

**CITY OF
WARWICK, RHODE ISLAND**



**PHASE II STORM WATER
MANAGEMENT PROGRAM PLAN**

MAY 2008

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SECTION 1 OVERVIEW AND COMMUNITY PROFILE

1.1 Overview

The Storm Water Phase II Final Rule is the Environmental Protection Agency's (EPA) effort to preserve, protect, and improve the Nation's water resources from polluted storm water runoff. Common storm water pollutants include pesticides, fertilizers, oils, salt, litter and other debris, and sediment. Another concern is the possible illicit connections of sanitary sewers.

Because Warwick is located within an urban boundary, the City is obligated to meet the Phase II Storm Water requirements. However, the City has previously dealt with many storm water regulations and issues as part of the Narragansett Bay Initiative to make the Bay swimmable and fishable. Warwick's Phase II efforts described herein are intended to meet the requirements of the regulations and supplement previous efforts regarding storm water.

The EPA determined there are six Minimum Control Measures that need to be addressed for the Phase II National Pollutant Discharge Elimination System (NPDES) program. These measures will be addressed by implementing Best Management Practices (BMPs) appropriate for Warwick's community. The BMPs will commence according to the schedules provided in this report. The six Minimum Control Measures for storm water monitoring are as follows:

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

Public education and outreach coupled with public participation/involvement allows Warwick residents to have a voice with regard to storm water. In addition, it expands the expertise and credentials of the City because the citizens offer a wide range of experiences, local knowledge, and input valuable to storm water quality improvement programs.

Illicit discharge detection and removal will lessen the amount of pollutants discharging to local water bodies. The City is, and has been, vigorously addressing this problem.

Construction site runoff and post-construction site runoff should be reduced and treated prevent pollutants and sediment from entering local water bodies.

Pollution prevention/good housekeeping is a critical minimum control measure because it concentrates on the maintenance of other control measures and municipal operations and it can make an immediate difference with local water body pollutant levels.

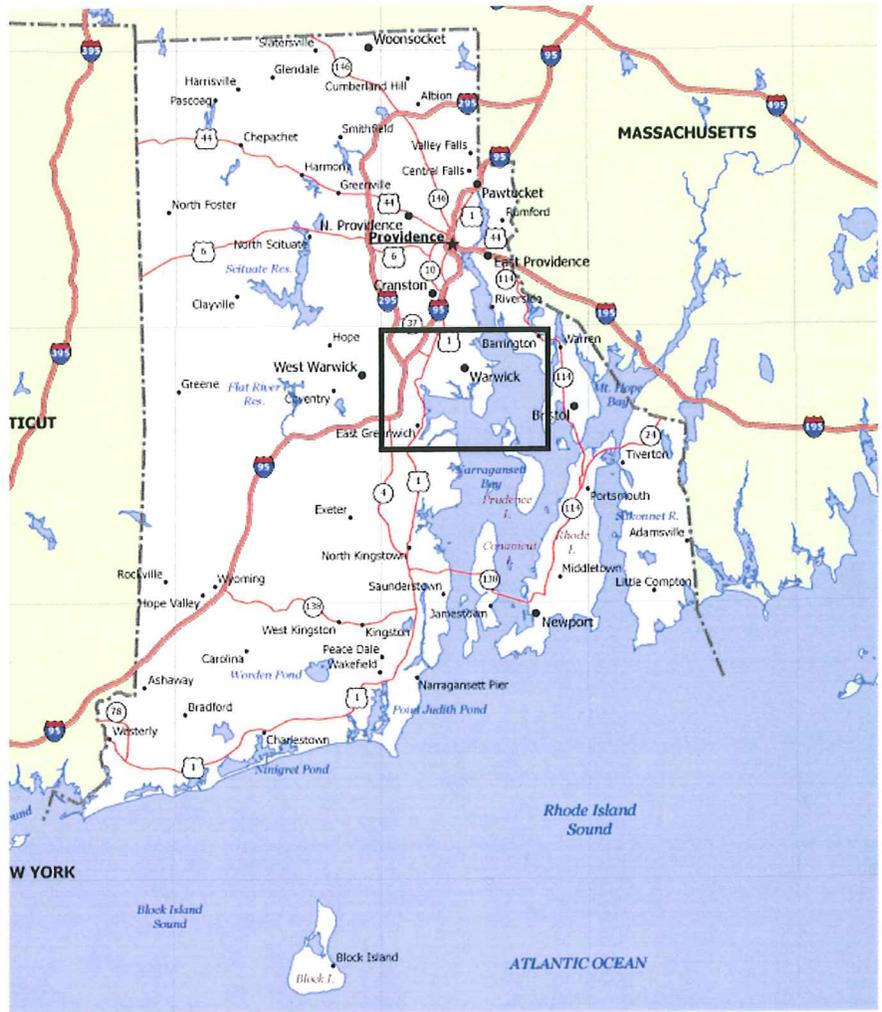
1.2 Community Profile

Geography

Warwick is located in central Rhode Island, slightly south of Providence, as shown in Figure 1-1. Warwick is approximately 5 miles south of Providence and 55 miles south of Boston. The City is bordered by Cranston to the north, East Greenwich to the south, Narragansett Bay to the east, and West Warwick to the west. Warwick has 35.50 square miles of land area and 14.12 square miles of water area. The total length of roadway owned by the State of Rhode Island is approximately 66 miles of the approximately 550 miles within the City.

Demographics

The 2000 Census yielded a population of 85,808. This represents an increase of approximately 0.45% from the 1990 Census value of 85,427. The U.S. Census defines an “urban area” as an area with a population density of at least 1,000 people per square mile. Warwick is considered an urban area, because its population density is 2,417 people per square mile.



**Figure 1-1
Warwick, Rhode Island Location Plan**

Demographics are an important component of a storm water management program. Since education programs must focus on all citizens, including disadvantaged and minority citizens, it is critical to know population statistics. Table 1-1 illustrates Warwick’s demographics. It is clear from these statistics that it is unnecessary to provide bilingual literature or programming in the Warwick community.

**Table 1-1
City of Warwick Demographics**

Race	Percent
White	95.2
Asian	1.5
Black or African American	1.2
American Indian and Alaska Native	0.2
Two or more	1.3
Other	0.6

Source: U.S. Census Bureau, 2000 Census

Climate

The following statistics, obtained from the National Climatic Data Center, are Warwick’s normal weather parameters:

- Normal January Temperature = 27.9° F
- Normal July Temperature = 72.7° F
- Normal Annual Precipitation = 45.5”

Government

A Mayor with a nine Member City Council runs Warwick’s local government. The Council holds monthly meetings on every second and third Monday at 7 pm.

1.3 Warwick's Storm Water Management Program

The City acting through the Department of Public Works, Division of Engineering is currently utilizing a variety of BMPs, identified by the EPA, to minimize pollutant loads into the local waterways and water bodies. The City intends to continue with the current practices, for each Minimum Control Measure, and supplement additional measures where required to adhere to the permit requirements.

Other entities contribute to Warwick's Interconnect Municipal Separate Storm Sewer System (MS4). The Rhode Island Department of Transportation, Rhode Island Community College, T.F. Greene Memorial Airport, and Goddard Memorial State Park maintain and are responsible for separate storm sewer systems that connect to Warwick's drainage system.

1.4 Contacts/Certifications

The following City of Warwick contacts are provided. The provided contacts are not intended to represent a list of the Storm Water Steering Committee members. This is a list of the City of Warwick elected officials and City employees who are involved in the SWMPP implementation and oversight.

City of Warwick Contacts

Scott Avedisian Mayor
3275 Post Road
Warwick, Rhode Island 02886
(401) 738-2000

City Council

Joseph Solomon, President

Robert Cushman	Charles Donovan, Jr.
Bruce Place	Raymond Gallucci
Helen Taylor	Steve Merolla
John DelGiudice	Donna Travis

City of Warwick Contacts (continued)

David Picozzi DPW Director
925 Sandy Lane
Warwick, RI 02889
(401) 738-2000 Ext. 6500

John DeLucia, PE, PLS DPW City Engineer
925 Sandy Lane
Warwick, RI 02889
(401) 738-2000 Ext. 6504

Eric Hindinger Engineer Program Manager (SWMP Coordinator)
925 Sandy Lane
Warwick, RI 02889
(401) 738-2000 Ext. 6537

Mark Carruolo Director
City of Warwick Planning Department
3275 Post Road
Warwick, RI 02886
(401) 738-2000 extension 6289

Dan Geagan Senior Planner
City of Warwick Planning Department
3275 Post Road
Warwick, RI 02886
(401) 738-2000 extension 6295

Pawtuxet River Authority and Watershed Council

Robert J. Nero Executive Director
Historic Harris Mill
618 Main Street
Coventry, RI 02816
(401) 615-7039

SECTION 2

RESOURCE PROTECTION

2.1 Greenwich Bay

Greenwich Bay is a 4.9-square mile section of Narragansett Bay and a sizable portion of Warwick discharges to it. The Greenwich Bay was closed to shellfishing in 1992 due to elevated levels of fecal coliform bacteria. As a result, it became imperative to find solutions in order to clean the Bay. In 1993, Warwick helped kick off the Greenwich Bay Initiative. It included a number of municipalities and agencies with the desire to clean up the Bay using the following criteria.

- Planning
- Research
- Pollution reduction
- Coastal management
- Education and training
- Individual Actions

Warwick enacted storm water regulations in January of 1996 to improve water quality in Greenwich Bay. A Watershed Overlay District was delineated to implement environmental protection measures in the watershed (1994). The Warwick City Harbor Management Plan was revised to account for water quality concerns in 1996.

2.2 Narragansett Bay

The majority of Warwick contributes to the Narragansett Bay Watershed. The Narragansett Bay Watershed drains approximately 112 square miles. It is almost perfectly aligned along a north-south axis. Eight municipalities contribute to the watershed from Massachusetts and Rhode Island. Greenwich Bay, the Providence River, and Mount Hope Bay are major appendages of Narragansett Bay. This watershed is a significant example of interstate

cooperation between local, state, and federal environmental agencies and non-profit organizations.

According to the Massachusetts Executive Office of Environmental Affairs the “Top Five” watershed priorities for the Narragansett Bay Watershed are as follows:

- Restore the water quality of the rivers, ponds and estuaries through the identification and minimization of pollution from point and nonpoint sources.
- Articulate a clear vision of open space protection with accompanying action plan to protect significant natural resources and to develop a regional greenbelt.
- Work to improve fish populations by maintaining the monitoring buoys in Mt. Hope Bay, and supporting the efforts of the Brayton Point Technical Advisory Committee.
- Solve long term water supply problems through water conservation and protection, and the assessment and development of future sources.
- Restore/improve the fish and shellfish resources within the watershed.

In the State of the Bay 2000 Report, the bay was given a rating of 4.5 out of 10 for its health. This means there is a lot of work to be done in order to clean the bay.

2.3 Pawtuxet River

The Pawtuxet River Watershed is located in central western Rhode Island. The river flows from west to east beginning in western Rhode Island. The Pawtuxet River flows through five communities. The Pawtuxet River Watershed includes the Scituate Reservoir, which is the largest drinking water source in Rhode Island. The Pawtuxet River Authority and Watershed Council’s goals are to protect and restore the Pawtucket River Watershed. The Council’s “Top Five” watershed priorities for the Pawtuxet River Watershed are as follows:

- To advance education for students, teachers, and the public as to the environmental importance of the Pawtuxet River and its surrounding watershed.
- To promote recreation to foster enjoyment and relaxation on and along the Pawtuxet River and its tributaries by the development of walking, biking, canoeing, boating, fishing and birding areas and programs.

- To stimulate preservation, protection, and ecological enhancement, by acquiring open space for public use and wildlife habitat, maintaining river control equipment, working with state and local government as well as private agencies to promote responsible residential and industrial uses of the watershed compatible with the need to safeguard the waters of the Pawtuxet system, and encouraging and initiating plans that establish priorities for long-term land preservation and stream corridor regeneration.
- To cultivate heritage by working cooperatively with preservation and historical societies throughout the Pawtuxet watershed to emphasize cultural and natural history.
- To develop the PRAWC by transforming it from a “river authority” to a “watershed council,” operating sound grants acquisition and project management systems, increasing membership, and utilizing current communication technology.

The Pawtuxet River Watershed Council held a meeting to refine and adopt a proposed monitoring program. Three one-day high school educator workshops were held at the three wastewater treatment facilities on the Pawtuxet River. The organization published articles in the Warwick Beacon among other newspapers.

2.4 Hunt-Potowomut Rivers

A small section of Warwick drains to the Hunt-Potowomut River Watershed. The Watershed drains approximately 25 square miles. Seven communities contribute to the Hunt-Potowomut Watershed. Tributaries join to form the Hunt River at the northern border of North Kingstown. At the southern edge of Warwick it widens to the Potowomut River and empties into Narragansett Bay slightly south of Greenwich Bay.

2.5 Providence River

The Providence River is formed by the confluence of the Woonasquatucket and Moshassuck Rivers and flows through Providence where it joins with the Seekonk River at the mouth of the Narragansett Bay.

2.6 Impaired Water Bodies

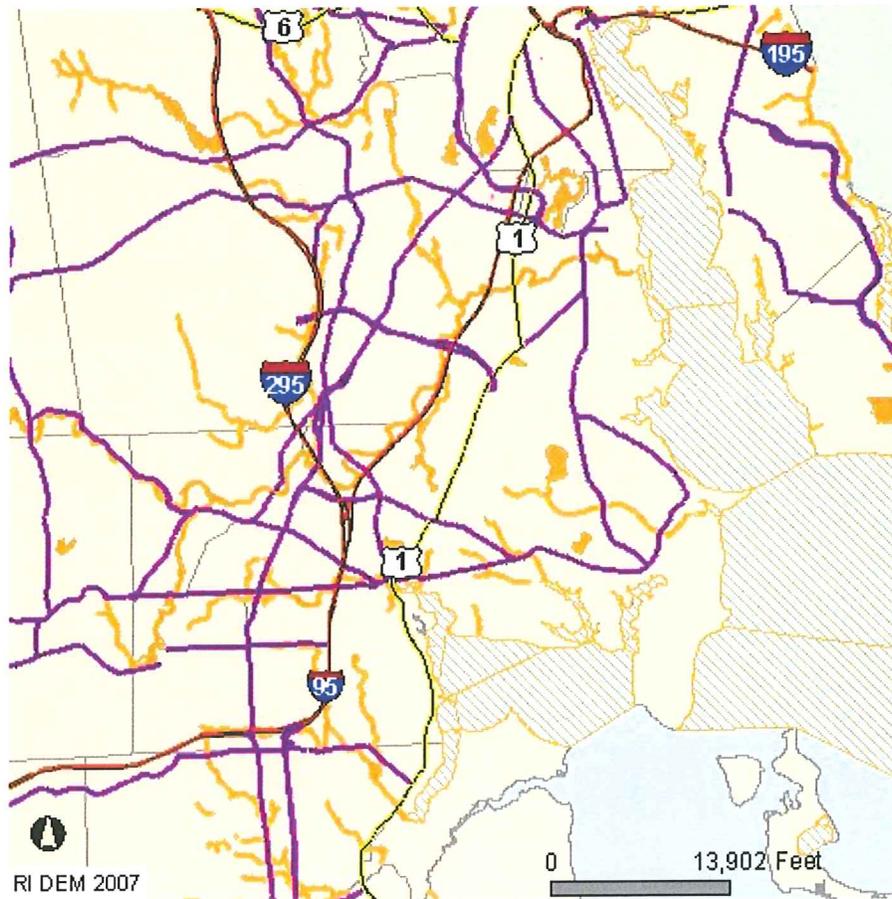
As required by Section 303(d) of the Federal Clean Water Act, the Rhode Island Department of Environmental Management developed a list of impaired water bodies. Figure 2-1 displays the impaired water bodies listed in State of Rhode Island 303(d) List of Impaired Waters (2000). Impaired water bodies are those that do not meet the Water Quality Standards with existing technology-based pollution controls alone. These water bodies require the establishment of total maximum daily loads (TMDLs). The goal of the TMDLs is to develop and implement plans aimed at restoring impaired water bodies to an acceptable condition that meets the Water Quality Standards and supports their designated uses.

The following is a list of impaired water bodies for Warwick and includes the pollutant or stressor causing the impairment.

