximated based on the age of roads and subdivisions as determined through the Town's GIS and Assessor's data, which provides information on the year parcels were established. Ages of stormwater structures were separated into three general age categories as summarized in Table 3-1.

New stormwater structures have been installed on many older roads to replace failing infrastructure or lack thereof during roadway reconstruction projects. This Master Plan has accounted for new construction of stormwater drainage through visual inspection, site plans, and interviews with the Town of Auburn staff. Figure 3-2 displays the storm drain network according to its age as approximated from available records.

3.1.2 Infrastructure Materials and Conditions

The types of materials used to construct the stormwater drainage system were determined through visual inspection, sewer and water plans and interviews with Town of Auburn staff and then extrapolated to other areas of Town with similar characteristics.

Piping

Materials

Stormwater pipes are the most difficult structures in the drainage system to assess due to poor access for inspection. As noted previously, the Town-owned stormwater system consists of approximately 34 miles of piping. Based upon observed pipe materials at each outfall and assuming that the upstream stormwater piping is the same material, the breakdown of Town-owned pipe materials was estimated as follows:

- Clay = 2% of pipes or approximately 0.8 miles
- Concrete = 54% of pipes or approximately 18.1 miles
- Corrugated Metal = 26% of pipes or approximately 8.7 miles
- PVC = 2% of pipes or approximately 0.8 miles
- HDPE = 16% of pipes or approximately 5.3 miles

Table 3-1. Summary of Storm Sewer System Age			
	Post-1980	**1950-1980**	**Pre-1950**
Qty of Pipe	9.64 miles (28.5%)	11.55 miles (34.2%)	12.63 miles (37.3%)
Locations	Recent developments in outerlying areas away from Town center, including: • Upland St. area neighborhoods • Potter Farms development • Hilltop Farms development • Bancroft St. area neighborhoods	• Bryn Mawr Ave. neighborhoods • Packachoag St. neighborhoods • Rochdale St. & Burnett St. neighborhoods • Millbury Street developments • Prospect Street neighborhoods	Concentrated in Route 12 corridor northward towards Worcester. Concentrated areas include: • Church St., Central St., & South St. neighborhoods in vicinity of Town Offices • Oxford St. North, Pinehurst Avenue, & Boyce St. neighborhoods • Packachoag St. & Elmwood St. neighborhoods
Assumed Condition	Overall good condition & in working order.	Overall fair condition depending on material.	Potentially deteriorated condition, failing structures & function
Anticipated Maintenance Needs	Cleaning and jetting, inspections.	Cleaning & jetting, reconstruction & replacement of failing structures, inspections.	Cleaning & jetting, complete reconstruction & replacement of failed structures & systems, inspections
Comments	Generally installed in large segments along a significant portion of a road. Typically include numerous catch basins & drainage manholes that discharge to a defined outfall.	Majority installed in 1950s (50 to 60 years old).	Installed with residential development between 1930s & 1940s. No findings of large-scale systems >80 years old. Few manholes & smaller catch basins.

However, based on existing site plans and interviews with long-term Town employees, there is reason to believe that corrugated metal pipes make up a significantly larger portion of the piping than listed above, possibly as much as 90% of the older piping. Based upon the estimated quantity of pre-1950's pipe (12.63 miles) as noted in above, the estimated length of corrugated metal pipe would be 11.37 miles (90% of 12.63 miles), which is slightly higher than the estimated length based upon outfall pipe observations. It is possible that localized pipe replacement has occurred at these outfalls, with such replacement limited to the last pipe segment immediately upstream

of the outfall while the remainder of the associated stormwater piping further upstream would still be corrugated metal.

Concrete pipes make up the majority of the storm drain network piping, with clay and PVC materials the least prevalent. Ductile iron pipes have also been observed at more than one location; however, they do not represent a significant portion of storm drain piping. HDPE storm drain piping has generally been used in new storm drain networks in the past decade.

Condition

The condition of drainage pipes was assessed at outfall locations and in specific drainage networks that were inspected, however, the majority of storm drain pipes could not be properly assessed due to excessive sediment in catch basins and/or installed hoods on pipes. A better understanding of pipe materials and conditions will be made after thorough cleaning of all catch basins in the Town. Of those that were inspected, many were found to be cracked or corroded, including a significant amount of corrugated metal. However, they were still maintaining their function to carry stormwater flows. If there is no flooding observed at catch basins, and outfalls are in good conditions, it was assumed that the storm drain piping is functioning and likely in good condition.

Past studies on the life expectancy of corrugated metal pipes have observed an average life expectancy of more than 80 years, with 17% having deteriorated or failed prior to 50 years. As noted above for the Town of Auburn, it is estimated that 11.37 miles of stormwater piping consist of corrugated metal piping greater than 50 years old. Assuming that 17% of this stormwater piping is deteriorated or failed, it is estimated that approximately 1.9 miles of this corrugated metal piping will need to be replaced.

Catch Basins

Materials

Catch basin structures are less varied in materials than piping, generally built of one of three materials: brick, block, or concrete.

Brick Structures

The oldest catch basins in Town correspond with the pre-1950s piping and were often small, square structures made of brick or stone. Visual inspection revealed many to be in disrepair with the brick and stone matrix often deteriorated and/or collapsing and the shallow structures filled with significant amounts of sediment. Regular cleaning of these structures will prevent allow for better stormwater management and treatment.

In areas with high volumes of stormwater runoff or fast flows, brick and stone structures are not recommended as they have been observed to lose bricks from

stormwater flows. In such locations, deep-sump pre-cast concrete structures will be the most stable.

Block Structures

Block structured catch basins were used for several decades during the middle and later part of the 20th century. Typically formed by cinder blocks and a cement matrix, these structures are the more structurally stable version of brick/stone catch basins. These structures have generally remained intact except in high volume locations, where high volumes and fast stormwater flows have washed out the walls. Cleaning of these structures should be performed regularly to improve stormwater quality and maintain system capacity.

Concrete Structures

Pre-cast concrete catch basins are the most common and preferred type of catch basin structure. These are present throughout the Town of Auburn, and have been used for several decades. They are the most structurally stable catch basin and can be used in high or low flow locations. Most of these structures have a sump in which sediment and debris settles from stormwater. Deep-sump catch basins are recommended for improving stormwater quality due to increased storage capacity for sediment. The extent of these catch basins is unknown due to accumulated sediment in the majority of structures in Town. Upon cleaning catch basins, the Town of Auburn should maintain and update records on catch basin structure and condition. This process is described in Section 7.0.

Condition

Catch basin conditions were assessed while field verifying and mapping the storm drain infrastructure. A significant number of catch basins (upwards of 200) had observed sediment and debris issues. These included catch basins that were covered with debris or sediment; catch basins completely filled with debris or sediment; and catch basins partially filled with debris or sediment. High standing water was also observed in several catch basins, which may be a result of clogged pipes or sediment filled catch basins.

Structural conditions of catch basins were generally fair. The exceptions are older brick and stone catch basins which have observable deterioration of the side walls. These structures are isolated in older neighborhoods of the Town and are few and far between. During catch basin cleaning and inspections, the Town will be able to determine necessary actions to address these deteriorating catch basins. Catch basins should be replaced with deep-sump precast concrete structures if deteriorating conditions are compromising the integrity of a road. Several small sink holes have been observed at catch basins that are structurally deficient.

Drainage Manholes

Drainage manholes are generally constructed with the same materials as the catch basins in the same area. Brick, stone, block, and pre-cast concrete drainage manholes were observed in the Town of Auburn. In most locations, drainage manholes serve as an access point where catch basins drain into a central drainage pipe. The base of most drainage manholes is shaped like a swale to direct stormwater and channelize flow.

Pre-cast concrete drainage manholes are very similar in design to pre-cast catch basins. Instead of having a swale-shaped base, these structures have sumps to trap sediment. An outlet pipe then allows stormwater to flow to the next manhole or outfall structure. These structures have been observed specifically along Upland Street and are likely in other large drainage networks.

Drainage manholes should be inspected regularly, on the same schedule as catch basins. Older brick and stone structures should be inspected to assess structural integrity, especially where high stormwater flows are present. Drainage manholes with deep-sumps will not need to be cleaned regularly if upstream catch basins are maintained. General upkeep of catch basins will decrease the need for maintenance of drainage manholes

Outfall Structures

There are 328 mapped outfall structures in Auburn consisting of three general types: 1) no structures except for the outfall pipe, 2) flared ends at the outfall; or 3) headwalls. Outfall locations that have no structures associated with it are described as having 'no protection'. These locations are more susceptible to stormwater flow velocities, erosion, and water quality issues. Outfalls with flared ends slow the stormwater flow velocity and spread the flows over a larger surface area. Headwalls at outfalls provide slope stability and alleviate erosion caused by stormwater exit flows. Outfall structures vary in effectiveness based on specific site characteristics.

Each outfall was inspected for its condition and to identify needed improvements during illicit discharge investigations. A description of the structural characteristics evaluated during field inspections is included in Table 3-2.

The inspections revealed:

- 23 outfalls with heavy erosion in need of stabilization – Scour marks or ruts are often present at these outfalls, a result of high stormwater flows and velocities. Such locations are often structurally unprotected (i.e. no headwall, rip rap, flared ends) and can cause excessive erosion and instability to the outfall itself. The eroded sediment can cause water quality problems downstream. A list of these outfalls is included in Table 3-3. Refer to Figure 3-3 for locations.

- 30 outfalls with cracks, corrosion or undermined headwalls in need of repair – These outfalls had varied insufficiencies including cracked or corroding pipes, partially buried or collapsed pipes, and unstable headwalls. Several locations with severe erosion had undermined outfall structures causing damage and

instability. A list of these outfalls is included in Table 3-4. Refer to Figure 3-3 for locations.

- 64 outfalls with heavy sediment, trash and debris deposits in need of cleaning – Heavy sediment deposits at outfalls signify that the particular storm drain network is prone to a high sediment load. Catch basins may not have deep-sumps or they may be filled with sediment, unable to trap incoming sediment loads. A list of these outfalls is included in Table 3-5. Refer to Figure 3-3 for locations.

Table 3-2. Structural Outfall Characteristics

Character	Description
Pipe Material	Pipe materials help characterize outfall integrity. Clay and non-reinforced concrete pipes are most likely to crack or collapse. Such failures could lead to flow restrictions or cause erosion that could further destabilize the foundation of adjacent storm drainage pipes and/or roadways. Corrugated metal pipes have been observed to have excessive corrosion. In some cases, stormwater was flowing through the base of the pipe, eroding soils beneath the pipe. Reinforced concrete and HDPE pipes are less likely to need repair because of their ability to resist structural failure.
Infrastructure Age	The age of the drainage network may indicate the potential for failure. Many of the old drainage networks were built with techniques that would not meet current design standards, and were designed to handle smaller runoff volumes from less developed area. The general age of each drainage network was determined by the Town of Auburn assessor's data. Oldest systems (pre-1950) should be inspected frequently and will likely need structural repair and maintenance. Systems constructed between the 1950s and 1980s may also be deteriorating. More recent drainage networks built after 1980 should be in good condition.
Pipe Size	Pipe size was assessed during outfall inspections to determine if each drainage system provides sufficient capacity for stormwater runoff. Most storm drain designs now require a minimum 12" diameter pipe. Outfalls with smaller pipes may be causing problems within the drainage network (e.g., flooding). These should be investigated during outfall inspections.
Outfall Structure	Outlet structures serve to help protect the surrounding area from erosion. Outfalls with headwalls, culverts or riprap were generally in better condition than those without.
Outlet Pipe Condition	Outlet pipes with cracks, separated joints, or visible corrosion are at a higher risk of structural failure. Pipes that are partially buried or submerged could not be properly assessed.

Table 3-3. Summary of Outfalls in Need of Stabilization		
Outfall ID	**Erodibility**	**Comment**
B-03	Heavy Erosion	
C-16	Heavy Erosion	Heavy sediment deposits
C-17	Heavy Erosion	Bank erosion
C-22	Heavy Erosion	
C-27	Heavy Erosion	Surging flow
C-28	Heavy Erosion	
C-29	Heavy Erosion	
C-30	Heavy Erosion	Badly eroded
C-31	Heavy Erosion	
C-38	Heavy Erosion	
C-74	Heavy Erosion	
D-05	Heavy Erosion	Piped stream
D-06	Heavy Erosion	Needs stabilization
E-14	Heavy Erosion	
G-13	Heavy Erosion	Piped stream
G-14	Heavy Erosion	
H-15	Heavy Erosion	
I-16	Heavy Erosion	Heavy sediment deposits
I-17	Heavy Erosion	
I-18	Heavy Erosion	
I-19	Heavy Erosion	
J-03	Heavy Erosion	Piped stream
L-06	Heavy Erosion	

Table 3-4. Summary of Outfalls in Need of Repair		
Outfall ID	**Pipe Condition**	**Comment**
A-08	Unknown	Undermined headwall
B-04	Other*	Dislodged pipe
B-33	Cracked	
B-36	Cracked	
C-03	Cracked	
C-04	Corroded	
C-16	Good	Undermined outfall
C-17	Good	Undermined outfall
C-28	Other*	Pipe crushed, covered
C-30	Cracked	Badly eroded
C-35	Corroded	
D-01	Corroded	
E-15	Unknown	
E-17	Cracked	Buried
G-01	Cracked	
H-08	Cracked	Pipe dislodged, sinkhole
H-15	Good	Undermined outlet pipe
H-17	Corroded	
H-18	Other*	Partially crushed
H-22	Corroded	
H-23	Corroded	
H-43	Cracked	
H-45	Exposed Steel	
I-05	Corroded	
I-18	Cracked	Instable headwall
I-19	Good	Instable headwall
I-23	Cracked	
I-24	Corroded	
M-11	Corroded	
M-13	Corroded	

Table 3-5. Summary of Outfalls in Need of Cleaning		
Outfall ID	**Deposits**	**Comment**
A-04	Heavy Sediment	
B-02	Heavy Sediment	
B-04	Heavy Sediment	Sediment delta
B-07	None	Clogged channel
B-14	Heavy Sediment	
B-15	Heavy Sediment	
B-16	Heavy Sediment	Pipe partially buried
B-18	None	Pipe buried
B-20	None	Pipe needs cleaning
B-22	Heavy Sediment	
B-23	Heavy Sediment	Sediment delta
B-24	Heavy Sediment	
B-27	Heavy Sediment	
B-28	Heavy Sediment	
B-36	None	Pipe completely filled
B-41	Heavy Sediment	
C-04	Paper/Trash	Needs cleaning
C-09	Paper/Trash	Buried outlet pipe
C-14	None	Heavy sediment deposits
C-21	Other*	Sediment deposits
C-34	Grease/Oil	Submerged pipe
C-39	Paper/Trash	Needs cleaning
C-40	None	Needs cleaning
C-42	None	Buried with debris
C-52	None	Pipe buried
C-58	None	Submerged, cleaning
C-74	Heavy Sediment	
D-05	Heavy Sediment	
D-06	Heavy Sediment	
E-07	Paper/Trash	Completely buried
E-19	None	Pipe buried
E-20	None	Needs cleaning
E-22	Heavy Sediment	Pipe buried by debris
E-23	Heavy Sediment	
E-25	Heavy Sediment	
E-30	Heavy Sediment	
G-06	None	Needs cleaning
G-08	None	Needs cleaning
G-17	None	Needs cleaning
G-22	Heavy Sediment	

Table 3-5. Summary of Outfalls in Need of Cleaning		
Outfall ID	**Deposits**	**Comment**
G-24	Heavy Sediment	
H-25	Paper/Trash	
H-26	None	Debris build up
H-30	Grease/Oil	Needs cleaning
H-31	Other*	Pipe buried
H-32	Paper/Trash	Pipe partially buried
H-33	Grease/Oil	Needs cleaning
H-62	Heavy Sediment	
H-64	Heavy Sediment	
I-01	Heavy Sediment	
I-02	Grease/Oil	Submerged, buried
I-03	Heavy Sediment	
I-04	Heavy Sediment	
I-05	Heavy Sediment	
I-08	Heavy Sediment	
I-21	None	Needs cleaning
I-23	Heavy Sediment	Covered with sediment
I-24	Heavy Sediment	
K-03	Heavy Sediment	
K-04	None	Filled with sediment
L-03	None	Needs cleaning
L-04	None	Needs cleaning
L-06	Heavy Sediment	
M-13	Heavy Sediment	

The details of these inspections are included in Appendix B.

3.2 Drainage Issues – Localized Flooding

In addition to the observations of infrastructure conditions, known flooding areas were identified through discussions with Town personnel.

Flooding is often associated with urban development as developed lands replace absorptive forests and fields with impervious surfaces. This results in increased peak runoff rates and volumes that quickly reach surface waters and is exacerbated by the filling in of wetlands associated with development. The filling in of these wetlands removes valuable flood storage.

Additionally, flooding can occur when the drainage networks built to carry stormwater runoff are inadequately sized or become clogged or broken, hindering the structures ability to safely pass flows.

3.2.1 Flooding Sites

A description of known flooding sites by street and subwatershed within Auburn is summarized in Table 3-6, along with possible improvements. Refer to Figure 3-4 for flooding site locations.

Note that many of the flooding sites in Auburn may be associated with high wetland and pond water levels which cannot be improved through simple BMPs or storm drain installations. Where improvements could be made, possible improvements were identified. The flooding at these locations is generally associated with poorly functioning storm drain networks or lack thereof. These sites are not generally related to high water levels from ponds and or rivers in the Town of Auburn.

