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Weston&Sampson ENGINEERS, INC.

Innovative Solutions since 1899

05

Middleborough, Massachusetts
WSE Project No. 202246

April 29, 2005

U.S. Environmental Protection Agency
Water Technical Unit
P.O. Box 8127
Boston, Massachusetts 02114

Re: Annual Report
NPDES Permit No. MAR041134

Dear Sir/Madam:

On behalf of the Town of Middleborough, Massachusetts, please find enclosed the Annual Report for permit year two in accordance with the terms of the town's NPDES Phase II Small Municipal Sanitary Sewer Systems (MS4) General Permit. As the report states, the town is in compliance with the permit, with the minor exception of where implementation of our minimum control measures did not meet our stated schedule documented in our July 2003 Notice of Intent.

Although not included in the July 2003 NOI, the town completed construction of a notable structural BMP project during permit year 2. The main focus of the project was to provide improved treatment for stormwater from Wareham Street and the town's DPW yard, accomplished through installation of deep sump and hooded catch basins, oil water separators, and a stormwater quality basin.

If you have any questions or require additional information, please do not hesitate to contact me at (978) 532-1900.

Very truly yours,

WESTON & SAMPSON ENGINEERS, INC.

Patricia C. Passariello, P.E.
Project Manager

Enclosure

cc: MADEP – Division of Watershed Management
John F. Healey, Town Manager
Donald A. Boucher, Highway Superintendent

O:\MIDDLEBOROUGH MA\SW PHASE II\CORRESPONDENCE\COVER LTR-YR2 ANNUAL REPORT.DOC

Municipality/Organization:	Town of Middleborough, Massachusetts
EPA NPDES Permit Number:	MAR041134
MADEP Transmittal Number:	W-040722
Annual Report Number & Reporting Period:	No. 1: March 2004-March 2005

NPDES PII Small MS4 General Permit Annual Report

Part I. General Information

Contact Person: John F. Healey Title: Town Manager

Telephone #: (508) 947-0928 Email: NA.

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature:

Printed Name: Wayne C. Perkins

Title: Chairman, Board of Selectmen

Date: 4/28/05

Part II. Self-Assessment

The Town of Middleborough, Massachusetts has completed the required self-assessment and has determined that, based on existing information, our municipality is in compliance with the conditions of the permit, with the minor exception of where implementation of our minimum control measures did not meet our stated schedule documented in our July 2003 Notice of Intent. The specific exceptions are detailed in Part III of this annual report.

Part III. Summary of Minimum Control Measures

Please see Table III, Summary of Minimum Control Measures located in Attachment A of this report.

Although not included in the July 2003 NOI, the town completed construction of a notable structural BMP project during permit year 2. The main focus of the project was to provide improved treatment for stormwater from Wareham Street and the town's DPW yard, accomplished through installation of deep sump and hooded catch basins, oil water separators, and a stormwater quality basin. The estimated TSS removal for the DPW was 25% per catch basin (three basins installed) and for the Wareham Street drainage area was 70% with the water quality swale/retention basin.

Part IV. Summary of Information Collected and Analyzed

The town hired Weston & Sampson Engineers, Inc. to complete an assessment of its municipal water, wastewater, and stormwater systems. The stormwater section of this Project Evaluation Report (PER) contains valuable information relating to the town's progress on compliance with the Phase II General Permit, including the minimum control measures. The stormwater section of the draft PER is included in Attachment B of this annual report to provide a more detailed representation of the town's efforts to date to control pollutants from being discharged to surface waters with its stormwater. The town has only recently received comments from required parties on this report and will be finalizing it shortly. Because of the delay in the comment period for this report, implementation of the recommendations, including those related to stormwater, has also been delayed. Upon completion of the final report, the town will begin implementation.

Part V. Program Outputs & Accomplishments (OPTIONAL)

Programmatic

Stormwater management position created/staffed	(y/n)	*No.*
Annual program budget/expenditures	($)	***SW not separate budget.***

Education, Involvement, and Training

Estimated number of residents reached by education program(s)	(# or %)	
Stormwater management committee established	(y/n)	***CAC established; needs expansion.***
Stream teams established or supported	(# or y/n)	***No.***
Shoreline clean-up participation or quantity of shoreline miles cleaned	(y/n or mi.)	***NA.***
Household Hazardous Waste Collection Days		
▪ days sponsored	(#)	***Wastes collected at town LF during all normal operating hours.***
▪ community participation	(%)	
▪ material collected	(tons or gal)	
School curricula implemented	(y/n)	***None under this program.***

Legal/Regulatory

	In Place Prior to Phase II	Under Review	Drafted	Adopted
Regulatory Mechanism Status (indicate with "**X**")				
▪ Illicit Discharge Detection & Elimination		***Note 1***		
▪ Erosion & Sediment Control	***Note 2***			
▪ Post-Development Stormwater Management	***Note 2***			
Accompanying Regulation Status (indicate with "**X**")				
▪ Illicit Discharge Detection & Elimination		***Note 1***		
▪ Erosion & Sediment Control	***Note 2***			
▪ Post-Development Stormwater Management	***Note 2***			

Notes: 1 Review and recommendations for revision of existing policies/procedures completed during Project Evaluation Report (PER).
2 Topic addressed in existing town policy, bylaws, ordinances, or other regulatory mechanism; however, review/revision specific to SWPhII required.

Mapping and Illicit Discharges

Outfall mapping complete	(%)	*25%*
Estimated or actual number of outfalls mapped	(#)	*21. This number reflects either pipe ends identified or mapping that indicates possible outfalls. Additional field verification required.*
System-Wide mapping complete	(%)	*10%*
Mapping method(s)		
▪ Paper/Mylar	(%)	*Record drawings exist for individual drainage projects, but are not filed/catalogued. Approximately 90% of outfalls located during PER were mapped with GPS and added to town GIS system. Schematic (not GPS) mapping of known drainage components was added to town GIS via PER.*
▪ CADD	(%)	
▪ GIS	(%)	
Outfalls inspected/screened	(# or %)	*Initial wet-weather sampling attempted on14 outfalls; samples taken @ 10 outfalls.*
Illicit discharges identified	(#)	*None.*
Illicit connections removed	(#) (est. gpd)	*0*
% of population on sewer	(%)	*33%*
% of population on septic systems	(%)	*67%*

Construction

Number of construction starts (>1-acre)	(#)	
Estimated percentage of construction starts adequately regulated for erosion and sediment control	(%)	
Site inspections completed	(# or %)	
Tickets/Stop work orders issued	(# or %)	
Fines collected	(# and $)	
Complaints/concerns received from public	(#)	

Post-Development Stormwater Management

Estimated percentage of development/redevelopment projects adequately regulated for post-construction stormwater control	(%)	
Site inspections completed	(# or %)	
Estimated volume of stormwater recharged	(gpy)	

Operations and Maintenance

Average frequency of catch basin cleaning (non-commercial/non-arterial streets)	(times/yr)	***2-3***[1]
Average frequency of catch basin cleaning (commercial/arterial or other critical streets)	(times/yr)	***2-3***[1]
Total number of structures cleaned	(#)	***810***[2]
Storm drain cleaned	(LF or mi.)	***NA***
Qty. of screenings/debris removed from storm sewer infrastructure	(lbs. or tons)	***263 tons***[2]
Disposal or use of sweepings (landfill, POTW, compost, recycle for sand, beneficial use, etc.)		***LF***
Cost of screenings disposal	($)	***NA-town LF***
Average frequency of street sweeping (non-commercial/non-arterial streets)	(times/yr)	***2/yr***[1]
Average frequency of street sweeping (commercial/arterial or other critical streets)	(times/yr)	***2/wk summer***[1]
Qty. of sand/debris collected by sweeping	(lbs. or tons)	***660 tons***[2]
Disposal of sweepings (landfill, POTW, compost, beneficial use, etc.)	(location)	***LF***
Cost of sweepings disposal	($)	***NA-town LF***
Vacuum street sweepers purchased/leased	(#)	***None***
Vacuum street sweepers specified in contracts	(y/n)	***NA***
Reduction in application on public land of: ("N/A" = never used; "100%" = elimination)		
▪ Fertilizers	(lbs. or %)	
▪ Herbicides	(lbs. or %)	
▪ Pesticides	(lbs. or %)	
Anti-/De-Icing products and ratios (% NaCl, % $CaCl_2$, % $MgCl_2$, % CMA, % Kac, % KCl, % Sand)	(%)	***100%NaCl***
Pre-wetting techniques utilized	(y/n)	***No***
Manual control spreaders used	(y/n)	***Yes***
Automatic or Zero-velocity spreaders used	(y/n)	***No***
Estimated net reduction in typical year salt application	(lbs. or %)	***NA.***
Salt pile(s) covered in storage shed(s)	(y/n)	***Yes***
Storage shed(s) in design or under construction	(y/n)	***NA.***

Notes: 1 Please see attached stormwater section of draft Project Evaluation Report (PER) for greater detail.
2 Reduction in quantities due to late start in 2005 due to long winter.

ATTACHMENT A

Table III
Summary of Minimum Control Measures

BMP ID#	Best Management Practice	Responsible Pa	Year Two	Planned Activities - Permit Year Three
1. Public Education				
1a	Distribute/post non-point source pollution poster	Town Manag		No activity scheduled for Year Three
1b	Air stormwater message on local cable access channel	Town Manag		Begin posting messages
1c	Obtain and distribute auto repair shop brochures	Town Manag		Distribute notices to all impacted local businesses
1d	Add stormwater information to town's Website	Town Manag	ting info. updated	Update information yearly
2. Public Participation				
2a	Expand Citizen's Advisory Committee	Town Manag	t held quarterly	Continue efforts to grow the CAC; hold bi-annual meetings
2b	Collect and recycle waste oil from residents	Highway Departm	s completed[1]	Continue to collect and recycle waste oil from residents[1]
2c	Collect paint from residents	Highway Departi		Continue to collect paint from residents[1]
2d	Implement a Catch Basin Stenciling Program	Town Manag		Stencil 50% of catch basins
3. Illicit Discharge Detection and Elimination				
3a	Map outfalls and receiving waters	Town Manag		Map 25% of outfalls that drain to urbanized area
3b	Review existing bylaws and regulations	Planning Departi		Determine if existing bylaws and regulations fulfill EPA requirements
3c	Develop Illicit Discharge Detection & Elimination Plan	Planning Departi		Make recommendations for inclusion into proposed plan
3d	Develop/Modify General Illicit Discharge Bylaw	Planning Departi		Propose recommendations for modifying/developing bylaw
4. Construction Site Runoff Control				
4a	Review existing site inspection practices	Planning Departi		Review existing site inspection practices
4b	Develop/modify site inspection program	Planning Departi		Develop/modify site inspection program
4c	Review existing bylaws and regulations	Planning Departi		Review existing bylaws and regulations
4d	Develop/modify bylaw for construction site runoff	Planning Departi		Develop/modify bylaw for construction site runoff
5. Post Construction Runoff Control				
5a	Review existing site inspection practices	Planning Deparr		Review existing site inspection practices
5b	Develop/modify inspection and maintenance practices	Planning Deparr		Develop/modify inspection and maintenance practices
5c	Review existing bylaws and regulations	Planning Deparr		Review existing bylaws and regulations
5d	Devleop/modify bylaws for post-construction site runoff	Planning Deparr		Devleop/modify bylaws for post-construction site runoff
6. Municipal Good Housekeeping				
6a	Street sweeping program	Highway Departi		Continue to sweep all streets a minimum of twice per year
6b	Catch basin cleaning program	Highway Departi	as completed[1]	Continue to check catch basins quarterly for sediment and clean every year

1 Please see detailed information presented in the attached stormwater sectic

2 Implementation schedule delayed due to delay in comment period and pub

ATTACHMENT B

Stormwater Section
DRAFT Project Evaluation Report (PER)

SECTION 5.0 – STORMWATER

5.1 Extents and Goals of the Study Area

In order to apply limited resources to areas of particular concern, Middleborough narrowed the assessment of its stormwater needs to a specific study area, rather than performing a town-wide study. For the purpose of this report, the stormwater study area is defined as areas where stormwater from the Town of Middleborough is tributary to the Taunton and Nemasket rivers. Although the town's municipal stormwater system services and discharges to other areas, the scope of work was limited due to the extent of study required for addressing the entire 72-square mile area of the town.