Impaired Water Bodies – Pawtucket River Basin

- Pawtuxet River – South Branch
Pb, Cd
- Pawtuxet River – Main Stem
Biodiversity Impacts, Nutrients, Hypoxia, Pb
- Three Ponds
Hypoxia, Nutrients, Cu, Pb, Pathogens
- Three Ponds Brook
Pb

Figure 2-1
303(d) Impaired Waters



Legend

Primary Road

Road Class

— Interstate Highway

— US Route

— State Route

▨ 303(d) Impaired Salt Waters

■ 303(d) Impaired Ponds

— 303(d) Impaired Streams

□ RI Municipalities

□ Connecticut

□ Massachusetts

- Sand Pond
Phosphorus, Low DO
- Meshanicut Brook
Pb, Cu

Impaired Water Bodies – Narragansett Basin

- Apponaug Cove
Nutrients, Hypoxia, Excess Algal Growth
- Baker Creek
Pathogens
- Buckeye Brook
Biodiversity Impacts
- Brushneck Cove
Pathogens, Nutrients, Hypoxia
- Buttonwoods Cove
Pathogens, Nutrients, Hypoxia
- Gorton Pond
Hypoxia, Excess Algal Growth
- Greenwich Bay
Pathogens, Nutrients, Hypoxia
- Greenwich Cove
Hypoxia, Nutrients
- Hardig Brook
Pathogens, Pb, Biodiversity Impacts,
- Hunt River
Pathogens
- Maskerchugg River
Pb, Cd, Cu
- Old Mill Creek
Pathogens
- Providence River

Hypoxia, Nutrients, Metals, Pathogens

- Sand Pond (North of Airport)
Hypoxia, Phosphorous
- Sandy Pond (Little pond)
Pathogens
- Tuscatucket Brook
Pathogens
- Warwick Cove
Low DO, Nutrients, Pathogens
- Warwick Pond
Hypoxia, Phosphorus, Excess Algal Growth
- Upper Narragansett Bay
Low DO, nutrients, pathogens

The State of Rhode Island 303(d) List of Impaired Waters (2000) uses the following five groups to describe the appropriate place in the TMDL process for each water body.

- Group 1 – These waters are not meeting Rhode Island Water Quality Standards and TMDL development is currently underway.
- Group 2 – These waters are not meeting Rhode Island Water Quality Standards and TMDL development is planned for the future.
- Group 3 – Monitoring data for these waters show violations of criteria for metals; however, all data is expressed as total metals. Based on the 1997 Amendments to Rhode Island's Water Quality Standards, metals criteria are now expressed as dissolved. Therefore, it is not known whether these waters have metal violations based on the revised criteria. Additional sampling is required to make this assessment.

- Group 4 – Assessments were made based on insufficient data and/or data that was dated. These waters need further monitoring to determine if there are Water Quality Standards violations.
- Group 5 – A TMDL, or a control action functionally equivalent to a TMDL, has been developed for these water bodies. Implementation is underway which will result in attainment of the standards. However, the standards will not be met within the next two years.

TMDL priority ranking is given to each water body and is not representative of the severity of water quality impacts, but rather reflects the priority given for TMDL development with consideration to shellfishing waters, drinking water supplies and other areas identified by the public as high priority areas. The priority rankings and target dates for TMDLs are outlined below in Table 2-1.

**Table 2-1
TMDL Priority Rankings and Target Dates**

Ranking	Description	Target for TMDL
T	Targeted (TMDL under Development)	2000 - 2002
H	High Priority for TMDL	2005 - 2007
M	Medium Priority for TMDL	2008 - 2012
L	Low Priority for TMDL	2012+

Table 2-2 identifies the priority ranking for development of TMDLs for impaired water bodies in Groups 1 to 4 in Warwick.

Table 2-2
Impaired Water Bodies – Groups 1 to 4

Water Body Name	Priority
Group 1	
Apponaug Cove	T
Brushneck Cove	T
Buttonwoods Cove	T
Greenwich Bay	T
Greenwich Cove	T
Hardig Brook (Pathogens)	T
Providence River (Hypoxia, Nutrients)	
Warwick Cove	T
Group 2	
Buckeye Brook	L
Gorton Pond	M
Hardig Brook (Biodiversity Impacts)	M
Pawtuxet River - North Branch	M
Print Works Pond (Pb)	L
Sand Pond (North of Airport)	L
Sandy Pond (Little Pond)	M
Three Ponds Brook	L
Three Ponds (Hypoxia, Nutrients, Cu, Pb)	L
Warwick Pond	L
Group 3	
Hardig Brook (Pb)	M
Pawtuxet River - North Branch (Cd)	M
Providence River (Metals)	L
Group 4	
Three Ponds (Pathogens)	L

* Target for TMDL is 2005 - 2010

Table 2-3 identifies the control action taken for the Group 5 impaired water bodies in Warwick.

Table 2-3
Impaired Water Bodies – Group 5

Water Body Name	Control Action
Hunt River	TMDL Approved 2001 (pathogens)
Upper Narragansett Bay	Due to CSOs; Approved Facilities Plan

	(pathogens)
Pawtuxet River - Main Stem	Permits issued to RIPDES dischargers (Biodiversity, Lead, Low DO, Nutrients)
Providence River	Due to CSOs; Approved Facilities Plan (pathogens)

The Group 1 water bodies identified in Table 2-2 do not meet the Rhode Island Water Quality Standards and TMDL development is underway. BMP control measures will be required to achieve improved water quality within the impaired water body. The additional measures are further explained in Section 6 - Impaired Waters / TMDL.

The Group 5 water bodies identified on Table 2-3 have no additional storm water requirements for Warwick beyond the six minimum measures.

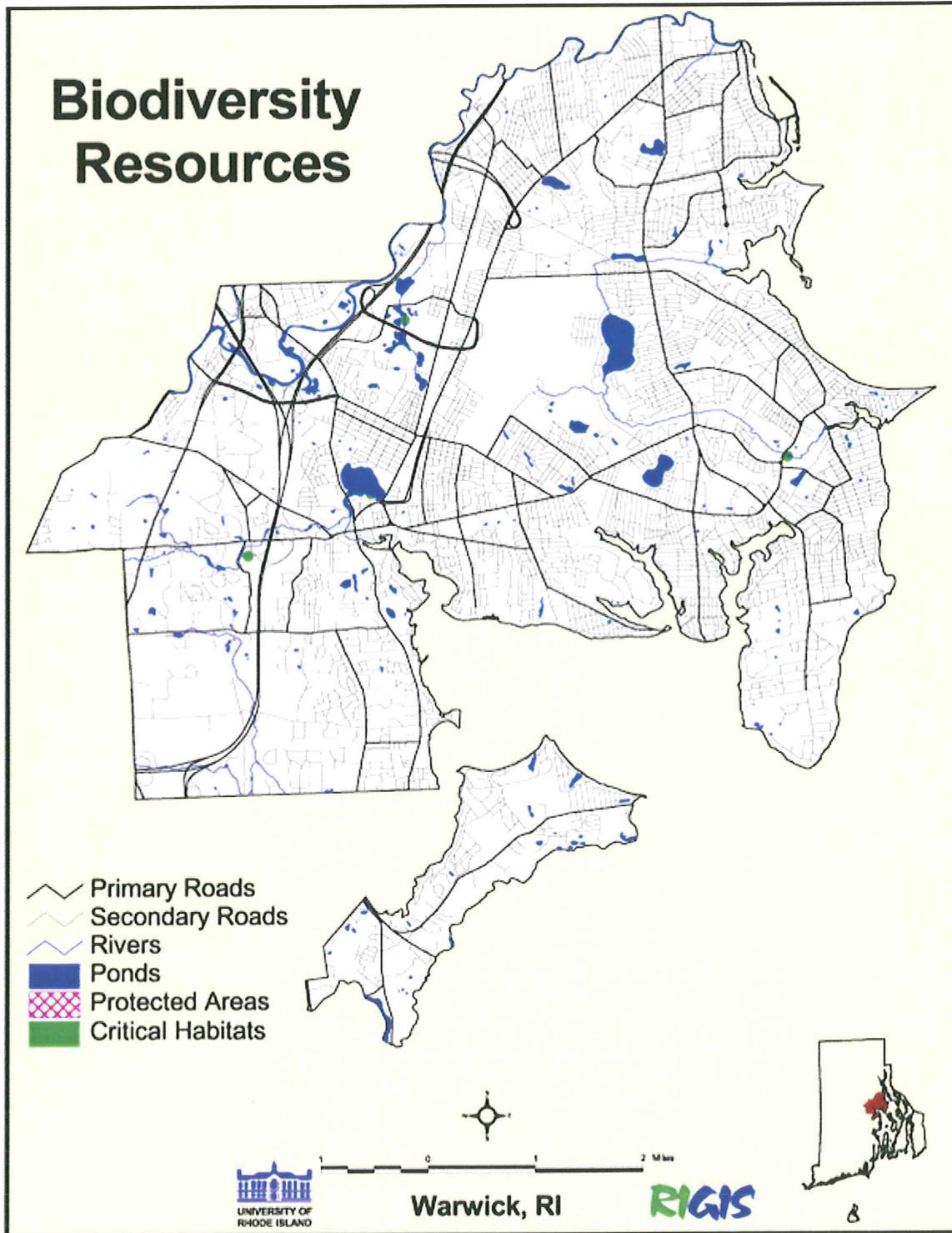
2.7 Critical Habitats

Figure 2-2 depicts the critical habitats in Warwick, Rhode Island. The delineated areas represent approximate habitats based on records of state-protected rare species in the Natural Heritage and Endangered Species database.

The information was obtained from the Rhode Island Geographic Information System (RIGIS) using the Rhode Island Department of Environmental Management Natural Heritage Program Database. The goal of the Program is to protect biological diversity in the State of Rhode Island through biological research and inventory, data management, environmental impact review, restoration and management of rare species and their habitat, land acquisition and education.

There is no reason to believe that the storm water discharges, allowable non-storm water discharges and discharge related activities will jeopardize the continued existence of any species or result in adverse modification or destruction of critical habitat.

Figure 2-2
Warwick Critical Habitats



2.8 Historic Property

There are 30 historic properties in the City of Warwick on the National Register of Historic Places (1995 Edition). The National Register provides a comprehensive listing of the buildings, structures, objects, and sites that have received local, state or national designations based on their historical or archaeological significance. The proposed BMPs outlined in Section 4 will not adversely affect any of the historic properties listed below.

Warwick Historic Properties

- Apponaug Historic District
- Budlong Farm
- Buttonwoods Beach Historic District
- Caleb Gorton High School
- Caleb Green High School
- Captain Oliver Gardiner High School
- Conimicut Lighthouse
- Cowesett Pound
- District Four School
- Elizabeth Spring
- Forge Farm
- Forge Road Historic District
- Gaspee Point Namquid (or Namquit) Point Reached
- Greenwich Cove Site
- Hopelands
- Indian Oaks
- James-Fones Greene High School
- John Waterman Arnold High School
11 Roger Williams Avenue
- Knight Estate
486 East Avenue

- Lambert Farm Site (RI – 269)
- Meadows Archaeological District
- Moses Greene House
- Pawtuxet Village Historical District
- Pontiac Mills
Knight Street
- Rhodes (Christopher) High School
25 Post Road
- Richard Wickes Greene High School
27 Homestead Avenue
- Russell Estate Outbuildings
- Trafalgar Site (RI – 639)
- Warwick Civic Center Historic District
- Warwick Lighthouse

2.9 Special Resource Protection Waters

Special Resource Protection Waters (SRPWs) are surface water bodies identified by RIDEM as high quality surface waters with significant ecological and recreational uses. SPRW waters may include but are not limited to:

- Wildlife refuge or management areas
- Public drinking water supplies
- State and Federal parks
- State and Federal Estuary Areas
- Waterbodies containing critical habitats

The Rhode Island Water Quality Regulations prohibits degradation of surface waterbodies identified as SPRWs. New or increased discharge or activity is not allowed unless the Director determines that proper mitigation and BMP's have been employed and designed properly.

According to the RIDEM list dated August 6, 1997, the following surface waters are SRPWs located in the City of Warwick:

- Gorton Pond

2.10 Outstanding Natural Resource Waters

Outstanding Natural Resource Waters (ONRW) are waters of National and State Parks, Wildlife Refuges, and other such waters having special recreational and ecological value. There are no ONRWs in Warwick, Rhode Island.

SECTION 3 DRAINAGE SYSTEM DESCRIPTION

3.1 General

The City of Warwick is located within the Narragansett Bay, Pawtuxet River, and Hunt Potowomut Watersheds. The City has been subdivided into nine major sub-watersheds. The sub-watersheds were identified and named by the Rhode Island Geographic Information System (RIGIS). Six of these sub-watersheds ultimately contribute the Narragansett Bay Watershed, two contribute to the Pawtuxet River Watershed, and one contributes to the Hunt Potowomut Watershed. Warwick's overall storm water collection system is comprised of pipes, culverts, streams, wetland areas, detention basins, lakes, ponds, and rivers.

3.2 Sub-Watershed Descriptions

Sub-watershed characteristics and locations are significant to Warwick's overall drainage system. The sub-watershed locations are illustrated in figure 3-1.

Sub-Watershed 1 – South Branch Pawtuxet River Sub-Watershed

Sub-watershed 1 (South Branch Pawtuxet River Sub-watershed), part of the Pawtuxet River Watershed, is located in western Warwick. It is bordered by West Warwick to the west. Sub-watershed 1 is situated west of Sub-watershed 5A. The sub-watershed area is one-tenth of a square mile. Storm water from the sub-watershed drains to the South Branch Pawtuxet River in West Warwick and Coventry. The South Branch Pawtuxet River flows into the Pawtuxet River as it enters Warwick in Sub-watershed 2. Land use is primarily multi-family residential and urban, single-family residential.

Sub-Watershed 2 – Pawtuxet River Sub-Watershed

Sub-watershed 2 (Pawtuxet River Sub-watershed), part of the Pawtuxet River Watershed, is located in northern Warwick. It is bordered by Cranston to the north and West Warwick to the west. Sub-watershed 2 is situated north of Sub-watershed 5A and west of Sub-watershed

7B. The sub-watershed area is approximately seven square miles. Storm water from the sub-watershed drains to the Pawtuxet River via several tributaries, which include Three Ponds and Three Pond Brook. The Pawtuxet River empties into the Providence River at Pawtuxet Cove.

Land use is predominantly residential, ranging from multi-family to high-density, single-family residential. The sub-watershed includes smaller areas of industrial use and pockets of agricultural and forestland. Major surface water bodies include Three Ponds, Sand Pond, Cranberry Pond, Three Pond Brook, and the Pawtuxet River. Major transportation facilities include Route 1, Route 113, Route 5, Route 117, Route 1A, Interstate 95, Interstate 295, the Airport Connector, and the Conrail Rail Lines.

Sub-Watershed 3 – Providence River Sub-Watershed

Sub-watershed 3 (Providence River Sub-watershed), part of the Narragansett Bay Watershed, is located in northern Warwick. It is bordered by Providence River to the east. Sub-watershed 3 is situated north of Sub-watershed 7B and southeast of Sub-watershed 2. The sub-watershed area is approximately three and one-half square miles. Storm water from the sub-watershed drains to the Providence River via unnamed tributaries. The Providence River discharges to Narragansett Bay.

Land use is primarily multi-family residential with transportation along the coast for docks. Major surface water bodies include Posnegonset Pond and Spring Green Pond. There are several coves along the Warwick coast, including Pawtuxet Cove, Passeonkquis Cove, and Occupasspatexut Cove. Major transportation facilities include Route 117 and Narragansett Parkway.

Sub-Watershed 4 – Maskerchugg River Sub-Watershed

Sub-Watershed 4 (Maskerchugg River Sub-watershed), part of the Narragansett Bay Watershed, is located in western Warwick. It is bordered by West Warwick to the west and East Greenwich to the south. The sub-watershed is situated south and west of Sub-watershed 5A. The sub-watershed area is approximately three and one-half square miles.

Storm water from the sub-watershed drains to Dark Entry Brook and small, unnamed tributaries, which discharge to the Maskerchugg River. The Maskerchugg River discharges to Greenwich Cove, which flows into Greenwich Bay.

Land use is primarily residential and forestland. Residential land use ranges from multi-family housing to suburban, single-family homes. In addition, there are pockets of commercial and industrial use. Major surface water bodies include Dark Entry Brook, the Maskerchugg River and Greenwich Cove. Major transportation facilities include Interstate 95, Route 1, Route 401, Route 2, Route 4, Route 3, and the Amtrak Rail Lines.

Sub- Watershed 5A – Greenwich Bay Sub-Watershed

Sub-watershed 5A (Greenwich Bay Sub-watershed), part of the Narragansett Bay Watershed, is located in central Warwick. It is bordered by West Warwick to the west and Greenwich Bay to the east. Sub-watershed 5A is situated north of Sub-watershed 4 and south of Sub-watersheds 2 and 7B. The sub-watershed area is approximately twelve and one-half square miles. Storm water from the sub-watershed drains to Greenwich Bay via several tributaries, which include Carpenter Brook and Tuscatucket Brook which discharge at Brush Neck Cove and Hardig Brook which discharge at Apponaug Cove.

Land use is predominantly residential, comprised mainly of urban, single-family homes. In addition, there are small areas of commercial use and forestland. Major surface water bodies include Carpenter Brook, Tuscatucket Brook, Hardig Brook, Gorton Pond, Tuscatucket Pond, Warwick Cove, Brush Neck Cove, Buttonwoods Cove, and Apponaug Cove. Major transportation facilities include Route 2, Route 117, Route 1, Route 113 and Interstate 95, the Theodore Francis Green Memorial State Airport, and the Amtrak Rail Lines.