3.3 Maintenance Practices

Existing maintenance practices were evaluated to determine the necessary level of improvement. Table 3-7 summarizes existing maintenance practices associated with the storm drain infrastructure.

Proposed future operation and maintenance practices for storm drain infrastructure are summarized in the Operation and Maintenance Plan.

Table 3-6 Flooding Site Summary Table

Sub-watershed	Site ID	Flooding Site	Location Description	Observed Flooding Problem	Possible Causes	Land Use	Drainage Area (acres)	Length of Road	Drainage Network	Comments	Possible Improvements
A	A-1	Rochdale St.	Rochdale St. where it crosses Stoneville Reservoir. The road surface is not much higher than the reservoir water level.	During heavy rain events, water flows over the road from the northern portion of Stoneville Reservoir.	Undersized, filled culverts.	Forest	61.3	380 feet	2 - 18" HDPE drainage pipes, each 50' long under Rochdale St., connecting northern portion of reservoir to southern portion.	No other drainage networks or structures on this portion of Rochdale Street or the associated drainage area. 2-18" HDPE pipes are partially filled with debris.	Cleaning, install larger diameter culverts at same location.
B	B-1	Stoneville Pond	Along Rochdale St.	Southwestern portion of the pond observed to flood residential properties abutting the pond. Located within 100-year flood plain.	High flood waters.					Pondville Pond water level is controlled by the dam at the pond outlet. Influx of water from Stoneville Reservoir increases pond water levels in the southwestern segment of the pond.	Undetermined.
C	C-1	Eaton Avenue	Off western side of Hampton St. sloping steeply down to where it meets Southbridge St. (Route 12).	Stormwater runoff bypasses catch basins due to steep slopes. Stormwater observed to scour the edges of Eaton Ave. Sediment and debris deposited at the base of the hill where Eaton Ave. intersects with Southbridge Street.	Ineffective drain network.	Moderate to high-density residential (1/4 to 1/2 acre).	8.24	880 feet	Stormwater collected in five catch basins. 316 feet of 12" pipe drains into 240 feet of 15" of drainage pipes along Eaton Ave. Outfall on the western side of Southbridge St. into Kettle Brook.	Excessive sediment and debris observed on the road surface at the base of the hill and scouring along the edges of Eaton Ave. There is a storm drain network in place along Eaton Ave., however, it is ineffective at collecting all stormwater runoff.	Installation of drain network along entire length of street.
C	C-2	Southbridge St. Court	Southbridge St. Court runs parallel to Southbridge St. near the intersection with Auburn St.	Dunns/Dark Brook located to the west has frequent high water during heavy rains. Flooding associated with high water levels in the entire area, sometimes due to closure of the dam at the Worcester Flood Diversion structure located in the large wetlands area to the north. Located within 100-year flood zone. Flooding does not appear to be related to stormwater drainage infrastructure problems.	High flood waters.						Undetermined.
C	C-3	Sword St.	Sword St. where it crosses Kettle Brook near Southbridge St., southeast of Leesville Pond and I-290. North Central part of Town, connecting Southbridge St. (Route 12) to Boyce St.	Kettle Brook exceeds its banks & flows onto Sword St. during heavy rains. The level of Kettle Brook is controlled by the level of Leesville Pond and the flood diversion tunnel location upstream from Sword St.	High flood waters.		>7,800 of Town & areas of Leicester, Millbury & Worcester flow through Kettle Brook at this location	100 feet crossing Kettle Brook	Nearby catch basins on Sword St. and small drainage swales discharge stormwater from the road surface directly into Kettle Brook. The brook flows through four 36" corrugated metal culverts located under Sword St. Water level submerges majority of culvert under normal conditions.	Heavy erosion alongside Sword St. exposing the tops of culverts.	Culverts need replacement.

C	C-4	Kettle Brook	Brook Rd. & Perry Place are affected by flooding.	Flooding during heavy rain storms occurs along Kettle Brook from the Stoneville Pond dam to the I-290 culvert. Brook Rd. & Perry Place are within 100-year flood plain.	High flood waters.	High-density residential.	Kettle Brook watershed includes drainage from Auburn, Leicester & Worcester.				Undetermined.
G	G-1	West St.	West St. near the intersection with Hardscrabble Rd. & under the I-90 overpass.	Stormwater often pools at this depression, creating a hazard to motorists.	Lack of storm drain network.	Industrial, highway, & forested.	4.99	1,004 feet & I-90 overpass	Stormwater from portions of West St., Hardscrabble Rd., and the I-90 overpass drain to this location. No installed storm drain networks at or within this flooding location. Portions of West Street further west have storm drain networks, as well as portions of Hardscrabble Rd.		Installation of drain network along this portion of the street.
H	H-1	Oxford St. North	South of the Auburn Police Station on Oxford St. North and north of I-90 overpass.	During heavy rains, stormwater floods this topographic depression. Flooding at this location has damaged motor vehicles & is a public safety concern.	Ineffective drain network.	High-density residential.	12.64	2,048 feet not including I-90 and its off ramp	Two catch basins at low point on Oxford St. North discharge adjacent to road. Other outfalls from nearby roads discharge within the vicinity of the flooding area, including 8", 12", 15" & 24" outfalls. No observed pipes or outfalls draining flooding area.		Installation of drainage piping.
H	H-2	Swanson Rd.	Near Swanson Rd. and I-290 off ramp. A significant stream draining a large area enters a culvert at this location, conveying stormwater under commercial developments on Swanson Rd. & the Auburn High School athletic fields. The culvert discharges in Dunns Brook, several hundred feet north of Southbridge St.	The 42" culvert pipe is partially filled with sediment and debris. Backwater floods some areas upstream of the culvert & portions of the commercial areas along Swanson Rd. & the athletic fields at Auburn High School. Some of the flooding may be a result of high levels at Dunns Brook during heavy rains.	Constricted flow, debris and sediment deposits.	High-density residential, highway & commercial.	88.96	12,595 feet not including commercial parking lots & development along Swanson Rd.	There are several drainage networks present in the drainage area. They all discharge (or eventually discharge) to the stream that enters the culvert near Swanson Rd. The 42" culvert is 1,200 feet long.	42" culvert is partially filled with sediment.	Cleaning of existing culvert, installation of sediment forebay.
H	H-3	Briarcliff Rd.	New development on Briarcliff Rd.	Existing stormwater infrastructure was clogging from erosion associated with construction of a new development. Inadequate erosion controls were used by the developer, allowing sediment to enter stormwater catch basins. The Town retrofitted existing catch basins with filter fabric to prevent heavy sediments from entering existing storm drains. A new storm drain network will be functioning at the completion of the development.	Lack of construction stormwater controls.					The Town is in the process of correcting this flooding problem.	Cleaning of existing structures.

I	I-1	Stone St.	Intersection of Stone St. & Grove St. Stormwater collects from rove & Stone St. and flows towards the intersection of Stone St. and Elm St. Moderate to low slope continues towards Elm St.	Catch basins overflow along Stone St. Stormwater runoff along Stone St. does not enter structures and becomes channelized along the edge of the road.	Ineffective drain network.	Low to moderate-density residential.	4.55	1,326 feet including portions or Stone St. & all of Grove St.	Two catch basins in flooding area, one on Grove St. & one at intersection of Grove & Stone St. There are 68 feet of pipe (unknown diameter & condition) believed to connect the two catch basins. No outlet pipes were observed. Catch basins are in poor condition with apparent cracking and settling of structures.	Concerns from residents conveyed to CEI staff during storm drain infrastructure mapping.	Installation of drain network, possible infiltrating catch basins.
K	K-1	Oxford St. South	Several hundred feet south of the intersection with Cedar St.	Stormwater runoff from the street and abutting residential properties has been observed to collect and flood lower lying properties along the western side of Oxford St. South.	Lack of storm drain network.	Low-density residential.	4.41	900 feet of Oxford St. South	No storm drain networks present within this flooding area or along this portion of Oxford St. South. The nearest storm drain network is several hundred feet north at the intersection with Cedar St.	Road surface deterioration caused by lack of storm drainage in this area.	Town has addressed with temporary solution: installation of infiltrating catch basins.
M	M-1	Elm St. & Brook St.	Elm and Brook St. in the vicinity of Pondville Pond. Unnamed brook draining subwatershed M and portions of Millbury enters Pondville Pond at this location.	Located within 100-year flood plain. Flooding appears to be the result of high water levels in the brook & pond during heavy rain events.	High flood waters.	Low-density residential & forest.					Undetermined.

Table 3-7. Summary of Existing Maintenance Practices	
Street Sweeping	Every Town road is swept once per year, beginning in the spring after snowmelt. Current schedule is based on precincts.
Catch Basin Cleaning	Current cleaning schedule is need-based. Structures are cleaned when problems are reported by Residents or if observed by Town personnel. Approximately 10% of catch basins are cleaned per year.
BMP Maintenance	There is no existing BMP maintenance schedule.

Figure 3-1

Storm Drain Infrastructure

Auburn, MA

LEICESTER

WORCESTER

MILLBURY

SUTTON

OXFORD

Leesville Pond

Stoneville Pond

Stoneville Reservoir

Dark Brook Reservoir

Tinker Hill Pond

Auburn Pond

Eddy Pond

Pondville Pond

Interstate 290

MassPike I-90

Southbridge Street

Washington Street

Legend

- Town Boundary
- Outlet
- Catch Basin
- Drainage Manhole
- Detention Pond
- Drainage Pipes
- Lakes, Ponds
- Wetlands
- Streams, Brooks
- Parcels

Data Source: MassGIS, Town of Auburn, CEI

N

W E

S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

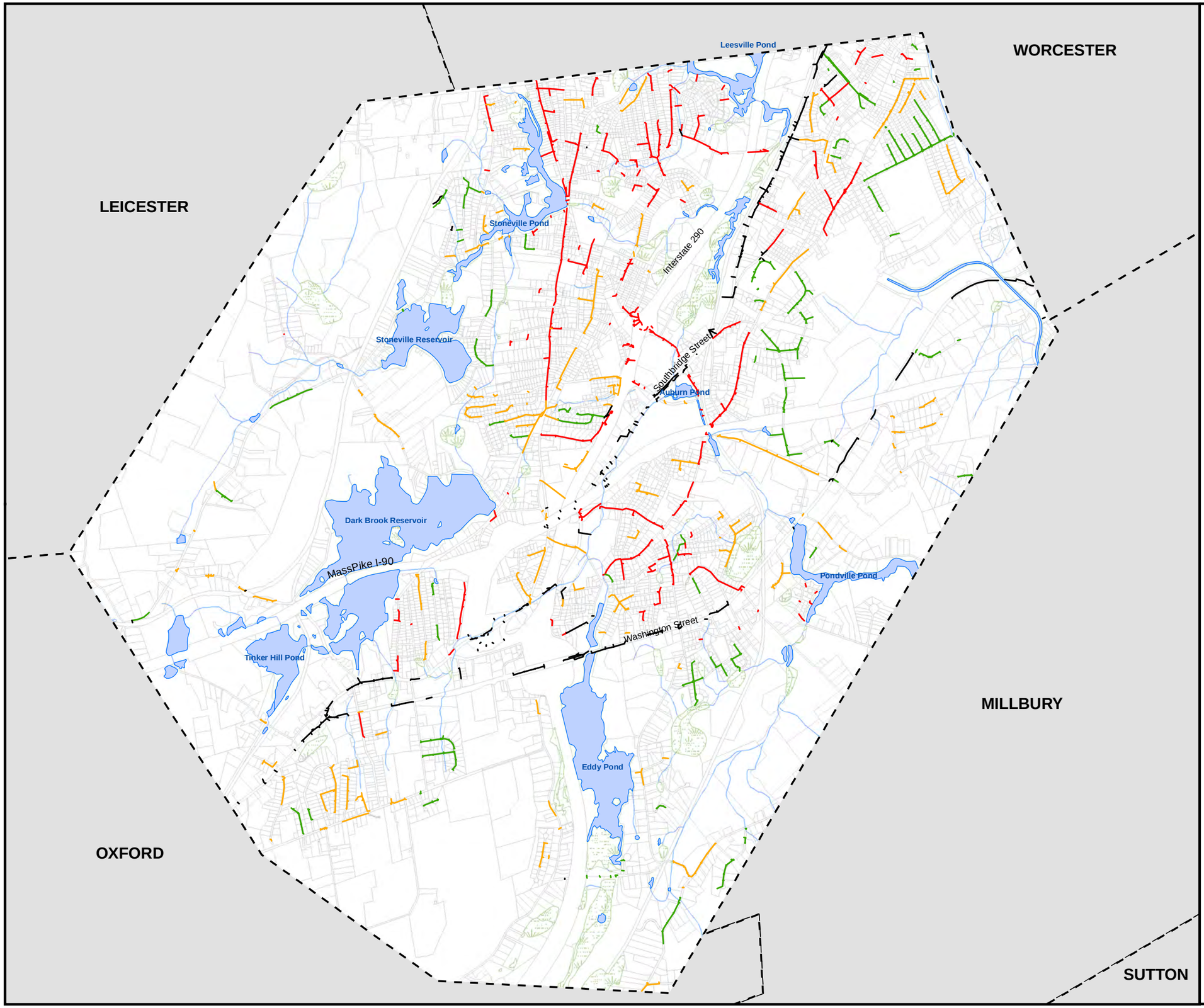


Figure 3-2

Storm Drain Infrastructure Age

Auburn, MA

Legend

- Town Boundary

Drainage Pipe Age

- Undetermined Age
- Pre 1950
- 1951- 1980
- Post 1980
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

Note:
Ages are approximate and are based upon Assessor's data with respect to age of development in specific areas.

N
W E
S

0 750 1,500 3,000 4,500 6,000 Feet

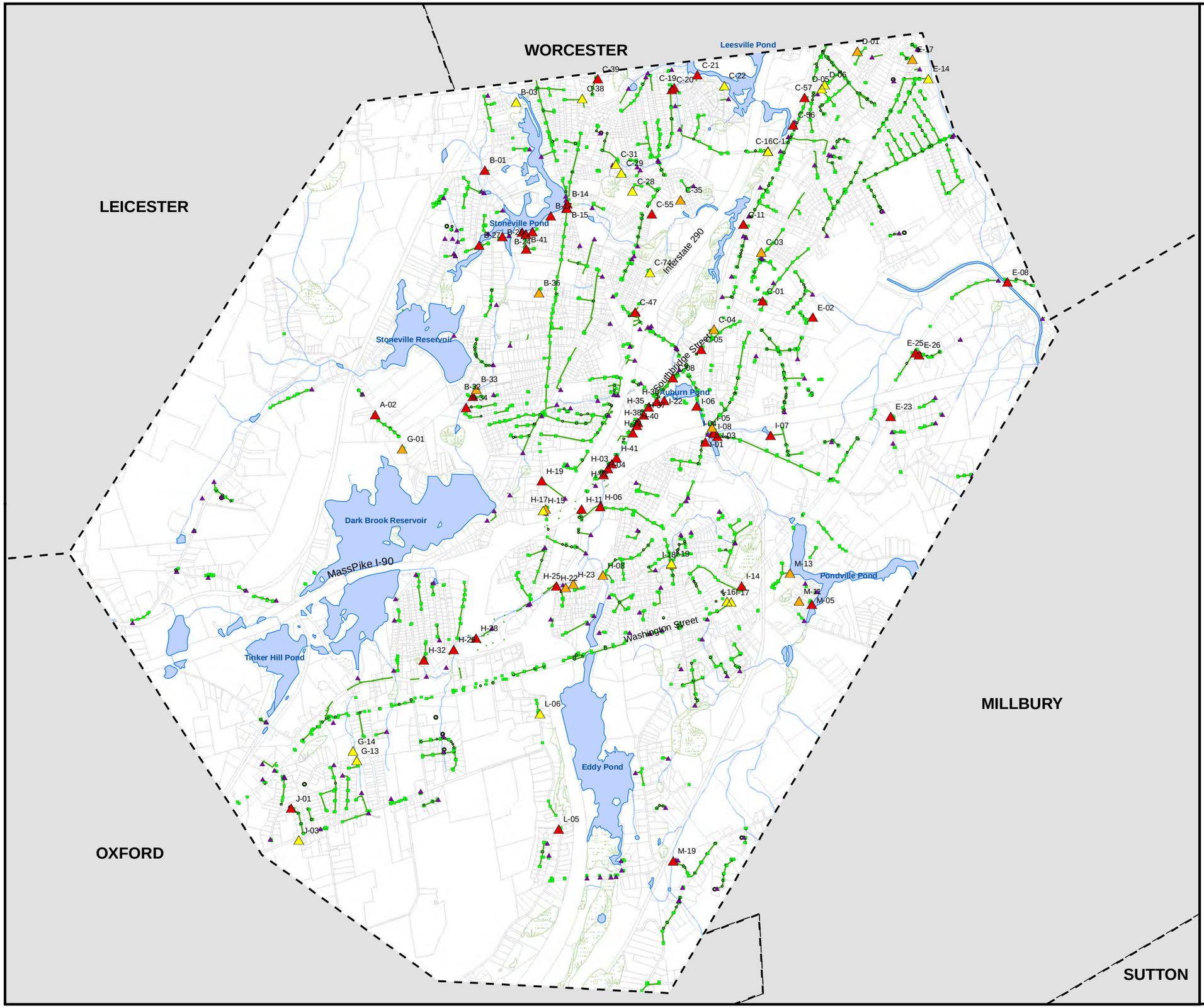
0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 3-3