The goals for the stormwater study area are as follows:

- Identify and map all stormwater discharges from the town to the Taunton and Nemasket rivers to provide additional knowledge of the drainage system
- Assess the water quality from the identified stormwater discharges to determine if they may be negatively impacting river water quality
- Provide a plan to allow for necessary remediation/treatment of stormwater discharges that are negatively impacting river water quality and address any future federal or state permitting requirements
- Develop a system for funding capital, operation and maintenance cost associated with the proper collection and treatment of stormwater (e.g., stormwater utility)

5.2 Description of Existing System

5.2.1 Background

Stormwater runoff is rainwater or snowmelt that flows into rivers, streams, lakes, and other receiving waters, either directly through point sources discharges from formal drainage networks or indirectly through non-point sources from overland flow. Pollution is a concern because stormwater runoff may wash pollutants from the ground surface and transport them into the receiving water. Stormwater pollution is of greatest concern where there are industrial, commercial, or agricultural activities and in developed areas where impervious ground can increase the accumulation of pollutants from common sources such as the atmosphere, motor vehicles, and litter. Some of the most common pollutants that may be present in stormwater include:

- Bacteria: from animal or human wastes
- Chlorides: from winter deicing operations
- Hydrocarbons: from motor vehicle oil, gas, and other petroleum products
- Metals: from industrial activities

- Nutrients: from fertilizing and other lawn and garden activities
- Pesticides: from agricultural and household insecticide/herbicide application
- Suspended Solids: from sand and other sediments from roadways and construction sites
- Large Solids: trash and debris

According to inventories of Massachusetts Rivers and streams compiled by the DEP, nearly half of the water quality problems in streams are attributable to stormwater. In addition, development has notably reduced the amount of pervious area and consequently the amount of stormwater infiltrating into the ground. This infiltration is necessary to recharge groundwater and aquifers that support vital base flow to rivers and drinking water wells.

A great deal of information regarding the effects of stormwater on our environment and ways to minimize these effects is provided in the two-volume Stormwater Management Handbook prepared by the DEP and the Massachusetts Coastal Zone Management. As of the date of this report, both volumes of the handbook were available for downloading at: www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

5.2.2 System Description

There is little documentation or mapping of the existing stormwater system within the Town of Middleborough. Prior to this project, no map of the stormwater system had been created. Records kept by the Highway Department consist primarily of drawings submitted to the Planning Board or other town departments by developers or other private parties. The town is currently in the process of obtaining ties for catch basins and drain manholes that form part of the town's drainage system. This information is being collected during the town's routine catch basin cleaning program. Weston & Sampson has schematically placed available information on catch basins into the GIS map begun as part of this project.

The Highway Department has many sets of plans submitted to the town over the years by consultants, developers, and other private parties. Unfortunately, most of these plans have just been placed in a pile, rather than being properly filed so that they can be easily referenced. The current practice is that all new plans are sent to the Town Manager, logged, and distributed to appropriate town departments for review. Once the project is completed, the Planning Board keeps the original as-built plans and forwards a copy to the Highway Department. When applicable, copies of plans are submitted to the Massachusetts Highway Department (MHD) to get credit for Chapter 90 Funding.

The amount of miles of pipe currently making up the Middleborough drainage system is unknown; however, Highway Department staff estimate that approximately 35% of the town has some sort drainage system. There is formal collection within the downtown and more "urban" areas of town. There are also a great number of subdivisions throughout town with their own collection and conveyance systems. Little to no formal collection system exists on the more rural roadways in town. Middleborough has a number of outfalls that discharge directly to surface waters. Other portions of the town are served by leaching basins that collect stormwater and infiltrate it directly into the ground.

Known drain line diameters in town range from 6 inches to 42 inches. Based on available information from newly established cleaning records, there are approximately 1,200 catch basins within the system; approximately ____ of these are leaching basins.

Approximately one third of the downtown drainage flows directly to the Nemasket River via formal collection and conveyance and another third flows towards the Nemasket River, but discharges overland prior to reaching the river. The other third of the downtown area flows away from the Nemasket River towards wetland areas and ponds, which were not part of the scope of this project. The areas of town near the Taunton River are generally quite rural and there are few, if any, collection and conveyance systems that flow to the Taunton River. The drainage "systems" in these areas consist primarily of catch basins or other inlet structures that collect stormwater from bridges and direct it to the river.

Funding for operation and maintenance of the drainage system comes from the town's general fund through a line item for Public Works. This line item funds highway, drainage, trees, and insect control. Any capital improvement work on the drainage system is funded in conjunction with roadway improvements through Chapter 90 funds. At present, there is no specific source of income for drainage improvements.

MHD is responsible for several roadways within Middleborough, including Routes 495, 44, 18, 28, and a small portion of Route 105 (from Route 28 to the Lakeville town line). MHD has sole responsibility for maintenance of the roadways and drainage systems associated with these routes.

5.2.3 Existing Practices

The town has a variety of practices and programs designed to reduce pollution of stormwater. Stormwater pollution prevention activities include not only maintenance-based practices for the collection system, but also town-wide programs designed to collect trash, recyclables, and yard wastes to reduce the amount of improper disposal and prevent pollutants from being introduced into runoff. The existing stormwater pollution prevention activities include, but are not limited to, the following:

- Catch Basin Cleaning: Catch basins within town are inspected on a quarterly basis. The town cleans catch basins twice per year depending on sediment accumulation. Leaching catch basins are generally cleaned three times per year. The town proceeds according to the plan that leaching basins are cleaned first, then subdivision catch basins, and then remaining catch basins throughout town. Catch basin cleaning is also coordinated with street sweeping to reduce sediment accumulations.

  The town owns and utilizes a clamshell for cleaning. A "self contained" unit was recently purchased, which is designed to reduce the release of stormwater during cleaning operations. Spoils from catch basin cleaning are temporarily stockpiled at the DPW garage and then transported to the town's landfill for disposal.

The town has a scale and tracks the tons of spoils trucked to the landfill. At one time, the town utilized oil sops to remove petroleum-based and other similar contaminants from the catch basins; however, the town has discontinued this practice due to the problems associated with handling and disposal of the spent oil sops, which are considered hazardous waste.

- Street Sweeping: The Middleborough Highway Department sweeps all streets in the town at least twice per year, typically spring and fall. The streets in the downtown area are swept twice per week during the summer months. The town owns their own sweeper. Residents are not required to move their cars from the street during street sweeping, which can hinder the effectiveness of the operation. Debris from street sweeping is stockpiled at the DPW until it is transported to the town's landfill for use as cover material. The town has a scale and tracks the tons of debris trucked to the landfill.

- De-icing: Town personnel use mechanical spreaders to conduct de-icing of town streets. Only salt is used. In the past, the town has tried brine (brewery byproduct) and also calcium chloride, but has always gone back to road salt. The town has established "low salt" areas surrounding their drinking water wells.

- Trash Removal: The town provides weekly curbside pickup of rubbish. Rubbish is taken to the SEMASS Resource Recovery Facility in West Wareham, Massachusetts for disposal. The SEMASS facility provides southeastern Massachusetts communities with an alternative to landfilling their municipal solid waste. Since opening in 1989, the facility has employed a shred-and-burn process, enabling the plant's processing of approximately 900,000 tons of solid waste each year. The resulting electricity meets the needs of more than 75,000 homes. The facility also recovers nearly 20,000 tons of recyclable metals from bottom ash annually (*http://www.ref-fuel.com/locations/semass.htm*).

- Recycling: The town conducts curbside recycling weekly. Collectibles include plastics #1 and #2, all glass, and newspapers. In addition, recycling drop-off is provided at the town's landfill during normal operating hours (Tuesday through Saturday). At the drop-off, residents can recycle cardboard, office paper, used motor oil, antifreeze, batteries, tires, paints, fluorescent lights, and propane tanks *(Don to get us complete list-end of October)*. In addition, the town has waste oil and paint collection days at the DPW. In 2002, approximately 7,400 gallons of waste oil; 1,150 gallons of latex paints; 635 gallons of oil-based paints; and 512 gallons of stains/urethane were collected from residents.

- Yard Wastes: Middleborough has encouraged composting by making compost bins available for purchase by residents. Through use of these compost units, residents have helped the town in dramatically reduce the amount of leaves, grass clippings, garden waste, and kitchen waste that goes to the local landfill. The Highway Department also has its own compost pile at the DPW. Among other things, residents may dispose of cow/horse manure, hay, straw, and brush up to three inches is diameter. In 2002 alone, approximately 900 tons of leaves and 450 tons of other waste were composted. The finished compost product is offered free to residents from a pile at the DPW.

- Spill Response: The Highway Department does not have a separate spill response program for the stormwater system. All activities within the Town of Middleborough relating to spill response are the responsibility of the Fire Department as part of the Hazardous Waste Program. The Fire Chief is also the hazardous waste coordinator. Although a separate spill response plan/kit is kept at the landfill, as required, the Fire Department maintains specialized equipment and properly trained personnel for hazardous spills and handles all responses.

5.2.4 Problem Areas

Although there is no formal documentation for on-going problems within the stormwater system and no previous stormwater sampling or investigations have been performed, the following known "problem areas" were identified through interviews with Highway Department staff:

- Pierce/Jackson Streets: The Pierce/Jackson Street area experiences flooding on a regular basis during rain events and snowmelt. Based on drainage calculations and hydraulic modeling, the drain lines in this area have inadequate capacity due to pipe size and slope. There are also a few catch basins in this area connected to the sewer system, as identified during dyed water flooding. It is hoped that drainage improvements can be coupled with on-going water and roadway improvements in this area.

- Wareham Street: The area near the Wareham Street Bridge experiences flooding on a regular basis during rain events and snowmelt. Runoff from the street does not enter the catch basins because the roadway does not have sufficient crown to get water to the gutters. Therefore, runoff flows down the street to the bridge, where the four existing drop inlets are inadequate to handle the added flow. The Wareham Street Drainage Improvement Project is currently addressing this problem.

- North/Nemasket Street Area: The area around North Street and Nemasket Street has no drainage collection and conveyance and runoff ponds and/or flows uncontrolled over streets.

- East Main Street Area: Stormwater runoff from the portion of East Main Street by the pump station is of concern. No collection/conveyance system exists and sheet flow from both sides of the hill flows off the roadway to a brook. There is no treatment of the stormwater before it goes to the brook.

- Rural Areas: Roads outside of the downtown area have no stormwater management systems to control the flow of runoff or minimize stormwater pollution.

5.2.5 Federal and State Permitting for Stormwater Discharges

The 1972 Clean Water Act (CWA) introduced the National Pollutant Discharge Elimination System (NPDES). The NPDES program was established as the fundamental regulatory mechanism of the CWA requiring direct dischargers of pollutants into waters of the United States to obtain a NPDES permit. Between 1972 and 1987, the NPDES permit program focused on improving surface water quality by reducing pollutants of industrial process wastewater and

municipal sewage. During this period, several nationwide studies on water quality, most notably the EPA National Urban Runoff Program (NURP) identified stormwater discharges as a significant source of water pollution.

The results of the NURP and similar studies, along with pressure from environmental groups, resulted in the reauthorization of the CWA in 1987 with the passage of the Water Quality Act (WQA). The WQA established a legal framework, and required EPA to develop a comprehensive phased program, for regulating municipal and industrial stormwater discharges under the NPDES permit program.