Sub-Watershed 5B – Greenwich Bay Sub-Watershed

Sub-watershed 5B (Greenwich Bay Sub-watershed), part of the Narragansett Bay Watershed, is located in the northern section of Warwick's Peninsula. Greenwich Cove borders it to the west and Greenwich Bay to the north. Sub-watershed 5B is situated north

of sub-watershed 6. The sub-watershed area is approximately two square miles. Storm water from the sub-watershed drains to Greenwich Cove and Greenwich Bay.

Land use is primarily developed recreation and forestland associated with Goddard Memorial State Park, with some residential use, ranging from multi-family housing to single-family homes. Major surface water bodies include Greenwich Cove and Greenwich Bay.

Sub-Watershed 6 – Hunt River Sub-Watershed

Sub-watershed 6 (Hunt River Sub-watershed), part of the Hunt River Watershed, is located in the southern part of Warwick's peninsula. It is bordered by East Greenwich to the west and North Kingstown to the south. Sub-watershed 6 is situated south of Sub-watershed 5B. The sub-watershed area is approximately one and one-half square miles. Storm water from the sub-watershed drains to Mawning Brook and Fay Brook, which discharge to the Hunts River. The Hunts River flows into the Powtowomut River, which discharges to Narragansett Bay.

Land use is predominately medium-density, suburban residential and forestland, with pockets of industrial use and wetlands. Major surface water bodies include Potowomut Pond, the Hunt River and the Powtowomut River.

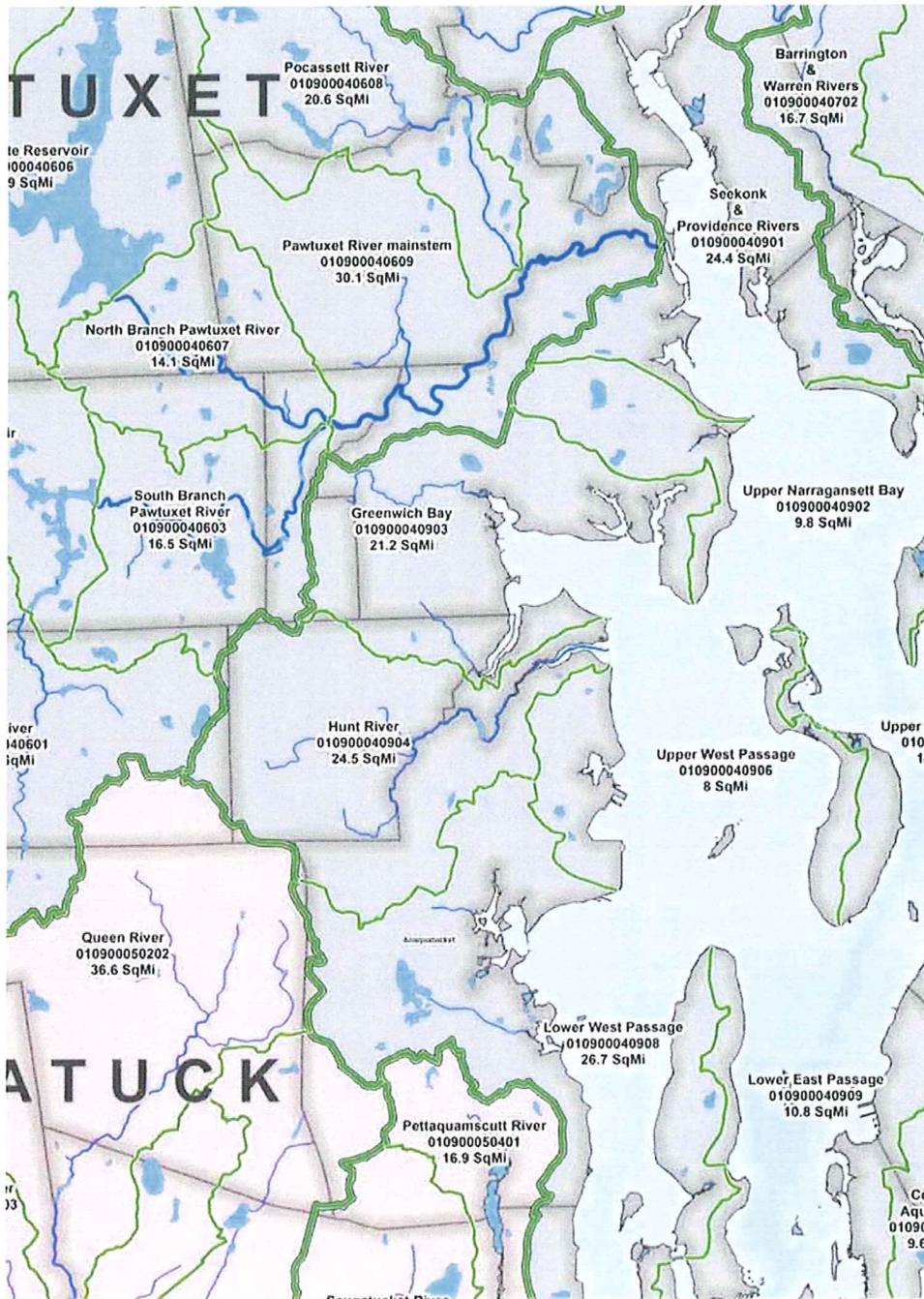
Sub-Watershed 7A – Narragansett Bay Sub-Watershed

Sub-watershed 7A (Narragansett Bay Sub-watershed), part of the Narragansett Bay Watershed, is located on the eastern tip of Warwick's peninsula between Salty Point and Marsh Point. It is bordered by Narragansett Bay to the east. Sub-watershed 7A is situated east of Sub-watershed 5B and northeast of Sub-watershed 6. The sub-watershed area is less than one-half of a square mile. Storm water from the sub-watershed drains to Narragansett Bay. Land use is primarily residential, consisting of multi-family housing and high-density, single-family homes. The sub-watershed also includes some wetlands.

Sub-Watershed 7B – Narragansett Bay Sub-Watershed

Sub-watershed 7B (Narragansett Bay Sub-watershed), part of the Narragansett Bay Watershed, is located in eastern Warwick. It is bordered by Narragansett Bay to the east. Sub-watershed 7B is situated south of Sub-watershed 3, east of Sub-watershed 2 and north of Sub-watershed 5A. The sub-watershed area is approximately seven square miles. Storm water from the sub-watershed drains to Narragansett Bay via tributaries, which include Buckeye Brook, Knowles Brook, Old Mill Creek, Lockwood Brook and Warner Brook.

Land use is predominately residential, consisting primarily of multi-family housing and high-density, single-family homes. Major surface water bodies include Warwick Pond, Little Pond, Buckeye Brook, Knowles Brook, Old Mill Creek, Warner Brook, Lockwood Brook and Mill Cove. Major transportation facilities include Route 117 and the Theodore Francis Greene Memorial State Airport.



**Figure 3-1
Sub-Watershed Map**

SECTION 4

MINIMUM CONTROL MEASURES

Warwick is currently implementing a storm water management program to reduce the discharge of pollutants to all resource areas including the impaired water bodies and special resource protection waters listed in Section 2. Therefore, the City, along with local watershed groups, has already established many of the BMPs that will be applied to the SWMPP. Additional measures are being developed in order to achieve compliance with the Phase II regulations. Proposed BMPs and measurable goals are provided herein to fully adhere to the regulations.

There are costs and time constraints associated with implementing these actions. That is the reason many of the measurable goals will be implemented in phases according to the indicated schedules. At this time, funding is not in place for all of the BMPs, and the measurable goals will not be accomplished if additional funding is not secured. The City is committed to aggressively pursuing funding from local, state, and federal sources and is committed to accomplishing as many of the measurable goals as possible. As time goes by and more funding becomes available, more aggressive and expensive BMPs and goals could be implemented. The goal of this plan is to reduce the overall effects of storm water pollutants to Warwick water bodies to the “maximum extent practicable.”

The Greenwich Bay TMDL document recommends prioritizing activities in the Brush Neck Cove and Apponaug Cove areas. Activities in the Warwick Cove, Greenwich Cove, Buttonwoods Cove, and the Northern Shoreline, which includes Bakers Creek areas are given the next level of priority in the Greenwich Bay TMDL document. The lowest priority areas according to the TMDL document are the Warwick Neck, Potowomut, and the Maskerchugg River areas. BMPs recommended in this document will be implemented in accordance with the Greenwich Bay TMDL document’s prioritization recommendations where it is applicable.

4.1 Public Education and Outreach

The DPW Director and the Planning Department are responsible for ensuring the implementation of proposed BMPs and measurable goals regarding public education and outreach.

Permit Requirements

“The operator must implement an ongoing public education program to distribute education material to the community over the term of the permit. The public education program must provide information concerning the impact of storm water discharges on water bodies. It must address steps and/or activities that the public can take to reduce the pollutants in storm water runoff. For State and federal operators the community consists of people who use the facility including employees and visitors.”

Minimum Measure Objective

This plan of action is successful if Warwick residents learn to feel a sense of responsibility regarding storm water pollution prevention. They will learn about actions that will directly benefit the cleanliness of local water bodies. This will create an educated community, which will foster support for funding initiatives and will benefit local water bodies greatly.

Current Practices

The City of Warwick is currently taking many steps to continuously educate the community about storm water related issues. Specifically, the City provides locations such as the library, City Hall and the DPW where fact sheets and brochures are accessible to the public. Typically the information is provided by or obtained from governmental and nongovernmental organizations such as: SRICD, Warwick Watershed Action Team, PRA, URI, Save the Bay, RIDEM and the EPA.

The City has been the beneficiary of efforts related to educating the community about storm water from organizations such as Save the Bay, the Warwick Watershed Action Team, and the SRICD. Additionally, the City has worked in conjunction with the

associations to administer the proper procedures for BMP implementation.

For example, the city of Warwick distributes flyers and also provides information on the City's website to inform residents about household hazardous wastes. The information describes the Eco-Depot, a free drop-off at the Rhode Island Resource Recovery Corporation's facility at the Central Landfill in Johnston. This program allows Rhode Island residents to schedule appointments to drop-off household hazardous waste. The drop-off is completed quickly by trained personnel who unload the waste, so residents do not have to exit their vehicles during this process. The flyer also provides information on alternatives to hazardous household products.

As previously mentioned, the City maintains a website, www.warwickri.gov/sanitation.htm, which provides additional information regarding proper disposal methods for common household products. The website also has a detailed list of various household waste products and methods to dispose of or recycle them. For instance, motor oil is disposed of in the oil igloo at the DPW City Yard.

The website also encourages Warwick residents to become involved in the local government by attending meetings. The meetings are required to be posted in three public locations: the website which instructs citizens to check newspapers, the bulletin board in City Hall, or the website to obtain meeting agendas.

The City has been involved with various agencies or groups that are dedicated to improving water quality. Public notices or mailings are distributed to the community for various projects. For example, the Greenwich Bay Initiative was established in 1992 to prevent harmful bacteria from entering the bay. The City provided residents with direct mailings during this project. In addition, the information was available at the public library and at City Hall. One example of this is the yearly *Warwick Recycling Calendar* distributed to Town residents. The calendar includes recycling facts, municipal recycling facility operating schedule, Christmas tree pickup dates, weekly yard waste pickup schedules, trash/recycling/yard waste pickup schedules during holiday weeks, lists of

items that can be recycled, instructions for separating recyclable items for pickup, items that are accepted at the municipal recycling facility, bulky item disposal instructions, paint disposal instructions, daily waste pickup schedules by street, and a list of City department contact numbers.

The City of Warwick also developed informational flyers about the harmful affects of pollution entering Greenwich Bay. The flyers provided Warwick residents with actions they could take to reduce the amount of pollution they contribute to the drainage system.

Greenwich Bay: An Ecological History, written by Sue Kennedy and Virginia Lee in 2003 was published and distributed by Rhode Island Sea Grant. Information regarding historic use, water quality, geologic features as well as personal anecdotes on these topics is provided in this document. The City of Warwick distributed this document to residents in 2003.

Sea Grant Rhode Island maintains a website (http://seagrant.gso.uri.edu/G_Bay/Management/index.html) providing Greenwich Bay Resource Management information. Links to information regarding Greenwich Bay's habitat and ecosystem, historic use, geological processes, land use and economy, and the Coastal Resource Council Greenwich Bay Special Area Management Plan (SAMP), are provided on this website. A link to this site will be added to the City of Warwick website.

The Warwick Harbor Management Plan is available on-line on the City of Warwick's Warwick Harbor management Commission's web page (<http://www.warwickri.gov/planning/harbormanagement/index.htm>). The page provides links to the Warwick Harbor Management Plan and City Ordinance Number 24, Harbors. The Harbor Management Plan provides information relative to several issues that impact Greenwich Bay water quality. The City's Harbor Ordinance regulates the disposal of waste in the harbor and environmental impacts to this important resource's water quality.

Mr. Daniel Geagan is a member of the Narragansett Bay and Watershed Council's Planning Commission. The Commission was established with the following purpose:

Develop a plan for the Bay and the watershed areas that incorporates environmental protection and restoration, sustainability, economic development, and socially equitable use of the resources. The plan must be a collaborative effort based on the fundamental premise that the Bay is inextricably linked to the environmental and economic health of Rhode Island as well as recognizing that protecting and enhancing the Bay as a resource is watershed based.

Information regarding the Commission's activities can be found on its website (<http://www.ci.uri.edu/GovComm/Default.htm>).

The University of Rhode Island Cooperative Extension (URICE) provides fact sheets regarding septic system maintenance, groundwater protection, lawn care, and actions citizens can take to reduce non-point source pollution.

Save the Bay was established to protect Narragansett Bay. Save the Bay provides educational opportunities for people to explore the bay. Some of Save the Bay's accomplishments include cleanups, workshops, and a project designed to eliminate combined sewer overflows from spilling into the bay when there is precipitation. The organization also brought students and families to the bay to learn about water quality and pollution. Save The Bay has worked with Rhode Island public school teachers to develop programs. Teacher training workshops provided teachers with valuable information about the bay. Brochures have been published, radio advertisement campaigns have been aired, and handbooks were created to educate people about the bay's ecosystem.

Save The Bay had Bay Station Kids Days in 2003. The objective of these days was to allow children to learn about the bay. The organization provided games and craft projects to assist with this objective.

Best Management Practices and Measurable Goals

The strategies listed below are in development at this time and are still under consideration by the City and the Storm Water Steering Committee.

1. Develop Outreach Strategies, Target Audiences, and Partnerships

The City and various watershed groups have completed many educational and outreach programs which create a strong sense of awareness about environmental issues for many residents, businesses, and visitors in Warwick. The City plans to expand upon its current practices to bring a higher level of awareness regarding storm water issues as required by the regulations. Educational outreach materials will focus on the impacts of storm water on local receiving water bodies, and illegal dumping into storm drains. Strategies will be developed to target specific audiences that could potentially have the greatest impact to minimizing pollutant loadings and to improving water quality. These audiences will include commercial, industrial, and institutional entities likely to have a significant impact on storm water.

The DPW will lead the effort with guidance from the Storm Water Steering Committee. The Storm Water Steering Committee was formed to assist with the submittal of the SWMPP and NOI. Meetings were held at the DPW building to introduce the committee to the Phase II process, obtain information regarding current practices related to storm water planning and to solicit input regarding BMPs.

<i>John DeLucia, P.E.</i>	<i>City Engineer</i>
<i>Eric Hindinger</i>	<i>Division of Engineering</i>
<i>Daniel Geagan</i>	<i>Planning Department</i>
<i>John Pagliaro</i>	<i>Building Official</i>
<i>Matthew Solitro</i>	<i>Warwick Sewer Authority</i>

The Storm Water Steering Committee is made up of City of Warwick officials. Local citizens have the opportunity to provide input through the Committee members.

Measurable Goals and Measures of Success

- The City will develop outreach strategies and partnership arrangements and take steps towards implementation within the first year of the program.
- The City will continue to expand the website to provide educational information and encourage involvement with the storm water program. Links will be established to other storm water websites.
- The City will continue encouraging and supporting the distribution of informational brochures and fact sheets through the Greenwich Bay Initiative.
- The City will expand partnerships with the University of Rhode Island Cooperative Extension and Save the Bay. These partnerships will allow the municipal officials to obtain training in stormwater related issues from these organizations. For example, the City participates in the Rhode Island Non-point Education for Municipal Officials (RI NEMO) Program operated by the University of Rhode Island Cooperative Extension. Municipal officials receive training from RI NEMO that allows them to identify water quality problems and adopt pollution control measures. The City will be cognizant of information and training opportunities offered by Save the Bay. Warwick, in conjunction with RIDEM and Save the Bay, holds an annual Bring Back the Bay Day. It includes activities, exhibits, and beach walks to inform people of the bay's significance.
- The City will continue implementing the CRMC Special Area Management Plan for Greenwich Bay.

2. Develop a List of Target Pollutant Sources

The City and local watershed groups have completed many programs that targeted a variety of pollutants thereby improving water quality. The City plans to expand upon previous efforts to develop and implement programs that will target known water quality problem areas such as impaired waters and TMDL reports. Additional discussions are necessary to refine the target pollutant sources and to develop the most effective education program possible.