Stormwater Outfalls in Need of Improvement

Auburn, MA



Legend

- Town Boundary
- Outfall

Outfalls Needing Improvements:

- Stabilization
- Repair
- Cleaning

Drainage Structures

- Catch Basin
- Drainage Manhole
- Detention Pond
- Drainage Pipes
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

N W E S

0 750 1,500 3,000 4,500 6,000 Feet

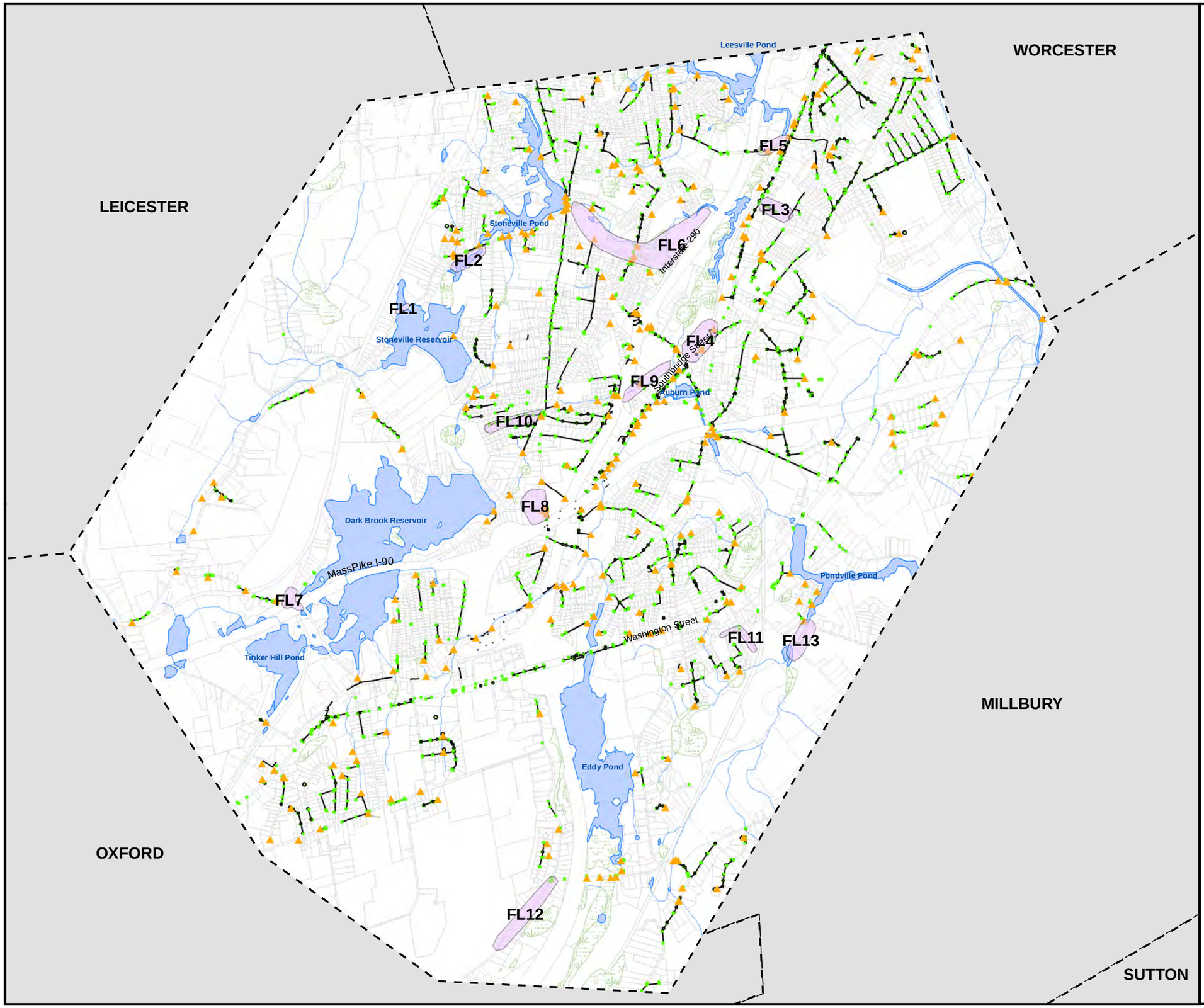
0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 3-4

Flooding Sites

Auburn, MA



Legend

- Town Boundary
- Flooding Sites
- Outlet
- Catch Basin
- Drainage Manhole
- Detention Pond
- Drainage Pipes
- Lakes, Ponds
- Wetlands
- Streams, Brooks
- Parcels

Data Source: MassGIS, Town of Auburn, CEI

N
W E
S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

4.0 Water Quality

Stormwater runoff picks up and carries away natural and human-made pollutants as it runs over the ground, depositing it into the nearest water ways. Due to the multiple diffuse sources of this polluted stormwater runoff, it is referred to as non-point source (NPS) pollution.

This Section describes the water quality of Auburn's water resources, potential pollution sources and methods to address stormwater pollution.

4.1 Subwatersheds

The process for analyzing stormwater quality began with work in the Phase II Stormwater Management Plan for the Town of Auburn completed by CEI. The Town was divided into 13 subwatersheds or subdrainage areas, providing a more management scale to evaluate the area, while providing more localized information on which to base decisions.

The subwatershed boundaries are natural boundaries dictated by the local topography. These boundaries generally follow ridgelines or high points and represent the area that drains to the furthest down gradient point, which was typically chosen where there was a lake or pond or major stream intersection. GIS data layers of topography and the stormwater drainage network provided by the Town and State were used to define the subwatershed boundaries. These subwatersheds are depicted in Figure 4-1.

Subwatersheds were prioritized based on the presence of public drinking water wells, beaches, Category 5 303d waters[1], and Category 4c 303d waters[2]. This information is listed in Tables 4-1 and 4-2. The purpose of the prioritization was to identify areas where greater protection may be needed (e.g., important resources to the Town or areas that were already impaired). Prioritization criteria has been updated since the Phase II plan to account for new public drinking wells installed by the Auburn Water District.

[1] Category 5 303d waters: Water requiring a TMDL.
[2] Category 4c 303d waters: Impairment not cause by a pollutant.

Table 4-1. Subwatershed Prioritization Scheme					
Sub-watershed	**1** (4pts) **Ground Water Supplies**	**2** (3pts) **Beaches**	**3** (2pt) **Class 5 303d Waters**	**4** (1pt) **Class 4C 303d Waters**	**Total Points**
A		√			3
B			√	√	3
C	√ (3 Wells)		√ (2 Waters)	√	17
D					0
E					0
F					0
G	√ (2 Wells)			√ (2 Waters)	10
H	√ (3 Wells)		√		14
I				√	1
J					0
K					0
L		√		√	4
M	√ (2 Wells)			√	9

Table 4-2. Subwatershed Priority Summary			
Rank	**Highest Priority** (10+ points)	**Moderate Priority** (3-9 points)	**Lowest Priority** (0-2 points)
Subwatershed	C,H,G	M,L,A,B	I,D,E,F,J,K

A description of each subwatershed is provided in Table 4-3.

Table 4-3. Summary of Subwatershed Characteristics				
Sub-watershed	**Size (acres)**	**Land Use**	**Impaired Waters & Beaches**	**Drainage Networks**
A	1,211	Low to moderate-density residential	Stoneville Reservoir, Rotary Beach	Few, mostly on Rochdale & Leicester Streets
B	780	Low to high-density residential	Stoneville Pond	Common in high-density neighborhoods
C	1,238	High-density residential, commercial, industrial, highway	Kettle Brook, Leesville Pond	Most roads have storm drain networks
D	114	High-density residential, industrial		Few storm drain networks
E	1,397	High-density residential, industrial, commercial		Most networks outfall to natural buffers
F	54	Low-density residential		No storm drain networks
G	1,706	Low to high-density residential, commercial, industrial, highway	Dark Brook Reservoir	Many storm drain networks, especially on State roads
H	1,161	Low to high-density residential, commercial, highway	Dunns Brook/Dark Brook, Camp Gleason Beach	High number and density of storm drain networks
I	604	Moderate to high-density residential, commercial, industrial	Auburn Pond	Most roads have storm drain networks
J	201	Low-density residential, highway		Few storm drain networks
K	452	Low-density residential		Few storm drain networks
L	528	Low-density residential, highway	Eddy Pond	Significant State storm drain networks
M	1,158	Low-density residential, industrial	Pondville Pond	Common in neighborhoods

4.2 Water Quality Problems

Every water body within the Town of Auburn is listed as an impaired water body on the 303d list of impaired waters. Table 4-4 summarizes the type of impairment associated with each water body with impaired waters shown previously on Figure 2-5.

Table 4-4. 303d Listed Waters in Auburn

Water Body	Category	Impairment
Dark Brook (Outlet of Eddy Pond to confluence with Kettle Brook)	Category 5	Unknown
Kettle Brook (Outlet of Waite Pond, Leicester, through Leesville Pond, Auburn, to inlet of Curtis Pond, Worcester)	Category 5	Nutrients, Organic Enrichment, Low DO, Flow Alteration, Pathogens
Auburn Pond	Category 4c	Noxious Aquatic Plants and Exotic Species
Dark Brook Reservoir	Category 4c	Exotic Species
Eddy Pond	Category 4c	Noxious Aquatic Plants and Exotic Species
Pondville Pond	Category 4c	Noxious Aquatic Plants and Exotic Species
Stoneville Pond	Category 4c	Noxious Aquatic Plants and Exotic Species
Tinker Hill Pond	Category 4c	Exotic Species
Leesville Pond	Category 4c	Excess Nutrients, Organic Enrichment, and Low DO Levels
Stoneville Reservoir	Category 2	Secondary Contact

Category 2 Waters: Attaining Some Uses; Other Uses Not Assessed
Category 3 Waters: No Uses Assessed
Category 4c Waters: Impairment Not Caused by a Pollutant
Category 5 Waters: Water Requiring a TMDL

As shown in Table 4-4, most of the impairments are for nutrients, noxious aquatic plants and aquatic species. Excessive plant growth is often associated with high nutrient levels in the water, particularly phosphorus in fresh water bodies. Phosphorus is generally the limiting nutrient in freshwater ecosystems and comes from diffuse nonpoint sources such as runoff from lawns, nutrients from fertilizer use, atmospheric deposition, sediment and pet and animal waste.

Pathogens were also noted within Kettle Brook and can come from septic systems, and fecal matter carried in stormwater runoff from domestic and wild animals.

Sediment is also a concern as pollutant such as phosphorus are often attached to sediment and it can lead to infilling of lakes and ponds. The Massachusetts Department of Environmental Protection (MassDEP) currently uses the removal of total suspended solids (TSS) as an indicator for overall pollutant removal and performance of best management practices (BMPs).

Category 5 waters, including Kettle Brook and Dark Brook require a Total Maximum Daily Load (TMDL) report to be developed, which defines the maximum pollutant load the water can receive without significant impairment and outlines reduction measures to attain this maximum loading. As of the writing of this report, a combined TMDL report for phosphorus has been prepared by MassDEP for Auburn Pond, Eddy Pond, Pondville Pond, and Stoneville Pond. A separate TMDL report has been developed by MassDEP for Leesville Pond. The TMDL reports are included in Appendix C.

4.3 Existing Water Quality BMPs

There are some existing water quality BMPs within Town, installed to manage stormwater runoff from specific developments when they were installed. An inventory and inspection of these BMPs was performed under this program to assess the condition of these BMPs and whether improvements are needed to enhance water quality treatment and functionality.

Fifteen detention basins and one water quality BMP were identified during these investigations. These are shown on Figure 4-2. The field inspection log providing the results of the investigations, including the existing condition and proposed improvements are included as Table 4-5. Most of the BMPs require maintenance to remove heavy vegetative growth and accumulated sediments and many will benefit from improvements such as the installation of sediment forebays to provide an easy access point for maintenance.

Table 4-5. Summary of Existing Water Quality BMPs

BMP ID #	Location	Type of BMP	BMP appear to be working?	Maintenance required?	Maintenance Access	Sediment Accumulation	Sediment Depth	Deposits	Structural Condition	Erodibility	Vegetation	Inlet	Outlet	Forebay	Comments	# of Pictures	Recommendations
EX1	Sunnyside Road	__ None __ Wet Pond __ Swale X Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	__ Easy X Moderate __ Difficult	X None __ Slight build up __ Heavy build up	____ inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X Undesirable Woody __ Invasive Plants	Size 18" Type Flared RCP	Size multi Type RCP Unknown	Yes	Catches runoff from small cul-de-sac area, ~12 houses. Phragmites present in a portion of the basin. At least the forebay area is always wet, possibly more as evident by the phragmites. Gravel present at bottom of basin. Outlets to a wooded low spot at the rear. 100-year rip rap overflow structure also present.	6	Remove heavy brush in the basin. Consider raising low flow outlet to provide additional storage.
EX2	Bridal Path Road	__ None X Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	X Easy __ Moderate __ Difficult	__ None __ Slight build up X Heavy build up	5 inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A __ None __ Channeling/Depressions __ Bank Erosion X Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse __ Undesirable Woody X Invasive Plants	Size 24" Type Flared RCP	Size multi Type conc 24" flared	No	Gets runoff from half the street, ~10 houses. Heavy buildup of phragmites in basin. Heavy erosion at inlet from construction activities in the area. Silt fence present but knocked over and covered in sediment. Incomplete fencing around the basin. Overflows to a stream at the rear behind the basin.	7	Remove invasive phragmites. Construct and maintain a sediment forebay. Remove excessive sediment in the basin. Fix erosion problem due to construction. Repair silt fence to reduce sediment intrusion. Finish fencing around the pond. Replace displaced riprap.
EX3	Booth Road	__ None X Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	__ Easy X Moderate __ Difficult	X None __ Slight build up __ Heavy build up	____ inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X Undesirable Woody X Invasive Plants	Size 12" Type Plastic	Size V-notch weir Type Conc	No	Receives runoff from a reasonably large subdivision. Heavy phragmites present in basin. Some vegetation growth on the banks. Small 6" PVC pipe drainage to pond, source unknown. Possibly a roof leader or french drain. Overflows to a neighboring stream via a V-notch weir and 24" plastic pipe.	8	Remove heavy brush in the basin. Remove invasive phragmites. Construct and maintain a sediment forebay. Explore source of small pipe.
EX4	Hilltop Farm Road	__ None X Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	__ Easy __ Moderate X Difficult	__ None X Slight build up __ Heavy build up	4 inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X Undesirable Woody X Invasive Plants	Size 12" Type Plastic	Size V-notch weir Type Conc	No	Drains subdivision, ~10 houses. Heavy phragmites present in basin. Some growth on the banks. Overflows to a neighboring stream via a V-notch weir and 24" plastic pipe, same stream and downstream of #3.	5	Remove heavy brush in the basin. Remove invasive phragmites. Remove excessive sediment buildup in the basin. Construct and maintain a sediment forebay.
EX5	Elizabeth Road 1	__ None X Wet Pond x2 __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	__ Easy __ Moderate X Difficult	X None __ Slight build up __ Heavy build up	____ inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress X Distressed __ Sparse X Undesirable Woody __ Invasive Plants	Size Unknown Type Unknown	Size V-notch weir Type To rear pond	No	Receives runoff from a portion of the street, ~8 houses or so. Double wet pond with first draining into the second through a v-notch weir. Second pond outlets to a wooded area at the rear. Very heavily wooded and overgrown. Unable to locate inlet in upstream pond due to heavy growth and locked gate.	6	Remove heavy growth in the basin, especially in the first/upstream basin. Construct and maintain a sediment forebay in the first pond. Explore basin for inlet pipe(s).
EX6	Elizabeth Road 2	__ None X Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	__ Easy __ Moderate X Difficult	X None __ Slight build up __ Heavy build up	____ inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X Undesirable Woody X Invasive Plants	Size 30" Type Plastic	Size V-notch weir Type To stream	No	Pond receives runoff from ~10 houses. Heavy flow in. Lots of phragmites present in the pond. Heavy wooded growth, especially at the outlet. Outlets to a stream at the rear of the pond.	8	Remove heavy brush in the basin. Remove invasive phragmites. Construct and maintain a sediment forebay. Consider raising low flow outlet to provide additional storage.
EX7	Westec Drive	__ None X Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	X Easy __ Moderate __ Difficult	X None __ Slight build up __ Heavy build up	____ inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress X Distressed __ Sparse X Undesirable Woody __ Invasive Plants	Size 36" x1 18" x2 Type Flared RCP	Size multi Type RCP	No	Receives runoff from an industrial/commercial area. Heavily wooded with many large rocks in the basin. Outlet destination is unclear, however appears to outlet below Route 20 to the other side, perhaps a stream or wooded area. Could also drain to the Route 20 system.	7	Remove heavy growth in the basin. Install gabions in the center of the basin to lengthen the flow paths from 2 of the 3 inlets.
EX8	Stonebridge Road	__ None X Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	__ Easy __ Moderate X Difficult	X None __ Slight build up __ Heavy build up	____ inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X Undesirable Woody X Invasive Plants	Size Unknown Type Single inlet	Size multi Type RCP	No	Drains ~5 houses. Heavily overgrown. Unable to access basin due to fenced/locked enclosure. Could not observe inlet, however appeared to be a single pipe at opposite end from outlet. Overflow to a stream at the rear.	5	Remove heavy brush in the basin. Remove invasive phragmites. Construct and maintain a sediment forebay.
EX9	Saybrook Way	__ None X Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X Yes __ No*	X Yes __ No*	__ Easy X Moderate __ Difficult	__ None X Slight build up __ Heavy build up	3 inches	X None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X Undesirable Woody X Invasive Plants	Size 30" Type Flared end	Size multi Type RCP	Yes, partly filled in	Collects runoff from ~15 house development. Also receives runoff from small swale entering near outlet. Overflows to wooded/wetland area at rear, however homeowner said that in big storms, overflows into swale since lower than outlet.	5	Remove heavy brush in the basin. Remove invasive phragmites. Remove excessive sediment buildup in the forebay. Consider raising low flow outlet to provide additional storage. Monitor and possibly remove swale or change grading so that outlet structure will function properly.