The NPDES Phase II rule, which was promulgated in December 1999, addresses small Municipal Separate Storm Sewer Systems (MS4s) serving a population of less than 100,000 people in urbanized areas. The Phase II Final Rule requires permitting of all operators of small MS4s that are located within the boundaries of a Bureau of the Census-defined "urbanized area" (UA) based on the latest decennial census. The EPA designated the Town of Middleborough as a Phase II community that must comply with the new NPDES regulations. A map of the Phase II stormwater "permit compliance area" for Middleborough, as determined by the EPA using the latest decennial (year 2000) census, is provided as Figure 5-1 on the next page.

The NPDES Phase II regulations require that the operator of a small MS4 develop, implement, and enforce a stormwater management program (SWMP). The objectives of the SWMP are to reduce the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the CWA. These objectives are accomplished through the implementation of Best Management Practices (BMPs) for each of the following six minimum control measures:

- Public Education and Outreach
- Public Involvement/Participation
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management in New Development and Redevelopment
- Pollution Prevention/Good Housekeeping for Municipal Operations

In Massachusetts, the EPA retained primacy as the Phase II permitting authority, but permits to discharge stormwater are jointly issued by the EPA and the DEP. To be considered for inclusion under the General Permit for MS4s, effective May 1, 2003, the Town of Middleborough submitted a Notice of Intent (NOI) to the EPA and DEP by July 30, 2003. In early 2003, Weston & Sampson assisted the town in the development of the Phase II SWMP to address each of the above six minimum control measures and to be incorporated into the NOI. A copy of the NOI, as well as detailed discussion regarding the SWMP developed for Middleborough, may be found in a report to the town prepared by Weston & Sampson entitled "Stormwater Management Plan and Notice of Intent", dated July 2003. The town was notified via certified mail from the EPA on January 27, 2004 that the NOI was determined to be complete and that the town had been granted authority to discharge stormwater.

Area of Focus:

NPDES Phase II Stormwater Program
Automatically Designated MS4 Areas
Middleborough, Massachusetts

Middleborough Town Boundary

Regulated Area (2000 Urbanized Area)

Town Population: 19,941
Regulated Population: 11,085

N W E S

EPA New England

0 0.8 1.6 2.4 Miles

Data Sources: Urbanized Areas from US Census Bureau (2000). Political boundaries from MassGIS. Hydrography from NHD. Transportation data from GDT at 1:24,000.
Map Created: 11/18/02; US EPA- New England GIS Center
L:/projects/stormwater/phase2/matowns/new/

5.2.6 Local Regulatory Mechanisms

The Planning Board, the Planning Department, and the Zoning Board regulate development in Middleborough, and therefore control the design and construction of new stormwater systems. There are two existing bylaw regulations that address development in Middleborough - the Subdivision Rules and Regulations and the Open Space Zoning Bylaw.

As part of the subdivision review process, subdivision plans must be submitted and reviewed by the Planning Board, Planning Department, and the town's consulting engineer. The Planning Board provides overall general comments on the subdivision plan submitted. The Planning Department is responsible for determining the adequacy of the erosion/sedimentation plan for each site. They also provide general review of the drainage design. The consulting engineer, hired by the town, provides detailed review of the drainage design, while providing a more general review of the erosion/sedimentation control plan. After the review process has been completed, any necessary changes are made to the erosion/sedimentation control plan, and the plan is then incorporated into the construction drawings. The conditions of approval are also specified at this time and relayed to the developer. During construction, Planning Department and Conservation Commission staffs perform site inspections. There is constant monitoring of erosion control practices at the site.

The Open Space Zoning Bylaw requires the developer to submit formal drainage calculations prepared by a registered professional engineer. It also requires that proper soil erosion and sedimentation control measures be employed to prevent sedimentation and siltation of existing surface water bodies and wetlands. It further states that the Planning Board may require that an erosion and sedimentation control plan be submitted if significant erosion is anticipated in slope areas. In addition to the Subdivision Rules and Regulations and the Open Space Zoning Bylaw, the town also follows DEP's Stormwater Standards as outlined in DEP's Stormwater Policy Handbook and DEP's Stormwater Technical Handbook.

The Conservation Commission is responsible for ensuring that the requirements of the Wetlands Protection Act are met. Prior to performing any construction or land alteration, in or adjacent to a wetlands resource area, the Conservation Commission must be consulted. In 2001, the Town of Middleborough established a Wetlands Bylaw Committee for the purpose of developing and implementing a wetlands bylaw. To date, the wetlands bylaw has not been implemented. Once it is implemented, it will be the Conservation Commission's responsibility to ensure that this bylaw is followed.

The town does not have a specific bylaw governing stormwater, nor does it have a specific bylaw governing non-stormwater (illicit) discharges to the drainage system. The town did adopt regulations regarding the use of public and private sewers and drains in February 1991; however, this regulation did not actually contain specific controls on discharges to the drainage system. The town also has a Water Resource Protection District (WRPD) bylaw, but this bylaw does not specifically prohibit non-stormwater discharges into the drainage system either. The WRPD bylaw creates districts only and allows for special permitting. At present, both the Conservation Commission and the Board of Health receive complaints from the pubic regarding non-stormwater discharges.

5.3 Results of Field Investigation

The ideal goal for the Stormwater field investigation would be to locate, map, and characterize all of the point source discharges from the Town of Middleborough's stormwater collection system to surrounding surface waters. However, due to the enormity of this goal for the entire 72-square miles that make up Middleborough, the project area for this study was limited to point source discharges to the Nemasket and Taunton Rivers. As resources permit, the town should pursue location, mapping, and characterization of point sources discharges of stormwater throughout town.

5.3.1 Stormwater Outfall Location

Weston & Sampson performed field investigation work to identify and map stormwater outfalls discharging to the Nemasket and Taunton Rivers in Middleborough. In preparation for the fieldwork, Weston & Sampson requested information on all known stormwater outfalls from the Middleborough Highway Department. Six "known" point source discharges and seven bridge crossings where street flow or drop inlets were assumed to discharge to the river were provided. Weston & Sampson also reviewed available mapping to create a list of roadways crossing the Nemasket and Taunton Rivers within the Town of Middleborough. These locations were chosen because, although the amount of formal stormwater collection is relatively low due to the rural nature of the area, it can be reasonably assumed that stormwater collection might exist on the roadways, with discharge points located at the river crossings.

The fieldwork consisted of going to each of the identified locations, attempting to locate any point source discharges to the rivers, and documenting the location and other information about the outfall. Documentation included pinpointing the outfall discharge point with the Global Positioning System (GPS) and collecting information such as the type, size, discharge point, and origin of the outfall, as well at date, time, and weather during the inspection.

Weston & Sampson was able to confirm the location of five of the six "known" outfalls with the field investigation. A schematic of the sixth was found; however, the discharge point was not located during fieldwork. Eleven additional outfalls were located through field investigation. Four of these outfalls were found by driving to roadway crossings and inspecting the area and seven were located by canoeing the Nemasket River from the end of Old Bridge Street at the Middleborough-Lakeville town line to Oliver Mills Park at Route 44/Nemasket Street. In addition, five more outfalls were identified through topographic survey related to ongoing design work for the Wareham Street Drainage Improvement Project and the Lower Nemasket Interceptor Sewer Improvement Project.

In total, Weston & Sampson identified 21 possible stormwater discharges to the Nemasket and Taunton Rivers or to areas tributary to them. The word "possible" is used because some of the outfalls require additional investigation to confirm their discharge location and/or determine if they actually discharge stormwater and are not plugged or otherwise disconnected. A list of all identified outfalls and their discharge locations is included in Table 5-1, below. A copy of the stormwater system map, including the outfalls located during the investigation, is included as Figure 5-2 in a map pocket at the end of this report.

Table 5-1
List of Identified Stormwater Outfalls

Outfall	Discharge Location	Source
495N @ Nemasket River	Overland to Nemasket River	Field Investigation
495S @ Nemasket River	Overland to Nemasket River	Field Investigation
495 Bridge Inlets	Nemasket River	Field Investigation
Coombs Street	Overland	Highway Department
East Main Street Factory	Nemasket River	Field Investigation
East Main Street 10-inch	Nemasket River	Known-Field Verified
East Main Street 24-inch	Nemasket River	Field Investigation
G&E	Swale to Nemasket River	Known/Wareham Design
Mayflower Avenue	Overland	Known-Field Verified
Nemasket Street 6-inch	Nemasket River	Field Investigation
Nemasket Street 10-inch	Overland to Nemasket River	Field Investigation
Nemasket Street 12-inch	Overland to Nemasket River	Field Investigation
North/Oak Streets	Overland	Highway Department
North/Spring Streets	Overland to Nemasket River	Interceptor Design
Pierce/Jackson Streets	To G&E system	Wareham Street Design
Pierce Street Playground	Swale to Nemasket River	Known-Field Verified
Plymouth Street-Sturtevant Bridge	Taunton River	Field Investigation
School Street Extension	Overland	Highway Department
Spencer Street	Swale to Nemasket River	Known-Field Verified
Taylor Way	Overland	Interceptor Design
Valley Road	Overland	Highway Department
Vernon Street-Pratts Bridge	Taunton River	Field Investigation
Wareham Street bridge inlets	Nemasket River	Known-Field Verified
Wareham Street Bridge	Nemasket River	Wareham Street Design
Wareham Street @ DPW (DPW)	Nemasket River	Wareham Street Design
Wareham Street @ DPW (Locust)	Nemasket River	Wareham Street Design
Wareham Street across from DPW	Nemasket River	Field Investigation

After the field investigation for this PER was completed, construction of the Wareham Street Drainage Improvement Project changed the number and location of some of these stormwater discharges. In general, the Wareham Street project included the following:

- Construction of a combined stormwater treatment basin for the Jackson Street, Wareham Street, and G&E drainage systems
- Installation of floatables control ("hoods") on catch basins tributary to the G&E system
- Construction of a stormwater treatment system (oil & grit separator) for the Wareham Street outfall across from the DPW
- Construction of a stormwater treatment system (oil & grit separator and outfall) for the DPW drainage system

- Construction of a stormwater treatment system (oil & grit separator and outfall) for the Locust Street drainage that runs through the DPW yard
- Elimination of the existing outfalls listed in the table above as "Wareham Street Bridge" and "G&E"

The stormwater treatment systems above were designed for "first flush". This design strategy is based on the theory that the highest concentration of pollutants is washed into the drainage system at the onset of a rainfall event and not at the middle of a storm when peak flow is generally experienced. First flush is defined as the first half-inch of precipitation, except in Critical Areas where it is the first inch of precipitation *(MA Stormwater Management Policy)*. In first flush design, the hydraulic capacity of the treatment system is sized to accommodate the highly polluted first flush while allowing larger, less polluted, stormwater flows to bypass the treatment system. Utilizing first flush design can significantly reduce the size requirements and costs associated with construction of stormwater treatment systems, while still maintaining acceptable levels of treatment.

5.3.2 Stormwater Sampling

Once field verification and mapping were completed for the identified outfalls, Weston & Sampson performed an initial round of wet-weather sampling in November 2002. The purpose of the sampling was to characterize the water quality at each of the known stormwater outfalls discharging to the Nemasket and Taunton Rivers. The results of the sampling are summarized in Table 5-2, on the following page. It should be noted that sampling was not performed at all outfalls listed in the table above because not all of the outfalls were identified before sampling was performed and because only outfalls discharging directly to the Nemasket or Taunton Rivers were sampled.