Pollutants of concern identified for the 303(d) impaired waters listed in Section 2.6 include metals, bacteria, nutrients, suspended solids, pathogens, low dissolved oxygen, and phosphorus. Other associated impacts including a lack of biodiversity, hypoxia, and excess algal growth were noted in these impaired waters. Other pollutants included in the General Permit list include fecal coliform, temperature, PCBs, turbidity, ammonia, sediment, and dioxins.

General Permit Part IV. B.1.b.5 includes a list of target pollutant sources. Target pollutant sources include litter control, pet waste management, septic system maintenance, vehicle maintenance and washing, hazardous waste management, commercial and industrial wastewater management, lawn fertilizing, and pesticide use. A list of pollutants of concern and their associated target pollutant sources will be prepared. These target pollutant sources will be the intended audience for the education and outreach program.

Measurable Goals and Measures of Success

- The City will develop a list of target pollutant sources within the first year of the program. The General Permit General Permit Part IV. B.1.b.5 list of target pollutant sources will be reviewed with a specific focus on those sources of pollutants of concern for the 303(b) impaired waters and the waters with approved TMDLs. A list of target pollutant sources will be developed

Figure 4-1 outlines the time constraints for education and outreach BMPs.

**Figure 4-1
BMP Schedule – Public Education and Outreach**

BMP	Year				
	2005	2006	2007	2008	2009
Develop Outreach Strategies, Target Audiences and Partnerships					
Develop Implementation Strategies					
Expand Existing Website and Add Links to Websites with Greenwich Bay Information					
Continue Greenwich Bay Initiative Brochure/Fact Sheet Distribution					
Expand Partnership with Save the Bay and the University of Rhode Island					
Continue Implementing the CRMC SAMP for Greenwich Bay					
Develop a List of Target Pollutant Sources					
Develop List					

4.2 Public Involvement/Participation

The DPW Director and the Planning Department are responsible for ensuring the implementation of proposed BMPs and measurable goals regarding public involvement/participation.

Permit Requirements

“All Public Involvement/Participation activities must comply with State and local public notice requirements.”

Current Practices

The Storm Water Steering Committee was formed to assist with the submittal of the SWMPP and NOI. Meetings were held at the DPW building to introduce the committee to the Phase II process, obtain information regarding current practices related to storm water planning and to solicit input regarding BMPs. The storm water committee members include:

<i>John DeLucia, P.E.</i>	<i>City Engineer</i>
<i>Eric Hindinger</i>	<i>Division of Engineering</i>
<i>Daniel Geagan</i>	<i>Planning Department</i>
<i>John Pagliaro</i>	<i>Building Official</i>
<i>Matthew Solitro</i>	<i>Warwick Sewer Authority</i>

The committee will continue to assist in the development and the implementation of the SWMPP throughout the permit period. Local citizens have the opportunity to provide input through the Committee members and at public meetings.

Minimum Measure Objective

The goal is to have a community dedicated to and actively involved with this storm water program. This will result in a community with a much bigger stake in surface water quality than an uninvolved community. As time passes, more volunteers and cleaner water bodies are the goals of this program.

Current Practices

The City has been actively involved with the Warwick Watershed Action Team. The Warwick Watershed Action Team is comprised of Warwick residents who are committed to protecting and improving water quality. The Warwick Watershed Action Team was formed in September of 2000 and meets regularly to address water quality issues within the City.

Warwick, in conjunction with RIDEM and Save the Bay, holds an annual Bring Back the Bay Day. It includes activities, exhibits, and beach walks to inform people of the bay's significance. Also, the Explore the Bay Program is conducted to give high school students the opportunity to do research on Greenwich Bay and to impart the knowledge gained from the experience to younger students.

The City has in recent years participated with the Pawtuxet River Authority (PRA) and the University of Rhode Island Watershed Watch Program (URIWW). The URIWW program is a state-wide volunteer monitoring program. It is designed to generate public participation with regard to water quality protection. Gorton Pond, Little Pond, Sand Pond, and Warwick Pond are currently being monitored as a result of this program.

The City is also involved with the Southern Rhode Island Conservation District (SRICD), Greenwich Bay Watershed, Warwick Watershed Action Team, the University of Rhode Island (URI), and Save The Bay. On several occasions these groups have worked with the City to identify areas of pollution by providing services such as water quality sampling and local neighborhood drainage system mapping.

In 1996, twenty-nine members of Warwick boards and commissions participated in a course conducted by the Rhode Island Sea Grant and URI. Training goals included assistance with making educated and integrated land use decisions and promoting and improving the relationships of boards and commissions in the Watershed. The program also helped identify sources of major water quality problems in the watershed, including the impacts of new and existing development and pollution risks.

Best Management Practices and Measurable Goals

The City of Warwick will seek to establish formal partnerships with groups such as: SRICD, Warwick Watershed Action Team, URIWW, and PRA to create a program that will expand upon the City's current practices.

1. Develop a Plan to Involve the Community in the SWMPP Development

The City will develop a plan that includes the identification of target audiences and a description of the types of groups engaged. The City intends to provide opportunities for public comment, and a written summary of responses in accordance with the regulations once the draft plan has been approved by RIDEM. In addition, once approved by RIDEM, the City will hold a public hearing and pursue City Council approval of the SWMPP.

The City and local watershed groups have completed many programs involving volunteers that actively improved water quality. The City plans to continue developing and implementing programs that will involve as many residents, businesses and visitors as possible. It is understood that additional discussions are required to define the public participation program. The Public Works Department will lead the effort with guidance from the Storm Water Steering Committee.

The City will provide adequate public notice of the draft annual report and will provide an opportunity for annual public comment prior to its submittal. Public notice of the draft annual report will be advertised in the local newspaper and posted at City Hall and the Department of Public Works headquarters. Copies of the draft annual report will be made available for public review at the Department of Public Works headquarters. A process for submitting comments on the draft annual report will distributed to parties who review the draft annual report at the Department of Public Works headquarters.

A public meeting will be scheduled if the requirements found in IV.B.2.b.2.iii are met. Public notice of the meeting date and time will be advertised in the local newspaper and

posted at City Hall and the Department of Public Works headquarters.

Measurable Goals and Measures of Success

- The City will develop public involvement strategies and take steps towards implementation within the first year of the program.
- Hold a public hearing for the final SWMPP. In addition, once approved by RIDEM, the City will hold a public hearing and pursue City Council approval.
- The City will compile an annual list of public participation activities that will be included in the annual report. The list will include a description of the types of public participation activities completed during each year.
- The City will annually provide adequate public notice of the draft annual report and provide an opportunity for public comment. A public meeting will be scheduled if the requirements found in IV.B.2.b.2.iii are met.

2. Storm Water Committee

The Storm Water Steering Committee will continue to meet throughout the SWMPP development. In addition, the committee will meet throughout the permit period to ensure the effective implementation of proposed BMPs.

Measurable Goals and Measures of Success

- Hold regular meetings throughout the first year of the program to develop the SWMPP.
- Hold quarterly meetings in years two through five.

**Figure 4-2
BMP Schedule – Public Involvement/Participation**

BMP	<i>Year</i>				
	2005	2006	2007	2008	2009
Develop a Plan to Involve the Community in the SWMPP Development					
Develop Implementation Strategies					
Hold a Public Hearing for the final SWMPP and Present to the City Council for Approval					
Prepare an annual list of public participation activities					
Annual Report Preparation and Public Participation/Comment					
The City will prepare the annual report					
The City will provide public notice of the draft annual report					
The City will hold a public meeting to discuss the draft annual report (if required)					
Storm Water Steering Committee					
Hold Meetings to Develop SWMPP					
Hold Quarterly Meetings					

4.3 Illicit Discharge Detection and Elimination

The DPW Director and Planning Department are responsible for ensuring the implementation of proposed BMPs and measurable goals regarding illicit discharge detection and elimination.

Permit Requirements

“At a minimum, the operator must develop, implement and enforce a program to detect and eliminate illicit discharges or flows into the small MS4 that includes the following:

1. *If not already existing, the operator must develop a storm sewer system map. The map must show the location of all outfalls and the names of all waters that receive discharges from those outfalls. At a minimum mapping of additional elements, such as, location of catch basins, manholes, pipes within the system, must be completed for those portions of the system that are associated with the investigation and tracing of illicit discharges detected from the dry weather survey of outfalls, identification of physical interconnections with other regulated MS4s, municipal construction activity projects, and catch basin inspections.*
2. *To the extent allowable under State law, the operator must effectively prohibit and enforce, through an ordinance or other regulatory mechanism available to the operator, non storm water discharges into the system that are not authorized under Part I.B.3 of this permit or another appropriate RIPDES permit, and must also address pet waste, litter, yard waste, and other waste (such as household hazardous wastes). The mechanism must include sanctions for non-compliance. The ordinance or other regulatory mechanism must provide for appropriate enforcement procedures and actions. If a regulatory mechanism does not exist by the time an application is required, development and adoption of such a mechanism must be included as part of the SWMPP.*
3. *The non storm water discharges listed in Part I.B.3. must be addressed if they are identified as being significant contributors of pollutants.*

4. *The operator must develop and implement a plan to detect and address non storm water discharges, including illegal dumping, into the system.*
5. *The illicit discharge plan must contain procedures to identify and initially target priority areas, locate illicit discharges, locate the source of the discharge, remove illicit discharges, document actions, and evaluate impact on sewer system subsequent to the removal.*
6. *The operator must inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper waste disposal. Operators of facilities owned or operated by a State or federal agency must inform public employees, and users of the facility of hazards associated with illegal discharges and improper waste disposal.”*

Minimum Measure Objective

The number of illicit discharges removed will be tracked, and the number of polluted outfalls should decrease as proposed BMPs are implemented. Also, the number of people who report suspicious activity such as dumping should increase due to the public education BMPs.

Current Practices

Wastewater

As previously discussed, degraded water quality in Greenwich Bay due, in part, to increased nutrients from storm water and septic systems led to the formation of the Greenwich Bay Initiative in 1992. The Greenwich Bay Initiative, a coalition of advocacy groups, was formed following the 1992 closure of the shell fishing grounds. Sustained violations of the bacteria standard caused the shell fishing grounds closure. They determined that a lack of wastewater management was the primary problem, as less than 20% of some areas were connected to the sewer system.

The Rhode Island Coastal Resources Management Council (CRMC) issued an assent (Assent File Number: 00-4-50, Assent Number: A00-4-50) on July 6, 2000. One of the Assent requirements was the following:

Within one year of completing the required improvements needed to meet the Department of Environmental Management's requirements for treatment capacity, for the areas that currently have sewers and the sewer system approved under this permit, the Warwick Sewer Authority will implement a mandatory tie-in program, for the areas within the drainage basins of Narragansett Bay and Greenwich Cove.

The WSA commissioned the URICE to analyze and develop a plan for prioritization, as it is impossible for all areas to hook-up at once. The URICE utilized an indicator-based assessment method called MANAGE (Method for Assessment, Nutrient-Loading, And Geographic Evaluation). MANAGE quantifies key indicators to gauge the overall human impact and natural vulnerability of the un-sewered areas. These areas were classified according to level of threat or vulnerability and were color-coded for easy reference: red for high, yellow for medium and green for low. Areas with the largest number of "high" indicators were given the highest priority for sewer connection. The city of Warwick, acting through WSA, utilizes the information provided by the URICE as a guide to prioritize sewer expansion.

In the 1996 Facility Plan, unsewered areas in Warwick were evaluated and a methodology was developed to determine the need for sewer service or for individual subsurface disposal system (ISDS) rehabilitation. A methodology for prioritizing areas of sewer need was also recommended.

In 1996 Warwick implemented a procedure to manage septic system complaints from residents. Each septic system complaint is documented and investigated. Action, such as repair, is then taken if the situation warrants it. Warwick has repaired approximately 336 failed septic systems since 1996. As part of the Facility Plan Affirmation, RIDEM ISDS

records were reviewed for reported violations and repair applications to determine if the conditions in the areas where septic systems are not necessary had changed since the 1996 Facility Plan. The results indicate that conditions had not worsened, as there have been only twenty-three violations since 1996. ISDS areas will continue to be monitored. If these areas do worsen, the City will consider alternate wastewater management practices.

Based on the 1996 Facility Plan and the URICE prioritization, new sewer lines were installed to provide sewer service and to eliminate failing septic systems in areas adjacent to resource areas. The city of Warwick plans to have all sewer systems constructed by December of 2011.

The city of Warwick is currently in the process of expanding its sewage treatment facility to accommodate these un-sewered areas. The process began in 1997 and is scheduled to be completed in 2011. It is expected that once the treatment facility is expanded, all properties adjacent to resource areas within the City will be required to connect to the sewer system.

The Warwick Sewer Authority issued a document titled *Mandatory Sewer Connection Program Amended Approach* dated April 2006. The document provides a summary of the Authority's history, the wastewater treatment facility construction and upgrade completed in 2004, and the sewer system construction projects. The document recommends an approach to establishing and implementing the mandatory sewer connection program. The document can be accessed at the Warwick Sewer Authority's website <http://www.warwickri.gov/wsa/mandatoryconn/index.htm>. The public can also access a mandatory sewer tie-in program brochure prepared by the Warwick Sewer Authority and the Authority's mandatory connection program letter schedule through the Authority's website.

The City of Warwick requires all sewer connections to comply with Chapter 66 - Sewers and Sewage Disposal of the City Ordinance. The ordinance prohibits the disposal of

hazardous waste into the public sewer system. In addition, all buildings or dwellings are required to be connected to a suitable individual sewage disposal system or connected to a sewer line.

The City accepts resident complaints regarding noxious odors, which emanate from the drainage system or from observing debris at discharge locations. The City performs a site inspection of the property in question and makes a record of the complaint. In addition, the City inspects the sanitary sewer system annually to identify and correct any problems.

The City's storm sewer map is currently depicted on a copy of the Tax Assessors maps. The plan can be provided to the RIDEM if required. The DPW estimates that there are 200 miles of drainage pipe and 600 discharges within the City. The drainage information depicted on the RIGIS mapping was obtained from a 1978 Sewer Facility Plan prepared by C.E. Maguire for the WSA. Additional outfall information was obtained from a 1998 report entitled, "Characterization of Nonpoint Pollutant Sources to an Estuary under Wet Weather Conditions Direct Stormwater Discharges," prepared by URI. The study involved the identification of ninety-seven city of Warwick outfalls. The report also indicated that wet weather and dry weather sampling occurred at seventeen and thirty outfalls, respectively. Discharges with high fecal coliform bacteria concentrations otherwise known as "hot spots" were identified as well. The outfalls identified in the report have been added to the City's drainage map.

The City of Warwick authorized \$130,000,000 for wastewater management and extended sewers to several coastal areas. An Oakland Beach Sewer Tie-In Demonstration Project provided free sewer connections for low-to-moderate income homeowners in the Oakland Beach section of the city. In 1997, a project began to connect approximately 900 condominiums and apartments with failing septic systems to the sewer line on Post Road. Alternative septic system designs have been installed by Warwick (began 1996). The City also provided septic system inspections to verify if systems need repair. Homeowners who need to repair systems applied for loans from the Septic Grant/Loan

Program.