Table 4-5. Summary of Existing Water Quality BMPs

BMP ID #	Location	Type of BMP	BMP appear to be working?	Maintenance required?	Maintenance Access	Sediment Accumulation	Sediment Depth	Deposits	Structural Condition	Erodibility	Vegetation	Inlet	Outlet	Forebay	Comments	# of Pictures	Recommendations
EX10	Erica Lane	__ None __ Wet Pond __ Swale X_ Detention Basin __ Forebay __ Other*	X_ Yes __ No*	X_ Yes __ No*	__ Easy X_ Moderate __ Difficult	X_ None __ Slight build up __ Heavy build up	_____ inches	X_ None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X_ Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X_ None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X_ Undesirable Woody X_ Invasive Plants	Size 18" Type RCP	Size 18" Type RCP	No	Receives runoff from small residential development. Wooded in portions of the basin. Some phragmites present. Inlet comes in very close to the outlet, minimal treatment. Drains to a wooded area or possibly wetland at the rear.	3	Remove heavy brush in the basin. Remove invasive phragmites. Construct and maintain a sediment forebay. Consider raising low flow outlet to provide additional storage. Install gabions in the center of the basin to lengthen the flow path.
EX11	Alex Circle	__ None X_ Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X_ Yes __ No*	X_ Yes __ No*	__ Easy X_ Moderate __ Difficult	X_ None __ Slight build up __ Heavy build up	_____ inches	X_ None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X_ Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X_ None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X_ Undesirable Woody X_ Invasive Plants	Size 18" Type RCP	Size multi Type RCP	No	Receives runoff from small subdivision, ~10 houses. 6" pipe going in appears to be a roof leader. Very heavy growth. Releases to wooded area at rear, possibly a small stream.	5	Remove heavy brush in the basin. Remove invasive phragmites. Construct and maintain a sediment forebay. Verify small pipe source.
EX12	Gwen Drive	__ None __ Wet Pond __ Swale X_ Detention Basin __ Forebay __ Other*	X_ Yes __ No*	X_ Yes __ No*	__ Easy X_ Moderate __ Difficult	X_ None __ Slight build up __ Heavy build up	_____ inches	X_ None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X_ Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X_ None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X_ Undesirable Woody __ Invasive Plants	Size 30" Type RCP	Size Type no outlet	No	Receives runoff from approximately 12 houses. Long, thin overgrown pond with substantial wooded growth. No outlet, all runoff must infiltrate into the ground.	5	Remove heavy brush in the basin. Construct and maintain a sediment forebay.
EX13	Dale Avenue	__ None __ Wet Pond __ Swale X_ Detention Basin __ Forebay __ Other*	X_ Yes __ No*	__ Yes X_ No*	X_ Easy __ Moderate __ Difficult	X_ None __ Slight build up __ Heavy build up	_____ inches	X_ None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X_ Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X_ None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	X_ N/A __ No Distress __ Distressed __ Sparse __ Undesirable Woody __ Invasive Plants	Size 18" Type RCP	Size multi Type RCP	No	Receives runoff from condo development and driveway. Dry, grassed detention basin. Overflows to Dale Street drainage system and then into a stream beyond. Emergency overflow also connects to street drainage system.	4	Construct and maintain a sediment forebay. Consider raising low flow outlet to provide additional storage.
EX14	Crow Hill Road	__ None X_ Wet Pond __ Swale __ Detention Basin __ Forebay __ Other*	X_ Yes __ No*	X_ Yes __ No*	X_ Easy __ Moderate __ Difficult	X_ None __ Slight build up __ Heavy build up	_____ inches	X_ None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X_ Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X_ None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse __ Undesirable Woody X_ Invasive Plants	Size 18" Type RCP	Size multi Type RCP	No	Collects runoff from small residential area, ~4 houses and street. Detention pond, some phragmites. Overflow destination unknown, but possibly the street drainage system or a nearby wooded area.	5	Remove invasive phragmites. Construct and maintain a sediment forebay.
EX15	Eddy Pond Wetland Area 2	__ None __ Wet Pond __ Swale __ Detention Basin X_ Forebay __ Other*	X_ Yes __ No*	X_ Yes __ No*	__ Easy X_ Moderate __ Difficult	__ None X_ Slight build up __ Heavy build up	_____ inches	X_ None __ Grease/Oil __ Grass Clippings/Compost __ Trash/Debris __ Other*	__ N/A X_ Good __ Corroded __ Cracked __ Exposed Steel __ Other*	__ N/A X_ None __ Channeling/Depressions __ Bank Erosion __ Displaced Riprap __ Other*	__ N/A __ No Distress __ Distressed __ Sparse X_ Undesirable Woody __ Invasive Plants	Size 18" Type RCP	Size Type Weir with concrete channel	Yes	Collects runoff from a small cul-de-sac. Two different outfalls discharge into separate forebay BMPs along the edge of the wetlands area. The outlets of the forebays are controlled by a weir followed by a concrete channel discharging towards the wetlands.	9	Remove sediment, brush and small trees which have started to grow in the forebay.

4.4 Additional Water Quality Needs

Additional stormwater controls are needed to help improve the water quality entering town waters and to meet the TMDLs. Improving water quality is the primary goal of the federal Phase II Stormwater Management Program, therefore is incorporated into this Stormwater Management Plan/Capital Improvement Plan.

BMPs were investigated with the primary focus of reducing phosphorus and sediment loads to Town waters, which will help reduce aquatic plants and excessive nutrient impairments described above. Site accessibility and ownership was a major factor in selecting potential sites for BMP improvements, as they offer the greatest potential and cost-effectiveness to construct stormwater BMPs.

4.4.1 BMP Site Selection

Since nearly every water resource within town is impaired, all would benefit from a reduction of pollutant loads. Potential BMP sites were selected and evaluated based on discharge locations (e.g., proximity to impaired water or water supply), size of drainage system and land ownership (e.g., potential for construction and accessibility). Based on these initial criteria, the sites presented in Table 4-6, presented by subwatershed, were selected as potential BMP locations. Possible BMPs are also included in this table. Figure 4-3 shows the location and watershed area for proposed BMPs.

In addition to the specific outfalls, municipally owned properties should also be targeted for implementation of stormwater controls, specifically those with large impervious surfaces such as parking and roofs. Improvements can be incorporated into future redevelopment projects and could serve as demonstration sites for developers and their engineers, while also treating pollution from the site.

Porous pavement, bioretention/rain gardens, and/or other suitable BMPs should be installed where possible to treat the first flush of stormwater runoff.

4.4.2 BMP Prioritization

The potential BMP sites described in Table 4-6 above were ranked and prioritized based on several criteria. The purpose of this ranking and prioritization is to determine which sites and BMPs should be constructed first during the 20-year stormwater master plan.

Table 4-6. Proposed BMP Summary Table & Priority Matrix

Subwatershed	Site ID	BMP Site	Location Description	Land Use	Drainage Area (acres)	Outfall Diameter	Soil Classification	Comments
A	P1	Rochdale St.	1000' west of intersection with Leicester St., adjacent to former Town landfill	Low density residential & forested.	10	15" HDPE	B	Located near wetlands. Drainage system has steep slope. Low flow observed several days after rain event from nearby residential & forested areas. Discharges to a buffered area. Unprotected outfall structure.
	P2	Sword St.	Drains industrial properties along Sword St. & runoff from I-290.	Industrial & highway.	18	15" Concrete	NC	Drains to Kettle Brook which flows into Leesville Pond. Observed sediment deposits at outfall. Near flooding area.
	P3	Southbridge St.	Southbridge St (Route 12).	Industrial, commercial, residential & forested.	20	-	NC	Large runoff volumes directly into Kettle Brook. Outfall partially buried & submerged. Majority of stormwater flows through MassHighway maintained structures on Route 12. High groundwater & surface water.
	P4	Leesville Pond Area 1	Drains area along Boyce St. & Sword St. Outfall behind Shore Drive.	High density residential & industrial.	123	-	C/D	
	P5	Leesville Pond Area 2	Drains area along Boyce St. & Sword St. Existing stream between Franklin St. & Boyce St.	Residential & industrial.	80	-	C/D	Low sloping channelized stream.
	P6	Leesville Pond Area 3	Two outfalls on Shore Drive draining directly into Leesville Pond.	Dense residential.	5	12" HDPE, 12" CMP	A	Sediment deposits at outfall.
C	P7	Leesville Pond Area 4	Two outfalls drain Adella St. & Summer St. neighborhoods. Outfalls into a stream that enters south basin of Leesville Pond.	Dense residential.	23	12" Clay, 24" CMP	C	Moderate erosion around 12" Clay pipe. 24" CMP is partially submerged & filled with sediment.
E	P8	Goddard Drive, Rice Rd.	Two outfalls drain Goddard Dr. & Rice Rd. neighborhoods.	Residential.	16	2 - 24" Concrete	C	Discharge to natural forested land on Town property with little observed erosion or vegetation distress.
	P9	Tinker Hill Pond	Outfall on Town propert adjacent to Tinker Hill Pond.	Low-density residential & forest.	4	24" Concrete	A	Within Zone II aquifer area for public drinking water wells.
	P10	Dark Brook Reservoir Area 1	Along Bryn Mawr Ave. Outfall drains directly towards Dark Brook Reservoir.		2	12" CMP	B	Heavy sediment deposits observed at outfall. Steep slopes increase erosion.
	P11	Dark Brook Reservoir Area 2	Intersection of Southbridge St. (Route 12) & West St.	Commercial.	16	18" DI	C/D	High groundwater & surface water.
G	P12	Dark Brook Reservoir Area 3	Outfalls along Warren Rd. & Bryn Mawr Ave. (south of I-90) discharge near Dark Brook Reservoir. DrainsWarren Rd. & Elbridge Rd. neighborhoods.	Residential.	9	2 - 12" CMP	B	Moderate erosion observed at outfalls. No structural protection at outfalls. Moderate slopes.
	P13	Dunns Brook Area 1	Outfall on Southbridge St. (Route 12) at the Auburn Golf Center & I-290 off ramp. Discharges directly to Dunns Brook.	Commercial.	8	-	NC	Next to three Zone I wellhead protection areas.
	P14	Dunns Brook Area 2	Three outfalls discharge directly into Dunns Brook.		28	Concrete, 36"	NC	Within Zone I wellhead protection area.
	P15	Dunns Brook Area 3	Oufall into Dunns Brook at Water St. Drains area along Southbridge St. & I-290.	Commercial.	12	24" Concrete	NC	High turbidity & conductivity observed at outfall.
	P16	Eddy Pond Area 1	Located off of Packard Ave., this outfall may be part of a piped stream system originating from the wetlands south of Paul St. Discharges flow into a steep gulley near the Eddy Pond Dam & contribute to Dunns Brook.	Dense residential.	26	24" Concrete	B	Some erosion in gulley.
H	P17	Eddy Pond Area 2	Between Central St. & Eddy Pond.	Residential.	1	10" HDPE	A	Outfall is located on a steep slope towards Eddy Pond & has no protection. Sediment deposits & moderate erosion observed.
I	P18	Auburn Pond Area	Adjacent to Swanson Rd. at Dunns Brook. Discharges runoff from Swanson Rd. & Auburn Mall. Last discharge point into Dunns Brook before it enters Auburn Pond.	Commercial.	3	21" Concrete	NC	Significant sediment deposits at outfall.
K	P19	Eddy Pond Wetland Area 1	Southern side of Cedar St. near Maywood Circle. Discharges to a natural buffer.		2	2 - 12" Concrete	A	Low slopes & high groundwater.
	P20	Stone Brook Wetland Area	Off Potter Farm Rd..	Residential.	10	12" Concrete	D	Within Zone II aquifer & adjacent to Zone I aquifer. Access may be difficult due to private property & forested areas.
	P21	Pondville Pond Area 1	Direct discharge to Pondville Pond.	Industrial.	19	42" CMP	NC	Highly corroded pipe material. Heavy sediment deposits at outfall.
M	P22	Pondville Pond Area 2	On Town property on a peninsula in Pondville Pond. Discharges directly into Pondville Pond.	Residential.	1	12" CMP	A	

Prioritization criteria is summarized in Table 4-7 and described below. Soil hydrologic groups (Figure 4-4) were not used in ranking BMP sites, however, were considered in selecting possible BMPs. For example, infiltration BMPs are not recommended in C or D (poor draining) soils.

Size of Drainage Area – Treating stormwater from a larger drainage area is generally more cost effective. An outfall that discharges stormwater from a few catch basins will not have the same pollutant load as a drainage system collecting stormwater runoff from an entire neighborhood, including roads. BMP sites were given a score of 2 if they discharge stormwater from an area ≥50 acres a score of 1 is they collect drainage from an area ≥10 acres, and 0 if they drain an area <10 acres.

Aquifer Recharge and Protection – Increasing stormwater volumes have been shown to decrease groundwater levels and groundwater supply yields. Furthermore, stormwater within public supply aquifers increases the chance of discharging pollutants to these groundwater supplies. Aquifer recharge and protection possibilities were therefore a characteristic chosen for the prioritization. BMP sites over a water supply aquifer with A/B hydrologic soils were assigned a value of 2, sites over a water supply aquifer with C/D hydrologic soils a value of 1, and sites not over a major aquifer were assigned a value of 0. Site locations within a water supply aquifer that had unclassified hydrologic soils received a value of 1.

Impairment – All water bodies in the Town of Auburn are 303d listed impaired waters, some of which require a TMDL. However, only some of these water bodies have a TMDL, which allocates specific pollutant loads to the water body and requires Towns to meet these allocations through the federal Phase II program. BMP locations that discharge directly to a water that has a TMDL receive a value of 2, and all others a value of 0.

Discharge – Stormwater that discharges directly into a water body will have a greater impact than stormwater that discharges over a natural buffer, where some removal of pollutants will occur. Therefore, BMP sites that discharged directly to a pond receives a value of 2, discharges directly to streams receive a value of 1, and discharges to woods or natural buffers a value of 0.

Access – Frequently older drainage systems were installed across property without a written and documented easement. Accessing and installing BMPs on private property can be very costly and nearly impossible if cooperation from the owner is not received. BMP sites were given a score of 2 if they were within town lands, a score of 1 if

they were within the roadway or on an easement, and 0 if they were on private property.

Land Use in Drainage Area – Stormwater discharges from industrial or commercial areas generally have higher concentrations of pollutants than residential or forested areas. Industrial/commercial land uses are assigned a value of 3, high density residential a value of 2, moderate density residential a value of 1, and low density residential a value of 0.

Table 4-7. BMP Ranking Criteria for Water Quality Characteristics

Water Quality Characteristics of Stormwater Drainage Outfall	Ranking Significance
Drainage Area	
≥50 Acres	2
≥10 Acres	1
<10 Acres	0
Aquifer	
Public supply & A/B hydrologic soils	2
Public supply & C/D hydrologic soils	1
Not located within a public supply	0
Impairment	
Discharge to water with TMDL	2
Discharge to water without TMDL	0
Discharge	
Direct discharge to pond	2
Direct discharge to stream	1
Direct discharge to woods or natural	0
Access	
Site is accessible and is on Town lands	2
Site is on Town lands, not easily	1
Site is not accessible or on Town Lands	0
Land Use in Drainage Area	
Industrial/Commercial	3
High Density Residential	2
Moderate Density Residential	1
Low Density Residential	0

A summary of the site screening methodology and results based on these criteria are shown in Table 4-8. Each investigated BMP was screened according to the following characteristics.