Weston & Sampson compared the sampling results with Massachusetts Surface Water Quality Standards (314 CMR 4.00) set for the Nemasket and Taunton Rivers. In Middleborough, both rivers are listed as Class B, Warm Water. Therefore, discharges to the rivers are required to meet or exceed the following standards:

- Dissolved Oxygen: Shall not be less than 6.0 mg/l in cold water fisheries nor less than 5.0 mg/l in warm water fisheries unless background conditions are lower.
- Temperature: Shall not exceed 83°F (28.3°C) in warm water fisheries, and the rise in temperature due to a discharge shall not exceed 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month).
- pH - Shall be in the range of 6.5 through 8.3 standard units and not more than 0.5 units outside of the background range. There shall be no change from background conditions that would impair any use assigned to this Class.
- Fecal Coliform Bacteria - Shall not exceed a geometric mean of 200 organisms per 100 ml in any representative set of samples nor shall more than 10% of the samples exceed 400 organisms per 100 ml.

Table 5-2
Results of Stormwater Sampling

PARAMETER	DET. LIMIT	UNIT	SPENCER ST @ HOUSING AUTHORITY 11/22/02; 7:40AM	WAREHAM ST BRIDGE INLETS 11/22/02; 8:06AM	EAST MAIN 10-INCH 11/22/02; 8:35AM	EAST MAIN 24-INCH 11/22/02; 8:50AM	NEMASKET ST BRIDGE 12-INCH EAST 11/22/02; 9:30AM	PLYMOUTH ST-STURTEVANT BRIDGE 11/22/02; 10:50AM	VERNON ST -PRATTS BRIDGE 11/22/02; 11:07AM	495S @ NEMASKET RIVER 11/22/02; 12:10PM	MAYFLOWER AVE 05/23/03; 8:15AM	PIERCE ST PLAY GROUND 05/23/03; 8:45AM
LAB ANALYSES(1)												
TOTAL COLIFORM	2	MPN/100 ml	>1600	>1600	>1600	>1600	>1600	>1600	>1600	900	500	3000
FECAL COLIFORM	2	MPN/100 ml	>1600	>1600	500	>1600	1600	500	1600	900	240	2400
ESCHERICHIA COLI	100	CFU/100 ml	1100	47000	200	4800	1600	<100	500	100	(note 3)	(note 3)
BOD_5	3	mg/l	20	83	7	12	34	38	18	13	8	<6
NITRITE (as N)	0.01	mg/l	0.01	0.02	0.01	0.02	<0.01	0.01	<0.01	<0.01	0.01	<0.01
NITRATE (as N)	0.01	mg/l	0.12	96	0.44	0.09	<0.01	0.07	0.03	0.33	0.32	1.6
T. SUSPENDED SOLIDS	2	mg/l	13	350	21	32	7.3	5.0	2.3	2.0	14	4.0
ALKALINITY (as $CaCO_3$)	1	mg/l	20	<1.0	20	22	<1.0	12	4	28	11	11
CHLORIDE	5	mg/l	<5.0	32	9.3	<5.0	<5.0	<5.0	<5.0	15	30	14
COD	4	mg/l	22	200	19	43	15	16	16	10	37	12
T. PHOSPHATE (as P)	0.05	mg/l	0.17	0.94	<0.05	0.21	<0.05	0.16	0.13	0.14	0.29	0.18
TKN (as N)	0.5	mg/l	0.8	2.3	0.9	0.8	0.5	0.6	0.5	0.7	1.1	0.7
AMMONIA (as N)	0.1	mg/l	0.4	0.7	0.4	0.2	<0.1	0.1	0.1	0.1	0.2	0.3
COPPER	0.05	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
LEAD	0.04	mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
ZINC	0.02	mg/l	<0.02	0.22	0.04	0.05	<0.02	0.02	<0.02	0.08	0.05	0.02
FIELD ANALYSES(2)												
pH	-	-	7.66	7.20	7.20	7.09	7.11	7.05	7.01	7.21		
CONDUCTIVITY	-	ms/ cm	0.017	0.119	0.033	0.18	0.007	0.028	0.011	0.092		
DO	-	mg/L	14.48	10.65	12.20	10.63	11.48	12.24	12.00	13.44		
TEMPERATURE	-	°C	10.20	9.65	9.37	9.53	9.25	10.09	9.39	9.50		

(1) Laboratory analyses performed by R.I. Analytical Laboratories, Inc.

(2) Field Analyses performed with the use of a Hydrolab Quanta from Palms Environmental & Survey.

(3) Quality control failed for analyses; results not reportable.

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- Solids - These waters shall be free from floating, suspended and settleable solids in concentrations and combinations that would impair any use assigned to this Class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- Color and Turbidity - These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class.
- Oil and Grease - These waters shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life.
- Taste and Odor - None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.

In general, sampling indicated that the primary concern within the project area is bacterial contamination. All outfalls sampled showed high total and fecal coliform and some showed high escherichia coliform. Although there is no set concentration for suspended solids, five outfalls along the Nemasket River were found to exceed the concentration allowed at the WPCF (5 mg/l) also discharging to the Nemasket River, indicating that further investigation is warranted. Although no limit is provided for metals, copper, lead, and zinc sample results rarely exceeded the detection limit; therefore, there is no indication that metals are a significant concern in the stormwater systems sampled.

5.3.3 Smoke Testing of Drains

As stated above, the results of the wet-weather sampling indicated bacterial contamination at each of the outfalls sampled. In general, bacterial contamination indicates the need for further study to identify possible illicit connections to the sewer system. However, Weston & Sampson did not complete further study for all of the areas under this contract for the following reasons:

- MHD Responsibility: Based on the jurisdictional requirements provided under the EPA Phase II program in Massachusetts, stormwater systems that collect runoff from State Highways and discharge directly to a surface water or channel leading to surface water are the responsibility of the MHD. Since the MHD will have to pursue mapping and BMPs for these outfalls, Weston & Sampson recommends that the Town of Middleborough not pursue further study of these outfalls and any associated tributary systems at this time. This recommendation is applicable to the following outfalls:

    - Route 495 North @ Nemasket River
    - Route 495 South @ Nemasket River
    - Route 495 @ Nemasket River (bridge drop inlets)

- Non-Point Source Pollution: Weston & Sampson did not complete further study under this contract for outfalls where the tributary area is overland flow (i.e., there is no piping system associated with the outfall). In these areas, contamination is due to non-point sources, which are outside of the scope of this contract. The town will want to pursue non-point source contamination at a later date. This statement is applicable to the Wareham Street Bridge Inlets.

- Tributary Area Under Construction: Further study was not completed under this contract for three outfalls due to ongoing construction. Two of the outfalls did not have flow during the wet-weather sampling work and Weston & Sampson recommends that these outfalls be inspected during a storm event after the completion of construction to determine their status. The third outfall had flow and was sampled, but should be re-sampled after the completion of construction. This statement is applicable to the following outfalls:

  - Nemasket Street Bridge 6-inch (south of river; east of street)
  - Nemasket Street Bridge 10-inch (south of river; west of street)
  - Nemasket Street Bridge 12-inch (south of river; east of street)

- On-going Drainage System Improvements: Further study was not completed for outfalls that were part of the Wareham Street Drainage Improvements. Since this project included rerouting of drain lines and installation of stormwater pollution control measures, including a treatment basin and oil and grease traps, Weston & Sampson recommends that further study of this area be conducted after construction. This statement is applicable to the following outfalls:

  - G&E
  - Wareham Street across from DPW
  - Wareham Street @ Bridge
  - Wareham Street @ DPW (DPW)
  - Wareham Street @ DPW (Locust Street)

- Additional Investigation/Sampling: Based on borderline levels of bacteria or inability to locate an outfall, Weston & Sampson recommends additional investigation and re-sampling at the following outfalls:

  - East Main Street 10-inch
  - East Main Street Factory
  - Plymouth Street @ Sturtevant Bridge
  - Vernon Street @ Pratts Bridge

Further study for illicit connection detection was completed for the remaining four outfalls:

- East Main Street 24-inch
- Mayflower Avenue
- Pierce Street Playground
- Spencer Street

Since no mapping is available for the area tributary to the East Main Street 24-inch outfall, illicit connection detection was not performed in this area. The town should complete mapping and illicit connection detection in this area. It should be noted that mapping is also required for the outfalls listed under "Additional Investigation/Sampling" above, should these outfalls be found to have bacterial contamination.

Weston & Sampson focused study in the drainage systems tributary to the outfalls located on Mayflower Avenue, Pierce Street Playground, and Spencer Street. Under the direction of Weston & Sampson, Savin Engineers, P.C. performed smoke testing of drains in these selected areas in July 2003. Approximately 16,447 LF of drain line was smoke tested. Only one illicit connection was identified within these three areas: a cross connection between the sewer and drainage systems at the intersection of Southwick Street and Oak Street.

5.3.4 Television Inspection of Drains

Based on the results of the smoke testing, television inspection was not indicated for any of the selected drainage systems. However, during construction of the Wareham Street Drainage Improvement Project, fecal contamination was visually observed in the stormwater treatment basin. Television inspection for illicit connections to the Jackson Street drainage system, tributary to the basin, was made an immediate priority. Approximately 4,747 LF of cleaning and television inspection was performed, but no illicit connections to the drainage system were identified. The fecal contamination is most likely due to pet waste washing into catch basins. A summary of the information gathered from the television inspection is provided in Table 5-3, below.

Table 5-3
Television Inspection of Drains – Jackson Street Drainage System

Street	From	To	Pipe	Aprx. Length	Comments
Frank Street	Shaw	Oak	15" RCP	431	Grade problems; broken pipe.
Jackson Street	N. Main	Dead end	24" RCP	1,139	Protruding service (8 inches)
Jackson Street	Dead end	Pond	42" CPP	243	None.
N. Main Street	Centre	Pierce	12" RCP	220	None.
Oak Street	Arch	Frank	15" RCP	420	Grade problems; sags; buried MH; broken pipe.
Pearl Street	Centre	Pierce	15" RCP	449	None.
Pierce Street	Oak	Pearl	15" RCP	715	Grade problems; sags; broken pipe.
Pierce Street	Pearl	N. Main	15" RCP	1,066	Grade problems; sags; protruding service (6 inches).
Pierce Street	School	N. Main	18"RCP	64	Grade problems; broken pipe
				4,747	

5.3.5 Dyed Water Testing

Dyed water tests were included in the Scope of Work for the purpose of confirming illicit connections to the drainage system based on smoke testing. The only connection identified during smoke testing was a cross connection between the sewer and drain system that does not require dye testing. Therefore, no follow up dyed water testing was performed.

5.4 Future Projections

5.4.1 Pollutant Loading

In an effort to identify and prioritize areas that could most benefit from improved stormwater management, estimates of pollutant loading from each of the identified stormwater outfalls were completed. Pollutant loading calculations included the following assumptions:

- Calculations were performed utilizing the Simple Method Equation for Storm Pollutant Export
- Since no comprehensive mapping exists for the stormwater system, Weston & Sampson utilized a variety of sources of information to estimate the drainage area associated with each stormwater outfalls including results from field investigation, interviews with Highway Department personnel, and maps of the town topography
- Typical impervious area percentages were taken from the DEP Stormwater Technical Handbook
- Loading calculations were completed utilizing typical pollutant characteristics taken from the NURP (EPA, 1993). For outfalls where sampling was performed, loading calculations were also completed utilizing the pollutant concentrations from these analyses

The results of the stormwater pollutant loading analysis are provided in Appendix C. It is important to point out that the results of outfall sampling indicated significantly lower concentrations of all pollutants than those recommended by the NURP. Therefore, the pollutant loading estimates calculated utilizing the NURP typical pollutant characteristics should be considered very conservative, or "worst case". It is recommended that the town sample each of the identified outfalls under a variety of runoff conditions to collect data regarding *actual* pollutant loadings. Utilizing the NURP typical characteristics rather than actual conditions could alter prioritization of the outfalls and lead to costly design and construction of structural BMPs for outfalls where actual pollutant loadings do not warrant them.