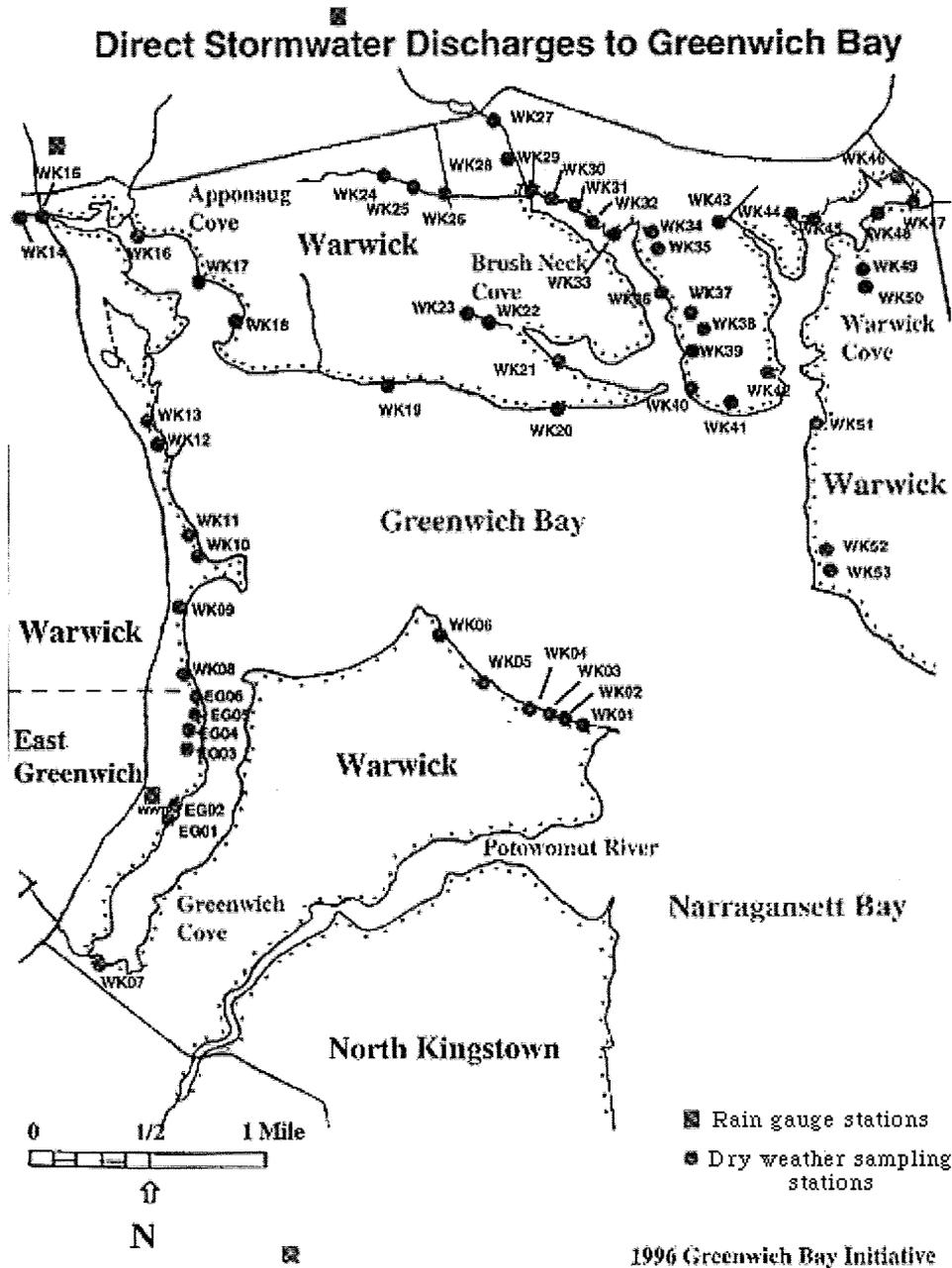
Sampling and Analysis

Raymond Wright (URI, Department of Civil and Environmental Engineering) has performed research in reference to storm drain discharges. He inventoried close to one-hundred (100) discharges within Warwick. He sampled storm drains during dry weather for fecal coliform bacteria and nutrients. The results indicated high levels of bacteria and nutrients which could have originated from neighborhoods without sewers. He also performed wet-weather sampling from the outfalls before, during, and after three storms. He analyzed the samples for the following: fecal coliform, nutrients, dissolved nitrate and ammonia phosphorus, total and volatile suspended solids, sodium and chloride, dissolved oxygen, and biological oxygen demand. Selected outfalls in East Greenwich and the Potowomut section of Warwick were sampled following three storm events. The selected outfalls along the Northern shoreline of Greenwich Bay were sampled following two storm events.

Wright set up stations where he could take water samples from the streams. He found two important sources of pollution to Greenwich Bay. Both areas were located along Hardig Brook. It was determined that the source of the bacteria was the manure on a farm washing into Hardig Brook. The City and DEM worked with the owners of the farm to stop storm water runoff from mixing with the manure and flowing into the brook. The City subsequently purchased the farm. The second source of pollution was a mill in Apponaug that was discharging to Hardig Brook. The owner hooked the mill's bathrooms into the city's sewer system.

This data was used to determine which outfalls are considered "hot spots" by contributing the most bacteria and nutrients to Greenwich Bay. The researchers looked at local land uses to determine which are the original sources of pollution. A computer model was created for the storm water discharges; it predicts the amount of pollution and the sources of pollution. This became part of the COASTMAP program to help the city of Warwick with its storm water program.

A plan showing Wright's sampling locations is provided.



Illicit Discharges

The City of Warwick Code of Ordinances includes existing ordinances that address illicit discharges. Chapter 2, Sewers and Sewerage gives the Warwick Sewer Authority the ability to prescribe rules and regulations for discharges and connections and to order

connection to the sanitary sewer system. Chapter 4, Animals and Fowl, requires dog owners to remove and dispose of feces from any sidewalk, street, public area, or private property not owned by the person who owns, possesses, or controls the dog, Chapter 22, Garbage Debris, and Rubbish, prohibits illegal dumping of garbage, rubbish, trash, hazardous waste, chemicals, and other solid waste into the city drainage system. Chapter 22 requires notification of spills to the City's fire department or police department. Yard waste management is regulated under this section. Article IV of Chapter 22 protects the Pawtuxet River and its environs from illegal and improper disposal of waste and establishes a program of regulation and enforcement to control and eliminate improper and illegal disposal of wastes in Pawtuxet River and its environs. Article VI of Chapter 22 establishes a leaf and yard waste collection and recycling program. Article VII of Chapter 22 protects Buckeye Brook and its environs from illegal and improper disposal of waste and establishes a program of regulation and enforcement to control and eliminate improper and illegal disposal of wastes in Buckeye Brook and its environs. Chapter 34 regulates laundries and dry cleaning establishments and requires the licensing of these facilities. Chapter 51, Planning and Development, includes design regulations for stormwater control in the Warwick Station Redevelopment District.

Best Management Practices and Measurable Goals

1. Storm Sewer System Map

The City will continue to develop a storm sewer system map utilizing the existing GIS data. The map will show the location of outfalls and the names of water bodies receiving discharges from these outfalls. Existing information regarding catch basin, manhole, and pipe locations will be included. In addition, information gathered during the tracing of illicit discharges detected during outfall sampling will be added during the duration of the program. Connections to other MS4s and municipal sites will be included as information is gathered.

The first step in this process will be to develop a database design for the storm drain network. The database design will be based on the coverage and shapefile GIS formats established for software developed by ESRI, and will contain both linear and node

attributes.

The GIS topology will allow the pipes and laterals of the system to be represented by linear features (arcs), while structures (manholes, catch basins, etc.) will be represented by points or nodes. The City does not have a highly accurate base map developed from photogrammetric methods. As a result, the 1:5,000-scale Digital Orthophoto images (SID or TIFF format) from aerial photography captured in April 1997 and vector data (shapefiles) from RIGIS will be used as the base map for the project.

The City will gather existing storm drain maps and/or digital data from URI, the Rhode Island Department of Transportation (RIDOT), the Southern Rhode Island Conservation District (SRICD) Brush Neck Cove and Warwick Cove list of stormwater outfalls, the SIRCD stormwater sampling reports, Professor Wright's Direct Stormwater Discharge Report, the RIDEM Shoreline Surveys, and BETA Engineering's 1992 Nonpoint Source Pollution Study for the City of Warwick. This information will be incorporated into the SWMPP data collection process. This will provide the avenue for attribute information to be attached to existing infrastructure, such as pipe size, material, structure type, etc. Physical interconnections with other MS4s (RIDOT, neighboring cities, etc.) will be included in this database and on the mapping. All information developed as part of this project will be created in a format compatible with the City's current system.

GPS will be used to locate the outfalls. A Trimble Geo XT GPS unit is used to locate the outfalls as well as the entire storm drain system. The GPS location will be accurate to less than 1 meter (3.28 feet). The GPS location information will be used to prepare the City's outfall location plan.

Evidence of illicit connections to the storm water system, petroleum residues or chemical odors shall be noted during the storm drain system mapping fieldwork. Observations of discharges which may be potentially related to an illicit discharge will be reported to the Warwick Storm Water Coordinator. The Warwick Storm Water Coordinator will provide this information to the Storm Water Coordinator for any physically connected MS4

system which may be interconnected to the portion of the Warwick storm sewer system where the potential illicit discharge is observed.

A pipe network will be developed. Any future construction activities which include additional drainage structures or modifications to the existing system will require the database information to be updated from as-built plans and information provided by the contractor.

Tagging of the outfall pipes will not be required. General Permit Section IV.B.3.b.2 states that tagging of outfalls is optional if the information used to create GIS outfall location maps is accurate enough to identify individual outfall pipes when revisiting their locations. The outfall location data collected with the GPS is of sufficient accuracy to allow the identification of individual outfall pipes.

Measurable Goals and Measures of Success

- The City will prepare a digital map of all outfalls and eventually the entire storm drainage system. Until that time existing paper maps will be referenced.
- The City will inspect all catch basins and manholes by 2008.

2. Outfall Testing Program

As part of the SWMPP, the City will conduct a storm drain discharge inspection, inventory, and environmental sampling program. A Quality Assurance Project Plan (QAPP) will be created to address quality control issues for field activities and sampling activities, equipment and laboratory controls, sampling blanks, duplicates, and spiked samples. Standard Operating Procedures (SOPs) will be developed to detect and address illicit discharges to the storm sewer system including discharges from illegal dumping, spills and ISDS systems. The plan will include catch basin and manhole inspections, complaint investigations, and dry weather field screening for non-storm water flows. SOPs will meet the requirements as outlined in the General Permit.

The City's dry weather sampling program will include an inspection of each of the

drainage discharges when an antecedent condition of three or more dry days occurs. This excludes those discharges that connect to the state drainage system. Discharge dimensions, condition, and estimated flow rates will be documented during this process. Any evidence of chemical contamination or fecal matter will be noted as well. Samples will be obtained if liquid is present in any discharge during dry conditions (no less than seventy-two hours after the last rainfall of 0.1 inches or more). Photographs will be taken to illustrate the discharge condition when samples are taken.

The samples will be analyzed for the following parameters:

- Temperature
- Conductivity
- Fecal Coliform Bacteria
- pH

Visual observations will include:

- odors
- sheen
- stressed vegetation
- coloration/staining
- algae growth
- sedimentation and/or scouring in the vicinity of the outfall
- Flow will be estimated by measuring the depth of flowing liquid in the outfall

Dry-weather sampling in areas not serviced by sanitary sewers will be conducted once between January 1st and April 30th and a second time between July 1st and October 31st. Dry weather sampling in areas serviced by sanitary sewers will only be required between July 1st and October 31st.

The first phase of dry weather sampling will indicate if sewage overflows have contaminated the discharges. Additional investigations and follow-up testing will be required for discharges which show evidence of sewage contamination. If follow-up

testing reveals potential contamination, the City will develop an inspection and testing program that identifies contamination sources and removal strategies. Areas will be prioritized by sampling discharges in close proximity to impaired water bodies prior to sampling other City discharges.

The City will implement the plan when funding becomes available. If funding is not available the City will research existing available data such as the RIDEM Shellfish Shoreline Survey Data, Save the Bay volunteer collected monitoring data, Professor Wright's monitoring data, or the TMDL monitoring data.

Measurable Goals and Measures of Success

- Inspect all City discharges by 2007.
- Complete two dry-weather surveys in areas not serviced by sanitary sewers (one between January 1st – April 30th and one between July 1st – October 31st) by 2008.
- Complete one dry-weather survey for those areas serviced by sanitary sewers (between July 1st – October 31st) by 2008.

3. Illicit Discharge Ordinance

The City's Storm Water Steering Committee in conjunction with the Department of Public Works will prepare a draft Illicit Discharge Detection and Elimination (IDDE) ordinance which will be presented to the City Council. The ordinance will be enacted in accordance with the Warwick Code of Ordinances, Part I Charter and Related Acts, Article II City Council, 2-18 through 2-25 which describe the process for the passage of ordinances by the City Council.

The goal of this ordinance will be to prevent and prohibit illicit discharge connections to the drainage system. The ordinance could stand alone or become part of a comprehensive storm water ordinance. To the extent allowable, the City will effectively prohibit and enforce, non storm water discharges into the system that are not authorized under the RIPDES Regulations and General Permit. The ordinance will address pet

waste, litter, yard waste, and household hazardous wastes. The ordinance will include enforcement procedures and actions. Specifically, the ordinance will include provisions for the removal of illicit discharge connections.

The City of Warwick Code of Ordinances includes existing ordinances that address illicit discharges. Chapter 2, Sewers and Sewerage gives the Warwick Sewer Authority the ability to prescribe rules and regulations for discharges and connections and to order connection to the sanitary sewer system. Chapter 22, Garbage Debris, and Rubbish, prohibits illegal dumping of garbage, rubbish, trash, hazardous waste, chemicals, and other solid waste into the city drainage system. Chapter 22 requires notification of spills to the City's fire department or police department. Yard waste management is regulated under this section. Article IV of Chapter 22 protects the Pawtuxet River and its environs from illegal and improper disposal of waste and establishes a program of regulation and enforcement to control and eliminate improper and illegal disposal of wastes in Pawtuxet River and its environs. Article VI of Chapter 22 establishes a leaf and yard waste collection and recycling program. Article VII of Chapter 22 protects Buckeye Brook and its environs from illegal and improper disposal of waste and establishes a program of regulation and enforcement to control and eliminate improper and illegal disposal of wastes in Buckeye Brook and its environs. Chapter 34 regulates laundries and dry cleaning establishments and requires the licensing of these facilities. Chapter 51, Planning and Development, includes design regulations for stormwater control in the Warwick Station Redevelopment District. Chapter 68, Soil Erosion and Sediment Control, prevents soil erosion and sedimentation from occurring as a result of nonagricultural development within the city by requiring proper provisions for water disposal, and the soil surfaces during and after construction, in order to promote the safety, public health, and general welfare of the city. Chapter 68 requires an erosion and sediment control plan submittal and approval prior to beginning regulated projects.

Measurable Goals and Measures of Success

- Review existing ordinance and develop recommendations for ordinance revisions within the first year of the program.

- If revisions are necessary, the City will hold a public hearing and the present ordinance to City Council, and adopt the ordinance by 2008.

4. Procedures for Eliminating Non Storm Water Discharges

Storm water discharges may not result in adverse affects on local water bodies depending on the content of the discharge. Procedures will be developed to inform RIDEM of any non storm water discharges, to inform residents, businesses and visitors of the hazards of illegal discharges, and to track all actions taken. Public education tools will be distributed to inform citizens about illegal dumping, as described under the Public Education and Outreach and the Public Involvement/Participation minimum control measures.

The City will develop an illicit discharge identification program. The program will prioritize the identification of illicit discharges in the area of the 303(b) impaired waters and waters that have an approved TMDL. Priority will also be given to the identification of illicit discharges in areas where the City receives high incidences of complaints about illegal non-storm water discharge connections. Non-stormwater illicit discharges may also be identified during BMP, catch basin, manhole and storm sewer inspections and operation and maintenance activities. The illicit discharge identification program will be supervised by the Storm Water Coordinator and implemented by the Department of Public Works staff. Illicit discharge complaints received by the City will be investigated by the Department of Public Works staff as part of the illicit discharge identification program.

The City will develop a program to implement the illicit discharge ordinance. The illicit discharge ordinance provisions will then be implemented. The illicit discharge ordinance will include provisions and requirements for the removal of the illicit discharge.

Currently the City of Warwick requires a Physical Alteration Permit for any work to be performed on City property. If any unauthorized work is detected, including illicit discharges, the improvement must be restored to its original state.

The City will develop a system to record and track all actions taken to detect and address illicit discharges. Information recorded in the system will include the location of the illicit discharge, the type of pollutants discharged in the illicit discharge, the actions taken to address the illicit discharge, the status of those actions, potential connection to an interconnected MS4, information provided to the interconnected MS4 coordinator, and the status of a referral to RIDEM.

A notification protocol will be developed that requires illegal discharges that are identified to be reported to RIDEM and tracking procedures will be developed that utilize the City's GIS mapping.

Illicit discharges may be identified in areas where the City of Warwick system is physically connected to another MS4 system. The RIDEM website includes a List of Storm Water Coordinators and this list will be used to identify the physically connected MS4 system coordinators. Physically interconnected systems include systems operated by the RIDOT, the Town of East Greenwich, and the City of Cranston. The City will contact the coordinators for systems that are when illicit discharges that may impact the interconnected system are detected. The City will provide the location and type of discharge from the illicit connection to the adjoining MS4 system coordinator.

Measurable Goals and Measures of Success

- The City will continue to encourage and support the Greenwich Bay Initiative and Save the Bay to distribute information to residents and businesses regarding illegal dumping and the illicit connection detection program.
- The City will develop a strategy for illicit discharge education within the first year of the program and implement the program in 2006.
- The City will develop a program to identify illicit discharges in 2007.
- The City will develop a program to implement the illicit discharge ordinance in 2008.
- The City will develop a tracking process in 2005.

- The City will develop procedures for referral to RIDEM in 2005.
- The City will develop a process to contact physically interconnected MS4 system Storm Water Coordinators when illicit discharges which may impact their system are identified in 2005.

Figure 4-3 provides time frames to act upon each illicit discharge detection and elimination BMP.

**Figure 4-3
BMP Schedule – Illicit Discharge Detection and Elimination**

BMP	Year				
	2005	2006	2007	2008	2009
Storm Sewer System Map					
Prepare an outfall map			█		
Inspect All City Catch Basins and Manholes				█	
Outfall Testing Program					
Inspect All City Discharges			█		
Complete Two Dry-Weather Surveys in Unsewered Areas				█	
Complete One Dry-Weather Survey in Sewered Areas				█	
Illicit Discharge Ordinance					
Develop the Ordinance					█
Hold Public Hearing, Present to the City Council, and Adopt the Ordinance					█
Develop a program to implement the Illicit Discharge Ordinance					█
Procedures for Eliminating Non Storm Water Discharges					
Distribute Information on Illegal Dumping and Illicit Connection Detection	█	█	█	█	█
Develop Strategy for Illicit Discharge Education and Implement the Education Program	█				

Develop a Program to Identify Illicit Discharges					
Develop an illicit discharge ordinance enforcement program					
Develop an Illicit Discharge Tracking Process					
Develop Procedures for RIDEM Referrals					
Develop a Program for Illicit Discharge Referrals to Physically Connected MS4 Coordinators					

4.4 Construction Site Storm Water Runoff Control

The City Engineer is responsible for ensuring the implementation of proposed BMPs and measurable goals regarding construction site storm water runoff control.