Table 4-8. Proposed BMP Summary Table & Priority Matrix						
BMP ID	**BMP Site**	**Drainage Area (acres)**	**Outfall Diameter (in)**	**Soil Group**	**Total Ranking Points**	**Rank**
P1	Rochdale Street	10	15	B	5	19
P2	Sword Street	18	15	NC	8	9
P3	Southbridge Street	20	-	NC	7	11
P4	Leesville Pond Area 1	123	-	C/D	10	2
P5	Leesville Pond Area 2	80	-	C/D	7	11
P6	Leesville Pond Area 3	5	12, 12	A	6	16
P7	Leesville Pond Area 4	23	12, 24	C	6	16
P8	Goddard Drive, Rice Road	16	24, 24	C	3	20
P9	Tinker Hill Pond	4	24	A	6	16
P10	Dark Brook Reservoir Area 1	2	12	B	9	6
P11	Dark Brook Reservoir Area 2	16	18	C/D	11	1
P12	Dark Brook Reservoir Area 3	9	12, 12	B	9	6
P13	Dunns Brook Area 1	8	-	NC	7	11
P14	Dunns Brook Area 2	28	12, 32, 36	NC	7	11
P15	Dunns Brook Area 3	12	24	NC	8	9
P16	Eddy Pond Area 1	26	24	B	7	11
P17	Eddy Pond Area 2	1	10	A	10	2
P18	Auburn Pond Area	3	21	NC	10	2
P19	Eddy Pond Wetland Area 1	2	12, 12	A	2	22
P20	Stone Brook Wetland Area	10	12	D	3	20
P21	Pondville Pond Area 1	19	42	NC	10	2
P22	Pondville Pond Area 2	1	12	A	9	6

4.5 Illicit Discharge Investigations

Potential illicit discharges or non-stormwater related discharges of water and pollutants to water bodies were also evaluated as part of the capital improvement program. An illicit discharge detection and correction program is required under the federal Phase II program to eliminate other sources of pollution to the Town's stormwater drainage network in an overall effort to improve water quality.

Auburn's stormwater outfalls were screened in the field to determine the potential for illicit discharge connections to its storm drain network. Illicit discharge characteristics at each outfall are summarized in Table 4-9.

A table of all the outfalls inspected and the findings of the inspections is provided in Appendix B. Continued outfall inspection and screening will be required under the Phase II program to identify and correct potential illicit discharges.

Table 4-9. Illicit Discharge Indicators	
Indicator	**Description**
Dry Weather Flow	Flows observed during dry weather represent non stormwater flows and indicate a potential illicit discharge. In some cases, flow may represent high groundwater or piped streams. Dry weather flows were sampled at the time of discovery to determine whether they contributed to pollution.
Surface Deposits	Deposits from stormwater runoff and dumping activities were assessed at each outfall. Deposits used to describe this category include grease/oil, trash, yard waste, sediment, foam, and no deposits found.
Distressed Vegetation	The condition of vegetation near an outfall is a good indicator of the quality of discharge at that location. Plants that are wilted or have discolored foliage may be an indication that contaminants are present in the stormwater. Contaminant sources may include pesticides and fertilizers from lawn applications, automotive chemicals from road surfaces, illegal dumping and illicit connections to the storm drain system.
Erosion	Soil erosion and channeling at outfalls contribute sediments to the receiving water. Sediment in streams and ponds negatively impacts aquatic life by burying aquatic habitat, spawning areas, fish eggs, and bottom dwelling macro invertebrates, a primary food source for fish. Sediment can also clog the gills of fish and other aquatic life, causing them to suffocate. Heavy metals and harmful bacteria are often bound to sediment particles and are washed into surface waters resulting in significant negative water quality impacts.
Surrounding Land Use	Surrounding land use may indicate the types and severity of pollution expected at an outfall. Industrial uses often have the highest potential pollutant loads, followed by commercial, agricultural, highway and residential with forested area contributing very little pollution.
Water Appearance	Water appearance including the presence of an oil sheen, cloudy/milky water, dark tea colored water, reddish/orange water and clear water were noted during observations.
Oil Sheen	*A sheen indicates the presence of a petroleum based product. Sources may include automotive and other petroleum-based products, chemical spills, and runoff from roadway surfaces.*
Cloudy/ Milky Color	*Cloudy/milky water may indicate contamination from soaps, sanitary wastewater, or paint. Sources include illicit connections, failing septic systems or broken sewer pipe and improperly disposed paint products.*
Dark Tea Color	*Dark tea colored water is typically caused by decomposing plant materials. This is often occurs where yard wastes have been dumped or water is discharging from a wetland area.*
Reddish/ Orange Color	*Reddish/orange typically indicated oxidized iron. Sources include industrial spills, waste disposal, or natural iron deposits.*
Odor	Odor may indicate potential contamination sources when there are no visual indicators. Odors may be associated with sewage or petroleum.

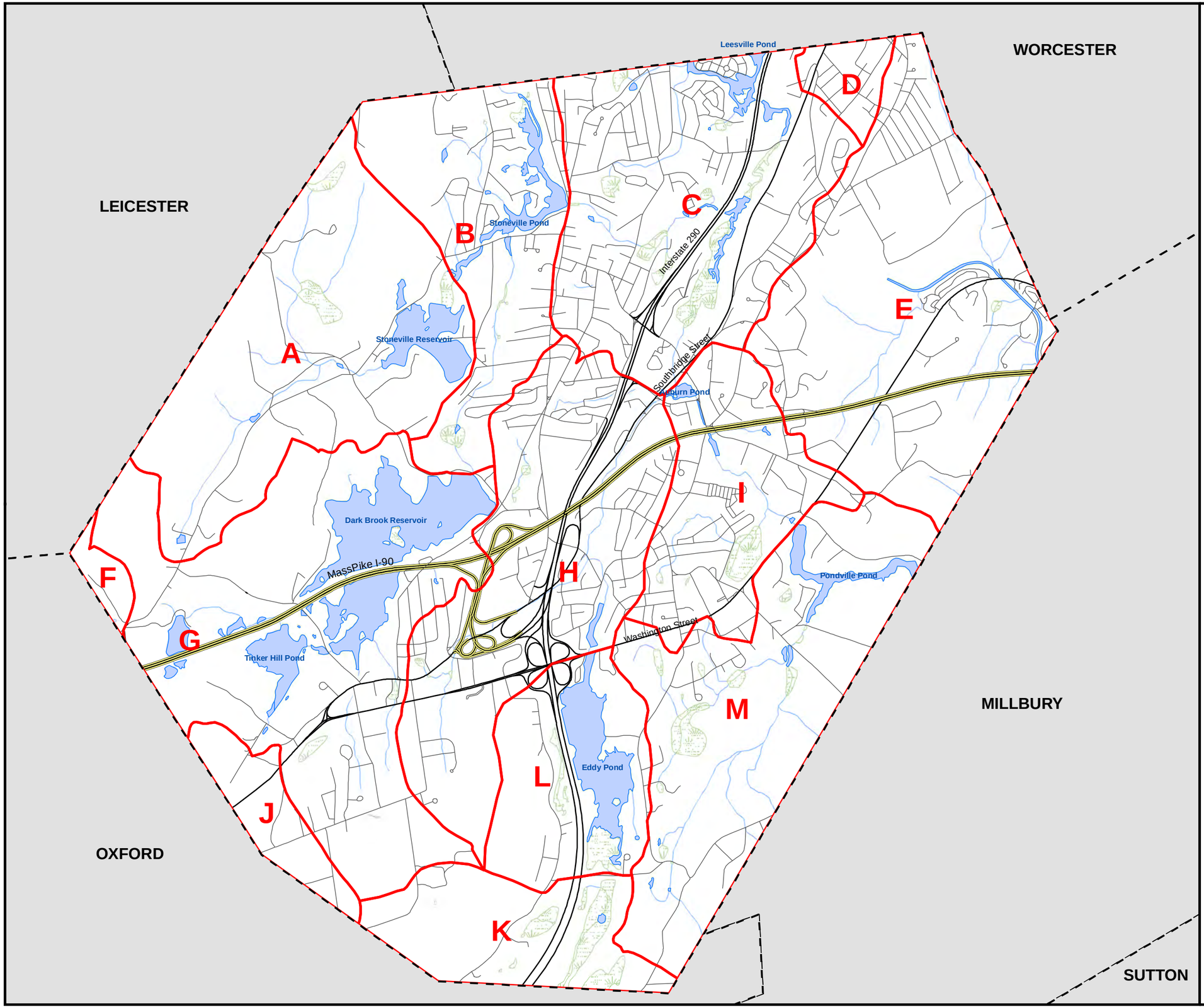


Figure 4-1

Subwatershed Boundaries

Auburn, MA

Legend

- Town Boundary
- Subwatershed Boundaries
- Roads
- State Highways & Roads
- Turnpike
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

N
W E
S

0 750 1,500 3,000 4,500 6,000 Feet

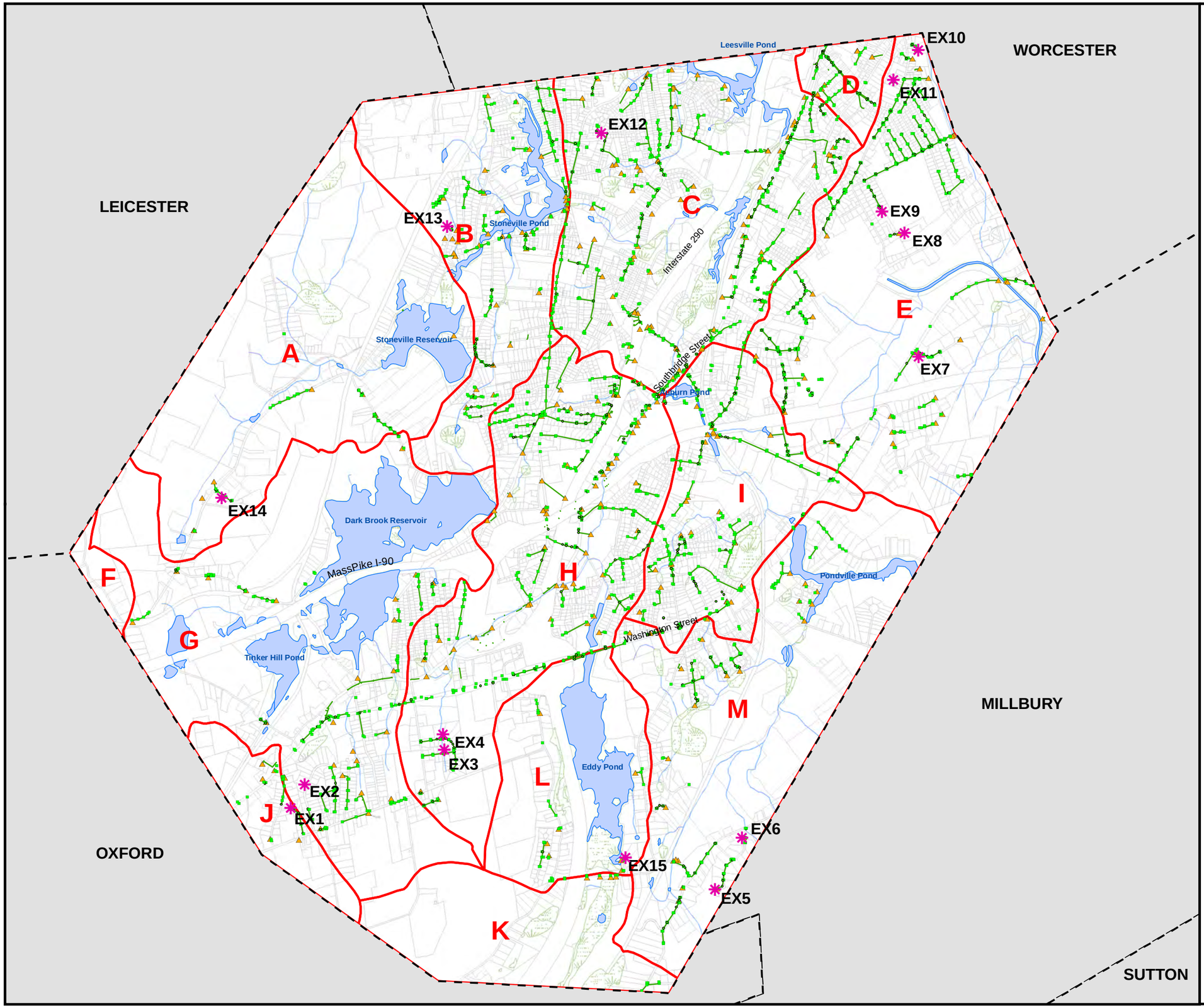
0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 4-2

Existing Water Quality BMP Locations

Auburn, MA



Legend

- Town Boundary

Drainage Structures

- Catch Basin
- Drainage Manhole
- Existing BMP
- Outfall
- Drainage Pipes
- Subwatershed Boundaries
- Lakes, Ponds
- Wetlands
- Streams, Brooks
- Parcels

Data Source: MassGIS, Town of Auburn, CEI

N
W E
S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

Figure 4-3

Proposed Water Quality BMP Locations

Auburn, MA

LEICESTER

WORCESTER

MILLBURY

SUTTON

OXFORD

Leesville Pond

Stoneville Pond

Stoneville Reservoir

Dark Brook Reservoir

Tinker Hill Pond

Eddy Pond

Pondville Pond

Auburn Pond

Interstate 290

MassPike I-90

Washington Street

Southbridge Street

A

B

C

D

E

F

G

H

I

J

K

L

M

P1

P2

P3

P4

P5

P6

P7

P8

P9

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P11

P12

P13

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P16

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P18

P19

P20

P21

P22

Legend

- Town Boundary
- Subwatershed Boundaries

Drainage Structures

- Outfall
- Proposed Water Quality BMP
- Catch Basin
- Drainage Manhole
- Detention Pond
- Drainage Pipes
- Water Quality BMP Watershed
- Lakes, Ponds
- Wetlands
- Streams, Brooks
- Parcels

Data Source: MassGIS, Town of Auburn, CEI

N W E S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

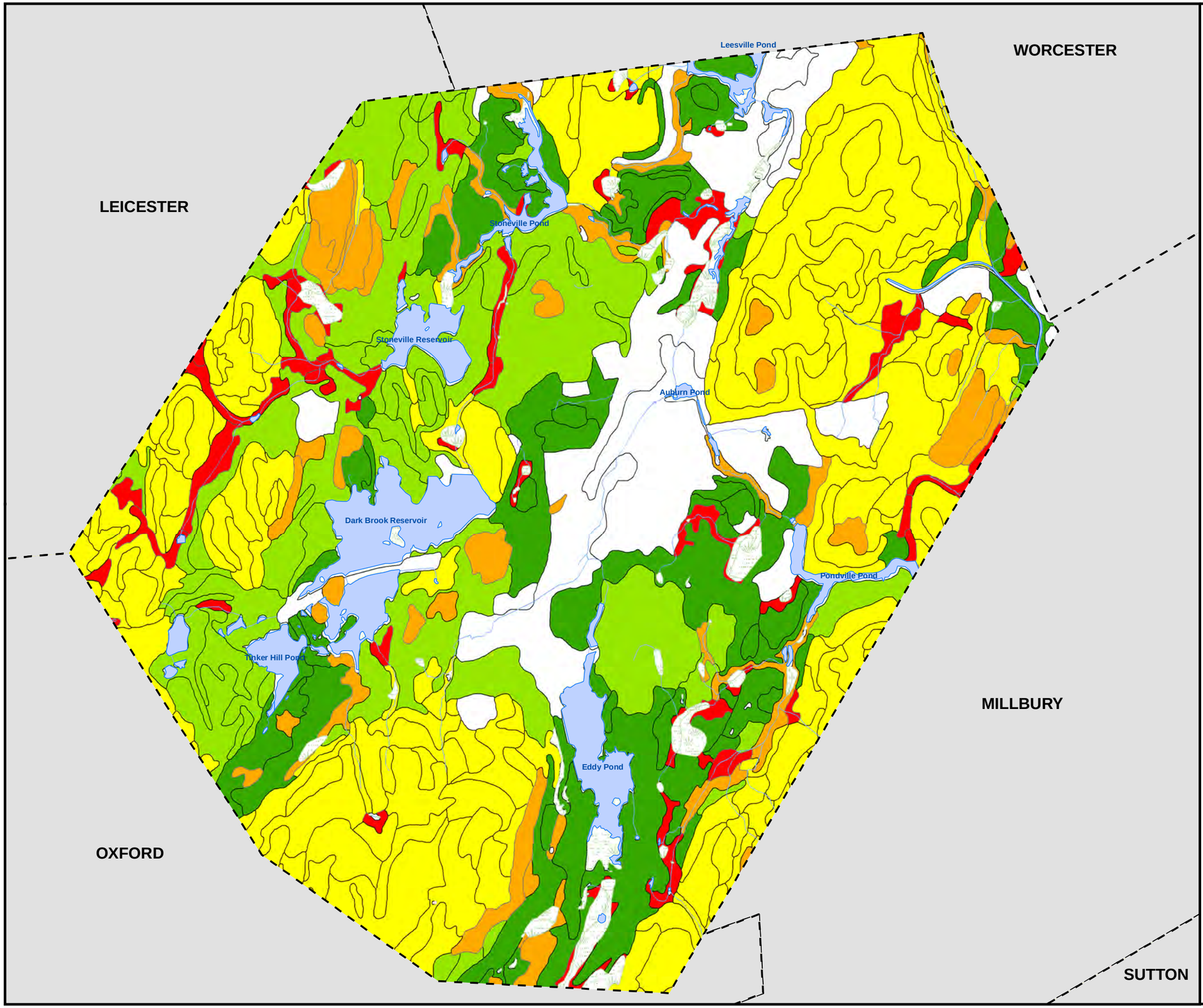

Figure 4-4

Soils Classification

Auburn, MA

Legend

- Town Boundary
- Lakes, Ponds
- Wetlands
- Streams, Brooks
- Soil Not Classified
- Soil Hydrologic Group A
- Soil Hydrologic Group B
- Soil Hydrologic Group C
- Soil Hydrologic Group C/D
- Soil Hydrologic Group D

Data Source: MassGIS, Town of Auburn, CEI

N
W E
S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

5.0 Recommendations

The Auburn Stormwater Management Master Plan describes a number of activities, including:

- structural stormwater treatment controls located where they will remove pollutants from stormwater runoff and improve downstream water quality,
- stormwater infrastructure improvements that will alleviate flooding areas and improve water quality, and
- non structural practices including increased catch basin cleaning, street sweeping and other maintenance activities, and
- public outreach and education to improve residents understanding of the need for these improvements and for their participation in improving water quality.