5.5 Needs Assessment

5.5.1 Specific Problem Areas

As discussed previously, the town has identified some specific areas where a variety of stormwater problems are known, or thought, to exist. The town needs to address known problems with flooding near Wareham Street Bridge and on Pierce/Jackson Streets.

The town also needs to address general stormwater management and water quality concerns in areas on North/Nemasket Streets, East Main Street near the Pump Station, and in rural areas.

5.5.2 Source Protection

Review of the stormwater outfalls identified as part of this project in relation to designated Water Resource Protection Zones for the town drinking water wells indicated that none of the identified outfalls are located within Zones 1 or 2. However, only outfalls discharging to the Nemasket and Taunton rivers were included within the scope of this project. Roads pass through the Zone 2 areas of all but one of the town's drinking water wells and most likely discharge stormwater to these areas, whether through formal drainage collection and conveyance systems or by uncontrolled sheet flow. In addition, all outfalls identified along the Nemasket River between Interstate 495 and East Main Street are located within the Zone 3 area designated for three town drinking water wells – East Main Street #1 and #2 and East Grove Street. Stormwater pollution identification and prevention efforts should be made a high priority in these areas.

5.5.3 NPDES Stormwater Phase II

Many of the town's stormwater needs are included within the 5-year plan proposed to comply with the NPDES Stormwater Phase II General Permit. As part of preparation of the Notice of Intent for inclusion under the General Permit, Weston & Sampson assisted the town with creation of an initial SWMP. The SWMP addresses the authority and personnel assigned responsibility for stormwater within the town; review and revision of town bylaws, regulations, and policies governing stormwater; assessment methods and schedules for ongoing stormwater quality monitoring; recommendations for operation and maintenance of the stormwater system, including the design and implementation of best management practices; development of a public education and outreach program; and means for periodic evaluation and revision of the SWMP itself. It should be noted that this initial SWMP is based on the needs of the town over the next five years and focuses primarily on bringing the town into compliance with new federal and state regulations. The SWMP will need continued review and revision to establish it as a perpetual guidance document for the town.

A brief summary of Middleborough's stormwater needs, which are also related to NPDES Stormwater Phase II, is as follows:

- Complete the computerized mapping of all drainage infrastructure - catch basins, drain lines, and outfalls - initiated under this project
- Develop and implement a public education and outreach program
- Review and revise town by-laws and regulations relating to stormwater for the municipal stormwater system, public/private industrial activities, and public/private construction activities
- Complete town-wide stormwater quality analyses, pollutant loading estimation, and pollutant source identification (illicit connection program) initiated under this project and as specified in Section 5.3.3

- Prepare and implement a written O&M Program for the stormwater system to ensure the best use of existing system components and provide for capital improvements
- Design and implement stormwater controls, including non-structural and structural BMPs
- Assure adequate funding to support the needs of the stormwater system on a perpetual basis

Additional discussion regarding these needs is provided below. Since mapping and public education are also needed for other programs, these items are discussed on a town-wide basis later in this report.

5.5.4 Stormwater Bylaws/Regulations

As discussed previously, Middleborough does not currently have a bylaw/regulation governing stormwater. Having a separate stormwater bylaw/regulation is not required; however, many communities are choosing to develop one in order to address new federal and state requirements. If the town does not wish to create a separate stormwater bylaw or regulation, it must still develop and implement certain required regulatory mechanisms. In order to be in compliance with the NPDES Phase II Stormwater regulations, at a minimum, the town must have regulatory mechanisms governing the following:

- Construction Site Runoff Control (CSRC): Although the town's existing subdivision rules and regulations contain language for erosion control during construction of new subdivisions, these regulations do not govern all new developments and redevelopments as required, but only projects that propose to divide a tract of land into two or more lots. Additional regulatory mechanisms must be developed and implemented to govern new developments and redevelopments that do not fall under the definition of a subdivision.
- Post Construction Runoff Control (PCRC): Although the town's existing subdivision rules and regulations contain language for calculation and control of drainage and sediment basins for new subdivisions, these regulations do not govern all new developments and redevelopments as required. Additional regulatory mechanisms must be developed and implemented to govern new developments and redevelopments that do not fall under the definition of a subdivision.
- Illicit Discharge Elimination: No current regulatory mechanisms exist for the prevention, detection, or elimination of illicit discharges to the drainage system. Development and implementation of an Illicit Connection Program is discussed in detail in the next section.

At the request of the town, Weston & Sampson has secured some existing guidance documents and example bylaws/regulations covering stormwater, CSRC, and PCRC available through federal, state, and local sources. The town should utilize these documents to assist them in modifying existing, or developing and implementing new regulatory mechanisms to ensure the protection of their water resources from stormwater pollution, and to maintain compliance with applicable federal and state regulations. The example documents are provided in Appendix D of this report.

During the revision or creation of all regulatory mechanisms governing stormwater, it is important that the town incorporate requirements for review by all applicable town departments including, at a minimum, the Planning Board, Conservation Commission, Building Department, and Highway Department. By requiring their review of all new developments and redevelopments, the town ensures long-term involvement and input regarding stormwater management from these departments.

5.5.5 Illicit Connection Program

The EPA Phase II regulations define an illicit discharge as "as any discharge to a municipal separate storm sewer that is not composed entirely of stormwater, except discharges pursuant to an NPDES permit and discharges resulting from fire-fighting activities". Illicit connections can be either direct (e.g., sewer piping that is improperly connected to the drain system, materials that have been illegally dumped into catch basins or other drainage components, floor drains that are connected to the drainage system, etc.) or indirect (e.g., damaged sewer lines leaking into damaged drain lines, failing septic systems leaking into damaged drain lines, etc.). Illicit connections result in contamination of the drainage system and subsequent discharge of pollutants to the environment. Every effort should be made to identify and remove all illicit connections to the drainage system through development and implementation of a comprehensive Illicit Connection Program.

An Illicit Connection Program is also required by the Stormwater Phase II regulations. According to the regulations, the minimum required components of an Illicit Connection Program are (*NEIWPCC*):

- Develop a drainage map illustrating the locations of all outfalls and the names/locations of receiving waters
- Provide appropriate regulatory mechanisms and enforcement procedures to prohibit illicit discharges
- Implement a plan to detect and eliminate illicit discharges, including illegal dumping
- Inform public employees, businesses, and the general public of hazards associated with illicit discharges and improper disposal of waste

Rather than expending resources to discuss the many elements of an Illicit Connection Program and its development, Weston & Sampson recommends that the town reference the multitude of existing guidance documents available. An EPA model ordinance is included with the examples provided in Appendix D. In addition, a well-written and comprehensive guide to the development and implementation of an illicit connection program is the Illicit Connection Detection and Elimination Manual – A Handbook for Municipalities published by the New England Interstate Water Pollution Control Commission (NEIWPCC) in January 2003. NEIWPCC developed this manual under a grant from the EPA to assist municipalities with compliance with Stormwater Phase II requirements; particularly, with the development of illicit detection and elimination programs. Middleborough should utilize this manual and other available references to develop and implement a comprehensive illicit connection program.

5.5.6 O&M Program

A Stormwater O&M Program should be developed and implemented to ensure that the collection system adequately conveys rain and snowmelt away from roadways, sidewalks, and public/private properties on a perpetual basis. As new stormwater treatment systems are designed and implemented, proper O&M will also be required to ensure that best available treatment is provided to remove pollutants from the stormwater before discharge to the environment.

The Stormwater Collection System does not differ significantly from the Sewer Collection System when it comes to the need for a comprehensive O&M Program. Although the type of water being conveyed and the system components may differ slightly, the benefits and elements of the O&M Program are essentially the same. Since these programs have essentially the same components and the development and implementation of a Collection System O&M Program for the wastewater system was discussed in detail under Section 4, the information is not repeated here. An outline for a stormwater O&M program is provided in Appendix B.

5.5.7 Best Management Practices

BMPs for stormwater should be designed to minimize the three primary problems associated with urban stormwater – increased rate of runoff, decreased groundwater recharge, and stream flashing. At a minimum, they should be designed to prevent untreated discharges to wetlands and waters, preserve hydrologic conditions that closely resemble pre-development conditions, reduce or prevent flooding by managing peak discharge and volumes of runoff, minimize erosion and sedimentation, reduce suspended solids and other pollutants to improve water quality, and provide increased production of sensitive natural resources. In selecting the appropriate BMP for each stormwater application, the designer should consider, at a minimum, the following:

- Potential Pollutant Loads in the Untreated Stormwater
- Post Development Peak Discharge Rates
- Recharge to Groundwater
- 80% of TSS removal
- Protection of Critical Areas
- Redevelopment Areas
- Erosion/Sediment Control
- Operation/Maintenance Plan

In addition, the designer should consider the following questions:

- Are there opportunities to meet quality standards and simultaneously meet peak discharge and groundwater recharge goals?
- What are the opportunities for utilizing comprehensive site planning in order to minimize the need for structural controls?
- Are there critical areas in the project area?

- Are there areas within the site where higher potential pollution load contributions are possible?
- What are the possible site constraints?
- Is the future maintenance of the system economically and structurally feasible for this BMP?
- Is the BMP option cost effective?

It is also important for the designer to understand that a single BMP might not be the best solution for the specific site; rather a system of BMPs may work better than any single BMP. Obtaining the most economical and cost effective solution to a problem is the goal of any designer. Comparing costs for different designs and combinations of BMPs is an important process in the design of a stormwater collection system. Long term as well as short term costs must be taken in consideration when selecting BMPs.

Education and instruction about the use of the BMP to collection system staff and the general public is very important in the BMP selection and acceptance process. Making the BMP an asset to the site is an important goal, especially when the BMP is openly visible to residents/taxpayers (e.g., a detention pond). In cases where residents are expected to pay for construction, operation and maintenance of the BMP(s), education regarding of the objectives of the BMP(s) are particularly important in the acceptance process.

5.5.7.1 Nonstructural Best Management Practices

Wherever possible, Middleborough should utilize nonstructural BMPs since they are generally less costly to implement and maintain. It should be noted, however, that most nonstructural BMPs require changes in policy, procedure, or behavior and may not be as easy to implement and maintain. The town has already implemented several nonstructural BMPs through their Highway and Planning departments. Weston & Sampson recommends that Middleborough continue with the implementation of nonstructural BMPs and then evaluate their performance after a period of two to five years, depending on the BMP. If the nonstructural BMPs are found to be supplying inadequate treatment at any outfalls, then the town should proceed with design and construction of structural BMPs for these outfalls only. Common non-structural BMPs that should be implemented, some of which the town has already established, are listed below.

<u>Land Use Management & Improvement Measures:</u>

- Encourage patterns of development that minimize NPS pollution
- Use planning to maximize infiltration on site
- Increase urban reforestation and riparian buffer restoration
- Apply water-wise landscaping strategies
- Draft ordinances and regulations to provide increased control over septic disposal systems, public sewerage and underground injection controls
- Strict use of wetland protection by-laws
- Implementation and promotion of open space initiatives

Public Education and Volunteer Measures:

- Educate public to encourage human behavior changes
- Use volunteers to stencil storm drains
- Create, enforce and educate public about proper animal (pet) waste disposal practices
- Increase awareness on proper fertilizer and pesticide application and yard waste management
- Increase awareness about household hazardous wastes and their proper disposal

At the request of the town, Weston & Sampson has researched and viewed a variety of available public education videos for stormwater. We selected two videos – one intended for children and one intended for public officials/adults – and purchased them on behalf of the town. We will forward the videos under separate cover as part of the scope of work for this project.

Control Measures:

- Vegetated buffer areas, grassed swales and vegetative filter strips
- Street cleaning (wet-vacuum or regenerative air vacuum equipment for particulate removal)
- Dust control (vegetation, mulch or wind barriers)
- Snow removal (snow from salt-treated areas kept away from sensitive water resource areas)
- Septic system inspection and maintenance
- Illicit connection and detection
- Spill response plans and training

Good Housekeeping Measures:

- Proper storage of materials, equipment, recyclables, and wastes
- Prompt and proper disposal of wastes
- Upkeep of vehicles and equipment

Additional discussion on some of the more popular of these control measures is offered below.