Permit Requirements

“The operator of the regulated small MS4 must develop, implement, and enforce a program to reduce pollutants in any storm water runoff to the MS4 from construction activities that result in a land disturbance of greater than or equal to one (1) acre. The operator must include disturbances less than one (1) acre if part of a larger common plan or if controlling such activities in a watershed is required by the Director. At a minimum, the program must be consistent with the requirements of the RIDEM RIPDES General Permit for Storm Water Discharge Associated with Construction Activity. It is recommended that the operator of the MS4 implements a program for review of construction activity throughout their jurisdiction, addressing direct discharges of storm water to waters of the State in addition to the discharges to the MS4. The construction site storm water runoff control program must include the development and implementation of the following:

1. *An ordinance or other regulatory mechanism to require sediment and erosion control and control of other wastes at construction sites, as well as sanctions to ensure compliance, to the extent allowable under State or local law. If such an ordinance does not exist at the time a permit application is required, development and adoption of an ordinance must be part of the program upon obtaining legal authority. Sanctions may include either monetary or non-monetary penalties.*
2. *Requirements for construction site operators to implement a sediment and erosion control program which includes best management practices that are appropriate for the conditions at the construction site and that at a minimum include the requirements of: Rhode Island Soil Erosion and Sediment Control Handbook (as*

amended).

3. *Require control of wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes.*
4. *Requirements for construction site operators to develop and implement a Storm Water Pollution Prevention Plan (SWPPP).*
5. *Procedures for plan and SWPPP review including procedures which incorporate consideration of potential water quality impacts. The site plan review must include procedures for review of sediment and erosion controls and design of BMPs to minimize water quality impacts.*
6. *Procedures for receipt and consideration of information submitted by the public.*
7. *Procedures for inspections and enforcement of control measures at construction sites.*
8. *Procedures for coordination of local and State construction permits and referrals of enforcement actions.”*

Minimum Measure Objective

Regulations will be developed that require a variety of BMPs to minimize the harmful affects of construction site activities. Soil and erosion control plans will be assessed based on the reduction of suspended solids and debris found in discharges in proximity to construction activities. To ensure that all procedures are completed, city officials will inspect the sites.

Current Practices

With respect to construction activity related to land development projects the city of Warwick currently requires applicants to comply with Chapter 68, Soil Erosion and

Sediment Control, of the City Ordinance (included in the Appendix). The ordinance requires applicants to submit erosion and sediment control plans to the Building Official for approval. The building Official then forwards the plans to the Department of Public Works, Planning Department, and the Planning Board for review and comment.

Chapter 68 allows the following exceptions to the permitting process:

Sec. 68-4. Permit required; exceptions.

(a) It shall be unlawful for any person to disturb any existing vegetation, grades, and contours of land without first applying for and receiving a permit from the building official.

(b) No permit shall be required under this chapter for the following:

(1) The construction, alteration or use of a single-family residential structure or appurtenance or a two-family residential structure or structures accessory thereto, which is or are to be constructed, altered or used individually and not as part of a development, provided such construction, including land disturbing activities, does not occur within 100 feet of any watercourse and has no slopes greater than ten feet vertical in 100 feet horizontal or ten percent, and where, in the opinion of the building official, no soil erosion will occur.

(2) Development projects where less than one-half acre is to be disturbed during one planting season, and which disturbance of soil is not within 100 feet of any watercourse, and has no slope greater than ten percent, and where, in the opinion of the building official, no soil erosion will occur.

(3) Accepted agricultural management practices such as seasonal tilling and harvest activities associated with property utilized for private and/or commercial agricultural or silvicultural purposes.

(4) An excavation which exhibits all of the following characteristics:

a. Is less than four feet in vertical depth at its deepest point measured from the average elevation of the natural ground surface;

b. Does not result in a total displacement of more than 100 cubic yards of material on any lot, land parcel, or subdivision;

c. Has no slopes steeper than ten feet vertical in 100 feet horizontal or approximately ten percent; and

d. Has all disturbed surface areas promptly and effectively protected to prevent soil erosion and sedimentation from occurring, including seeding and/or sodding; provided

that all disturbed surface areas which will be exposed for a period of time in excess of 30 days shall be covered with a suitable temporary protective ground cover until permanent ground cover is in place.

(5) Grading, as a maintenance measure, or for landscaping purposes on existing developed land parcels or lots, provided that all of the following conditions are met:

a. The aggregate of area(s) affected or stripped at any one time does not exceed 10,000 square feet;

b. The change of elevation does not exceed two feet at any point;

c. All bare surface area is promptly seeded, sodded, or otherwise effectively protected from erosive actions; and

d. The grading does not involve a quantity of material in excess of 500 cubic yards.

(6) Grading, filling, removal or excavation activities and operations undertaken by the city under the direction and supervision of the director of public works for work on streets, roads or rights-of-way dedicated to public use; provided, however, that adequate and acceptable erosion and sediment controls are incorporated in engineering plans and specifications and employed. Appropriate controls shall apply during construction as well as after completion of such activities.

(Ord. No. O-94-18, § I(3), 8-9-94; Ord. No. O-97-21, § I, 9-8-97)

The Building Official uses the “Rhode Island Erosion and Sediment Control Handbook,” as a reference in determining the suitability and adequacy of the erosion and sediment control plans.

The City also relies on the state to review projects requiring approval under the state Freshwater Wetlands Act, G.L. 1956, § 2-1-15 et seq., as amended. The state permit and any conditions would then be incorporated into the soil erosion and sediment control plan.

The City may require performance bonds, deposit of money, or negotiable securities to cover the costs associated with implementing all erosion and sediment control measures shown on the plan. If the activity is within 100 feet of any watercourse or within an identified flood hazard district, or on slopes in excess of ten percent, then the filing of a performance bond is required.

In accordance with the provisions of Chapter 68 the City has the right take whatever actions it deems necessary to correct violations and to assert a lien on the subject property in the amount equal to the costs of remedial actions.

The Building Official or his/her designated representative, and the City Engineer are responsible for inspection and enforcement of the soil erosion and sediment control plan. The Building Official requires that all work must be completed in accordance with an approved inspection and construction schedule. The Building Official will keep a record of all inspections. Upon completion a final inspection is made and a final summary report is prepared and kept on record in the Department of Inspections and in the DPW permanent inspections file.

Best Management Practices and Measurable Goals

The City has many of the development regulations in place to adequately control any soil disturbance area of one acre or more. Soil and erosion control plans are required for all major subdivision and land development projects. The City will evaluate their current regulations and update them to ensure that all land disturbances over one acre comply with applicable soil and erosion control practices.

1. Ordinance and Regulation Review and Updates

The City will continue to enforce its current regulations and ordinances related to erosion and sediment control. The City will ensure that penalties are given to violators of the current regulations or ordinances. The City, with input from the Storm Water Steering Committee, will develop revisions that include enforcement provisions to ensure compliance, a standard policy for the control of wastes related to construction activities, requirements for discarded building materials, concrete truck wash out, chemicals, litter, sanitary wastes, and other construction related wastes.

Measurable Goals and Measures of Success

- Develop recommendations for ordinance revisions within the first year of the program.

- Hold a public hearing and the present ordinance revisions to City Council by 2008.
- Continue enforcing current erosion and sediment control regulations.
- Track the number of penalties given for regulation violations by the 2006.

2. Construction Plan Reviews and Site Inspections

The City will review all plans for construction projects to ensure compliance with soil erosion and sedimentation controls and structural and non-structural BMP requirements. The current review process was established in 1996 with the adoption of the Development Review Regulations. All Building Permits and Planning Review Applications are logged into an Excel spreadsheet and followed through the completion of the project. All State permits are required prior to the issuance of a Building Permit or Planning Board approval.

Inspection procedures will be developed to ensure compliance. A minimum of two inspections will be performed for each site. The first will be completed during construction to ensure that the soil erosion and sedimentation control plan is being followed. The second inspection will be performed after final stabilization of the site. A note will be made for any inadequacies on sites/plans found by inspectors. Any violations will be submitted to the contractor in a report within five days of the review.

Measurable Goals and Measures of Success

- Continue to review all construction project plans and SWPPPs for construction projects within the regulated area.
- Continue to track all Building Permits and Planning Review Applications.
- Complete two inspections for all construction projects within the regulated area that discharge or have the potential to discharge to the MS4 by the second year of the program.
- Track the number of non-compliant permits reported by the second year of the program.

- Develop procedures for referral to the state for non-compliant construction site operators within the first year.

Figure 4-4 depicts the amount of time proposed to employ each BMP.

**Figure 4-4
BMP Schedule – Construction Site Storm Water Runoff Control**

BMP	Year				
	2005	2006	2007	2008	2009
Ordinance and Regulation Review and Updates					
Develop Recommendations for Ordinance Revisions	█				
Hold Public Hearings and Present Ordinance Revisions to the City Council					█
Continue Enforcing Existing Regulations	█	█	█	█	█
Track Penalties Given for Regulation Violations		█	█	█	█
Construction Reviews					
Continue Plan Reviews for all Construction Projects	█	█	█	█	█
Continue to Track all Building Permits and Planning Review Applications	█	█	█	█	█
Complete Two Inspections for All Construction Projects Within the Regulated Areas		█	█	█	█
Track the Number of Non-Compliant Permits Reported		█	█	█	█
Develop Procedures for Referrals to State for Non-Compliance	█				

4.5 Post Construction Site Storm Water Runoff Control in New Development/Redevelopment

The City Engineer and Building Official are responsible for ensuring the implementation and compliance of proposed BMPs and measurable goals regarding post construction site storm water runoff control in new development/redevelopment.

Permit Requirements

“The operator must develop, implement and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than or equal to one (1) acre, including projects less than one (1) acre that are part of a larger common plan of development or sale that discharge into the MS4. It is recommended that the operator of the MS4 implements a plan review and inspection post-construction program throughout their jurisdiction, addressing direct discharges of storm water to waters of the State in addition to the discharges to the MS4. The program must ensure that controls are in place to prevent or minimize water quality impacts. The post construction program must include:

- 1. Development and implementation of strategies which include a combination of structural methods such as detention basins, wet basins, infiltration basins and trenches, dry wells, galleys, vegetated swales, and vegetated filter strips and/or non-structural BMPs appropriate for the community.*
- 2. An ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects, that includes non-structural and structural BMPs, as well as their installation and operations and maintenance (O&M), and sanctions to ensure compliance, to the extent allowable under State and local law. If such an ordinance does not exist, development and adoption of an ordinance must be part of the program.*

3. *Procedures for site plan review to ensure that design of controls to address post-construction runoff are consistent with: The State of Rhode Island Stormwater Design and Installation Manual (as amended).*
4. *Procedures to ensure adequate long term operation and maintenance of BMPs.*
5. *Procedure to develop and implement strategies to reduce runoff volume which may include minimizing impervious surface areas such as roads, parking, paving or other surfaces, encouraging infiltration of non-contaminated runoff, preventing channelization, encouraging sheet flow, and where appropriate, preserving, enhancing or establishing buffers along surface water bodies and tributaries.*
6. *Procedures for coordination of local and State post-construction storm water management in new and redevelopment permitting and referrals for enforcement actions.”*

Minimum Measure Objective

The overall goal is to implement regulations that require development and redevelopment projects to include water quality BMPs in the development plans on a city-wide basis. City officials will ensure that all maintenance procedures are completed by responsible parties and will inspect the sites to enforce compliance. The citizen panels will discuss alternative BMPs that may be added to the regulation if current practices are deemed ineffective.

Current Practices

The City of Warwick’s current policy is a minimum “zero net increase” in storm water runoff for new development and redevelopment projects. There is no minimum size project for the “zero net increase” requirement. The City also incorporates the Rhode Island Storm Water Design and Installation Manual as a reference to review best management practices for proposed projects.

Additionally, in accordance with City Ordinance 82-1, Obstruction or Diversion of Watercourse (see Appendix), it is unlawful to obstruct or divert a stream, ditch, gully, creek, brook or any natural drain.

Best Management Practices and Measurable Goals

The City will establish a plan review and inspection program for all development and redevelopment projects that disturb greater than one acre of land, including projects less than one acre that are part of a common plan of development or sale that discharge into the MS4. The program will include the analysis of possible actions to prevent the disturbance of land or water systems. The sites will be inspected and monitored to ensure that the correct BMPs are used. Non-structural and structural BMPs will be combined to create an effective plan.

1. Ordinance Review and Updates

The City, working with the Storm Water Steering Committee, will develop revisions to the current ordinances to address post-construction storm water management. The revised ordinance will include provisions pursuant to the Rhode Island Stormwater Design and Installation Manual. The revisions will also include provisions for enforcement and long-term maintenance of drainage systems. Inspections will be performed for all sites after construction is completed.

Measurable Goals and Measures of Success

- The City will review existing ordinance and policies with regards to post construction runoff and will develop recommendations for regulation and ordinance revisions within the first year of the program.
- If revisions or additions are necessary, public hearing will be held and revisions will be presented to City Council for adoption by 2006.

2. Plan Review and Site Inspections

The City will develop procedures for pre-application meetings for development and redevelopment projects. These meetings will be used to educate representatives of

construction projects on City policies in regards to storm water quality and soil erosion and sedimentation controls. The City will review plans for all construction sites with resulting land disturbance greater than one acre. The City may accept projects that have been reviewed by other state programs such as Wetlands, RIPDES, Water Quality Certification and/or CRMC. The City will review plans for post construction BMPs for the control of storm water runoff from new development and redevelopment projects that result in discharges to the MS4.

Measurable Goals and Measures of Success

- The City will develop procedures for pre-application meetings for development and redevelopment projects
- Comprehensive plan reviews and inspections for all construction projects within the regulated area that discharge or have the potential to discharge to the MS4 by the second year of the program.

3. BMP Inspection and Maintenance

BMP inspection and maintenance will serve to measure the effectiveness of implemented storm water BMPs. BMP failure can become detrimental to property, cause injury, or worsen the affects of storm water. Some BMPs may require more frequent inspection than others. The City will establish standard procedures for field inspection of BMPs including development of inspection checklists. The checklists will include the BMP requirements, expectations, design criteria, date of implementation, etc.

Measurable Goals and Measures of Success

- Comprehensive inspections will be performed for all construction projects within the regulated area that discharge or have the potential to discharge to the MS4 by the second year of the program.
- Further develop strategies for ensuring long-term operation and maintenance of the selected BMPs by the second year of the program.
- Develop procedures for tracking operation and maintenance actions and enforcement actions by the second year of the program.

Figure 4-5 illustrates the time constraints for implementing the proposed BMPs.

**Figure 4-5
BMP Schedule – Post Construction Site Storm Water Runoff Control in New
Development/Redevelopment**

BMP	Year				
	2005	2006	2007	2008	2009
Ordinance Review and Updates					
Develop Recommendations for Ordinance Revisions	█				
Hold Public Hearings and Present Ordinance to the City Council		█			
Plan Review and Site Inspections		█	█	█	█
Develop Procedures for Pre-application Meetings for Development and Redevelopment Projects	█				
Comprehensive Inspections for All Construction Projects in Regulated Areas		█	█	█	█
BMP Inspection and Maintenance					
Develop a Strategy for Ensuring Long Term Operation and Maintenance of Selected BMPs		█			
Develop Procedures for Tracking Operation and Maintenance Enforcement Actions		█			

4.6 Pollution Prevention/Good Housekeeping for Municipal Operations

The DPW Director is responsible for ensuring the implementation of proposed BMPs and measurable goals regarding pollution prevention/good housekeeping for municipal

operations.

Permit Requirements

“The operator must:

- 1. Identify all operations such as activities and facilities that have a point source or the potential for a point source discharge of storm water to an MS4 or waters of the State associated with activities or operations that have the potential to introduce pollutants to storm water runoff.*
- 2. Develop and implement a program to prevent and reduce pollutant runoff and runoff volumes from facilities owned and operated by the MS4 operator, and from the MS4 and structural BMPs. The program must include an employee training component.*
- 3. Develop and implement a program to prevent and reduce storm water pollution from operations and maintenance activities that have the potential to introduce pollutants to storm water runoff.*
- 4. Develop inspection procedures and schedules for long term O&M of municipal facilities, municipal structural BMPs and the MS4.*
- 5. Develop and implement an employee training program for good housekeeping, pollution prevention, and O&M of BMPs.*
- 6. Implement a site-specific SWPPP developed for each facility that discharges storm water associated with industrial activity.”*

Minimum Measure Objective

This measure will improve the efficiency of municipal operations and reduce the amount

of pollution from city-owned facilities and the drainage system. Proper operation and maintenance procedures are key factors that will ensure that this goal is realized.