These recommendations are summarized below. The costs and schedule for implementing the recommendations are noted in Table 5-1 at the end of this section.

#1 Increase Infrastructure Maintenance

Street sweeping, catch basin cleaning and regular cleanout/maintenance of stormwater controls like detention basins effectively removes sediments and pollutants like phosphorus if good equipment is used. Outdated equipment wastes staff time and is less effective. Employing vacuum or regenerative air sweepers to clean streets can improve the overall quality of the town's valuable water and infrastructure resources by preventing siltation and sedimentation of water bodies and by reducing flooding.

#1a Annual Street Sweeping

Auburn has 87 miles of roadway that need at least annual sweeping to remove sediment, debris and trash that has collected on the roadway. The Town successfully accomplishes this activity. The master plan also identifies 19 miles of roadway recommended for more frequent sweeping, as shown on Figure 5-1, based on observations of sediment accumulation on the streets, proximity to water bodies and lack of sediment controls (refer to O&M Plan for details).

Auburn currently uses mechanical street sweepers, an old technology that can create air pollution and is ineffective at removing finer pollutant-laden sediments even after repeated sweeping. These fine sediments then fill up adjacent waterways and may cause algae blooms. Regenerative or vacuum air sweepers thoroughly cleanse roadways without the air pollution, usually in one pass.

Recommendation: Purchase a regenerative air street sweeper and sweep streets at frequency determined through O&M Plan.

Actions:

1) Sweep all streets annually in the spring.
2) Sweep the identified 19 miles a minimum twice per year, spring and fall.

3) Track sediment collected from sweeping operations and adjust efforts as necessary based on accumulations (e.g., some area may need more sweeping, while others may need less).

Objectives: Reduce sediment and phosphorus loads to Town surface waters from roadways.

Budgeted Capital Costs: $200,000 for regenerative air sweeper.

Budgeted Annual Costs: $50,000 for labor, equipment O&M, and sediment disposal

#1b Annual Catch Basin Cleaning

Auburn has 1,635 catch basin structures that serve to collect runoff, removing some of the sediment. Access to clean and maintain drain pipes is through these catch basins, and they provide a junction point to connect stormwater piping from different directions. They require regular cleanout to remove the deposited sediments -- otherwise it may be washed downstream into streams, lakes and ponds or may clog and cause flooding when the catch basin surcharges. This can lead to other problems when the water creates a new path, eroding soils and undermining pavement. Good care of catch basins and piping helps reduce pavement damage from excess water, potentially reducing repaving costs.

Catch basins should be cleaned at least annually to remove accumulated sediment.

Recommendation: Clean catch basins annually in accordance with O&M Plan (Appendix C) and adjust frequency as needed based on the amount of sediment obtained.

Actions:

1) Clean all catch basins annually in the spring.
2) Track sediment collected from sweeping operations and adjust efforts as necessary based on accumulations (e.g., some areas may need more frequent sweeping: others less).
3) Identify catch basins that need a hood or replacement (see Recommendation #4c for details).

Objectives: Reduce sediment and phosphorus loads to surface water; protect pavement from water damage; prevent localized flooding associated with clogged structures.

Budgeted Capital Costs: Refer to Recommendation #4c for capital costs associated with replacement of deteriorated catch basins or installation of hoods.

Budgeted Annual Costs: $57,225 to hire a contractor to clean all catch basins annually and dispose of sediments.

#1c Maintain Existing Stormwater BMPs

The master plan identifies 16 existing stormwater controls or best management practices (BMPs) in Auburn (see Figure 4-2). Each control was inspected in preparation of the

plan (see Appendix B for inspection logs). All need maintenance such as annual mowing to prevent woody vegetation and removal of accumulated sediment so that they will not fill up with sediment and stop functioning or cause flooding.

Recommendation: Inspect and maintain existing stormwater BMPs on an annual basis, including mowing and sediment removal.

Actions:
1) Inspect stormwater BMPs annually in the spring.
2) Mow vegetation to control woody growth.
3) Remove accumulated sediments.

Objectives: Maintain the town's investment in stormwater controls, protect water quality and prevent flooding.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $8,000 per year to mow and clean out sediments.

#1d Clean Stormwater Outfalls

Auburn has 328 stormwater outfalls that were inspected either as part of the Town's Stormwater Management Master Plan or as part of Phase II stormwater regulatory compliance program. There was excessive sediment accumulation at 64 of these outfalls (refer to Table 3-5 and Figure 3-3). The sediment contributes to water quality problems in the receiving water and can lead to infilling of water bodies, reducing capacity and eventually requiring dredging. Improved maintenance of catch basin structures in the future will reduce sediment accumulation at outfalls, but some initial cleaning of the 64 outfalls is also required to remove existing accumulations.

Recommendation: Remove accumulated sediment from the 64 outfalls.

Actions:
1) Remove accumulated sediment from the 64 outfalls identified in Table 3-5.
2) Perform annual maintenance of 10 structures per year, making any other necessary improvements identified during maintenance activities (e.g., improvements to headwalls, erosion controls, etc.).

Objectives: Reduce sediment and phosphorus loads to Town surface waters.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $64,000 for initial sediment removal at 64 structures, with $10,000 per year to remove sediments and make improvements at outfall structures (10 structures per year).

#2 Implement Structural Water Quality Controls

As described in Section 4.0, almost all of the surface water resources in Auburn have impaired water quality and are listed on the 303d list of impaired waters. Most problems relate to excess aquatic vegetation and high nutrient levels (particularly phosphorus) that cause algae blooms, odors and unsightly conditions or recreational closures. Twenty-two locations were identified as candidate sites where BMPs might be built to reduce phosphorus and sediment loads to water resources.

Recommendations and cost estimates for the twenty-two sites are summarized in Table 5-2 below and shown in Figure 4-3.

Recommendation: Design and install BMPs for the locations in Table 5-2.

Actions:

1) Prepare design plans and specifications for the construction of the BMPs.
2) Obtain necessary permits for construction.
3) Develop an Operations and Maintenance (O&M) Plan for each BMP.
4) Construct BMPs.

Objectives: Reduce sediment and phosphorus loads to Town surface waters from stormwater discharges.

Budgeted Capital Costs: $1,625,000 for design, permitting and construction.

Budgeted Annual Costs: $11,000 for annual maintenance of all 22 structures ($500 each structure). Annual maintenance costs will vary each year depending on when each structure is constructed, with lower maintenance costs in the beginning of the program, accumulating to $11,000 once all structures are constructed.

Table 5-2. Proposed Water Quality BMPs		
Site ID	**BMP Options**	**Capital Cost**
P1	Rochdale Street - install plunge pool	$18,750
P2	Sword Street - install plunge pool, flooding improvements, upstream diverted bioretention (pump station)	$75,000
P3	Southbridge Street - install plunge pool and swale at outfall	$37,500
P4	Leesville Pond Area 1 - install large plunge pool or forebay/wetpond or upstream structure improvements	$312,500
P5	Leesville Pond Area 2 - install check dams and swales or structures or off-line treatment	$187,500
P6	Leesville Pond Area 3 - install deep-sump catch basins or plunge pool or swale	$25,000
P7	Leesville Pond Area 4 - install plunge pools or basin	$125,000
P8	Goddard Drive/Rice Road - cut in forebay/plunge pool or upstream structure improvements for wetland pretreatment to collect sediment	$62,500
P9	Tinker Hill Pond - install plunge pool or swale	$37,500
P10	Dark Brook Reservoir Area 1 - install plunge pool and rip rap	$25,000
P11	Dark Brook Reservoir Area 2 - install bioretention or wet basin	$125,000
P12	Dark Brook Reservoir Area 3 - install plunge pool and cascading swales	$56,250
P13	Dunns Brook Area 1 - install infiltration chambers or off-line proprietary filter	$62,500
P14	Dunns Brook Area 2 - install plunge pools or upstream basin conversions	$62,500
P15	Dunns Brook Area 3 - install roadside swale (vegetated), plunge pool at surface runoff and/or upstream structure	$62,500
P16	Eddy Pond Area 1 - upstream deep sump catch basin/structure (e.g., baffle tanks)	$75,000
P17	Eddy Pond Area 2 - install upstream deep sump catch basins/structures	$37,500
P18	Auburn Pond Area - install sediment trap	$37,500
P19	Eddy Pond Wetland Area 1 - install upstream deep sump pretreatment and/or forebay/level spreader	$31,250
P20	Stone Brook Wetland Area - install plunge pool/level spreader	$12,500
P21	Pondville Pond Area 1 - install wet pond, obtain easement	$150,000
P22	Pondville Pond Area 2 - outlet stabilization with level spreader	$6,250
	Total Capital Cost	$1,625,000

#3 Retrofit Existing Stormwater BMPs

As described in Section 4.0, Auburn has 16 existing stormwater BMPs inspected under this program. Most are detention basins or wet ponds installed to manage stormwater runoff from specific developments. Most have excessive sediment or woody vegetation and are not working as designed. Also, many were not designed for easy maintenance and have no sediment forebay for cleanout. A copy of the inspection log and results is included in Appendix B. Table 5-3 summarizes the proposed recommendations and associated cost estimates to retrofit these BMPs to function better and provide better water quality treatment, flood protection and simplified, less expensive maintenance. Refer to Figure 4-2 for site locations.

Table 5-3. Water Quality Retrofits to Existing BMPs

Site ID	BMP Options	Cost
EX1	Sunnyside Road - raise low flow outlet, remove brush	$5,000
EX2	Bridal Path Road - install forebay, remove invasives, remove sediment, repair silt fence, complete fencing, replace displaced riprap	$15,625
EX3	Booth Road - install forebay, remove brush & invasives	$16,250
EX4	Hilltop Farm Road - install forebay, remove brush & invasives, remove sediment	$16,250
EX5	Elizabeth Road 1 - install forebay in first pond, remove heavy growth	$16,250
EX6	Elizabeth Road 2 - install forebay, raise low flow outlet, remove heavy vegetation & invasives	$17,500
EX7	Westec Drive - install gabions to lengthen flow paths, remove heavy growth	$3,750
EX8	Stonebridge Road - install forebay, remove heavy vegetation & invasives	$16,250
EX9	Saybrook Way - raise low flow structure, remove heavy vegetation & invasives, remove sediment	$6,250
EX10	Erica Lane - install forebay, raise low flow outlet, install gabions, remove heavy vegetation & invasives	$17,500
EX11	Alex Circle - install forebay, remove heavy vegetation & invasives	$16,250
EX12	Gwen Drive - install forebay, remove heavy vegetation	$16,250
EX13	Dale Avenue - install forebay, raise low flow outlet	$13,750
EX14	Crow Hill Road - install forebay, remove invasives	$12,500
EX15	Eddy Pond Wetland Area 2 - clean existing structural BMP	$12,500
	Total Cost	$201,875

Recommendation: Design and install BMPs retrofits for the locations in Table 5-3.

Actions:
1) Prepare design plans and specifications for the construction of BMP retrofits.
2) Obtain necessary permits for construction.
3) Develop an Operations and Maintenance (O&M) Plan for each BMP.
4) Construct BMP retrofits.

Objectives: Reduce sediment and phosphorus loads to Town surface waters from stormwater discharges.

Budgeted Capital Costs: $201,875 for design, permitting and construction.

Budgeted Annual Costs: Maintenance is covered under Recommendation #1c Maintain Existing Stormwater BMPs.

#4 Rehabilitate Existing Infrastructure

The extent and condition of Auburn's stormwater infrastructure was assessed in the development of this Stormwater Management Master Plan, with the detailed findings presented in Section 3.0. About one third of the storm sewer system is pre-1950, with deteriorating catch basins and manholes.

Outfalls were physically inspected during this program and previous Phase II compliance activities to assess their physical condition. In addition to the excessive sediment accumulations at the 64 structures described above, several structures were found to need some structural improvement to address erosion and structural deficiencies.

#4a Stabilize Eroded Outfalls

Twenty-three outfalls were observed with heavy erosion and in need of stabilization (refer to Figure 3-3). Many of the locations were unprotected with no headwall, riprap, flared ends, etc. and the high stormwater flows and velocities have eroded the soils at the outlet. These soils then enter the surface water body, contributing to infill and carrying other pollutants that stick to sediment, such as phosphorus.

Recommendation: Stabilize erosion at the 23 outfalls using appropriate techniques for each site (e.g., headwall, riprap).

Actions:
1) Review inspection reports and visually inspect outfalls to determine needed stabilization.
2) Prepare designs and permits where needed.
3) Install erosion controls.

Objectives: Reduce sediment and other pollutant loads to Town surface waters from erosion. Keep infrastructure in good operating condition.

Budgeted Capital Costs: $143,750 for design, permitting and construction at all 23 "eroded" outfall locations. Note that not all locations will require design and permitting.

Budgeted Annual Costs: Maintenance is covered under Recommendation #1d Clean Stormwater Outfalls.

#4b Repair Outfalls

Thirty outfalls were observed with structural deficiencies (refer to Figure 3-3). These deficiencies varied including cracked or corroding pipes, partially buried or collapsed pipes, and unstable headwalls. Some of the locations with severe erosion had undermined outfall structures in need of repair.

Recommendation: Repair damaged infrastructure at the 30 outfalls using appropriate techniques for each site.

Actions:

1) Review inspection reports and visually inspect outfalls to determine needed repairs.
2) Prepare designs and permits where needed.
3) Make repairs.

Objectives: Keep infrastructure in good working order to prevent erosion and minimize localized flooding.

Budgeted Capital Costs: $187,500 for design, permitting and construction at all 30 "structurally deficient" outfall locations. Note that not all locations will require design and permitting.

Budgeted Annual Costs: Maintenance is covered under Recommendation #1d Clean Stormwater Outfalls.

#4c Replace/Rehabilitate Deteriorated Pipes and Catch Basins

As noted previously in Section 3, the Town's stormwater infrastructure consists of approximately 34 miles of pipe, with 13 miles pre-1950. Most of the pre-1950 pipe is corrugated metal, estimated at 90% or 11.37 miles. Based upon past studies of the life expectancy of similar piping in other communities, it is expected that 17% of the pre-1950s piping (1.9 miles) is deteriorated and needs replacement. Additionally, older catch basins do not have deep sumps or hoods and may warrant specific retrofitting work such as installation of a protective hood (i.e., The Eliminator by Ground Water Rescue, Inc.).

Recommendation: Replace deteriorated stormwater piping, inclusive of associated manholes and catch basins, as specific areas of deterioration (and failure) are identified as part of the annual Infrastructure Maintenance program. Retrofit specific catch basins with hoods as they are identified through routine catch basin cleaning and inspection, in

order to target catch basins that are the "last step" before outfall or have a tendency to receive a significant amount of sediment.

Actions:

1) Visually inspect pipes that are now buried as part of the catch basin cleaning.
2) Document pipe materials and condition in the stormwater GIS database.
3) Coordinate drainage replacement projects with planned roadway projects.
4) Prepare designs and permits where needed.
5) Repair failing stormwater piping and associated structures.
6) Retrofit existing catch basins with hoods as warranted.

Objectives: Restore hydraulic carrying capacity and function of existing infrastructure, protect roads from undermining and protect water bodies from water pollution.

Budgeted Capital Costs: $1,700,000 for design, permitting and construction of the initial 2 miles of pre-1950s piping within the first 10 years, with provisions an additional $1,700,000 for the second 10 years, as the stormwater infrastructure continues to age. Note that design and permitting costs may be less if stormwater work is done as part of an overall roadway rehabilitation project. Additionally, construction costs may be less if performed with in-house labor and equipment. These improvements should occur within the first 10 years of the planning cycle, with subsequent allowance provided in future years for the ongoing aging infrastructure and required replacement.

Budgeted Annual Costs: Maintenance is covered under Recommendation #1b Perform Annual Catch Basin Cleaning.

#4d Improve Flooding

Thirteen areas within Town were identified as having flooding problems. While some may be improved with infrastructure improvements, many appear to be associated with high wetland and pond water levels, which cannot be easily improved through infrastructure improvements. The list of flooding locations is presented in Table 5-4, with proposed improvements and costs for six of the locations.

Table 5-4. Recommended Flooding Improvements				
Subwatershed	**Site ID**	**BMP Site**	**Possible Improvements**	**Budgeted Cost**
A	FL1	Rochdale St.	Cleaning, install larger diameter culverts at same location.	$62,500
B	FL2	Stoneville Pond	Undetermined. Within 100-year floodplain.	
C	FL3	Eaton Avenue	Installation of drain network along entire length of street.	$62,500
	FL4	Southbridge St. Court	Undetermined. Within 100-year floodplain.	
	FL5	Sword St.	Undetermined. Water levels controlled by Leesville Pond.	
	FL6	Kettle Brook	Undetermined. Within 100-year floodplain.	
G	FL7	West St.	Installation of drain network along this portion of the street.	$187,500
H	FL8	Oxford St. North	Installation of drainage piping.	$151,875
	FL9	Swanson Rd.	Cleaning of existing culvert, installation of sediment forebay.	$56,250
	FL10	Briarcliff Rd.	Cleaning of existing structures. Cost covered under annual maintenance program.	
I	FL11	Stone St.	Installation of drain network, possible infiltrating catch basins.	$468,750
K	FL12	Oxford St. South	Installation of drain network along this portion of the street. Ongoing project being performed directly by Town.	
M	FL13	Elm St. & Brook St.	Undetermined. Within 100-year floodplain.	
Total				$989,375

Recommendation: Implement flooding improvements presented in Table 5-4.