Site Planning: Site planning is the most effective approach to managing stormwater runoff. The importance of planning cannot be underscored in its ability to cut costs and use of structural technologies in the stormwater management plan. Management planning can reduce flooding and pollution problems when implemented early. Non-structural site planning is almost always less expensive, more efficient and better for the environment than structural counterpart. Some techniques include:

- Minimize impervious surfaces
- Maintain natural buffers and drainage ways
- Minimize creation of steep slopes
- Minimize placement of new structures over porous of erodible soil
- Reduce frontage and other setbacks

- Establish planned unit developments
- Establish cluster developments
- Reduce horizontal footprint of buildings and parking areas
- Use shallow grassed roadside swales and parking lot islands
- Utilize "turf pavers" of gravel or other porous stone
- Maintain largest amount of pre-development vegetation as possible

Other techniques include fitting the development to the existing terrain. For example, matching road alignments to existing contours. Further utilizing the natural terrain's drainage system can be useful as well as reproducing the predevelopment hydrologic conditions of the site in designing a non-structural or structural stormwater collection system.

Local Bylaws and Regulations: Local bylaws and regulations can be one of the most important tools in constructing BMP's for structural and non-structural stormwater management practices. Local statutes cover may cover issues not mentioned in either state or federal regulations. This can prove very useful for sites that fall below the threshold for triggering a state or federal regulation. Many different types of bylaws exist; therefore, it is important to research each of the town's bylaws thoroughly to find specific statutes appropriate to the project site.

Street and Parking Lot Sweeping: Street-sweeping efforts can reduce the amount of total suspended solids (TSS) that enter a stormwater collection system. Street sweeping effectiveness largely depends on when the sweeping is carried out, the type of equipment used, and the frequency of the sweeping. For example, infrequent street sweeping with mechanical sweeping equipment has removal efficiencies of no more than 20%. Street sweeping is typically completed during the late spring, summer and early fall; however, this schedule misses the peak time of deposit into the collection system, reducing effectiveness. Sweeping should be performed during the period following winter snowmelt to maximize removal efficiencies. Newer technologies, including vacuum type sweepers, have shown increased efficiencies. In addition, sweeping at a greater frequency – monthly or weekly –increases removal efficiency.

Catch Basin Cleaning: Catch basin cleaning can be an instrumental part of a non-structural stormwater collection plan. The removal of sediment from the sump of the catch basin can reduce the total amount of TSS in the collection system. Much like street sweeping, however, catch basin cleaning must be completed at the most effective time. An early winter thaw is an excellent time to implement catch basin cleaning. Removing the sediment at this time is crucial because the heavy flow period around the spring season has not arrived yet. Cleaning catch basin during the summer is only mildly effective in removing TSS from the system.

Snow and Snowmelt Management: Proper management of snow storage and snow de-icing chemicals can reduce the amount of sediment and pollutant runoff impacts. Limited use of de-icing compounds as well as careful storage practice can prevent pollutant loading from these substances. Some possible snow and snowmelt management techniques are:

- Using alternate de-icing compounds such as calcium chloride and Calcium Magnesium Acetate (CMA)
- Designate "low salt" or "no salt" areas around sensitive water bodies
- Reduce use of de-icing compounds by better maintaining equipment and through better driver training
- Store de-icing compounds in a sheltered area protected from precipitation

Public Education: Public education is a vital tool in reducing non-point pollution. Informed citizens are less likely to discharge potentially harmful materials into the environment. This topic is quite broad in its ability to limit pollution but there are a few behaviors that should be especially considered.

- Lawn and garden activities
- Turf management (on golf courses, athletic fields etc)
- Pet waste management
- Proper storage, use, and disposal of household hazardous chemicals
- Prosper operation and maintenance of septic systems
- Commercial operations and activities
- Water conservation and litter control

Pollution Prevention Plans: Creation of a stormwater pollution prevention plan (SWPPP) is an effective non-structural source control that is easily implemented. In addition, development of a SWPPP is required by law under the guidelines set forth in EPA's NPDES Stormwater Permit Program. This program requires that industrial sites greater than one acre develop and implement a SWPPP before construction. The plan is required for all stormwater discharges related to construction activity for sites with defined industrial uses and recommended for other land use activities that are below the one-acre threshold.

The town should ensure that SWPPPs are created and implemented for all applicable sites. SWPPPs are instrumental in reducing pollutant loads that originate from construction sites. These reduced loads also ease stress on existing structural stormwater collection systems, thereby lowering maintenance costs of the existing system.

5.5.7.2 Structural Best Management Practices

After a period of implementation and evaluation of nonstructural BMPs, a few outfalls will probably be found to require additional treatment. Middleborough should design and construct structural BMPs for these outfalls. Many different factors will ultimately influence the selection of a structural BMP design. One of the more important factors in

the selection of a structural BMP is soil suitability. Some structural BMPs require specific soil types for the technique to work effectively. Permeability of the soils at a site is most often the governing factor in the stormwater collection system design. Infiltration techniques will not work well in soils with low permeability. Conversely, wet ponds will not work in soils with high permeability. Some other factors influencing structural BMP selection include:

- Drainage Area / Watershed to be served
- Depth to water table
- Depth to bedrock
- Slope of existing topography
- Thermal Enhancement
- Proximity to Wells and Foundations

Some examples of common structural BMPs are provided below.

Detention Systems:
- Detention ponds
- Underground tanks
- Oversized pipes
- Proprietary separator systems

Retention Systems:
- Wet ponds (retention ponds or basins)

Constructed Wetlands:
  - Wetland channels
  - Stormwater wetlands

Infiltration Systems:
- Infiltration trenches and basins
- Porous pavement

Filtering Systems:
- Surface sand filters
- Underground sand filters
- Water quality inlets
  - Proprietary filtration devices

Erosion and Sedimentation Control:
- Streambank stabilization.
- Riprap lined and paved channels
- Slope drains and flumes
- Outlet stabilization structures
- Stormdrain inlet protection controls

- Sediment basin and trap
- Grade stabilization structure
- Silt fence
- Road salt storage facility

Additional discussion on some of the more popular of these control measures is offered below.

Extended Detention Basins: Extended Detention Basins are designed to hold storm water for at least 24 hours. This detention time allows solids to settle out of the stormwater, removing a large percentage of the TSS from the system. It also helps control flooding conditions that might develop due to a large precipitation event. The advantages of extended detention basins are low cost, good retrofitting options for future expansion, removal of large amounts of sediment and absorbed pollutants, creation of aquatic habitat, and less potential for hazards than deeper permanent pools.

Wet Retention Basins: Wet retention basins or wet ponds accomplish many of the same goals that extended detention basin do, but using some different methods. Wet retention basins are unlike extended detention basins in that water is always present in the pond. The permanent pool of water is the main instrument to treat the incoming stormwater. The pool allows increased settling times for incoming flows. This increased settling time enhances the efficiency of the settling process, removing a high percentage of the TSS of the stormwater. Wet basins are typically deeper than extended detention basins. This allows for increased storage capacity for large storm events. Wet retention basins work by displacing the previous stormwater water in the retention with the current stormwater from the storm event. Wet basins have many advantages in that they create a permanent aquatic habitat for a variety of biologic activity, can be designed with different outlet control structures to control different storms that might occur, and can be a valuable asset for a project site that increases property values by providing fire protection and recreation areas.

Wet basins have their disadvantages as well. They are more costly due to the increased amount of excavation; therefore, require more land for construction, which may be prohibitive in some projects where land acquisition is not possible. The also may pose problems to the biologic life in and around the draining area of the site and contribute to downstream warming of other streams and ponds since they tend to warm the water they store during the summer months.

Constructed Wetlands: There are four basic types of constructed wetland design types: shallow marsh systems, pond/wetland systems, extended detention wetlands, and pocket wetlands. Constructed wetlands are much like wet basins in that are relatively large structural stormwater management techniques to control stormwater for large drainage areas. Constructed wetlands are primarily designed to remove pollutants and sediments. They accomplish this through biological uptake, retention and settling. Constructed wetlands differ from natural wetlands in that they do not provide all the ecological functions that at natural wetland might. Constructed wetlands have some additional

design considerations that other BMPs do not, including the fact that they should not be constructed in places where natural wetlands exist, and that they require large amount of dry weather base flow to operate efficiently, generally, no less than 10 acres.

Water Quality Swales and Drainage Channels: Water quality swales are designed to convey water from one point to another while removing a portion of the particulates in the water. These devices are open channel conveyers that use rock and grassed swales as the lining for the channel. Grassed swales are known as biofilters for their ability to remove pollutant and sediment loadings from the water being transported.

Drainage channels are similar to swales but have a different objective in stormwater management. They are designed to move water rapidly or with great volume, conveying large amounts of stormwater that could occur during a large (10-year) event. Drainage channels don not have design modifications that enhance pollutant removal rates.

Infiltration Trenches: Infiltration trenches are shallow trenches that are filled with stone and act as underground reservoirs for the stormwater to be collected in. Once collected, this stormwater runoff seeps into the ground and aids in groundwater recharge. Infiltration trenches are designed with a series of layers that the collected runoff travels down through, creating a biofiltration area where microbes and organisms can process any pollutants that might be carried in the stormwater.

Infiltration Basins: Infiltration basins are similar to infiltration trenches in that they allow collected stormwater runoff to infiltrate into the ground through permeable soils beneath the device. Pretreatment is a crucial issue in designing an infiltration basin. The collected runoff must be treated or the efficiency of the device will not be acceptable.

Dry Wells: Dry wells are used to treat so called clean runoff that comes from roof drainage systems. These systems are not designed for treating stormwater runoff with high pollutant and sediment loads. A dry well is a cylindrical type device that is installed below grade. The dry well contains many holes for the collected stormwater to seep through, recharging the ground water system. The infiltration of clean stormwater runoff increases the efficiency of the entire system, mainly because the dry well removes clean stormwater that would otherwise be conveyed to other, treatment-orientated BMPs. The drywell has many advantages, but it also has some disadvantages, including high failure rates due to clogging, limited applicability in relation to drainage area size, and limited treatment of stormwater runoff.

Sand Filters/Organic Filters: Sand filters are also known as filtration basins. These basins consist of multiple layers of sand, peat or other materials that remove sediment and trace metals. They are also somewhat effective in removing nutrients, BOD, and coliform bacteria. Some designs include apparatus to include biological uptake for pollutant removal. The primary advantages of this design are its ability to recharge the groundwater when treatment is complete, reduced surface runoff and volume, reduced peak discharge volume, and the fact that it can be adapted to many different kinds of sites. The disadvantages of this design are that pretreatment is required to prevent

clogging of the device under heavy flow conditions, frequent maintenance is required to ensure maximum efficiency, the units are fairly expensive to install and construct, and they are often deemed unattractive when not covered by grass or other material.

Water Quality Inlets/Deep Sump Catch Basins: Water quality inlets and deep sump catch basins provide a structural solution to the common problem of separating sediment and pollutants from discharge into a stormwater collection system. Water quality inlets are large devices that contain a series of chambers. Each chamber has a different design goal ranging from the removal of floating debris to the capture and eventual settling out of sediment and oil. Stormwater collected and conveyed to these devices is transferred through each chamber until it is ultimately discharged either to an outfall or into another BMP.

Deep sump catch basins work in much the same way as water quality inlets. These devices accomplish their goal in different ways however. Deep sump catch basins do not contain chambers. Instead sediment and pollutants are separated from the discharged water by adjusting the height of the inlet and outlet pipes as well the orientation with respect to the stormwater in the basin. The device works on the principle that oil, grease and pollutants will rise to the top of the sump and sediment will sink. The outlet pipe is orientated so that the elevation of the water inside the sump must be greater that the height of the outlet pipe for water to flow out of the sump. This allows only the stormwater that has been settled and removed of grease oil to discharge from the device.