Current Practices

The City is currently implementing many BMPs to ensure pollution prevention and good housekeeping. Some of the BMPs already developed include storm drain cleaning, maintenance programs, and street sweeping.

The City currently has a street sweeping program that involves sweeping all streets annually. Street sweepings are handled in accordance with the applicable RIDEM and USEPA regulations.

The City of Warwick was actively involved in establishing “A Strategic Plan for the Reclamation of Greenwich Bay” in 1994. The plan has provided the framework for decision making and timelines for bay restoration efforts. In 1995, Warwick was involved in the implementation of agricultural best management practices by implementing practices to reduce agricultural runoff. Also, Warwick purchased a \$200,000 drain cleaning machine to reduce the pollution from road drainage (1996).

The DPW conducts routine cleaning and maintenance of the storm drain system. This includes an intensive schedule to inspect and clean four-hundred catch basins and six-hundred discharges annually. Eleven water quality BMPs (Vortech®) are inspected and cleaned annually as well. Thirty-five detention and retention basins are inspected and cleaned every year. Material collected during cleaning operations is stockpiled and disposed of in accordance with the applicable RIDEM and USEPA regulations. As a result, there is a significant reduction in pollutants and solids discharged to water bodies in the city.

The most recent work was identified in a report prepared by the SRICD entitled, “Assessment of Retrofit Feasibility of Selected Storm Water Systems in the Brush Neck Cove Watershed,” 2001. The report identified thirteen drainage systems within the Brush

Neck Cove sub-watershed, approximately 1,597 acres, as having the highest potential pollutant loading. Of the thirteen systems, five locations were selected by the City of Warwick for installation of swirl separators prior to the discharge point. Swirl separators are specifically designed to remove sediment, oils, and greases.

The city of Warwick received a grant under section 319 of the Clean Water Act to install Vortechnic® storm water BMPs at the following five locations, as depicted on Figure 3-2 in Section 3:

- Intersection of Gordon Avenue and Hawksley Avenue
- Canfield Court
- Shand Avenue
- Cottage Grove
- Spring Grove

Additionally, as a component of a Warwick Cove Water Quality Enhancement Project, the City installed a Vortechnic® system on Samuel Gorton Avenue, two units on Cowesett Road, and several units at T.F. Green Airport to address water quality issues.

In addition, the SRICD also received a grant under 319 of the Clean Water Act to assess the feasibility of treating many systems not addressed under the city of Warwick's 319 grant and to design two water quality BMPs. As a result of the study, the city of Warwick selected White Avenue and Boyle Street for SRICD to design water quality BMPs. In addition, the City requested SRICD investigate BMPs for two locations along Burbank Drive and one on Burgess Street.

The City of Warwick maintains a list of structural BMPs owned and operated by the City. This list includes 20 Vortechnic® systems and 37 City owned detention/retention basins. In addition, the City's list of detention/retention basins includes one abandoned detention/retention basin, one Federal owned detention/retention basins, two State owned detention/retention basins, and 52 privately owned detention/retention basins. A copy of these lists can be found in **Appendix 1**.

Best Management Practices and Measurable Goals

1. Predictive BMP, Catch Basin, and Storm Sewer Program

The development of a standardized BMP, catch basin, manhole, and storm sewer inspection program will continue in the future to include subsequent inspections, cleaning operations, and maintenance operations of storm water system components.

A standardized inspection form for catch basins, manholes, and storm sewers will be created, which includes information regarding the condition of the structure, construction material (brick, precast concrete, etc.) depth to invert, size, condition and type of pipes into and out of the structure, and condition of the frame and cover. The form shall be completed during each catch basin, manhole or storm drain cleaning operation. Evidence of illicit connections to the storm water system, petroleum residues or chemical odors shall also be noted on the forms. The presence of floatables will be noted on the form.

Implementing a maintenance plan for catch basins, manholes, and storm sewers will provide the tools to move past preventative maintenance to the next cost-effective level: predictive maintenance. Preventative maintenance typically involves cleaning and/or repairing a catch basin or manhole before the catch basin or manhole fills up with debris or fails for other reasons. Preventative maintenance may still result in cleaning certain catch basins and manholes more frequently than required. Preventative maintenance for storm sewers would occur when the pipes become clogged or fail for some other reason. Predictive maintenance involves cleaning/repairing a catch basin, manhole, or storm sewer just prior to it filling with debris, clogging, or failing. Predictive maintenance for the community would be based on developing a predictive cleaning model utilizing a wide variety of available asset management software.

The predictive cleaning model should be driven by the following data:

- Individual catch basin and manhole cleaning history
- Storm sewer cleaning history

- Quantity and nature of debris removed over time
- Predictive factors such as tree cover, topography, and surface conditions.

The predictive cleaning model would be built with data from the catch basin, manhole, and storm sewer inspection and cleaning program and work order history data if available. The model would originally predict the optimal time interval between catch basin, manhole, or storm sewer cleanings. Over time, the model accuracy would improve as additional work order history data was loaded. Ultimately, the procedure would result in the following:

- Reduced cleaning frequency for catch basins, manholes, and storm sewers that do not accumulate significant amounts of debris
- Increased cleaning frequency for catch basins, manholes, and storm sewers that chronically accumulate large quantities of debris.

Materials generated during the cleaning and maintenance of catch basins, manholes, and storm sewers will be disposed in accordance with applicable state and federal regulations.

GIS tools, such as ArcView , can also be utilized to provide visual aids for predictive maintenance model calibration. In addition, the routing of catch basin, manhole, and storm sewer cleaning crews can be aided with GIS driven routing programs. The other elements of the maintenance plan would include optimal use of both in-house crews and outside contractors to provide an overall catch basin, manhole, and storm sewer maintenance plan at the lowest possible cost to the City.

Vortechnic® units will be operated and maintained in accordance with the CONTECH Stormwater Solutions, Inc. operation and maintenance manual. A standardized Vortechnic® unit inspection form will be developed. Evidence of illicit connections to the storm water system, petroleum residues or chemical odors shall also be noted on the forms. The presence of floatables will be noted on the form. The Vortechnic® units will be maintained in a manner consistent with the manufacturer's maintenance requirements. Maintenance activities will be performed as required to maintain compliance with the

discharge limits.

A detention/retention basin operation and maintenance inspection program will be developed. A standardized detention/retention basin inspection form will be developed for City owned basins. Evidence of illicit connections to the storm water system, petroleum residues or chemical odors shall also be noted on the forms. The presence of floatables will be noted on the form. The detention/retention basins will be maintained in accordance **Rhode Island Stormwater Design & Installation Standards Manual** suggested maintenance activities. Materials generated during the cleaning and maintenance of detention/retention basins will be disposed in accordance with applicable state and federal regulations.

A BMP, catch basin, and storm sewer inspections, cleaning, and operation and maintenance record keeping system will be established. Inspection and O&M activities will be tracked with this system. BMP O&M records will be used to devise a maintenance schedule for these units and to identify units which require more intensive inspection and O&M activities than those recommended in the **Rhode Island Stormwater Design & Installation Standards Manual** and which units require a less intensive O&M schedule. This record system will also be used to record the information required for the catch basin, manhole, and storm sewer predictive cleaning model.

The BMP, catch basin, manhole, and storm sewer inspection forms will note if evidence of illicit connections to the storm water system, petroleum residues or chemical odors are observed during the inspection. If evidence of illicit connections is observed, the evidence will be provided to the Storm Water Coordinator for investigation under the illicit discharge detection program. The presence of floatables will be noted on the inspection form.

Measurable Goals and Measures of Success

- The City will develop an operations and maintenance program for BMPs, storm sewers, and catch basin inspection/cleaning within the first year of the program.

- The City will inspect/clean all BMPs, storm sewers, catch basins and manholes annually by the third year of the program.
- The Predictive Model will be used to evaluate the inspection and cleaning data collected during the first two years of annual inspections. A revised inspection and cleaning schedule for BMPs, catch basins, manholes, and storm sewers will be devised using Predictive Model.

2. Street Cleaning

The City will continue to clean all of the streets once per year for the duration of this plan. Critical environmental areas, as defined as areas located within areas whose stormwater discharges to surface water bodies with approved TMDL documents and/or 303 (d) impaired waters, will be swept first, and also, twice per year if resources are available.

The street cleaning program will help reduce the presence of floatables and other pollutants in the storm water system. Street cleaning removes floatables and other pollutants prior to their entering the system.

Material collected during the street sweeping program will be managed in accordance with the Appendix A Management of Street Sweepings in Rhode Island of the RIDEM Solid Waste Regulations as revised October 2005.

Measurable Goals and Measures of Success

- Sweep all roads once, city-wide, every year.
- Sweep critical environmentally sensitive areas before other areas twice per year by the third year of the program.
- Manage Street Sweepings in accordance with the RIDEM Solid Waste Regulations

3. Outfall Inspection and Erosion Control Program

Scouring at outfalls and erosion in roadside areas, ditches, and swales can introduce sediment and other pollutants including floatables into the storm drain system. An outfall inspection and erosion control program will be developed.

One component of the Outfall Inspection and Erosion Control Program will be an outfall inspection program. An outfall inspection program will be developed. Initially scouring at outfalls will be identified during the outfall GPS location work. Annual inspection of outfalls will be performed. The inspection program will be designed to identify scouring and excessive sedimentation at outfalls. The inspection data will be used to identify outfalls that need maintenance. The outfall inspection data collected in the first two years of annual inspection will be used to devise a predictive outfall inspection program. Outfall inspection frequency in subsequent years will be based on the visual observations made during the first two annual inspections. Outfalls where excessive scouring is observed will be stabilized with gravel and/or rip rap as required. Outfalls with scouring and outfalls with excessive sedimentation will be included on the Annual Report.

An erosion control program will be developed. The erosion control program will include a provision for reporting erosion observed along the roadside, in drainage ditches and swales, and at outfall scoured areas to the Department of Public Works director. City employees will be educated on identification of erosion of roadside shoulders, ditches, and scoured outfall discharges. The Department of Public Works will coordinate stabilization of these areas where it is needed to eliminate the discharge of pollutants. Materials such as gravel or rip rap will be used to reduce the storm water runoff velocity in eroded areas. Grass, shrubs, and/or trees may also be used to stabilize eroded areas.

The erosion control inspection and maintenance program will help reduce the presence of floatables and other pollutants in the storm water system. Street cleaning removes floatables and other pollutants prior to their entering the system. The erosion control

program will prevent floatables and other pollutants from entering the storm sewer system by eliminating pathways for their flow into the system.

Measurable Goals and Measures of Success

- Develop outfall inspection and erosion control program by 2005.
- Implement outfall inspection and erosion control program by 2006.
- Revise outfall inspection program in 2008.

4. Municipal Employee Training

The DPW will develop a list of training materials that will be used to educate City employees about pollution prevention and good housekeeping. These materials will come from applicable external sources, such as the RIDEM, EPA, and the University of Rhode Island.

The DPW will provide copies of the outreach materials and the illicit discharge connection education materials to City employees in the DPW, Engineering, Parks and Recreation, Sewer Authority, and School Department staffs. The distribution of these materials to the employees of these City Departments will keep their staffs informed of the ongoing education and outreach efforts.

All DPW, Engineering, Parks and Recreation, Sewer Authority, and School Department employees involved in operation and maintenance activities related to stormwater discharges will be trained on pollution prevention and good housekeeping measures using the materials collected and developed. Topics will include:

- Park and open space maintenance
- Fleet and building maintenance
- New construction and land disturbances
- Storm water system maintenance

Measurable Goals and Measures of Success

- Develop training materials during years one through three of the program.

- Implement employee-training program by 2008.

5. City Owned Industrial and Non-Industrial Facilities

The City of Warwick owns and operates the following industrial facilities:

- DPW Maintenance Facility
- The Warwick Sewer Treatment Facility

The City of Warwick will develop a list of non-industrial facilities owned and operated by the City.

The City will develop a list of operations, activities, and facilities that have the potential to introduce pollutants into storm water runoff and are covered under this program. These operations take place at City owned industrial and non-industrial facilities.

The City will develop a list of city owned industrial and non-industrial facilities. A narrative that includes the following information will be prepared for each facility:

- Operations and activities that have the potential to introduce pollutants into storm water runoff
- Existing conditions
- Runoff volumes
- Assessment of potential pollutants
- Structural controls
- Preventative Maintenance
- BMP inspection
- Chemical and material storage practices
- Spill and leak prevention and response methods
- Vehicle maintenance, fueling, and washing
- Employee training
- Strategies to reduce runoff volumes such as reducing impervious surfaces and infiltration of stormwater

The City will evaluate the existing conditions at each City owned industrial and non-industrial facility to develop strategies to reduce runoff and eliminate pollution sources. BMPs that accomplish these goals will be implemented.

The City will complete Storm Water Pollution Prevention Plans (SWPPPs) in accordance to Part IV.B.6.b.5 of the General Permit for the following industrial facilities owned and operated by the city of Warwick:

- DPW Maintenance Facility
- The Warwick Sewer Treatment Facility

Measurable Goals and Measures of Success

- Develop a list of City owned industrial and non-industrial facilities by 2005 that includes a narrative for each facility
- Evaluate the existing conditions at each City owned industrial and non-industrial facility to develop strategies to reduce runoff and eliminate pollution sources by 2007.
- Implement BMPs identified in each facility's narrative by 2008
- Develop SWPPPs by the end of the first year of the program (2005).

6. City Construction Projects

The City of Warwick may be required to design and construct new elements for its MS4 system or repair existing elements of the system. The design and construction of these new elements will be completed in accordance with the RIDEM's **Rhode Island Stormwater Design & Installation Standards Manual**.

Erosion and sediment and water quality controls will be implemented on all construction projects undertaken by the City. The need for erosion and sediment and water quality controls on the City construction projects will be evaluated in accordance with the requirements found in the Chapter 68, Soil Erosion and Sediment Control, of the City Ordinance and the *Rhode Island Soil Erosion and Sediment Control Handbook* (as

amended). When erosion and sediment and water quality controls are required on City construction projects they will be installed and maintained in accordance with Chapter 68, Soil Erosion and Sediment Control, of the City Ordinance and the *Rhode Island Soil Erosion and Sediment Control Handbook (as amended)*.

Measurable Goals and Measures of Success

- Develop strategies and procedures for assessment of flow management projects by 2005.
- Develop strategies and procedures for implementing erosion and sediment and water quality controls on city construction projects by 2005.

Figure 4-6 illustrates the time constraints for implementing the proposed BMPs in reference to pollution prevention and good housekeeping in municipal operations.

Figure 4-6
BMP Schedule – Pollution Prevention and Good Housekeeping for Municipal Operations

BMP	Year				
	2005	2006	2007	2008	2009
Predictive BMP, Catch Basin, Manhole, and Storm Sewer Program					
Develop Operations and Maintenance Program for BMP, Catch Basin, Manhole, and Storm Sewer Cleaning	█				
Inspect and Clean System Components Annually in Accordance with the Program	█	█	█	█	█
Use the Predictive Model to Devise a revised inspection and cleaning program			█	█	█
Street Cleaning					
Sweep all roads once per year	█	█	█	█	█
Sweep environmentally sensitive areas when resources are available twice per year			█	█	█
Manage Street Sweepings in Accordance with the RIDEM Solid Waste Regulations	█	█	█	█	█
Outfall Scouring and Erosion Control Program					
Develop Outfall Scouring and Erosion Control Program	█				
Implement Outfall Scouring and Erosion Control Program		█	█	█	█

Revise Outfall Scouring Inspection Program Based on First Two Years Annual Inspection Data							
Municipal Employee Training							
Develop training materials							
Implement Employee Training Program							
City Owned Facilities							
Develop a List of City Owned Industrial and Non-Industrial Facilities that Includes a Narrative for Each Facility							
Evaluate the existing conditions at each City owned industrial and non-industrial facility to develop strategies to reduce runoff and eliminate pollution sources.							
Implement recommended BMPs at City Owned Industrial and Non-Industrial Facilities							
Complete individual SWMPPs at City Owned Industrial Facilities							
City Construction Projects							
Develop strategies and procedures for assessment of flow management projects.							
Develop strategies and procedures for implementing erosion and sediment and water quality controls on city construction projects.							