Actions:

1) Prepare design plans and specifications for the flooding improvements.
2) Obtain necessary permits for construction.
3) Construct flooding improvements.

Objectives: Reduce flooding throughout Town.

Budgeted Capital Costs: $989,375 for design, permitting and construction.

Budgeted Annual Costs: Annual maintenance will be performed as part of Recommendation #1.

#5 Control Noxious Aquatic Plants

Four of Auburn's ponds have invasive species that require control to prevent them from spreading and taking over the pond. These include Auburn Pond, Eddy Pond, Pondville Pond and Stoneville Pond. All are impacted with *Cabomba caroliniana* and Stoneville Pond also contains *Myriophyllum*. Since these ponds are listed on the 303d list for noxious aquatic plants and improvement of water quality for 303d listed water bodies is a goal of the Phase II program, control of aquatic vegetation has been carried forward in this plan.

Based on discussions with Lycott Environmental, chemical treatment is the recommended management approach for all four ponds. Treatment costs are summarized by pond in Table 5-5.

Table 5-5. Recommended Controls for Invasive Species

Pond	Control Method	Average Annual Cost	Comments
Auburn Pond	Chemical treatment	$3,000	
Eddy Pond	Chemical treatment	$8,000	
Pondville Pond	Chemical treatment	$16,000	$20,000 first year, $12,000 second year & third year, $20,000 fourth year and so on
Leesville Pond	Chemical treatment	$8,600	$20,000 first year, $8,000 thereafter
Total Cost		$35,600	

In addition to the chemical treatment, Lycott Environmental also recommended some selective dredging of the four ponds to remove accumulated sediments. This would minimize the amount of annual maintenance required, however is extremely expensive. Estimated dredging costs are provided below for three of these ponds for informational purposes, but have not been included in the capital improvement plan.[1]

[1] The costs of dredging are high, pointing to the importance of keeping sediments out of local water bodies through diligent catch basin cleaning, street sweeping and maintenance of outfalls. Neither the costs of roadway replacements, new paving or dredging are included in this plan, but effective implementation of this plan will help reduce future repaving and dredging as well as improve water resources and recreation.

Estimated Pond Dredging Costs			
	Auburn Pond	**Eddy Pond**	**Pondville Pond**
Dredge Area (sf)	12,550	90,000	1,000,000
Dredge Depth (ft)	5	5	5
Dredge Volume (cy)	2,325	16,667	185,186
Cost	$186,000	$1,333,360	$14,814,880

Recommendation: Perform annual chemical treatment of invasive species for Auburn Pond, Eddy Pond, Pondville Pond and Leesville Pond.

Actions:

1) Perform annual chemical treatment of invasive species in Auburn Pond, Eddy Pond, Pondville Pond and Leesville Pond.
2) Periodically check the need for program adjustments.
3) Annual Winter Drawdown of water levels where possible

Objectives: Reduce the spread of invasives in the pond.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $35,600 on average, varies each individual year based on the cycle noted in Table 5-5.

#6 Administration

A considerable amount of Town staff time will be required to administer this Stormwater Management Master Plan and comply with the Phase II requirements. The Town should designate staff to fulfill these requirements, including updates to existing GIS maps (e.g., mapping of stormwater outfalls, new or upgraded piping, new or retrofitted BMPs), inspections of BMPs and new developments, review of proposed stormwater designs, tracking of maintenance program, etc.

Recommendation: Provide staff to ensure and track the implementation of the proposed program.

Actions:

1) Hire new personnel to implement the stormwater program. It is anticipated that approximately 50% of this individual's time and effort would be focused on the stormwater program, with the balance dedicated to general engineering support.

Objectives: Implement plan and comply with Phase II to improve water quality and stormwater infrastructure.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $30,000 for salary, as a supplement to the existing salary budgeted for the Town's Land Use Enforcement Officer (position presently vacant).

#7 Public Education

Based upon developed property parcels, about 88% of Auburn is residential while 12% is non-residential (primarily industrial or commercial). Both types of development contribute to non-point source pollution from generalized sources such as vehicle emissions and drippage; uncontrolled pet wastes; lawn and garden fertilizers; car washing; and uncontrolled runoff from impervious surfaces such as driveways, roadways, and parking lots.

A public education program targeting residential and business uses can help reduce these sources by keeping residents and businesses informed of the importance of protecting water quality, the cost benefits of keeping pollutants out of surface waters (e.g., it is less expensive to prevent than to remediate), and emphasizing work the Town is doing to protect water quality including implementation of a Stormwater Utility. This approach tackles the source of the pollution rather than expending significant funds on end-of-pipe treatment structures or costly in-lake controls. Public education/outreach is also required by permit under the Phase II NPDES program.

The following components are proposed:

#7a Website Enhancements and Upkeep

The Town of Auburn is now updating its website to include more information and links on the impacts of stormwater runoff and what residents and businesses can do to minimize these impacts.

Recommendation: Enhance and periodically update the existing website to provide information pertaining to stormwater including:

- the impacts of stormwater runoff;
- the importance of protecting surface waters;
- information on what citizens can accomplish with small changes in how they deal with wastes and rainwater;
- information on how improper use and function of septic systems can impact surface water supplies;
- information on illicit discharges and the Town's associated regulations;
- information on Household Hazardous Waste Collection Days;
- proper fertilizer and pesticide use;
- proper disposal of yard waste;
- proper disposal of pharmaceuticals and personal care products;
- highlight stormwater improvement projects performed by the Town of Auburn;
- links to other sites regarding stormwater runoff and watershed protection.

Actions:

1) Research tips for citizens to include on the website.
2) Develop a website containing the information.
3) Update the website periodically to include information on Town projects and changes in stormwater information.

Objectives: Prevent pollution at the source. Improve public relations between Town and residents/businesses by informing residents of the work and improvements performed by the Town.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $1,000 per year for website upkeep.

#7b Participate in Pond Cleanups

Participation in a river, stream and pond cleanup program was one of the measures proposed by the Town in its Phase II Stormwater Management Program. The Town currently works with the Leesville Pond Watershed and Neighborhood Association to coordinate efforts and has participated in cleanups of Leesville Pond. This relationship should continue and the Town should foster cooperation with other groups to continue cleanup efforts as needed.

Cleaning of waterways provides immediate visual evidence of work being performed by the Town, while building public relationships and helping water quality.

Recommendation: Work with local advocacy groups to conduct stream and pond cleanups to remove trash and debris from local waters.

Actions:

1) Work with local advocacy groups to coordinate efforts.
2) Recruit volunteers by advertising in local newspapers, Town website, and through mailings.
3) Identify cleanup methods and organization needs for different resource waters.
4) Conduct cleanup activities for 2-3 resources per year.

Objectives: Build relationships with local advocacy groups and residents/businesses while improving water quality.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $1,000 for annual coordination and supplies (e.g., trash bags).

#7c Implement Public Outreach Program

The distribution of educational materials can help to keep residents informed of the importance of water protection and their role in it, however, one or two periodic mailings is not likely to have as great of an impact as a consistent program with regular mailings on a set schedule. A long-term continuing education program that incorporates a combination of press releases, flyers, brochures, newsletters and/or other mailings is thus recommended. The program could begin by highlighting upcoming projects such pond cleanups or BMP construction projects that help to improve water quality. A quarterly newsletter or brochure might also be considered, focusing on:

- Stormwater projects – Keep residents informed of ongoing stormwater projects in the Town, such as installation of water quality BMPs or flooding controls. Highlight grant funds obtained to complete these projects to help keep stormwater utility rates down.

- Lawncare and fertilizer use – Outline low or no fertilizer options for lawncare. Provide examples of fields where alternative practices are used (e.g., compost rather than chemical fertilizers are used to maintain the Boston Red Sox field). Highlight where free compost can be obtained if given away by the Town. Highlight where residents can dispose of leaves and other yard waste. Offer discounted composters.

Recommendation: Develop a public outreach program with scheduled mailings, such as quarterly. Seasonally time the mailings to have the greatest impact. For example, discuss lawn care in the spring and leaf management and composting in the fall. Include a website address and contact information on mailings.

Actions:

1) Develop information to be included in mailings.
2) Print materials.
3) Quarterly mailings.

Objectives: Educate residents and businesses on how they can help prevent stormwater pollution. Build positive public relations.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $5,000 for creating, printing and mailing materials, plus staff time.

#8 Other Phase II Compliance

The Town is also obligated to implement its Stormwater Management Program under the federal Phase II permit requirements. The first five-year permit term has ended and the Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MassDEP) are in the process of drafting the new permit conditions. While the new Massachusetts Phase II permit has not yet been released, a

draft was released in New Hampshire and for one Massachusetts watershed and similar requirements are anticipated for other Massachusetts watersheds. Among these are requirements for an illicit discharge program, wet weather monitoring, system mapping and development of individual Stormwater Pollution Prevention Plans for town operated maintenance facilities. The following actions will help the Town comply with existing and upcoming Phase II permit requirements:

#8a Perform Annual Stormwater Training

The existing Phase II program requires annual training of Town staff involved with any component of Phase II implementation, whether it be good housekeeping to prevent pollution or review of subdivision plan to ensure stormwater controls are in place.

Recommendation: Perform annual stormwater training of Town staff.

Actions:

1) Prepare or contract curriculum/course materials.
2) Conduct annual stormwater training session for Town Departments.

Objectives: Keep staff educated of Phase II requirements and pollution prevention measures.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $1,500 per year to contract single training session for all employees.

#8b Assess Illicit Discharge Potential

The draft NPDES Phase II permits (expected to be mirrored throughout Massachusetts) calls for the delineation of catchments or drainage units and ranking of each catchment for the potential to have illicit discharges as “low”, “medium” or “high”.

Recommendation: Delineate catchments for water bodies or outfalls and rank based on the potential for the presence of illicit discharges.

Actions:

1) Delineate catchments based on receiving water, land use type, outfall, etc.
2) Develop ranking criteria that considers the potential for illicit discharges.
3) Rank catchments and document in a plan.

Objectives: Prioritize illicit discharge efforts to eliminate non-stormwater discharges into the Town’s stormwater drainage network.

Budgeted Capital Costs: $10,000 to map catchments and develop prioritization plan.

Budgeted Annual Costs: N/A

#8c Perform Outfall Screening for Illicit Discharges

The draft NPDES Phase II permits (expected to be mirrored throughout Massachusetts) calls for dry weather screening of 25% of outfalls each year. Screening involves physically inspecting the outfall under dry weather conditions and sampling dry weather flows for analysis of conductivity, turbidity, pH, chlorine, temperature, surfactants, potassium, ammonia and *E. Coli*.

Recommendation: Perform outfall screening and sampling of dry weather flows.

Actions:

1) Inspect 25% of outfall annually, beginning in "high" ranked areas.
2) Collect samples of dry weather flows and submit for analysis.
3) Investigate and correct illicit discharges discovered through screening activities.

Objectives: Identify and remove illicit discharges to the storm drain system to reduce pollution loads to receiving waters.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $8,200 to contract labor and analytical. Assumes 10% of outfalls will have dry weather flows requiring analytical analysis. Labor assumes two field personnel per day, inspecting an average of 20 outfalls per day.

#8d Perform Wet Weather Monitoring

The draft NPDES Phase II permits (expected to be mirrored throughout Massachusetts) calls for wet weather monitoring of 25% of the outfalls each year. Wet weather monitoring involves the collection of stormwater flows from the outfall under specific rainfall conditions. Samples must be analyzed for conductivity, turbidity, pH, chlorine, temperature, surfactants, potassium, ammonia and *E. Coli*.

Recommendation: Perform wet weather sampling of 25% of the outfalls annually.

Actions:

1) Establish sampling conditions (e.g., amount of rainfall, time of collection in storm).
2) Collect samples of wet weather flows and submit for analysis.
3) Tabulate data for reporting.

Objectives: Help the State establish a database of water quality data.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $49,000 to contract labor and analytical. Labor assumes four field personnel a day, collecting wet weather samples from an average of eight outfalls per day.

#8e Estimate Directly Connected Impervious Cover

The draft NPDES Phase II permits (expected to be mirrored throughout Massachusetts) calls for estimation of directly connected impervious surfaces in each catchment, with updates to account for added or removed acres. This has already been completed to some extent for the Stormwater Management Master Plan; annual updates can track changes in delineated catchment areas.

Recommendation: Track directly connected impervious areas within the Town by catchment and keep records of changes as they occur.

Actions:

1) Update directly connected impervious area estimations as changes are proposed
2) Track these with GIS or other database.

Objectives: Comply with Phase II requirements to better understand and prioritize areas for stormwater improvements.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: Town staff to update maps and database.

#8f Develop Written O&M Procedures for Municipal Facilities

The draft NPDES Phase II permits (expected to be mirrored throughout Massachusetts) calls for development of written O&M procedures for parks (includes fertilizers, pesticides), building and facilities (storage and use of materials, waste management), vehicles and equipment (storage, repairs and fueling), roadway and sewer systems (inspections and cleaning), winter activities (salt storage and usage and snow disposal).

The O&M plan provide written documentation of the procedures to be followed with pollution prevention in mind. This promotes consistency amongst employees and minimizes the potential for pollution.

Recommendation: Prepare O&M plans for the Highway Department, Fire Department, Cemetery Garage, Parks & Sewer.

Actions:

1) Identify activities at each of the above facilities.
2) Establish and document appropriate operation and maintenance that incorporate good housekeeping practices to minimize the potential for releasing pollutants.
3) Distribute plans to all employees involved in operations and maintenance and incorporate into training.

Objectives: Promote consistency between employees. Reduce potential for pollution.

Budgeted Capital Costs: $25,000 (assumes $5,000 per plan prepared by a consultant)

Budgeted Annual Costs: N/A

#8g Develop/Update SWPPP for Town Operation Maintenance Facilities

The draft NPDES Phase II permits (expected to be mirrored throughout Massachusetts) requires development of Stormwater Pollution Prevention Plans (SWPPPs) for any town operated maintenance facilities. A SWPPP was prepared for the highway garage under the original Phase II permit program, however, should be updated to account for any changes to the facility and/or regulatory requirements. A plan is also needed for the Sewer Facility due to maintenance activities performed there.

Recommendation: Update the SWPPP for the Highway Garage and prepare a SWPPP for the Sewer Facility.

Actions:

1) Review existing SWPPP for Highway Garage, identify any changes to the facility.
2) Update the SWPPP for the Highway Garage.
3) Prepare a SWPPP for the Sewer Facility that covers any operations that may come into contact with stormwater runoff.

Objectives: Reduce the potential for pollution from Town maintenance facilities.

Budgeted Capital Costs: $20,000 (assumes $10,000 per plan prepared by a consultant)

Budgeted Annual Costs: N/A

#8h Annual Reporting

The Phase II permit program requires Town's to submit an annual report documenting the progress of implementing its Phase II program.

Recommendation: Prepare required annual reports.

Actions:

1) Document progress with Phase II program as it occurs.
2) Summarize progress in the required annual report and submit to EPA and MassDEP.

Objectives: Document progress on implementation of Phase II program to regulators.

Budgeted Capital Costs: N/A

Budgeted Annual Costs: $2,500 (assumes annual report prepared by consultant).