5.5.8 Funding

It is obvious from extent of the Needs Assessment above and the many articles currently being published, that implementation and continued operation of a stormwater management program has significant cost implications. In the past, funding for stormwater related operations and improvements in most communities, including Middleborough, has been part of the general fund and paid via taxes as a line item for Public Works (or similar department) in the annual budget. However, changes in environmental focus and regulatory requirements dictating improved stormwater quality have significantly increased cost of maintaining a stormwater program. Middleborough is considering alternative methods for raising the funds required to meet and sustain the additional financial demands of stormwater management.

A wide variety of funding mechanisms are available including, but not limited to Stormwater Utilities, Revenue Bonds, Enterprise Funds, Federal Government Grants, Special Purpose Local Option Sales Taxes, State Revolving Fund Loans, Impact Fees, Special Assessment, and System Development Charges. The following is a general breakdown of available funding methods, by use category *("New Options for Stormwater Financing", Cyre, 1983)*:

Revenue for Annual Operating Expenses

General fund
Drainage Utility Service Charges
Interfund Loans to Drainage Utility (transition only)

Funding For Major Capital Improvements

General Obligation Bonding Repaid by Property Taxes
Revenue Bonding Repaid by Utility Service Charges
Utility Tax Revenues
Community Development Block Grant Funds

Fees and Charges

Plan Review and Inspection Fees
On-site Detention/Retention System Inspection Fees
Impact Fees
System Development Charges
General Facilities Charges
In-lieu-of Construction Charges
Latecomer Fees for Developer Extensions

Funding for Special Services and Projects

Local Improvement Districts
Utility Local Improvement Districts
Area of Special Benefit Financing
Special-purpose Taxing Districts

In the past, communities generally used grant/loan programs to supplement general fund or municipal bonds. In more recent years, communities have been moving towards those mechanisms that are "user based". These programs are based on individual usage rather than on general surcharges to property taxes, and are often set up as Enterprise Funds. Water and sewer services are typically funded in this manner. A great deal of controversy surrounds the benefits and drawbacks of user-based programs for the purpose of stormwater management. Some of the basic advantages and disadvantages of user-based funding mechanisms are listed in Table 5-2, below.

Table 5-2
Advantages & Disadvantages of User-based Funding Mechanisms

Advantages	Disadvantages
• Less reliance on taxes/keeps taxes lower • Promotes fairness • Encourages environmental protection • Increases accountability • More flexible financing • Results in more autonomy • Operates more like a business • Increases managerial discretion • Leads to better tracking of infrastructure • Not subject to legal constraints (i.e., Proposition 2-1/2) • Less vulnerable to competition/political trade-offs during the budgetary process	• Regressive, impose a higher burden on low- and middle-class • May lead to adverse behavior if fees are too high • Cannot be deducted on income taxes • Facilitates revenue bonds with higher interest rates and less scrutiny • May result in fewer budgetary tradeoffs • Fund transfers may raise fairness issues and lead to difficult financial statements • Results in more labor to administer program and track capital.

Some of the other more popular funding mechanisms currently being explored for stormwater management include:

- Impact Fees: Impact fees are intended to place the cost of stormwater management for each new development directly on the party(ies) developing the property. Indirectly, these costs are also passed down to those who purchase the properties. Impact fees relieve taxpayers from having to pay for costly new public services that do not directly benefit them. They also can promote smart growth, since they force developers to shoulder the costs of the services for their new project (*http://stormwaterfinance.urbancentert.htm*).

  The disadvantage of impact fees is that they encourage and fund stormwater management in new developments, while providing limited funding for existing system components. Impact fees are also just one of many fees assessed to developers, the cumulative effect of which may discourage developers from pursing projects within Middleborough. In addition, impact fees are often the subject of legal challenge based on the question of whether the fee is directly related to the benefits provided, and why new developments must pay while existing developments are exempt.

- Inspection or Permit Fees: Inspection and permit fees are one of many types of fees that municipalities are allowed to establish to offset the costs of operational expenses. Stormwater inspection fees are generally administered as part of building or other new development inspection programs. Permit fees are generally administered as part of permit applications such as building permits, clearing or grading permits, stormwater permits, and sewer or drain connection permits (*http://stormwaterfinance.urbancentert.htm)*.

  The major disadvantage of inspection and permit fees is that they tend to be one-time fees charged at the beginning or end of a project and, therefore, are not a good source of steady revenue for stormwater management. In addition, these types of fees increase the overall cost of a project and can discourage investors from pursuing new development opportunities within Middleborough.

- Special Assessments for Benefited Properties: Special assessments are intended to place all or a portion of the cost of construction or repair of stormwater facilities on those properties that will directly benefit from the improvements. Special assessments are generally allowed when the benefit received is different in type and degree from benefits provided to the community as a whole. When special assessments are utilized in areas where the benefits vary significantly between properties, the assessments should vary in proportion to the benefits received. Special assessments are generally charged based on a per acre basis *(Golgowski & Dowling)*.

  The disadvantage of this type of funding mechanism is that the cost of design and construction of stormwater improvements can be quite high and it is often unreasonable to fund the project strictly by special assessment, since the burden on the property owners would be too high. Supplemental funding is normally required from other sources. Especially in areas where the number of properties receiving benefit - and contributing by

special assessment – is small, the negative publicity generated by special assessments outweighs the financial benefit.

- Dedicated Contributions: Dedicated contributions are intended to project the cost of O&M of a new stormwater system over a set number of years and assign this cost to the developer as part of construction. In the case of a dedicated contribution, the municipality, rather than the property owner(s), assumes responsibility for O&M of the stormwater system after the initial warrantee period has expired. The contribution is based on several factors including, but not limited to the type of system, the amount of O&M required, the anticipated annual costs of O&M, the anticipated interest earned by the contribution, and the percentage of cost-sharing (if any) between the developer and the community. Unlike general tax revenues, dedicated contributions can provide a secure, dedicated funding source for stormwater O&M activities *(http://stormwaterfinance.urbancenter).*

  The disadvantages of dedicated contributions are that they are only applicable to new developments and that cost burden is, once again, placed on the investor, which can discourage them from pursuing development in Middleborough. In addition, the benefit runs out after a predetermined number of years.

- Utility Fees or Stormwater Utilities: Stormwater utility fees or established Stormwater Utilities are intended to provide a continuous user-based revenue source to support all aspects of stormwater management. Some communities employ utility fees controlled through an Enterprise Fund for water and sewer services. Like these services, stormwater utility fees are not subject to the existing "Proposition 2-1/2" tax cap limitations placed on general tax revenues. At the request of the town, detailed discussion regarding the development and implementation of a stormwater utility is provided in the next section.

In the end, choosing the appropriate funding mechanism, or mechanisms, for Middleborough will require a great deal of effort to research and debate what will work within existing town practices. In using any one, or a combination of these funding mechanisms, it is important that the revenue be deposited in a separate, dedicated account and that all expenditures be properly linked to specific stormwater management activities. In addition, the chosen mechanism(s) must be favorable to town officials, taxpayers, and residents. Substantial information regarding financing options for stormwater management is available from standard and web-based guidance documents and published articles.

5.5.8.1 Stormwater Utilities

A stormwater utility (SWU) is one of several user-based programs for supporting stormwater needs. A SWU is a separate entity, owned and operated by a municipality (or regional body), dedicated to the operation and maintenance of the stormwater system. Much like a business, a SWU has its own revenues, expenses, and personnel, which are detached from the financial and budgetary system of the municipality. The current Middleborough Gas & Electric Department is an example of a similar municipal utility.

There are five major steps for establishing a SWU, each of which is discussed in more detail below:

1. Determine the scope of responsibility for the utility through a Needs Assessment
2. Estimate the required revenues to support the scope of work
3. Decide upon the type of assessment and the rates to be set
4. Develop the legal basis for establishing the utility and its authority to assess the rates (i.e., ordinance, bylaw, regulation)
5. Gain political/public support in order to implement the utility

Scope

SWUs are normally responsible for all aspects of the stormwater system, including proper operation and maintenance of system components, monitoring and maintaining good water quality, flood control, capital improvement planning and implementation, and code enforcement. However, some of these tasks may be better suited to existing departments and, therefore, not included in the SWU. For example, if a community has an existing engineering department, this department may have more appropriate resources for capital improvement planning, design, and construction. Many communities handle inspection and enforcement of codes through their planning or health departments and may not wish to have the SWU take over this role.

In addition, communities may also choose to fund some stormwater activities through other mechanisms, even if the planning and oversight is maintained by the SWU. For example, construction of large capital improvement projects is often funded through bonds or other town-appropriated means.

Since the organizational structure and resources of each community are different, it is important to specifically design the scope of responsibility for the SWU based on the needs of that community.

Revenue Estimate

Once the scope of responsibility has been carefully and thoroughly defined, an estimate of the total revenue required to support that scope must be made. Although the amount of revenue may seem insignificant at the planning stage, it is actually the foundation for the entire SWU, since it is justification for the fee structure. In addition, the amount of revenue and the times at which the revenue is needed will facilitate evaluation and selection of proper assessment methods and fees to meet projected demands. Revenue estimates should include analysis of startup costs, short-term expenses, and long-term sustainability.

Assessment Methods and Rate Setting

SWUs may regulate quantity, quality, and rates associated with the discharge of stormwater to the stormwater system. There are a variety of assessment methods used, but most involve an estimate of the amount of impervious area or runoff from each property. Some communities set categorical standards based on land use. Most assessment methods are directly related to the size (acreage) of the property. In general,

assessment methods are designed to put the majority of the cost burden upon properties with the largest amounts of impervious area (i.e., parking lots and buildings) where the amount of stormwater runoff will be the greatest. It is common to provide rate-relief incentives for property owners who implement and maintain BMPs.

Once the assessment method has been selected, the associated rate or fees must be determined. Rate setting is directly related to the amount of revenue that needs to be generated to support the SWU and rates should be set to meet revenue projections. In rate setting, it is important to understand that a significant amount of revenue is required to get the new SWU established and that there will not be rate-funded revenue at inception. However, setting initial rates high enough to offset startup costs is generally ill advised as it causes rates to be set too high. Rates that are perceived as too high are not desirable at startup when gaining political and public approval for the SWU is of utmost importance. A graduated rate schedule that starts rates low and increases them over a period of one to five years is recommended, even though the SWU will require other funding to support startup and operating expenses during this period.

Local Regulatory Mechanism

The main hurdles for the local regulatory mechanisms are how to distinguish the user fee from a tax, how to establish a user charge system that is fair, and how to decide what elements must be added to existing policy to establish the user charge system. In towns, SWUs are generally established by town ordinance, though they can also be established by local regulation or bylaw. Although it is desirable to make an ordinance easy to read and concise, the best way to minimize legal challenges and their associated costs is to ensure that the ordinance is as explicit and detailed as possible. It should also be consistent with existing community codes and accurately reflect the decisions and concerns of the municipality developing the ordinance. At a minimum, the town ordinance should thoroughly and completely:

- Justify the need for the utility
- Establish the utility and its power to collect fees
- State who shall oversee the operation of the utility
- Define the utilities jurisdiction and physical boundaries
- Detail the fee structure and rates, including identification of who is or is not to be charged
- Supply billing and collection regulation, procedures and penalties
- Designate or establish a Special Fund or Account in which the fees are to be deposited
- Provide a process for adjustment and appeal
- Reference applicable federal and state laws and regulations
- Define and clarify terms utilized within the ordinance
- Include proper Article or Chapter designations in the Municipal Code
- Protect the municipality from liability against claims relating to flooding or other associated damage from the stormwater system
- Ensure severability so that, in the event that one part of the ordinance is deemed invalid by a court, the remaining portions of the ordinance are not affected

- Specify the effective date of the ordinance, to include establishing a separate date for when billing can begin

Legal Basis

There is a Bill being reviewed by the Senate and House of the Massachusetts Legislature that gives individual municipalities and districts the authority to establish a SWU. As stated in the Bill, the municipalities and districts shall by ordinance, by-law, or regulation establish a SWU that will improve the quality of the state's rivers, streams, lakes, estuaries and wetlands. According to the Bill, the SWU may be operated by any department, board, commission, or district that conducts municipal wastewater collection and/or treatment program or by a separate utility established within the municipality whose function is to operate a stormwater program. Any entity authorized to carry out such a stormwater program shall be referred to as the SWU.