APPENDIX 1

SWTS No.	Unit	STREET	NORTHING	EASTING	DATE INSTALLED	Status
SWTS-001	Vortech 11000	Warwick Neck Ave @ Samuel Gorton Ave			2001	
SWTS-002	Vortech 16000	Cowesett Rd @ Post Rd			1998	
SWTS-003	Vortech 16000	Cowesett Rd west of Tivoli Ct			1998	
SWTS-004	Vortech 9000	Cowesett Rd @ Cowesett Green Dr			1998	
SWTS-005	Vortech 7000	Cowesett Rd west of Woodfield Dr			1998	
SWTS-006	Vortech 5000	Cowesett Rd west of Peaceful Lane			1998	
SWTS-007	Vortech 4000	Helen Ave east of Bakers Creek Rd			1998	
SWTS-008	Vortech 9000	Edgewater Dr west of Oak Tree Ln			1998	
SWTS-009	Vortech 11000	Gordon Ave @ Hawksley Ave			2001	
SWTS-010	Vortech 3000	Canfield Ct @ end			2001	
SWTS-011	Vortech 7000	Shand Ave @ end			2001	
SWTS-012	Vortech 7000	Cottage Grove Ave @ end			2001	
SWTS-013	Vortech 7000	Spring Grove Ave @ end			2001	
SWTS-014	Vortech 7000	Shawomet Ave @ Symonds Ave			2003	
SWTS-015	Vortech 3000	Royal Ave @ end			2003	
SWTS-016	Vortech 11000	Rock Ave @ Bluff Ave			2003	
SWTS-017	Vortech 9000	Burbank Dr @ Sudbury St			2005	Not yet on line
SWTS-018	Vortech 5000	Burgess Dr @ end			2005	Not yet on line
SWTS-019	Vortech 3000	Davis Ct @ end			2005	Not yet on line
SWTS-020	Vortech 3000	Smile Ct				
SWTS-021						
SWTS-022						
SWTS-023						
SWTS-024						
SWTS-025						

BASIN-DATA.XLS: MASTER DATABASE OF STORMWATER HOLDING STRUCTURES: CITY OF WARWICK, NOVEMBER 7, 1997.						
REF. #	NAME/LOCATION	BASIN TYPE	PLAT	LOT	WATERSHED	REMARKS
9	CONTOUR RD.; LOVE LN. EST. #7.	RESIDENTIAL; RETENTION-1	233	142	DARK ENTRY BROOK	ABANDONED.
53	UPLAND CT.; OFF WARWICK AVE.	RESIDENTIAL; DETENTION-1	363	16	PARSONAGE BROOK	CITY [PRELIMINARY].
36	TIVOLI COURT; COMWESSETT MEADOWS.	RESIDENTIAL; DETENTION-1	236	179	HARDIG BROOK	CITY [RIP-RAP].
80	EDYTHE STREET.	DETENTION-2; LEVEL SPREADER-1	363	7	WARNER BROOK	CITY [STONE SWALE].
51	PRINCETON ESTATE; WOODFIELD DR.	RESIDENTIAL; DETENTION-2	231	4	MASKERCHUGG BROOK	CITY [WETLANDS].
2	ALLANA CT.; ALCIA CL. - CAREY EST.	RESIDENTIAL; DETENTION-2	239	35,55	MASKERCHUGG BROOK	CITY.
5	BRIARBROOK EST. - GREEN HILL WAY.	RESIDENTIAL; DETENTION-1	217	130	MASKERCHUGG BROOK	CITY.
6	CARR'S LANE; OVERVIEW EST.	RESIDENTIAL; DETENTION-1	261	65,66	PAWTUXET RIVER	CITY.
13	EASTGATE DR.; EASTMAN VILLAGE.	RESIDENTIAL; DETENTION-1	275	70	PAWTUXET RIVER	CITY.
14	GEORGE CL.; ROYAL OAK EST.	RESIDENTIAL; DETENTION-1	287	284	PAWTUXET RIVER	CITY.
17	HENDRICKEN CT.	RESIDENTIAL; DRYWELLS.	350	470	KNOWLES BROOK	CITY.
21	JERILYNN CL.; SARGEANT EST.	RESIDENTIAL; RETENTION-1	365	303	APPONAUG COVE	CITY.
22	JOSEPH CT.; MAJOR POTTER HILL #1.	RESIDENTIAL; DETENTION-1	223	214	DARK ENTRY BROOK	CITY.
26	RHODES SCHOOL. @ PALM BLVD.	NATURAL BASIN-1	288	424	PAWTUXET RIVER	CITY.
27	PAMELA CL.; GREENWOOD GARDENS.	RESIDENTIAL; DRYWELLS.	269	107	PAWTUXET RIVER	CITY.
28	PEACOCK RD.; LOVE LN. EST. #8.	RESIDENTIAL; DETENTION-1	234	174	DARK ENTRY BROOK	CITY.
30	REED ST.; DUPLEXES IN PONTIAC VILLAGE.	RESIDENTIAL; DETENTION-1	274	163	PAWTUXET RIVER	CITY.
32	SHENANDOAH RD. EXTENSION.	RESIDENTIAL; DETENTION-1	236	181	HARDIG BROOK	CITY.
46	WILDE FIELD DR.	RESIDENTIAL; DETENTION-1	350	692	LITTLE POND	CITY.
48	SPINNAKER LN.; COVE HILL ESTATES I,II,III.	DETENTION-1; LEVEL SPREADER-1	237	394	HARDIG BROOK	CITY.
50	CHANDELLE IND. PARK; MACH CL.	COMMERCIAL; DETENTION-2	325	24	BUCKEYE BROOK	CITY.
56	WHISPERING LN.; OFF COMWESSETT RD.	RESIDENTIAL; MULTIPLE DRYWELLS	328	9,40	DARK ENTRY BROOK	CITY.
59	JACQUELINE CT.; EAST VIEW EST.	RESIDENTIAL; RETENTION-1	379	449	NARRAGANSETT BAY	CITY.
60	ZACHARIAH PLACE; OFF LAKESHORE DR.	RESIDENTIAL; DETENTION-1	328	487	WARWICK POND	CITY.
67	BREANA LANE; GREENWICH TERRACE.	DETENTION-1; DRAIN SWALE-1	266	607,609	GORTON POND	CITY.
68	JONATHAN CT.; SAND POND ESTATE.	INFILTRATION BASIN-1	312	483	SPRING GREEN POND	CITY.
69	POSNEGANSETT AVE.	DRAIN SWALE-1	300	312	POSNEGANSETT POND	CITY.
72	JERRY ST.; BRIER GLEN ESTATE.	DETENTION-1	238	93	DARK ENTRY BROOK	CITY.
79	WINMAN COURT.	DETENTION-1 [OUTLET WEIR]	246	317	HARDIG BROOK	CITY.
83	LILLIAN COURT; "THE OAKS".	RETENTION-1	269	10	THREE POND BROOK	CITY.
84	EMILY LANE; WINMAN TERRACE #2	DETENTION-1; 12" OUTLET	246	317	HARDIG BROOK	CITY.
85	STEP CIRCLE; "STILLWATER GLEN".	DETENTION-1; 12" OUTLET	340	293	BUCKEYE BROOK	CITY.
87	NICOLAS LANE; "TOLLGATE FARMS".	DETENTION-2	247	8	HARDIG BROOK	CITY.
92	SPOONER ESTATES I,II; MIA CT.	LEACHING GALLEY-4 WITH C.B.	269	21	THREE POND BROOK	CITY; OVERFLOW DRAINAGE.
25	METRO CENTER PARK.	INDUSTRIAL; RETENTION-3	276	10,17	PAWTUXET RIVER	CITY; P. 270; L. 456.
88	SEVENTEEN FARMS II; SLEEPY HOLLOW FARM DR.	DETENTION-3; WETLANDS OUTLET	229	75	MASKERCHUGG BROOK	CITY; PRELIMINARY.
90	ALDRICH ESTATE; TEA HOUSE LANE.	RETENTION-1	381	26	NARRAGANSETT BAY	CITY; PRELIMINARY.
93	N.F. MUNICIPAL RECYCLING FACILITY, RANGE RD.	RETENTION-1; INFILTRATION-1	349	1	BUCKEYE BROOK	CITY; VEG. SWALE; COMPOST.
10	COMWESSETT CORNER SHOP CTR.; QUAKER LN.	DETENTION-2; LEVEL SPREADER-1	240	1,14	HARDIG BROOK	COMMERCIAL.
19	HOLIDAY INN AT CROSSINGS.	LEACH CHAMBER-1; DETENTION-1	265	21,22	PAWTUXET RIVER	COMMERCIAL.
23	LEESONA; 333 STRAWBERRY FIELD RD.	LEACH FIELD [INFILTRATION]-1	342	4	BUCKEYE BROOK	COMMERCIAL.
24	SUMMIT SQUARE [CHILISj]; 1276 BALD HILL RD.	NATURAL BASIN-1	255	10	HARDIG BROOK	COMMERCIAL; WETLANDS.
12	EAGLE RUN DR.	PRIVATE; DETENTION-2	228	1	MASKERCHUGG BROOK	CONDOS.
31	ROBIN'S WAY; WINGATE VILLAGE PLAT.	RESIDENTIAL; DETENTION-1	295	501	PAWTUXET RIVER	CRANBERRY POND.
20	INDIAN HILL RD.; LOVE LN. EST. #6.	RESIDENTIAL; LEVEL SPREADER-1	223	168	DARK ENTRY BROOK	FARMINGTON?
44	WARWICK POST OFFICE; STR. FLD. RD.	SEDIMENT TRAP-1	342	390	TUSCATUCKET BROOK	FED. GOV.
8	COLLEGE HILL APTS.; 33 COLLEGE HILL RD.	LEACH CHAMBER-1; PRIVATE	260	34	PAWTUXET RIVER	INFILTRATION DRAINS.
33	SOMERVILLE LUMBER; W. NATICK RD.	COMMERCIAL; DETENTION-3	273	3	MESHANTICUT BROOK	J.T. HOME CTR.
4	BALD HILL PLAZA; 1245 BALD HILL RD.	COMMERCIAL; RETENTION-1	254	1	PAWTUXET RIVER	LECHMERE; PRIVATE.
55	CONDOS AT #3674 POST RD.	PRIVATE; DETENTION-1	366	8	GREENWICH BAY	MARY'S POND.

BASIN-DATA.XLS: MASTER DATABASE OF STORMWATER HOLDING STRUCTURES: CITY OF WARWICK; NOVEMBER 7, 1997.						
REF. #	NAME/LOCATION	BASIN TYPE	PLAT	LOT	WATERSHED	REMARKS
49	SHOWCASE CINEMA; DIVISION ST.	COMMERCIAL; DETENTION-1	215	2	MASKERCHUGG BROOK	NATIONAL AMUSEMENT.
18	OFFICEMAX; RT. 2- WARWICK MARKETPLACE.	COMMERCIAL; RETENTION-2	260	32	PAWTUXET RIVER	PAPA GINOS.
43	WARWICK INDUSTRIAL PARK; BELLOWS ST.	DETENTION-1; OPEN DITCHES	291	58	PAWTUXET RIVER	PRIVATE (NATURAL).
86	WALMART/ CITIZEN'S BANK; #800/ 840 POST RD.	DETENTION-1; LEVEL SPREADER-1	294	1	LAKWOOD BROOK	PRIVATE (PARKING/ WETLANDS).
74	ENGLHARD CORP.; #263 KILVERT ST.	COMM.; MULT. LEACHING PITS.	278	1	PAWTUXET RIVER	PRIVATE (UNDERGROUND).
65	SHAW'S MARKET; #1500 BALD HILL RD.	COMMERCIAL; DETENTION-1	241	12	HARDIG BROOK	PRIVATE (WETLANDS).
42	BRIARWOOD MEADOW APTS.; #940 QUAKER LN.	RETENTION-3; SEDIMENT TRAP-3	226	1,4,18	MASKERCHUGG BROOK	PRIVATE (WRWK. FARMS).
1	AAA-KENT OFFICE PARK; RT. 117.	COMMERCIAL; DETENTION-1	247	11	HARDIG BROOK	PRIVATE.
7	CENTERPOINT OFFICE PARK; 120 CENTERVILLE RD.	INFILTRATION POND-3	244	43	HARDIG BROOK	PRIVATE.
11	COWSETT GREEN ESTATE.	RESIDENTIAL; DETENTION-1	232	41	DARK ENTRY BROOK	PRIVATE.
15	GREEN INDUSTRIAL PARK; PAVILION AV.	COMMERCIAL; DETENTION-1	311	69	SPRING GREEN POND	PRIVATE.
34	STOP & SHOP; CROSSROAD PLAZA.	COMMERCIAL; DETENTION-1	350	550	PARSONAGE BROOK	PRIVATE.
35	SUISSE CHALET; 36 JEFF. BLVD.	MULTIPLE DRYWELLS	285	5	PAWTUXET RIVER	PRIVATE.
37	TOLLGATE ASSOC.; #390 TOLL GATE RD.	COMMERCIAL; RETENTION-1	247	91	HARDIG BROOK	PRIVATE.
40	VILLAGE GREEN CONDOS; APPONAUG.	RESIDENTIAL; MULTIPLE DRYWELLS	244	109	HARDIG BROOK	PRIVATE.
41	WARWICK EXECUTIVE PARK & SUMMIT OFFICE.	COMMERCIAL; DETENTION-3	243	7,51	HARDIG BROOK	PRIVATE.
47	WILLOW GLEN CONDOS.	DETENTION-2	350	472	PARSONAGE BROOK	PRIVATE.
52	TWIN OAK CONDOS; W. SHORE RD.	LEACH DRAIN-1 (STONE TRENCH)	319	557	OCCUPASSTUXET COVE	PRIVATE.
54	CENTERVILLE COMMONS; #875 CENTERVILLE RD.	COMMERCIAL; DETENTION-1	248	7	HARDIG BROOK	PRIVATE.
57	GATE MED. CTR.; #215 TOLL GATE RD.	LEACH GALLEY-1	246	182	HARDIG BROOK	PRIVATE.
58	KILLEY SQUARE CONDOS.	RETENTION-2	339	21	BUCKEYE BROOK	PRIVATE.
61	MOBIL GAS STATION; APPONAUG.	LEACH GALLEY (D.V.J-2)	245	152	GORTON POND	PRIVATE.
62	TELMORE RD.; QUAKER IND. PK.	COMMERCIAL; DETENTION-1	215	19	MASKERCHUGG BROOK	PRIVATE.
64	TRITON REALTY; #1545 BALD HILL RD.	RETENTION-1 (RIP-RAP)	249	12	HARDIG BROOK	PRIVATE.
66	CITY LINE IND. CONDOS; #11 KNIGHT ST.	DETENTION-1	275	109	PAWTUXET RIVER	PRIVATE.
70	LARCHWOOD ESTATE.	DETENTION-1; CULVERT OUTLET	233	141	DARK ENTRY BROOK	PRIVATE.
73	HARBORVIEW ESTATE (ANGLESEA).	LEVEL SPREADER-2	382	361,373	GREENWICH COVE	PRIVATE.
75	KENT COUNTY HOSPITAL; TOLL GATE RD.	DETENTION SWALE-1 (PARKING LOT)	256	78	HARDIG BROOK	PRIVATE.
81	SHALOM APTS.; SHALOM DR.	DETENTION-1; LEVEL SPREADER-1	271	190	PAWTUXET RIVER	PRIVATE.
91	SPENCER WOODS DR. - CONDOMINIUMS.	DETENTION-5	227	10,11	MASKERCHUGG BROOK	PRIVATE; PRELIMINARY.
77	#221 & 231 JEFFERSON BLVD.	INDUSTRIAL; LEACH GALLEY-1	282	64,68	PAWTUXET RIVER	PRIVATE; C.B. INLET.
76	NEW ENGLAND TECH.; #2480 POST RD.	DRYWELL GALLEY-4 (UNDERGROUND)	344	149,154	THREE POND BROOK	PRIVATE; PARKING LOT.
78	QUINN FUNERAL HOME; #2435 WARWICK AVE.	RETENTION-1 (PIPE INLET)	350	622	LITTLE POND	PRIVATE; PARKING LOT.
82	DUNKIN DONUTS; #27 JEFF. BLVD.	DETENTION-1; SWALE INLET	284	275	PAWTUXET RIVER	PRIVATE; PARKING LOT.
39	VILLAGE GREEN APTS.; #200 POST RD.	RETENTION-1; REPLACEMENT POND	283	941	PAWTUXET RIVER	PRIVATE; PAWTUXET VILLAGE.
89	CONDOS AT #4390 POST RD.	INFILTRATION BASIN-1	220	226	GREENWICH BAY	PRIVATE; PRELIMINARY.
38	U.P.S.; PLAN WAY.	COMMERCIAL; LEACH GALLEY-1	279	33	PAWTUXET RIVER	PRIVATE; UNDERGROUND.
45	WETHERSFIELD COMMONS; THRUSH RD.	DETENTION-1; NATURAL POND	270	280	PAWTUXET RIVER	PRIVATE; WILLIAMSBURG DR.
63	BUSINESS POST RD.; APPONAUG.	DETENTION-1 (TRENCH)	267	208	GORTON POND	STATE.
71	OLD WARWICK AVE. @ KNIGHTS OF COLUMBUS.	DETENTION-2	351	11,26	BUCKEYE BROOK	STATE.
29	PILGRIM SENIOR CTR.; 27 PILGRIM PKWY.	LEACH CHAMBER-1; CITY	300	330	POSINEGANSETT POND	UNDERGROUND.
16	GREENBRIER CONDOS; NEW LONDON AV.	PRIVATE; DETENTION-3	252	6,7	PAWTUXET RIVER	VALLEY VIEW.
3	BALD HILL COMMONS; SAM'S CLUB, SPORTS AUTH.	RETENTION-1; DETENTION-3	254	3,13	HARDIG BROOK	WETLANDS; PRIVATE.