Table 5-1. 20-Year Stormwater Compliance Costs (O&M and Capital)

Stormwater Compliance Component	Annual Compliance Costs					5 year Compliance Costs		
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016 - 2020	FY 2021 - 2025	FY 2026 - 2030
#1 Increase Infrastructure Maintenance	$ 189,225	$ 125,225	$ 125,225	$ 125,225	$ 125,225	$ 826,125	$ 626,125	$ 626,125
#1a Perform additional street sweeping								
Purchase street sweeper (regenerative air / vacuum)	$ -	$ -	$ -	$ -	$ -	$ 200,000	$ -	$ -
Additional street sweeping (19 miles)	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 250,000	$ 250,000	$ 250,000
#1b Perform annual catch basin cleaning *(1600+ structures)*	$ 57,225	$ 57,225	$ 57,225	$ 57,225	$ 57,225	$ 286,125	$ 286,125	$ 286,125
#1c Maintain existing stormwater BMPs *(16 BMPs)*	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 40,000	$ 40,000	$ 40,000
#1d Clean stormwater outfalls - clean outfalls with heavy sediment, trash and debris	$ 74,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 50,000	$ 50,000	$ 50,000
#2 Implement Structural Water Quality BMPs Throughout the Town	$ -	$ -	$ 125,000	$ 75,500	$ 1,500	$ 470,000	$ 687,500	$ 327,500
P11 Dark Brook Reservoir Area 2 - install bioretention or wet basin	$ -	$ -	$ 125,000	$ 500	$ 500	$ 2,500	$ 2,500	$ 2,500
P17 Eddy Pond Area 2 - install upstream deep sump catch basins/structures	$ -	$ -	$ -	$ 37,500	$ 500	$ 2,500	$ 2,500	$ 2,500
P18 Auburn Pond Area - install sediment trap	$ -	$ -	$ -	$ 37,500	$ 500	$ 2,500	$ 2,500	$ 2,500
P21 Pondville Pond Area 1 - install wet pond, obtain easement	$ -	$ -	$ -	$ -	$ -	$ 150,000	$ 2,500	$ 2,500
P4 Leesville Pond Area 1 - install large plunge pool or forebay/wetpond or upstream structure improvements	$ -	$ -	$ -	$ -	$ -	$ 312,500	$ 2,500	$ 2,500
P10 Dark Brook Reservoir Area 1 - install plunge pool and rip rap	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,000	$ 2,500
P12 Dark Brook Reservoir Area 3 - install plunge pool and cascading swales	$ -	$ -	$ -	$ -	$ -	$ -	$ 56,250	$ 2,500
P22 Pondville Pond Area 2 - outlet stabilization with level spreader	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,250	$ 2,500
P2 Sword Street - install plunge pool, flooding improvements, upstream diverted bioretention (pump station)	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,000	$ 2,500
P15 Dunns Brook Area 3 - install roadside swale (vegetated), plunge pool at surface runoff and/or upstream structure	$ -	$ -	$ -	$ -	$ -	$ -	$ 62,500	$ 2,500
P3 Southbridge Street - install plunge pool and swale at outfall	$ -	$ -	$ -	$ -	$ -	$ -	$ 37,500	$ 2,500
P5 Leesville Pond Area 2 - install check dams and swales or structures or off-line treatment	$ -	$ -	$ -	$ -	$ -	$ -	$ 187,500	$ 2,500
P13 Dunns Brook Area 1 - install infiltration chambers or off-line proprietary filter	$ -	$ -	$ -	$ -	$ -	$ -	$ 62,500	$ 2,500
P14 Dunns Brook Area 2 - install plunge pools or upstream basin conversions	$ -	$ -	$ -	$ -	$ -	$ -	$ 62,500	$ 2,500
P16 Eddy Pond Area 1 - upstream deep sump catch basin/structure (e.g., baffle tanks)	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,000	$ 2,500

Table 5-1. 20-Year Stormwater Compliance Costs (O&M and Capital)								
Stormwater Compliance Component	**Annual Compliance Costs**					**5 year Compliance Costs**		
	FY 2011	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016 - 2020**	**FY 2021 - 2025**	**FY 2026 - 2030**
P6 Leesville Pond Area 3 - install deep-sump catch basins or plunge pool or swale	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,000	$ 2,500
P7 Leesville Pond Area 4 - install plunge pools or basin	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 125,000
P9 Tinker Hill Pond - install plunge pool or swale	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 37,500
P8 Goddard Drive/Rice Road - cut in forebay/plunge pool or upsream structure improvements for wetland pretreatment to collect sediment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 62,500
P1 Rochdale Street - install plunge pool	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,750
P20 Stone Brook Wetland Area - install plunge pool/level spreader	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,500
P19 Eddy Pond Wetland Area 1 - install upstream deep sump pretreatment and/or forebay/level spreader	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,250
#3 Retrofit Existing Stormwater BMPs	$ -	$ -	$ -	$ 5,000	$ 48,125	$ 37,500	$ 56,250	$ 55,000
EX1 Sunnyside Road - raise low flow outlet, remove brush	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ -
EX2 Bridal Path Road - install forebay, remove invasives, remove sediment, repair silt fence, complete fencing, replace displaced riprap	$ -	$ -	$ -	$ -	$ 15,625	$ -	$ -	$ -
EX3 Booth Road - install forebay, remove brush & invasives	$ -	$ -	$ -	$ -	$ 16,250	$ -	$ -	$ -
EX4 Hilltop Farm Road - install forebay, remove brush & invasives, remove sediment	$ -	$ -	$ -	$ -	$ 16,250	$ -	$ -	$ -
EX5 Home Depot - remove heavy vegetation (PRIVATE)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EX6 Elizabeth Road 1 - install forebay in first pond, remove heavy growth	$ -	$ -	$ -	$ -	$ -	$ 16,250	$ -	$ -
EX7 Elizabeth Road 2 - install forebay, raise low flow outlet, remove heavy vegetation & invasives	$ -	$ -	$ -	$ -	$ -	$ 17,500	$ -	$ -
EX8 Westec Drive - install gabions to lengthen flow paths, remove heavy growth	$ -	$ -	$ -	$ -	$ -	$ 3,750	$ -	$ -
EX9 Stonebridge Road - install forebay, remove heavy vegetation & invasives	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,250	$ -
EX10 Saybrook Way - raise low flow structure, remove heavy vegetation & invasives, remove sediment	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,250	$ -
EX11 Erica Lane - install forebay, raise low flow outlet, install gabions, remove heavy vegetation & invasives	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,500	$ -
EX12 Alex Circle - install forebay, remove heavy vegetation & invasives	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,250	$ -
EX13 Gwen Drive - install forebay, remove heavy vegetation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,250
EX14 Dale Avenue - install forebay, raise low flow outlet	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,750
EX15 Crow Hill Road - install forebay, remove invasives	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,500

Table 5-1. 20-Year Stormwater Compliance Costs (O&M and Capital)								
Stormwater Compliance Component	**Annual Compliance Costs**					**5 year Compliance Costs**		
	FY 2011	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016 - 2020**	**FY 2021 - 2025**	**FY 2026 - 2030**
EX16 Eddy Pond Wetland Area 2 - remove sediment & brush	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,500
#4 Improve Existing Infrastructure	$ 170,000	$ 221,875	$ 203,125	$ 203,125	$ 265,625	$ 1,265,625	$ 1,072,500	$ 1,318,750
#4a Stabilize eroded outfalls - stabilize outfalls with observed heavy erosion	$ -	$ 14,375	$ 14,375	$ 14,375	$ 14,375	$ 71,875	$ 14,375	$ -
#4b Repair outfalls - repair outfalls with observed cracks, corroded pipes, undermined headwalls/pipes	$ -	$ 37,500	$ 18,750	$ 18,750	$ 18,750	$ 93,750	$ -	$ -
#4c Replace/rehabilitate deteriorated pipes and catch basins	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 170,000	$ 850,000	$ 850,000	$ 850,000
#4d Improve Flooding								
FL1 Rochdale Street (A-1) - replace 200 feet of pipe	$ -	$ -	$ -	$ -	$ 62,500	$ -	$ -	$ -
FL3 Eaton Avenue (C-1) - replace 300 feet of pipe to entrance inlet conditions	$ -	$ -	$ -	$ -	$ -	$ 62,500	$ -	$ -
FL7 West Street (G-1) - install structures and BMPs, replace 600 feet of pipe	$ -	$ -	$ -	$ -	$ -	$ 187,500	$ -	$ -
FL8 Oxford Street North (H-1) - replace 500 feet of pipe and install BMP	$ -	$ -	$ -	$ -	$ -	$ -	$ 151,875	$ -
FL9 Swanson Road (H-2) - install forebay at culvert, clean sediment, source reduction at Bed, Bath & Beyond	$ -	$ -	$ -	$ -	$ -	$ -	$ 56,250	$ -
FL11 Stone Street (I-1) - replace 2,200 linear feet of pipe on Stone, Elm & Riverside or install a series of leaching catch basins	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 468,750
#5 Control Noxious Aquatic Plants - Auburn Pond, Eddy Pond, Pondville Pond & Stoneville Pond	$ 61,000	$ 31,000	$ 31,000	$ 39,000	$ 31,000	$ 171,000	$ 163,000	$ 171,000
Auburn Pond - chemical treatment	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 15,000	$ 15,000	$ 15,000
Eddy Pond - chemical treatment	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 40,000	$ 40,000	$ 40,000
Pondville Pond - chemical treatment	$ 20,000	$ 12,000	$ 12,000	$ 20,000	$ 12,000	$ 76,000	$ 68,000	$ 76,000
Leesville Pond - chemical treatment	$ 30,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 40,000	$ 40,000	$ 40,000
#6 Administration - GIS work, reviews, inspection	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 150,000	$ 150,000	$ 150,000
#7 Public Education	$ 7,000	$ 7,000	$ 7,000	$ 7,000	$ 7,000	$ 35,000	$ 35,000	$ 35,000
#7a Website enhancements and upkeep	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 5,000	$ 5,000	$ 5,000
#7b Participate in pond cleanups (Phase II Program)	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 5,000	$ 5,000	$ 5,000

Table 5-1. 20-Year Stormwater Compliance Costs (O&M and Capital)								
Stormwater Compliance Component	**Annual Compliance Costs**					**5 year Compliance Costs**		
	FY 2011	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016 - 2020**	**FY 2021 - 2025**	**FY 2026 - 2030**
#7c Implement public outreach program - press releases, flyers, brochures, newsletters, articles	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 25,000	$ 25,000	$ 25,000
#8 Other Phase II	$ 71,220	$ 106,220	$ 61,220	$ 61,220	$ 61,220	$ 306,098	$ 306,098	$ 306,098
#8a Perform annual stormwater training	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 7,500	$ 7,500	$ 7,500
#8b Assess illicit discharge potential for all areas - delineate catchments or drainage units, evaluate data for each catchment, rank each catchment for potential to have illicit discharges as "low", "medium" or "high"	$ 10,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
#8c Perform outfall screening for illicit discharges - dry weather outfall screening & source investigation	$ 8,184	$ 8,184	$ 8,184	$ 8,184	$ 8,184	$ 40,918	$ 40,918	$ 40,918
#8d Perform wet weather monitoring	$ 49,036	$ 49,036	$ 49,036	$ 49,036	$ 49,036	$ 245,180	$ 245,180	$ 245,180
#8e Estimate directly connected impervious cover and report on the number of acres added or removed	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
#8f Develop written O&M procedures for municipal facilities	$ -	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -
#8g Develop/update SWPPP for town operated maintenance facilities - highway and sewer facilities	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -
#8h Annual reporting	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 12,500	$ 12,500	$ 12,500
Total Direct Costs for all Stormwater Compliance Components	$ 528,445	$ 521,320	$ 582,570	$ 546,070	$ 569,695	$ 3,261,348	$ 3,096,473	$ 2,989,473
Indirect Costs	$ 123,000	$ 121,000	$ 133,000	$ 126,000	$ 131,000			
Operating Reserve	$ 39,000	$ -	$ -	$ -	$ -			
Total Costs for all Stormwater Compliance Components	$ 690,445	$ 642,320	$ 715,570	$ 672,070	$ 700,695			
Average Annual Compliance Costs (first 5 years)					$ 684,220			

Figure 5-1

High Maintenance Street Sweeping Locations

Auburn, MA

LEICESTER

WORCESTER

MILLBURY

SUTTON

OXFORD

Leesville Pond

Stoneville Pond

Stoneville Reservoir

Interstate 290

Southbridge Street

Auburn Pond

Dark Brook Reservoir

MassPike I-90

Tinker Hill Pond

Washington Street

Pondville Pond

Eddy Pond

Legend

- Town Boundary
- High Maintenance Street Sweeping
- Roads
- State Highways & Roads
- Turnpike
- Lakes, Ponds
- Wetlands
- Streams, Brooks

Data Source: MassGIS, Town of Auburn, CEI

N W E S

0 750 1,500 3,000 4,500 6,000 Feet

0 0.15 0.3 0.6 0.9 1.2 Miles

Comprehensive Environmental Inc.

6.0 Stormwater Funding

The Stormwater Management Master Plan identifies the activities necessary for compliance with the NPDES Phase II General Permit. In addition to the existing NPDES permit conditions, the proposed activities address the anticipated requirements of the pending permit renewal. Draft NPDES Permits are being issued on a watershed basis, with the Town of Auburn covered under the Interstate South-Flowing Watershed. EPA anticipates release of this specific NPDES permit in 2010, although the specific release date has not been established. Based upon draft NPDES Permits released for the North Coastal Watershed, the anticipated conditions have been identified and subsequently included in this summary in order to establish a 20 year plan as required by MassDEP.

Due to existing resource limitations, the Town is only able to respond to stormwater issues once they have become an emergency. Additional funding is required in order to shift to a proactive approach and comply with the NPDES General Permit requirements and make other system improvements to protect roads and drainageways.

A proactive approach also provides long term financial savings, since proactive maintenance results in cost avoidance. Inability to proactively maintain the stormwater infrastructure often creates bigger problems that are more expensive to address in the future such as sediment accumulation within drain piping (potentially requiring replacement), sediment accumulation within Town ponds (ultimately may require expensive dredging) and potential pipe failures and associated impacts on roadways (emergency road closures and road reconstruction).

Options for funding the stormwater management compliance activities include the following:

- General Fund (taxation)
- Grants and Loans
- Fee-based Stormwater Enterprise Fund

This Section describes the funding alternatives and the specific impact on the various property owners within Town.

6.1 General Fund / Taxation

Funding of drainage system maintenance and repair has historically been through the Highway Department budget in the General Fund. This approach allocates the cost of the stormwater compliance activities based solely upon a property's valuation, without any connection to the impact a specific property has on the Town's stormwater infrastructure and its waterways and ponds. This method would not require any increased

administrative costs, since the tax rate would simply be adjusted to account for the approved stormwater budget.

However, the Highway Department budget (and staffing level) has been repeatedly cut over the years and the ongoing lack of maintenance of the drainage system means that the Town's stormwater infrastructure and roads are deteriorating increasingly rapidly. Fixing the damage will become even more expensive, with costs increasing every year that maintenance is put off. Paying for increased maintenance and proactive regulatory compliance through the General Fund has two main problems: 1) the budgeted funds are not necessarily dedicated to stormwater or the Highway Department; and 2) there is inequity in that residences bear the largest monetary burden even though businesses typically produce the most runoff.

6.2 Grants and Loans

Grants and loans can provide some funding, and these are being actively sought to help defer some of the costs of the stormwater management program. In particular, the following grant programs are administered by MassDEP provide the Town with financial assistance towards NPDES Phase II permit compliance:

- 604b Grants (Water Quality Studies)
- 319 Grants (Water Quality Improvement Projects)

However, state and federal agencies are unlikely to contribute grant monies for cleanup of water bodies if basic maintenance of the drainage system is unfunded. Specifically, grant programs do not fund basic maintenance of a Town's infrastructure, which must be locally funded.

Additionally, grant funds are typically limited and highly competitive.

It is recommended that the Town pursue grant opportunities, recognizing that any grant funds will be limited in amount and frequency, and will therefore be a supplement to local funding.

6.3 Fee-based Stormwater Enterprise Fund

A fee-based Stormwater Enterprise Fund provides an assessment of costs in proportion with a property's stormwater runoff and impact on the drain system and Town waterways and ponds. Based on average rainfall and impervious areas, a typical residential property produces less than 50,000 gallons of runoff per year compared to the typical non-residential property which produces more than 1 million gallons of runoff per year.

The fee-based Stormwater Enterprise Fund also assesses stormwater compliance costs among all groups within Town, including those entities which are tax-exempt.

The recommended fee-based structure consists of a uniform fee for all residential properties and a varying fee for all non-residential properties based upon impervious area. This assessment is based upon a defined "equivalent residential unit (ERU)" which corresponds to the typical residential properties. Each residential property is considered a single ERU, while non-residential properties are defined as multiple ERUs, in proportion to the extent of their impervious area in comparison to the typical residential property. The extent of impervious area directly correlates with the amount of stormwater runoff and its impact on the Town's stormwater infrastructure and waterways and ponds.

A potential abatement of up to 50% of the stormwater fee is typical for larger properties in other stormwater fee systems, depending on the level of onsite stormwater treatment being performed by the property owner.

Funds would go to a dedicated Stormwater Fund, similar to a savings account, that requires funds be spent on stormwater related expenditures and can be carried over. The Fee system creates a consistent and stable revenue stream, key to long-term savings and effective operations.

6.4 Charges and Impact on Property Owners

The following assumptions were used in calculating the stormwater charges (tax basis versus fee basis) and the impact on typical residential and non-residential property owners:

- Town has a current tax base of approximately $2 billion, split between residential (74%) and non-residential (26%).
- Typical residential property has approximately 2,000 square feet of impervious surface, including roofs and pavement.
- Non-residential properties cumulatively have over 21,000,000 square feet (sf) of impervious area with an average of 45,000 sf.

If funded through General Fund (taxation), the stormwater compliance costs would result in a required tax increase approximately as follows, proportioned in accordance with the Town's existing tax structure:

- Residential Tax Rate Increase $0.31 per $1,000 valuation
- Non-residential Tax Rate Increase $0.51 per $1,000 valuation

If funded through a fee-based Stormwater Enterprise Fund, the stormwater compliance costs would result in the following charges:

- Residential Properties would be assessed an annual charge of $52

- Non-residential Properties would be assessed an annual charge of $52 per equivalent residential unit, with an average annual charge of $1,196 based upon a typical impervious area of 45,000 sf.

Refer to Table 6-1 for the estimated impact upon the Town's various property owners.

Table 6-1. Summary of Estimated Impact

Classification	***Fee Basis***	***Tax Basis***
Residential	$52 per year $4.33 per month flat fee all residential properties	On average $79 per year based on property value
Non-Residential (average costs)	$1,196 per year $100 per month on average based on volume of runoff	On average $417 per year based on property value

Residential tax impact based upon a "typical" residential property with $255,000 valuation. Non-residential charges based upon "typical" non-residential property with 45,000 sf impervious area and $822,000 valuation.