The SWU, with the approval of the municipal authority, may adopt regulations to protect the public health, safety and welfare and the environment and to ensure proper and safe operation of the stormwater system by regulating the direct and indirect discharge of wastewater and stormwater. The SWU is expressly authorized to adopt regulations that are stricter in their protection of the environment than such state legislation and regulation. At a minimum, the local SWU shall:

- Work in cooperation with the Watershed Initiative administered by the EOEA and with the Stormwater Management Program administered by the DEP and make efforts to meet the standards established for specific watersheds for the proper control and cleanup of storm discharges.
- Complement the river basin water quality management plans pursuant to 33 USC Section 319, and the estuary management plans pursuant to 33 USC section 320.
- Comply with Phase I and II of EPA's stormwater regulations.
- Formulate plans and establish priorities for stormwater management systems and watersheds to need the needs of the community for flood protection and protection of water quality.
- Treat watersheds as integrated systems and shall work to lower the concentrations of pollutants within the watersheds within their jurisdiction.

In addition to any other funding mechanism available to any municipality or district, to construct, operate or maintain stormwater programs, the SWU may adopt a system of stormwater utility fees sufficient to support the operation, construction and maintenance of the stormwater program. Municipalities and districts are authorized to raise and collect in advance from all property owners within a municipality, district, or benefit area an annual, quarterly, or monthly fee or an assessment based upon amount of impervious surface, or other reasonable method, as provided in sections 15 and 16 of Chapter 83 of the General Laws.

Gaining Support for the SWU
As trivial as it may seem, selection of appropriate names for the SWU and associated fees is one of the very first steps in gaining political and public support. Names that imply that the purpose of the utility is to improve drainage and protect the environment rather than names that imply additional expenses and bills can go a long way toward improving how the utility is perceived. For example, use "water protection program" instead of "stormwater utility", or "pollution abatement fee" instead of "drainage fee".

Other details aside, the single most important factor in gaining political and public support is a comprehensive public information and education program. When people understand what they are being asked to pay for, they are much more likely to be in favor of it. This is especially true for SWU's, since it is difficult for the general public to make the connection between municipal stormwater activities – such as street sweeping and catch basin improvements - and the personal benefits from improved ground and surface water quality and decreased flooding of streets and basements. Proactive information and education programs also help to defuse rumors and other non-truths that commonly circulate due to ignorance or misinformation campaigns.

After the SWU is implemented, the public information and education program should be continued. Not only is public education required by the EPA Phase II regulations, but it also provides additional benefits including, but not limited to:

- Maintaining acceptance of fee structure and rates
- Minimizing unwarranted appeals
- Promoting good stormwater management practices by property owners
- Ensuring municipal accountability
- Informing ratepayers about how fees are being used

A great deal of guidance is available on designing and maintaining effective public information and education programs for stormwater and other municipal programs. Middleborough should research what types of programs would best reach the largest population of ratepayers and other desired recipients.

5.5.8.2 Stormwater Management from the Wastewater Department

As stated above, stormwater management activities are currently the responsibility of the Highway Department. At the request of the town, Weston & Sampson has investigated incorporating stormwater management into the existing Wastewater Department. Although stormwater management could be incorporated into the Wastewater, or any other town department, Weston & Sampson does not feel that it is the most effective use of the town's existing personnel and resources. The reasons for our opinion are as follows:

- The Highway Department is currently staffed with personnel who have knowledge and experience about stormwater and the town's existing drainage system. These individuals are also properly trained and licensed for stormwater management activities and equipment operation. Sewer Department personnel do not have this level of knowledge and experience,

nor do they have the appropriate training or licenses to operate the equipment. In addition, the Sewer Department does not currently have adequate personnel to handle stormwater management in addition to their current responsibilities. Moving the responsibility for stormwater management to the Sewer Department would require a significant change in department staffing.

- Incorporation of stormwater management into the Sewer Department will lead to an inability to properly pay for sewer department expenses, since it is not likely that the town will pursue increased sources of funding to offset the addition of stormwater responsibilities. If stormwater management is treated as a separate entity (or line item in the general fund), the town will be forced to properly secure the necessary funds.

- The Sewer Department is funded by an enterprise fund supported on revenues generated from sewer billing. Funding stormwater management through the Sewer Department Enterprise Fund would be inequitable, placing the majority of the cost of stormwater management on sewer customers. This may also subject the town to significant voter resistance and/or costly legal actions.

- Under the sewer department, stormwater improvements would probably not be eligible for funding under Chapter 90. Many of the town's existing drainage improvements are currently funded under this highway program.

- The responsibility for trash and recycling pickup, street sweeping, and catch basin cleaning are best kept together since they are dependent activities requiring coordinated scheduling. Division of these responsibilities between two separate departments would most likely reduce their overall effectiveness.

- The Highway Department currently owns and operates street sweeping and catch basin cleaning equipment as part of existing stormwater management practices. Ownership of this equipment would need to be formally transferred from the Highway Department to the Sewer Department. The Sewer Department has no room to store the equipment, nor do they benefit from use of either machine.

It is recommended that the town consider one of two different alternatives other than incorporating stormwater management into the Sewer Department: (1) keeping stormwater management under the Highway Department; or (2) creating a new Stormwater Department. In either case, the town should provide a *separate* source of funding for stormwater management through one, or a combination of the mechanisms discussed above. Even if the town determines that utilizing the general fund is the best practice, a separate line item should be established for stormwater management rather than simply increasing the budget assigned to an existing department.

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APPENDIX B

Suggested Outlines for Operation & Maintenance Programs

Suggested Outline
STORMWATER SYSTEM
OPERATION & MAINTENANCE PROGRAM

INTRODUCTION
- Purpose
- Benefits
- Regulatory Compliance
- Need for a Written Plan

DRAINAGE SYSTEM O&M
- Description of Facilities
- Inspection
- Cleaning
- Maintenance and Repairs
- Illicit Connections
- Easements
- Good Housekeeping and Pollution Prevention

SCHEDULING
- Inspection
- Maintenance

PERSONNEL
- Staffing
- Licensure
- Training

SAFETY

PUBLIC RELATIONS, CUSTOMER SERVICE, AND COMMUNICATION

RECORDS AND REPORTING
- Regulatory Compliance
- Forms
- Computerized Record Keeping

ENSURING ADEQUATE RESOURCES

CAPITAL IMPROVEMENT PROGRAM

NEW CONSTRUCTION AND TOWN PROCEDURES

EMERGENCY RESPONSE PLAN

APPENDIX C

Stormwater Pollutant Loading Analysis

Pollutant Loading - Outfalls Discharging Overland Flow in Nemasket and Taunton Tributary Area

Subareas	Drainage Area (ac)	% Impervious	Land Use	Runoff Coefficient	Estimated Concentration (mg/l)									Pollutant Load (lbs/year)								
					BOD	COD	NO2+NO3	TKN	Total P	TSS	Cu	Pb	Zn	BOD	COD	NO2+NO3	TKN	Total P	TSS	Cu	Pb	Zn
495S @ Nemasket River	0.35	100%	Industrial	0.06	62	62	0.93	1.6	0.42	108	0.05	0.18	0.18	12	12	0.18	0.32	0.08	21	0.01	0.04	0.04
495N @ Nemasket River	0.35	100%	Industrial	0.06	62	62	0.93	1.6	0.42	108	0.05	0.18	0.18	12	12	0.18	0.32	0.08	21	0.01	0.04	0.04
Coombs St.	16.68	35%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	111	867	15.30	1.96	5.27	1938	0.43	1.53	1.53
Mayflower Ave.	121.06	50%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	822	6452	113.87	14.55	39.22	14423	3.16	11.39	11.39
Nemasket St.-10"	Note 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nemasket St.-12"	10.28	35%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	68	534	9.43	1.20	3.25	1194	0.26	0.94	0.94
North/Oak Sts.	32.97	35%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	218	1714	30.24	3.86	10.42	3831	0.84	3.02	3.02
North/Spring Sts.	9.07	35%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	60	471	8.32	1.06	2.87	1054	0.23	0.83	0.83
School St. Ext.	44.80	30%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	294	2309	40.75	5.21	14.03	5161	1.13	4.07	4.07
Taylor Way	8.13	30%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	53	419	7.39	0.94	2.55	937	0.21	0.74	0.74
Valley Rd.	5.08	30%	Residential	0.05	13	102	1.8	0.23	0.62	228	0.05	0.18	0.18	33	262	4.62	0.59	1.59	585	0.13	0.46	0.46

Note 2: drainage area same as Nemasket St.-12"; assumption 10" to be abandoned for new 12" during construction.

Pollutant Loading Based on Sampling Results

Subareas	Drainage Area (ac)	% Impervious	Land Use	Runoff Coefficient	Estimated Concentration (mg/l)									Pollutant Load (lbs/year)								
					BOD	COD	NO2+NO3	TKN	Total P	TSS	Cu	Pb	Zn	BOD	COD	NO2+NO3	TKN	Total P	TSS	Cu	Pb	Zn
495S @ Nemasket River	0.35	100%	Industrial	0.06	13	10	0.33	0.70	0.14	2	0.00	0.00	0.08	3	2	0.07	0.14	0.03	0	0.00	0.00	0.02
East Main St.-24"	25.00	40%	90% R-10% I	0.05	12	43	0.11	0.80	0.21	32	0.00	0.00	0.05	154	552	1.41	10.28	2.70	411	0.00	0.00	0.64
East Main St.-10"	0.03	35%	Residential	0.05	7	19	0.45	0.90	0.00	21	0.00	0.00	0.04	0	0	0.01	0.01	0.00	0	0.00	0.00	0.00
Mayflower Ave.	121.06	50%	Residential	0.05	8	37	0.33	1.10	0.29	14	0.00	0.00	0.05	506	2341	20.88	69.59	18.35	886	0.00	0.00	3.16
Nemasket St.-12"	10.28	35%	Residential	0.05	34	15	0.00	0.50	0.00	7	0.00	0.00	0.00	178	79	0.00	2.62	0.00	38	0.00	0.00	0.00
Pierce St. Playground	7.00	10%	Residential	0.05	6	12	1.60	0.70	0.18	4	0.00	0.00	0.02	20	41	5.47	2.39	0.61	14	0.00	0.00	0.07
Plymouth St.	0.32	100%	Residential	0.06	38	16	0.08	0.60	0.16	5	0.00	0.00	0.02	7	3	0.01	0.11	0.03	1	0.00	0.00	0.00
Spencer St.	53.66	45%	Residential	0.05	20	22	0.13	0.80	0.17	13	0.00	0.00	0.00	556	612	3.62	22.25	4.73	362	0.00	0.00	0.00
Vernon St.	0.32	100%	Residential	0.06	18	16	0.03	0.50	0.13	2	0.00	0.00	0.00	3	3	0.01	0.09	0.02	0	0.00	0.00	0.00
Wareham St. bridge inlets	0.40	35%	Residential	0.05	83	200	96.02	2.30	0.94	350	0.00	0.00	0.22	17	41	19.57	0.47	0.19	71	0.00	0.00	0.04